Spatial Distribution Pattern of Macrobenthos in East Johor Straits

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ABSTRACT

This paper discusses the distribution and composition patterns of macrobenthic communities at the eastern end of the Johor Straits. Sediment samples were collected using a ponar grab (mouth area 0.025 m^2) at 5 selected stations adjacent to Tg. Pengelih. The macrobenthic community in this study area comprised a various phyla of invertebrates, including 30 families of polychaetes, 6 taxas of crustaceans, 3 families of bivalves, 2 families of echinoderms and 1 family of each peanut worm (Sipunculid) and ribbon worm (Nemertina). Total macrobenthos from all stations ranged between 1104 to 1624 individuals/m^2. The polychaete worms were the most dominant group that contributed 55% to 78% of the total macrobenthos. The crustacean was the second dominant group, which contributed about 11% to 40%, followed by molluscs with 1% to 11%. The other groups contributed only about 1% to 2%.

ABSTRAK

Artikel ini membincangkan corak taburan dan komposisi komuniti bentik di perairan timur Selat Johor. Sampel-sampel sedimen diambil menggunakan pencekup Ponar (luas bukaan 0.025 m^2) di 5 stesen yang terletak berhampiran Tg. Pengelih. Komuniti makrobentik di kawasan ini terdiri daripada pelbagai filum invertebrata. Ini termasuklah 30 famili poliket, 6 taksa krustasea, 3 famili molluska 2 famili ekinoderm dan masing-masing 1 famili sipunculid dan nemertina. Jumlah makrobentos yang diperolehi daripada semua stesen berjulat antara 1104 hingga 1624 individu/m^2. Cacing poliket merupakan kumpulan yang paling dominan yang menyumbang sebanyak 55% hingga 78% daripada keseluruhan makrobentos. Kumpulan yang kedua dominan adalah krustasea yang menyumbang sebanyak 11% hingga 40%, diikuti oleh molluska sebanyak 1% hingga 11%, manakala kumpulan selebihnya hanya sebanyak 1% hingga 2%.

Introduction

Benthos is a group of animals that live in the sediment or crawling on the surface of the seafloor. These animals that are bigger than 0.5 mm in body size are classified as macrobenthos (Knox, 2001). They feed either by ingesting the sediment or filtering the suspended materials available in the water column. Two interrelated groups of organisms can be found associated with the benthos. The first group is the infauna. These organisms live within the substrate and either feed within the sediment or on the surface. The second are epifauna that are organisms typically living on the seafloor. The macrobenthos population is therefore are closely related to the sediment texture and stability and water movement within the area they live in (McLusky & McIntyre, 1988). The seabed within the study area is considered as soft substrate and comprises a mixture of mud (silt and clay) and sand.

The coastal water of Tanjung Pengelih is demarcated by a narrow Calder Harbour separating it from Pulau Tekong of Singapore. Along this Carder Harbour, the coastline is heavily vegetated by a thick mangrove forest fringe interconnected with a complex network of mangrove creeks that extend from Sg. Lebam, Sg. Belungkor and Sg. Santi on the eastern side of Johor Straits. This narrow channel is also subjected to a busy navigation channel related to heavy downstream industries in Pasir Gudang, Johor and Sembawang, Singapore, tourism and strategic security activities carried out by Malaysia and Singapore. Despite potential marine environmental stress due to such activities, the information about marine biota from this area has rarely been published. In this paper the status of benthic communities in terms of the distribution and composition pattern from the eastern end of the Johor Straits was evaluated.

Methodology

Five stations were selected to describe the existing benthic environment of the study area (Figure 1). Sediment samples were collected using a ponar grab (mouth area 0.025m^2). The sediment samples were gently washed and screened through a 0.05mm mesh size sieve. The benthic organisms retained on the sieve were preserved in 4% buffered formalin in seawater before they were brought to the laboratory. In the laboratory they were washed and sorted into major phyla and fixed into 70% alcohol. The specimens then were sorted into the major groups before being identified up to family level. Analysis on the population was carried out using Microsoft Excel to calculate the diversity and evenness indices. The Shannon Weiner diversity index and Pielou Evenness index were calculated using the following formula (Magurran, 1983).

Shannon Weiner (H') $= -\Sigma n_i/N \log_2 n_i/N$

Where: n_i = number individuals of i

N = Total number of individual in sample

Pielou index (J) $= H'/Ln\ S$

Where: H' = diversity index

S = number of family (taxa)

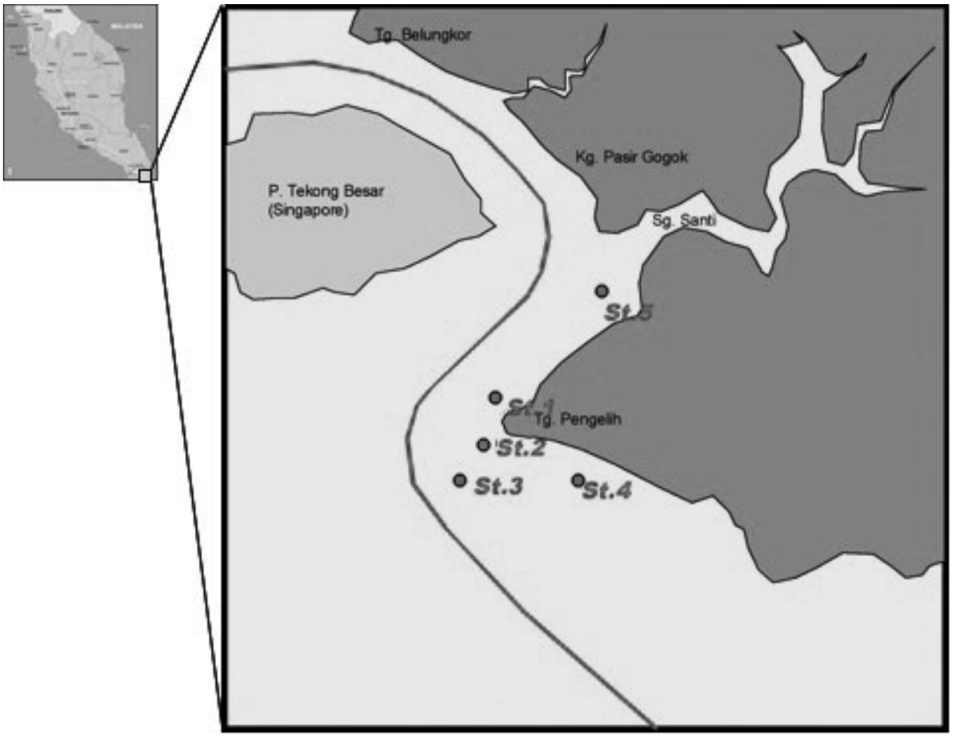


FIGURE 1. Map of South East Johore showing the study sites

Results

Most of the animals were identified up to family level and the abundance of each family and taxa is summarized in Table 1. The macrobenthic community found in this study area comprised of various invertebrate phyla. A total of 30 families of polychaetes, 6 taxas of crustaceans, 3 families of bivalve Molluscs, 2 families of echinoderms and 1 family each of peanut worm (Sipunculid) and ribbon worm (Nemertina) were identified. The results showed that the benthic habitat of Tanjung Pengelih and its surrounding area (Stations 1, 2 and 3) did not differ much in abundance of total macrobenthos compared to Sungai Santi river mouth (Station 5). Total macrobenthos counted at Stations 1, 2, and 3 were 1104, 1360 and 1200 individuals/m^2 respectively, while Station 5 recorded 1288 individuals/m^2. However, a higher abundance was recorded at Station 4 that was located near Tanjung Merak with a total of 1624 individuals/m^2.

At all stations, polychaete worms were the most dominant group that contributed about 55 to 78% of total macrobenthos (Figure 3). The percentage of polychaetes was almost similar at Stations 1 – 4 while their contributions were much higher at Station 5. The crustaceans were the second dominant group with a contribution of about 11% to 40%, followed by molluscs with 1% to 11%. The remaining groups contributed only about 1% to 2%. In terms of diversity, Station 1 and 3 had the lowest number of families (24 and 25 taxa) while Stations 2 and 4 had 30 and 31 families respectively.

TABLE 1: Composition and Density of Macrobenthos (Individuals/m^2)

Family/Taxa	St 1	St 2	St 3	St 4	St 5
POLYCHAETA					
Amphinomidae	0	0	0	0	8
Capitellidae	192	136	96	232	256
Cirratulidae	32	72	88	72	136
Cossuridae	8	0	0	8	8
Eunicidae	0	24	16	16	0
Flabelligeridae	0	8	24	0	0
Glyceridae	56	0	0	8	16
Goniadidae	0	0	0	8	0
Hesionidae	0	8	8	0	8
Lacydoniidae	0	8	0	0	0
Lumbrineridae	64	80	64	48	136
Lysaretidae	0	0	0	8	8
Magelonidae	0	0	0	8	0
Maldanidae	0	104	16	120	24
Neptyidae	0	16	0	24	16
Nereididae	0	0	8	8	0
Onuphidae	8	24	16	0	16
Opheliidae	8	8	0	0	0
Orbiniidae	0	24	16	40	16
Paraonidae	24	64	64	176	32
Phyllodocidae	8	8	0	8	0
Pilargidae	24	16	8	8	16
Poecilochatidae	0	0	0	0	16
Polynoidae	8	0	0	0	0
Sigalionidae	0	0	0	0	16
Spionidae	32	64	40	48	144
Sternaspidae	16	32	0	56	8
Syllidae	168	32	160	32	88
Terebellidae	0	8	8	8	16
Trichobranchidae	8	16	0	8	16
Subtotal: Polychaeta	**656**	**752**	**632**	**944**	**1000**
CRUSTACEA					
Amphipod	176	344	216	312	88
Apseudidae	56	96	56	104	72
Gonaplacidae	0	8	16	0	16
Isopoda	48	32	40	64	24
Pasiphaeidae	0	0	8	0	8
Bodotridae	48	64	56	48	56
Subtotal: Crustaceans	**328**	**544**	**392**	**528**	**264**
MOLLUSCA					
Nuculanidae	0	0	0	24	0
Tellinidae	48	16	128	8	16
Veneridae	8	16	8	24	0
Subtotal: Molluscs	**56**	**32**	**136**	**56**	**16**
OTHERS					
Amphiuridae	16	8	0	0	0
Ophiucomidae	0	0	0	32	0
Sipuncula	32	8	16	48	8
Nemertea	16	16	24	16	0
Subtotal: Other groups	**64**	**32**	**40**	**96**	**8**
Total no. of individuals	**1104**	**1360**	**1200**	**1624**	**1288**
Total no. of family (taxa)	**24**	**30**	**25**	**31**	**29**
Shannon Wiener diversity index (H')	**3.85**	**4.01**	**3.95**	**3.96**	**4.05**
Evenness index (J)	**1.21**	**1.18**	**1.23**	**1.15**	**1.20**

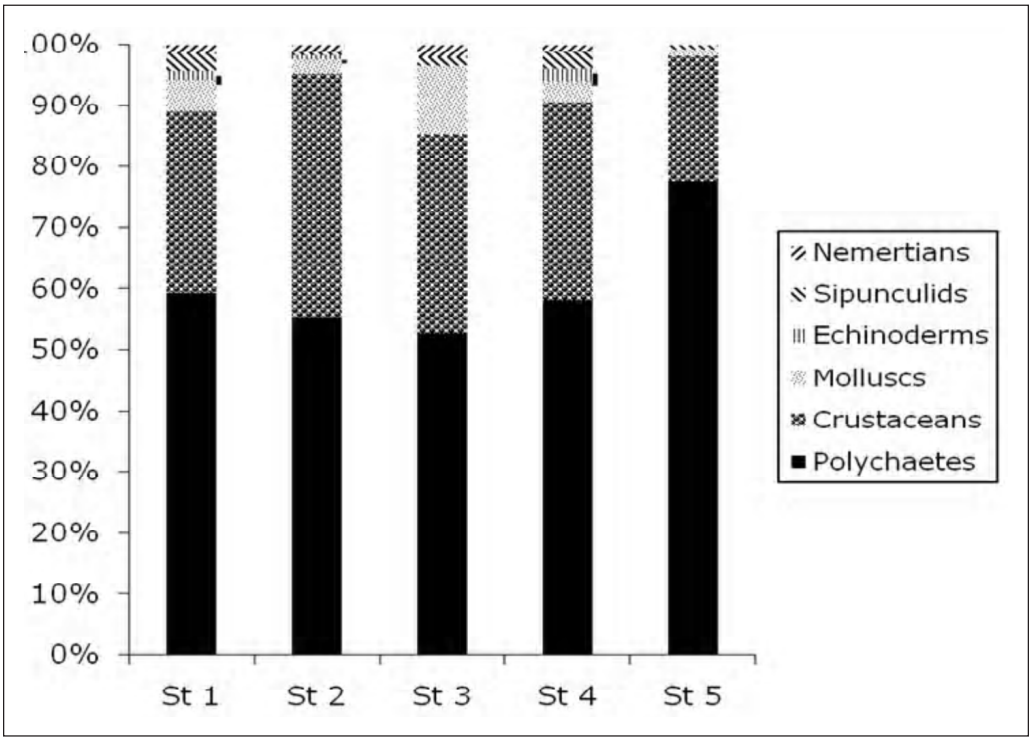


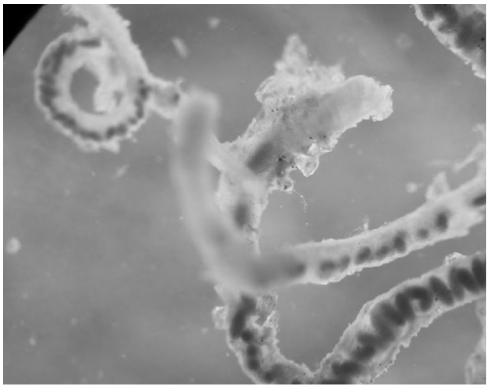
FIGURE 2: Percentage for Major Groups of Macrobenthos at Each Station

The Shannon-Weiner diversity index calculated from all stations was generally high with a small ranged of values between 3.85 and 4.05.

Among the polychaetes, the most dominant group was deposit feeders such as Capitellidae, Cirratullide and Spionidae (Figure 3), with a contribution of more than two-third of the total polychaetes. A similar pattern could be applied to all stations. Most of the crustacean was gammaridean amphipods that represented more than half of the total crustaceans. Other groups were apseudid tanaidacean and small benthic crabs (Gonaplacidae). Phylum Mollusca was only represented by small bivalves, such as tellinids and venerids. Other groups of invertebrates, found in less significant numbers, were infaunal brittlestar and unsegmented marine worms (sipunculids and nemertians).

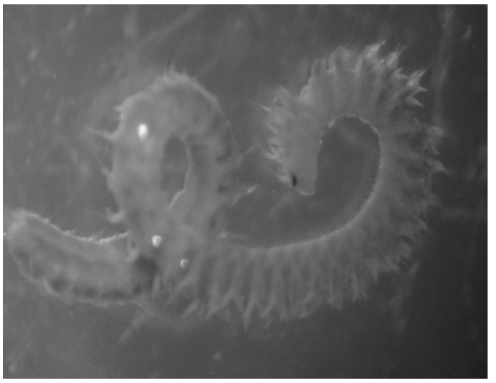
Discussions

The abundance and composition patterns of macrobenthos found during this study generally follow a similar trend as shown in the previous studies by UKM Pakarunding 2002 and Nabilah (2007) conducted in the East Johor Straits (Selat Tebrau) and South Johor. Our data revealed the homogeneity in abundance and species (taxa) composition. In many

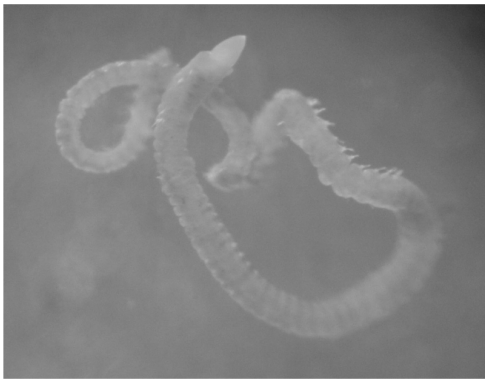


Capitellidae

Cirratullidae



Spionidae



Lumbrinereidae

FIGURE 3: Photographs of the Most Abundant Polychaete Worms from the Study Area

cases, Thompson and Lowe (2004) noted that the species composition and abundances of each assemblage primarily reflected responses to the estuarine salinity gradient and differences in sediment type. They believed that the species composition and abundances of each assemblage tended to be temporally consistent, but the spatial distribution of some assemblages changed in response to increased freshwater inflows. Our results showed that all stations, particularly those located in the Sg. Johor estuarine basin comprising Sg. Santi and a small channel adjacent to Tg. Pengelih were characterised by similar assemblages. Less significant spatial variation in this estuarine area was probably due to insignificant variation of salinity gradient.

The presence of a higher number of deposit feeder animals might be due to the general texture of the seabed in this area, which was muddy sediment. The domination of polychaetes has been reported in many studies conducted in mangrove estuaries and coastal areas (Maurer & Vargas, 1984; Alongi, 1990; Hutchings, 1998). Hutchings (1998) added that these worms were well represented in this ecosystem both in terms of number of individuals and species. However, they exhibited considerable variations in recruitment in both time and space, which were often reflected in adult distributions.

In a previous study conducted in Singapore's side of the Johor Straits, Lin (2003) found that soft-bottom showed some seasonal changes in the abundance and diversity of macrobenthic fauna. The lowest values were recorded in December but gradually changed in composition pattern. Seasonal changes were also reported by Lotfi *et al*. (1994) during a biannual monitoring in South China Sea (Pulau Redang).

Acknowledgement

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