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EFFECT OF POLLUTION DUE TO COCONUT HUSK RETTING ON THE SPECIES DIVERSITY OF BENTHIC COMMUNITIES OF COCHIN BACKWATERS

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ABSTRACT

The variation in abundance, distribution, biomass and species diversity of benthic communities of a retting zone was studied in comparison with that of a non-retting area. The distribution patterns of benthic population was essentially controlled by the hydrographic changes produced as a result of retting. The population density and the species diversity of the benthic fauna were low in the retting zone while a higher species diversity and density were observed in the marginal and clean zones. The reduction in the population of the retting ground was the adverse effect of decades of retting activity and the consequent pollution of the region by the retting leachlets.

INTRODUCTION

Retting of coconut husk is the basic process involved in the production of coir and coir goods which is one of the most popular traditional occupations in the coastal areas of Kerala. Coconut husk retting is considered as one of the important sources of pollution in the Cochin backwaters. As a result of retting, large quantities of organic substances including pectin, pectosan, fat, tannin and also toxic polyphenols are liberated into the ambient water by the activity of bacteria and fungi. The term 'retting' is a technical form of the word 'rotting' and designates the process of decomposition of the tissues surrounding the vegetable fibres (Nathawal, 1967). All these processes contribute to pollution of water and air, highly turbid greyish water and mercaptan-like smell pervade the yards and nearby areas. This is reported to have a devastating effect on flora and fauna.

One of the major features of animal communities is their diversity, which varies from one environment to another. A diversity index is a measure of the way in which individuals in an ecological community are distributed among species. Various theories based on time (Fischer, 1960; Simpson, 1964), spatial heterogeneity (Simpson, 1964), competition (Dobzhansky, 1950; Williams, 1964), predation (Paine, 1966) and productivity (Cornell and Orias, 1964) have been proposed to explain the differences in animal diversity in various environments.

The present paper deals with the impact of pollution due to coconut husk retting on the abundance and species diversity of benthic macrofauna.

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Material and Methods

The benthic samples were taken fortnightly from four selected stations located in the Cochin backwaters (Fig. 1) for a period from April to September, 1988 using a Van Veen grab having an effective sampling area of 0.04 m^2. Station I (60 cm deep) was a retting well located in an intensively polluted area, from where the retted husks are regularly removed. Station II (60 cm deep) was one of the retting wells from where the retted husks have already been removed (both located at Chittoor). Station III with a depth of 1 m was in the marginal zone located 1 km south of the retting zone. In order to compare the intensity of pollution due to retting Station IV, 5 km south of Chittoor in an unpolluted area (reference zone) was selected. The grab contents were screened through a 0.5 mm sieve and the residue was preserved in 5% neutral formalin with rose bengal stain for further analysis. For the comparison of values, the number of animals per haul was converted into number per 0.1 m^2. The biomass of organisms was measured by weighing the organisms after removing the external water and emptying the water from cavities (Crisp, 1971). Biomass values are presented as wet weight (g/m^2). The Shannon's diversity index (Odum, 1963) had been applied to study the species diversity of benthic fauna.

Results and Discussion

The major macrobenthic groups observed during the present investigation were polychaeta, crustacea and mollusca. The distribution pattern of the benthic population at retting zone showed considerable quantitative and qualitative variations. The minimum density of animals was found at Station I, the intensively polluted area, and the

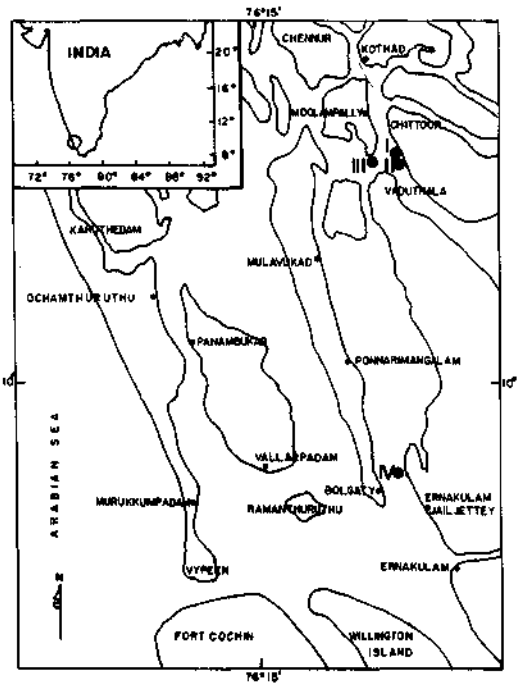

Fig. 1. Map of the study area showing the sampling stations.

maximum at Station IV, the clean zone. Altogether 37 taxa were identified during the sampling period. These included 15 species of polychaetes, 14 species of crustaceans, 4 species of molluscs, two species of sipunculids and one species each of nematod and fish. Only one species of polychaete was observed from the intensively polluted station, whereas 10 species were identified from the reference zone. Six species of polychaetes viz., *Branchiocapitella* sp., *Scyphoproctus djiboutiensis, Dendronereis aestuarina, Prionsopio polybranchiata, Nereis* sp. and *Ancistrosyllis constricta* were distributed in stations II - IV. Crustaceans were mainly represented by amphipods, isopods, tanids, cumaceans and decapods. Amphipods were relatively more abundant at Station III and IV. Altogether four species, *Corophium triaenonyx,*

Quadriviso bengalensis, Melits zeylanica and caprellids were recorded from Station III and IV. Isopods and cumaceans were completely absent in Station II. Among the tanids, *Apseudes chilkensis* was encountered in stray numbers at station II of the retting zone during monsoon. Of the four species of molluscs collected, *Nuculana mauritiana* and *Arca* sp. were recorded from Station II. Molluscs and crustaceans were completely absent in Station I.

The decreasing trend in the benthic fauna from Station IV to Station I shows the adverse effect of the intensity of pollution of the habitat due to retting process. Though the substratum at the retting zone was suitable for polychaetes and crustaceans, their scarcity in the area may be due to the accumulation of organic material, high sulphide content and anaerobic conditions in the bottom deposit. Unnithan *et al.* (1975) and Remani (1979) also reported that the accumulation of organic material beyond the tolerance level affects the survival of crustaceans with a consequent reduction in their number at selected areas in Cochin backwaters.

The total biomass from different zones showed considerable variations. The maximum biomass was recorded from the reference zone (Station IV) where the monthly values ranged from 1.7 (July) to 183.13 g/m^2 (June), and the minimum from the Station I of the retting zone (0 to 1.0 g/m^2). The main reason for the increase in biomass at Station IV was the occurrence of large numbers of amphipods and isopods during the month of June.

The diversity index (H) values obtained for polychaetes and crustaceans, the dominant groups in the bottom fauna from all the four stations are given in Tables 1 & 2. In general the diversity values were low in the retting zone when compared with marginal and reference zones. The diversity index of bottom fauna remained as zero throughout the study period in Station I as crustaceans were completely absent and only one species of polychaete was recorded from this region. The diversity index values of polychaetes in Station II ranged from 0 to 1.271; Station III from 0 to 1.735 and station IV from 0.6365 to 2.00034. While the diversity index of crustaceans varied from 0 to 0.898 in Station II, it varied from0 to 1.831 in Station III and 0 to 1.600 in Station IV.

Diversity is at a minimum when all the individuals belong to the same species, and at a maximum when the individuals belong to different species. The diversity values for both polychaetes and crustaceans were low in the retting zone when compared to the marginal and clean zones. The 'H' values for polychaetes at Station I (0 throughout) and II (0 to 1.271) in the retting zone were lower than those of other stations in the marginal and reference zones, thus highlighting the prevailing lower number of species as well as individuals. A large number of species is the reflection of a mature biological community which is under minimum stress. The lower diversity observed in the retting area highlights the intensity of the pollution caused by retting process. In the present study it is seen that the anoxic, stressed conditions prevailing in the retting ground resulted in the reduction of the number of species of polychaetes and crustaceans and had converted the area into a barren noxious biotope.

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TABLE 1. *Species diversity of polychaetes*

Sampling Date	Station I			Station II			Station III			Station IV		
	N	n	H	N	n	H	N	n	H	N	n	H
19. 4. '88				63	3	1.056						
11. 5. '88	0	0	0.00	42	3	0.835	30	2	0.637	35	2	0.683
19. 5. '88				166	6	1.020						
6. 6. '88	0	0	0.00	120	3	0.721	163	6	1.51	25	3	0.974
21. 6. '88	0	0	0.00	20	1	0.000	15	1	0.00	25	3	1.055
13. 7. '88	20	1	0.00	100	3	0.898	165	5	1.487	70	5	1.400
28. 7. '88	0	0	0.00	65	4	1.271	70	1	0.00	220	7	1.777
10. 8. 88				60	3	0.824	190	4	1.371	30	2	0.637
22. 8. 88	102	1	0.00	15	2	0.637	90	6	1.735	160	4	1.220
7. 9. 88	0	0	0.00	10	2	0.693	155	3	0.699	305	9	2.000
29. 9. 88				45	2	0.349	165	3	1.010	98	5	1.359

N - Polychaete population density, n - number of species, H - Species diversity.

TABLE 2. *Species diversity of crustaceans*

Sampling Date	Station I			Station II			Station III			Station IV		
	N	n	H	N	n	H	N	n	H	N	n	H
19. 4. '88				7	1	0.000						
11. 5. '88	0	0	0.00	0	0	0.00	20	1	0.000	406	6	1.381
19. 5. '88				0	0	0.00						
6. 6. '88	0	0	0.00	50	3	0.398	1110	11	1.831	7323	7	0.955
21. 6. '88	0	0	0.00	0	0	0.000	520	4	0.851	2191	5	0.219
13. 7. '88	0	0	0.00	40	1	0.000	300	6	1.589	160	6	1.600
28. 7. '88	0	0	0.00	150	1	0.00	160	3	0.777	185	2	0.343
10. 8. 88				90	2	0.531	500	5	0.731	200	2	0.693
22. 8. 88	0	0	0.00	45	1	0.00	900	2	0.657	70	1	0
7. 9. 88	0	0	0.00	0	0	0.00	835	5	1.194	229	5	1.125
29. 9. 88				40	2	0.562	190	2	0.547	201	4	0.511

N - Crustacean population density, n - number of species, H - Species diversity.

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