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A CRITIQUE ON THE OCCURRENCE AND DISTRIBUTION OF MACROZOOBENTHOS IN A TRADITIONAL PRAWN FIELD AND ADJACENT MANGROVES IN COCHIN BACKWATERS

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ABSTRACT

Community structure and distribution of macro-zoobenthos in a 'Chemmeen Kettu'—an aquaculture pond was evaluated in relation to prevailing environmental factors and compared with the macrofauna of mangroves in the surrounding margin of pond. Macrofaunal density estimated was 8918/m^2 and 5254/m^2 in the pond and mangrove habitat respectively. Polychaetes dominated in the pond (43.91%) and mangroves (41.23%) followed by molluscas and crustaceans. The rich population density and species composition in the prawn field, compared to mangroves, was related to the variability in substratum characteristics.

The characteristic difference in sediment textural complexity seem to be responsible for the variability in community structure of benthos in the two habitats. Dominance of benthos particularly polychaetes in 'Chemmeen Kettu' field was significantly associated with the food resources input from decomposed mangrove litters in the form of detritus. The supply of detritus may also virtually enhance the availability of nutrients in the water of the prawn field. This suggests better scope for aquaculture in brackish water pond lined with mangroves in the margin.

INTRODUCTION

BIOLOGICALLY, mangroves have great significance in capture fisheries as well as aquaculture because the detritus and organic matter content derived from mangals enter into the initial food chain of various economically important shell and finfishes. Conversion of mangroves for paddy and coconut cultivation together with setting of fish ponds is in vogue in West Bengal, Kerala, Karnataka, Goa and Maharashtra (Parulekar, 1985). In India, a lot of aquaculture farms have been developed in the mangrove ecosystem or in estuaries bordered with mangrove vegetation, and in Kerala, such an area is named as 'Chemmeen Kettu'. The knowledge on the distribution and abundance of benthic organisms in such prawn field as well as in the mangroves along the edge of that field is limited. In the present investigation, an attempt has been made to study the macrozoobenthos from aquaculture pond bordered with mangroves.

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MATERIAL AND METHODS

An aquaculture prawn field, a tidefed pond, endowed with rich mangrove vegetation dominated by *Rhizophora mucronata* and *Avicinnia* sp. on the embankment, was selected for the study. The area is situated at Maradu, 20 km away from Cochin barmouth. The investigation was carried out for one year from June 1990 to May 1991 except October 1990. Sediment samples (in triplicate) were taken from the pond, 2-4 m away from the margin and mangroves using a box corer (120 cm^2 area). For mangroves, sediment samples were taken among the flora and this area is submerged only during the high tide period. Population density was expressed as no/m^2 and faunal diversity was measured (Ludwig and Reynolds, 1988). Sediment texture (Krumbein and Petti John, 1938) and organic matter content were analysed.

RESULTS AND DISCUSSION

Table 1 presents sediment characteristics and organic matter values of the study area.

Substratum was sandy in the pond throughout the year while in the mangroves it was silty sand in monsoon period (June-September), clayey sand in the postmonsoon (October-January) and premonsoon period (February-May). Maximum organic matter were found in the mangrove sediment (%) ranging from 4.66 to 5.42. Organic matter varied from 1.26 to 1.50 in the sediment of pond. The fact that the organic residues deduced from the putrefaction of mangrove detritus is percolated into the sediment and this may be the reason for high organic matter concentration in the sediment of mangroves than that of the pond (Sunil Kumar, 1996). Salinity, temperature and dissolved oxygen of water, in general, varied from 0.91 to 18.32‰, 28° to 33.5°C and 3.22 to 6.29 ml/l respectively in the whole study area.

TABLE 1. *Sediment characteristics in relation to seasons in the study area (All values are in %).*

	Sand	Silt	Clay Pond	Sediment Type	Organic matter
Monsoon	82.14	13.26	4.60	Sandy	1.50
Postmonsoon	84.54	8.43	7.03	Sandy	1.46
Premonsoon	83.42	4.58	12.00	Sandy	1.26
		Mangrove			
Monsoon	52.35	31.26	16.39	Silty sand	4.66
Postmonsoon	58.74	18.95	22.31	Clayey sand	5.42
Premonsoon	62.87	13.72	23.41	Clayey sand	4.84

TABLE 2. *Diversity indices of species richness (R1), diversity (H^1) and evenness (E_2) in the study areas.*

	Pond			Mangrove		
	R_1	H^1	E_2	R_1	H^1	E_2
June	2.13	1.77	0.59	1.75	1.76	0.73
July	1.97	1.75	0.72	1.03	1.37	0.79
Aug.	2.42	1.97	0.65	1.25	0.81	0.61
Sep.	3.44	2.20	0.65	1.76	1.38	0.57
Nov.	1.78	1.37	0.56	1.68	1.24	0.86
Dec.	1.44	1.30	0.73	0.91	0.64	0.95
Jan.	2.92	1.96	0.66	2.82	1.98	0.91
Feb.	1.21	0.98	0.67	2.08	1.64	0.86
Mar.	1.92	1.50	0.90	1.82	1.10	1.00
Apr.	1.12	1.01	0.92	1.24	1.06	0.96
May	—	—	—	—	—	—

A total of 21 and 17 species of benthic fauna were recorded at the pond and mangrove respectively. Polychaetes were the most common group present in the study area. In the pond, the most dominant organisms were Polychaeta—*Dendronereis aestuarina*; Crustacea—*Gammarus* sp., Mollusca—*Villorita cyprinoides* (juvenile) and *Hydrobia* sp., while in mangroves the dominant ones were Polychaeta—*Nereis glandicincta* and mollusca—*Hydrobia* sp.

Indices of Shannon species diversity (H') varied from 0.98 to 2.2 in the pond and 0.64 to 1.98 in the mangroves (Table 2). Species richness (R1) ranged from 1.12 to 3.44 and 0.91 to 2.82 in the pond and mangrove habitat respectively. Eveness values varied between 0.56 and 1.00 in the whole study area.

Monthly variations of major macrofaunal taxa are given in Table 3. Total population density was 8918/m^2 in the pond and 5254/m^2 macrozoobenthos, since there has not been substantial difference in these factors in these two habitats. The maximum population density

TABLE 3. *Monthly variations of major macrofaunal taxa (no/m^2) in the two habitat.*

Month (June 1990-May 1991)	J	J	A	S	N	D	J	F	M	A	M
					Pond						
Polychaeta	333	167	500	750	472	222	722	250	139	83	278
Tanaidacea	—	56	28	—	—	—	—	—	28	—	—
Amphipoda	722	83	—	56	28	—	56	—	28	56	—
Isopoda	—	—	—	28	—	—	—	—	—	—	—
Decopoda	—	—	28	—	—	—	—	56	—	—	—
Bivalvia	611	472	806	194	194	111	28	28	—	—	—
Gastropoda	222	194	361	167	111	111	83	—	28	28	—
Total	1888	972	1723	1195	805	444	889	334	223	167	278
					Mangrove						
Polychaeta	694	250	222	306	139	83	194	83	28	56	111
Tanaidacea	—	—	—	—	—	—	28	—	—	—	—
Amphipoda	—	56	28	28	—	—	83	—	—	28	—
Isopoda	28	139	28	—	—	—	28	56	—	—	—
Decapoda	—	—	—	—	—	—	—	—	—	—	—
Bivalvia	—	—	—	—	—	—	—	—	28	—	—
Gastropoda	389	306	—	444	—	—	—	111	28	56	—
Others	417	611	28	56	28	—	—	56	—	—	—
Total	1528	1362	306	834	167	83	333	306	84	140	111

in the mangrove. In the monsoon period the increase in the population density in the pond was largely due to the dense occurrence of *Dendronereis aestuarina* and the Juveniles of *Villorita cyprinoides* and in the mangrove due to the dominance of *Nereis glandicincta.*

The variability of community structure in the two distinct areas appeared to have been related to the nature of edaphic characteristics. Other environmental factors like salinity, temperature and dissolved oxygen was not found to influence the distribution pattern of

was found in the pond where the substratum being sandy and with plenty of detritus, virtually mangrove origin. The average quantity of detritus, resulting from mangrove litter fall was estimated to be 1500 kg/ha/year from the mangrove areas at Cochin (Rajagopalan *et. al.,* 1986a). Although low organic matter was observed in 'Chemmeen Kettu', the sandy substratum mixed with detritus provides an ideal habitat for the abundance of benthos. Aravindakshan *et. al.* (1992) stated that in the prawn culture fields of Cochin backwater,

substratum with more sand and clay was more correlated with faunal production. Substratum with more sand content provides more interstices, permeability and micro-habitats so that food particles can move through it and permanent burrows can exist there (Sunil Kumar, 1995). In the mangroves the clayey sand and silty sand along with the patent availability of organic matter may not be suitable for high benthic production. This type of firm substratum provides little intertices so that burrowing of benthos becomes difficult. Also this area is apparently submerged only during the high tide period. The lower population density recorded here could be attributed to the distinctive features cited above. Thus, the pattern of community structure was correlated with the nature of sediment and availability of food and those present in a wide variety of sediment types area precisely responding to sedimentary gradients with copious changes in abundance (Ansari *et. al.*, 1994).

A direct relationship between benthic production and demersal fishery resources has also been reported (Harkantra *et. al.*, 1980; Prabu and Reddy, 1987). The data of the two habitat given in the present study can be used to assess the potentiality of benthic productivity in the traditional prawn field. The mangrove ecosystem eventually provides an excellent supply of organic detrital matter in the early food chain of many economically important organisms. The aquaculture importance of mangrove ecosystem was discussed (Jayaseelan and Krishnamurthy, 1980; Macintosh, 1982; Silas, 1987).

The increasing benthic population enter into the food chain of organisms belonging to the higher trophic level which suggest that there is an immence scope for aquaculture in 'Chemmeen Kettu' endowed with rich mangrove vegetation. The indescriminate exploitation of mangrove resources of Cochin backwaters for various purposes (Rajagopal *et. al.*, 1986b; Vannucci, 1986) and other mangrove areas should be minimised. Steps should be taken to afforest mangrove flora in the newly excavated as well as existing aquaculture ponds.

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