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Benthic Communities in the Areas under and around the Fish-Culture Rafts at the Kuala Trengganu River Estuary, Malaysia

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Abstract

Macrobenthos communities at the Kuala Trengganu River estuary, Malaysia were studied. Faunal composition and species diversity were analyzed. Community types were determined by similarity and cluster analyses, and species diversity was expressed through calculated information statistics of grabbed samples. The community in the area under the fish-culture rafts which was predominated by *Tharyx* sp. was controlled by sedimentary pollution, and other communities around them may have been controlled by some biotic or physical environmental factors.

It has been demonstrated that the species composition and species diversity of a benthic community have correlations with environmental elements (Yamamoto, 1954; Thorson 1955; Nakao, 1977, 1979, 1982: Kagawa, 1980; Li and Nakao, 1985). Of several good indicators of water and sedimentary pollution, the species diversity of a benthic community is an especially good one (Wilhm, 1972).

The object of this study is, therefore, to demonstrate the presence of sedimentary pollution of the area under the fish-culture rafts at Kuala Trengganu River estuary through analyses of the species composition and species diversity of the benthic community.

Materials and Methods

Benthos samples were collected with a small Smith-McIntyre grab sampler with 1/20 m^2 in sampling area at five stations (Fig. 1), on 28 October 1986. Grabbed contents were washed through a sieve with a 1 mm mesh. All animals retained on the mesh were preserved in 5% formalin solution, identified into species, and then counted individually.

Morisita's similarity index (Morisita, 1959) was applied to measure the similarity among the samples and the group average method was adopted for classifying the samples into groups of similar samples (Mountford, 1962).

Species diversity is expressed as the Shannon-Wiener information statistic (Pielou, 1966).

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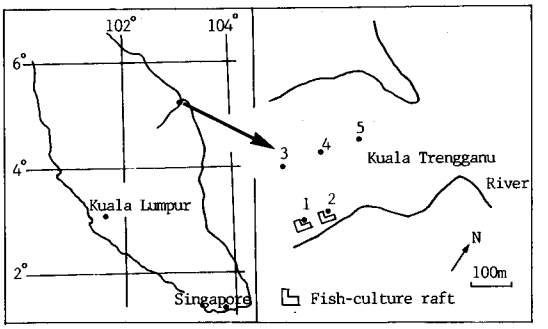

Fig. 1. Location of sampling sites at Kuala Trengganu River estuary, Malaysia.

Results and Discussion

A total of 34 species was collected in this study (Table 1). The population was composed of 24 species of polychaetes, 4 species of molluscs, 4 species of amphipods, and 1 species of both echinoderm and nemertinea. Of these, the most abundant species was polychaete *Tharyx* sp. belonging to the Family Cirratulidae. It occurred abundantly at St 1 and St 2, but rarely at the other stations. The sedentary polychaete *Paraprionospio pinnata* was distributed at all stations in small numbers. One of the Family Amphiomidae occurred abundantly at St 2 and St 5, and *Nereis* sp. and an unidentified polychaete were the numerically dominant species at St 4.

In previous studies the sedentary polychaetes, *Tharyx pacifica* which is a very closely related species to *Tharyx* sp. collected in this study, and *P. pinnata* have been pointed out to occur in muddy sediments with rich organic content in Japanese coastal areas (Kitamori, 1963; Kagawa, 1980; Fuji et al., 1980). In this study *Tharyx* sp. was more abundant at the stations under the fish-culture rafts but *P. pinnata* was widely distributed in the study area.

If the nature of a few samples taken from broad areas are very similar to one another in their species composition and individual numbers, it may be considered that these samples are extracted from the same community type. The spatial extent of these samples, therefore, may be deemed as that of the same community type. Along the same lines, the differences in species composition and spatial extent of communities may be caused by the differences in the biotic or physical environmental factors.

To obtain the benthic community types based on the classification of the samples in this study area, indices of similarity were calculated by the formulae of Morisita (1959) and Mountford (1962) described above and are shown in Fig. 2 as a trellis diagram and Fig. 3 as a dendrogram respectively.

Comparison of species and their individual compositions between samples at St 1 and St 2 showed high similarity. Therefore, these communities under the fish culture rafts were considered to be of the same community type. Comparison of St 3 and St 5 indicated a mere similarity but this cluster was not similar to the cluster of St 1 and St 2. St 4 was not similar to the other clusters.

The community under the fish-culture rafts, which was predominated by *Tharyx* sp. was not similar to other communities (Fig. 3). It may be considered that

Table 1. Individual numbers of macrobenthons per 1/20 m² at Kuala Trengganu River estuary.

Species	station				
	1	2	3	4	5
Amphiomidae	7	13	—	—	21
Phyllodocidae	—	1	—	—	—
Sigambra sp.	—	1	2	0	1
Nereis sp.	—	—	—	16	1
Platynereis bicanaliculata	—	2	—	—	—
Glysera alba ?	—	—	1	1	—
Eunice sp.	—	—	—	1	—
Marphysa sp.	—	1	—	—	—
Lumbrineris acuta	—	—	—	1	—
Lumbrineris sp.	1	—	—	—	—
Paraphonospio pinnata	4	3	4	2	9
Spio sp.	—	—	—	2	—
Spionidae	—	—	—	—	1
Cirriformia tentaculata	1	1	—	—	—
Tharyx sp.	118	102	—	—	4
Cossura sp.	—	—	1	—	—
Pherusa s6.	—	—	—	1	—
Sternaspis scutata	—	—	—	—	6
Notomastus latericeus	—	—	—	2	1
Euclymene sp.	1	—	—	—	1
Owenia sp.	—	—	1	—	—
Ampharete sp.	—	—	—	1	—
Lysilla sp.	1	3	—	—	—
Unidentified polychaete	—	—	—	12	1
Macoma sp.	—	2	—	—	—
Solen sp.	—	—	1	—	—
Phacosama laminata ?	—	1	—	—	—
Gastropodae	—	1	—	—	—
Gammaridae	—	—	—	1	—
Caprella sp.	—	—	—	1	—
Mysidae	—	—	—	1	—
Hermit crab (Paguridae ?)	—	—	3	—	1
Ophiuroidae	—	—	—	—	2
Nemertinea	—	—	2	—	—
Number of species	7	12	8	13	12

	1	2	3	4	5
1					
2	0.998				
3	0.018	0.020			
4	0.003	0.003	0.088		
5	0.099	0.262	0.335	0.104	

Fig. 2. Trellis diagram showing similarity index (Morisita's index) between pairs of samples collected.

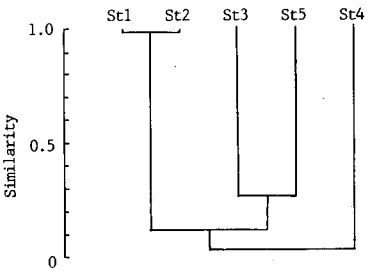

Fig. 3. Plot of result of the cluster analysis as a dendrogram.

Table 2. Diversity H′ of benthic communities.

	Station				
	1	2	3	4	5
Diversity H′	0.74	1.37	2.79	2.71	2.63

there were some differences in environmental factors between the areas under the fish-culture rafts and those around them. Kagawa (1980) showed that under the fish-culture rafts in the Seto Inland Sea, Japan, communities predominated by *P. pinnata* were distributed on the bottom which had high organic content. In the present study area, however, *P. pinnata* was widely distributed in small numbers but no community predominated by *P. pinnata* occurred.

Also, St 1 and St 2 showed the lowest values in diversity indices, being 0.74 and 1.37 respectively, and St 3 showed the highest value, being 2.79. The St 4 and St 5 values were significantly higher than those of St 1 and St 2 (Table 2). The community under the fish-culture rafts showed a remarkably low diversity value while the other communities indicated higher values.

The diversity index tends to be low in benthic communities in the polluted areas (Wilhm, 1972) and high in biologically controlled communities (Odum, 1961; Sanders, 1968). Though not actually analyzed, the bottoms at St 1 and St 2 were muddy sediments with smell of rotten eggs (H_2S). Therefore, considering the bottom characteristics and the very low diversity index, the sediments of these stations under the fish-culture rafts may be polluted. It is guessed that the bottoms may be polluted by excretory debris of the cultured fish and uningested food. The other stations had sandy-mud bottoms; these communities with high diversity values may not be affected by sedimentary pollution.

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