Malaysian Journal of Science **24**: 133 - 138 (2005)

A Preliminary Study of the Macrofauna of Sandy Shore and Mangrove Forest of the North East Coast of Langkawi

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ABSTRACT This study reports on the macrofauna (epifauna and infauna) of two sandy shores (Burau Bay and Tanjung Rhu) and a mangrove forest (Tanjung Rhu). A total of sixty taxa were recorded from both the sandy shores and the mangrove forest. Burau Bay Beach recorded 25 taxa, Tanjung Rhu mangrove forest recorded 23 taxa while Tanjung Rhu Beach recorded 22 taxa. Soil water salinity and pH was quite similar from the beach as well as the mangrove forest but there was appreciable difference between percent soil organic content from the beach habitats to that of the mangrove forest, being higher in the latter. The beach fauna mainly comprised of polychaetes, bivalves and gastropods while that of the mangrove forest was dominated by crustaceans and three species of gastropods

ABSTRAK Kajian ini malaporkan makrofauna (epifauna dan infauna) di pantai pasir (Burau Bay dan Tanjung Rhu) dan hutan bakau (Tanjung Rhu). Sejumlah enam puluh taxa di sampel dari kedua -dua pantai pasir dan hutan bakau. Burau Bay mencatat 25 taxa, hutan bakau Tanjung Rhu mencatat 23 taxa manakala pantai pasir Tanjung Rhu mencatat 22 taxa. Kemasinsn air dan pH tidak berbeza bagi pantai pasir dan hutan bakau tetapi peratus kandungan organik dari pantai pasir adalah kurang dari hutan bakau. Organisma pantai pasir didominasi oleh poliketa, bivalvia dan gastropoda manakala organisma dari hutan bakau didominasi oleh krustasea dan tiga sepsis gastropoda.

(macrofauna, epifauna, infauna, mangrove, sandy shore

INTRODUCTION

Pulau Langkawi is well known for its coastal tourist industry and its duty free status. The progress of tourism development with high tourist arrivals has brought about an increase in foreign exchange earnings for Malaysia and at the same time an increase in the social mobility of the islanders. Such a progress is however not without costs, for it may impact ecological processes of the sensitive marine and coastal habitats. Coastal habitats are recognized as feeding, breeding and nursery grounds for fish, prawns and crabs [1, 2, 3, 4, 5, 6 and 7].

Notwithstanding the relatively large expanse of mangroves on the north eastern section of Langkawi Island (Kilim, Kisap and Air Hangat), there is paucity of studies on the biodiversity of its coastal habitats and their ecological as well as economic importance. Most reports are unpublished Environmental Impact Assessment (EIA) studies related to coastal developments. A recent study is that by Norhayati and Latiff [8] who reported on the mangrove floristic composition and the biomass of the Kisap Mangrove Forest Reserve.

The present study involves determining the macrofauna of sandy as well as mangrove shores and is part of a larger study to determine the biodiversity of Langkawi Island. Most studies on macrofauna have been limited to the mainland coastal habitats of Peninsular Malaysia [9, 10, 11, 12, 13, 14 and 15] but Berry [16] however determined the macrofauna of the sandy shore of north Penang.

Study Site

Benthic macrofauna were sampled at two sandy shore locations in Burau Bay (west) and Tanjung Rhu (northeast), and at Tanjung Rhu Mangroves (northeast) at the mouth of Sungai Padang (a tributary of Sungai Air Hangat) (Figure 1). Tanjung Rhu Beach is located adjacent to the Tanjung Rhu mangrove forest. Sampling at Burau Bay Beach was done to compare the macrofauna to that at Tanjung Rhu Beach.

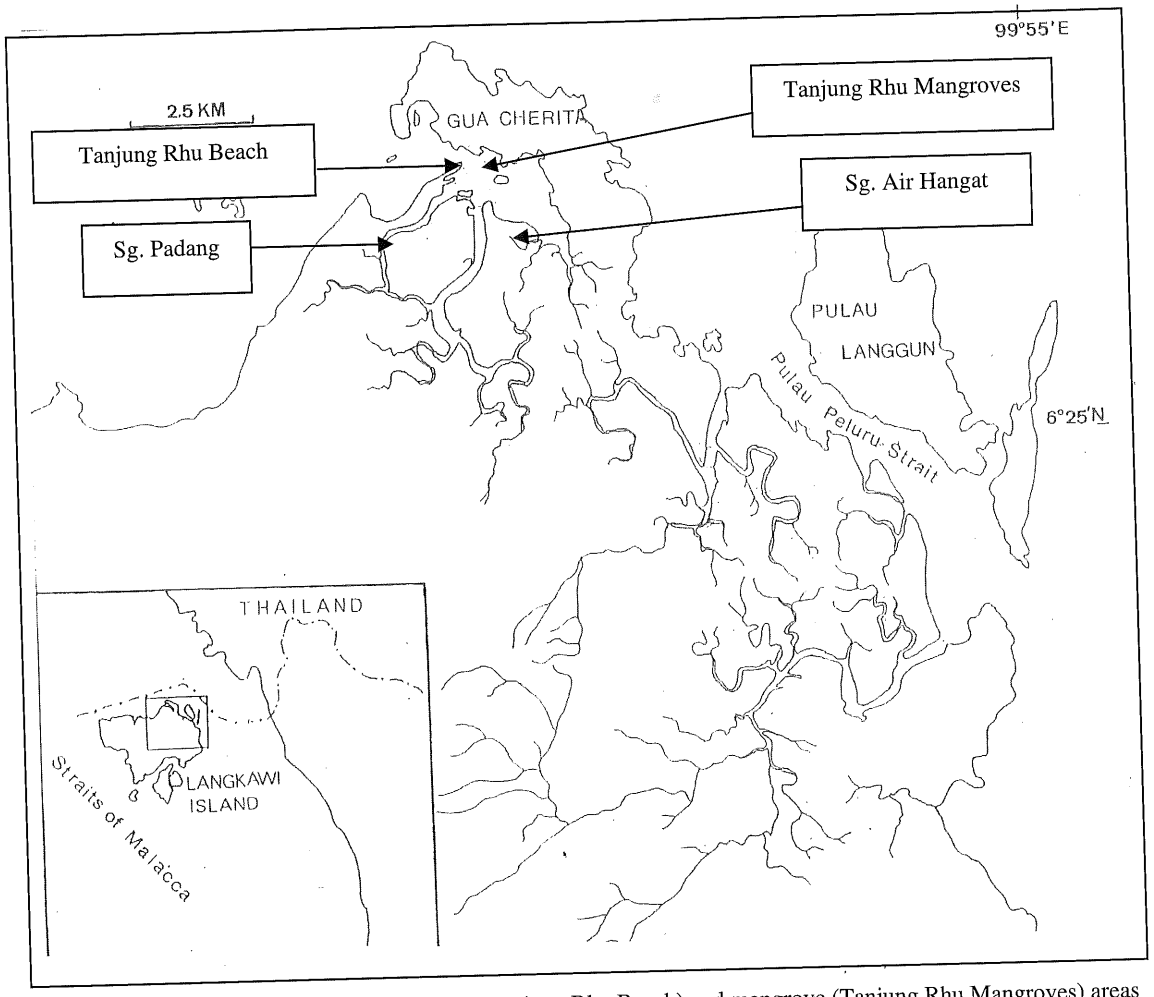

Figure 1. Map showing study sites for beach (Tanjung Rhu Beach) and mangrove (Tanjung Rhu Mangroves) areas

MATERIALS AND METHODS

Macrofauna Sampling

The quadrat method was employed to determine the density of the epifauna and infauna down to a depth of 20 cm. At each sampling station two 50 cm X 50 cm quadrat samples were taken. Mud and sand samples collected were then sieved through a 2 mm mesh. All sampled infauna and epifauna were preserved in 5% buffered formalin and later identified in the laboratory to the lowest taxon level.

At Tanjung Rhu Beach, ten quadrats each placed 10 m apart were taken from the upper shore to the lower shore covering a total distance of 110 m. At the mangroves of Sungai Padang eight quadrats each placed 4 m apart were taken from the upper shore to the boundary of the mudflats covering a total distance of 32 m, while at Burau Bay Beach four sampling quadrats each placed 10 m apart were taken from the upper shore to the lower shore covering a distance of 30 m.

Physical and Chemical Parameters
Salinity (parts per thousand, ppt), temperature (^{O}C) and pH of soil were determined by a portable YSI meter.

Soil and Sand Organic Content
Organic content from sand and mangrove mud was determined by burning soil and sand sediments at 60°C for 24 hours in a muffle furnace, and recorded as percent (%) organic content.

RESULTS AND DISCUSSION

Physical and Chemical Parameters
The soil water salinity generally ranged from 23 ppt – 30 ppt at the beach habitats and 22 ppt – 29 ppt at the mangrove habitat. There was a larger range in temperature recorded in the mangrove habitat (32.2 °C – 37 °C) as compared to the beach habitats (Burau Bay beach: 30.1 °C – 32.3 °C; Tanjung Rhu Beach: 31.1 °C – 35.2 °C). pH was uniform for the beach habitats and the mangrove habitat. The soil organic content differed between beach habitats and mangrove habitat (mangrove: 0.6% – 1.6%; beach: 0.2% – 0.4%). However, the soil organic content from Tanjung Rhu Beach was higher to that measured at Burau Bay Beach (Table 1).

Macrofauna
A total of twenty-five and twenty-two taxa were recorded from Burau Bay Beach and Tanjung Rhu Beach respectively, while twenty three taxa were recorded from Tanjung Rhu mangroves (Table 2).

The density of the macrofauna was generally low for most taxa except for gastropods from the mangrove habitat and polychaetes from the beach habitats. The mangrove habitat was mainly dominated by crustaceans and three species of gastropods while the beach habitats were dominated by polychaetes, bivalves and gastropods.

Bivalves were sampled only from the beach habitats while the abundant crustaceans, *Uca rosea, Upogebia* sp. and *Xeropthalmus pinnotheroides* were sampled only in the mangrove habitat.

The gastropods, *Assiminea brevicula, Cerithidea cingulata* and unidentified *Cerithidea* sp. were abundant from the mangrove habitat (Table 2).

The diversity of the macrofauna recorded from the present study is relatively high but the density was however quite low for most taxa. This is perhaps due to the low sampling frequency rather than the status of the benthic fauna of the island. Nevertheless, the higher numbers of gastropods and crustaceans recorded from the mangrove forest show that it has higher secondary productivity as compared to the beach habitats. Chong [11] however showed that the sandy shore of Morib supported an abundant community of crustaceans, bivalves and polychaetes.

Higher energy inputs as primary production in communities tend to support larger secondary production [17]. Sarpedonti & Sasekumar [18] showed that there is a high density of diatom in the top 0.2 cm layer of mangrove sediments. The gastropods, *A. brevicula, C. cingulata* and *Cerithidea* sp. were abundant from the mangrove floor at Tanjung Rhu mangroves. These gastropods perhaps feed on the abundant diatoms and other algae thus supporting their larger numbers.

The higher organic content of the soil of the mangrove forest at Tanjung Rhu is perhaps related to the higher detritus content within the forest. The higher soil organic content of the Tanjung Rhu Beach as compared to Burau Bay Beach is perhaps related to detritus being flushed from the Tanjung Rhu mangrove forest by Sungai Padang and Sungai Air Hangat to the coastal waters.

The distribution and abundance of macrofauna on sandy and mangrove shores can be influenced by various factors such as grain size, organic content, beach slope, sand moisture, and density of bacteria in the sediment, food in the surf water and predator-prey relationships and competition. Determination of the above parameters would require extensive studies and perhaps could follow after the present study.

Table 1. Physical and chemical parameter readings measured at Burau Bay Beach, Tanjung Rhu Beach and at Tanjung Rhu Mangrove

GPS Reading	Burau Bay Beach 6° 21.780 ' N, 99° 40.270' E				Tanjung Rhu Mangroves Na							Tanjung Rhu Beach 6° 27.414 ' N, 99° 49.467' E									
Distance from reference point (m)	0	10	20	30	0	4	8	12	16	20	24	40	50	60	70	80	90	100	110	130	150
Salinity (ppt)	29.0	28.0	26.0	25.0	27.0	27.0	22.0	25.0	27.0	27.0	29.0	30.0	25.0	25.0	23.0	25.0	25.0	25.0	26.0	27.0	27.0
Temperature (°C)	30.2	30.1	na	32.3	37.0	36.3	34.5	35.3	35.1	35.8	32.2	33.7	33.6	33.1	35.2	34.7	34.0	34.2	34.0	33.7	33.5
pH	6.3	7.0	na	7.1	7.4	7.5	7.6	7.6	7.6	7.7	7.4	7.5	7.7	7.7	7.7	7.8	7.7	7.7	7.6	7.7	7.7
Soil Organic Content (%)	0.2	0.2	0.2	0.2	0.6	1.5	1.6	0.8	0.8	0.9	1.2	0.1	0.3	1.2	0.3	0.3	0.4	0.4	0.3	0.4	0.4

Ppt – parts per thousand
GPS – Geographical Positioning Satellite
Na – not available

Table 2 Macro fauna taxa sampled from three sampling stations in the North East of Langkawi Island

Taxa	Burau Bay Beach (no/m^2)	Tanjung Rhu Mangroves (no/m^2)	Tanjung Rhu Beach (no/m^2)
Crustacea			
Alpheus sp.			2
Anomura sp.	2	2	7
Brachyura sp.	9	1	
*Diogenes*sp.			5
Grapsidae sp.		1	
Matuta sp	1		
Ocypodidae sp.		3	1
Pilumnidae sp.		1	
Potamididae sp.		1	
Sesarmid sp.		1	
Shrimp sp.			1
Uca annulipes		1	
Uca rosea		21	
Uca sp.		1	
Bivalvia			
Bivalvia sp.			3
Gafrarium sp.			2
Glauconomidae sp.			1
Meretrix sp.			1
Marginellidae sp.			1
Nereididae sp.	6		
Oyster sp.	1		
Solenidae sp.			
Pisces			
Gobiid sp.			1
Sipunculoidea			
Phascolosoma sp.		1	
Others			

Uca sp.		1	
Upogebia sp.		8	
Xenopthalmus pinnotheroides		32	
Gastropoda			
Assiminea brevicula		26	1
Cerithidea cingulata		270	
Cerithidea sp.	7	157	4
Conus radiatus	1		
Cypreae erosa	1		
Estellacar olivacea		1	
Littoraria canifera		1	
Littoraria vespacea		1	
Littorina sp.	1		
Littorinidae sp.	1		
Nassarius sp.			7
Naticidae sp.	2		
Nerita albicilla	1		
Nerita sp.	1	1	
Polinices sp.			1
Strombidae	2		
Siphonaridae	8		
Thais sp.			2
Trochus sp.	1		
Turbinidae			
Turritellidae			
Veneridae	2		
Others			
Ribbon worm	1		
Sea pen			1
Architectonicidae	2		2
Hymenosomatidae			1
Cirrepedia			
Balanus sp.	3		
Tetraclita sp.	1		
Polycheata			
Nereis sp.	2	5	6
Lagisca sp.	1		
Polychaete sp.1	3		
Polychaete sp. 2	18	3	2
Holothuroidea			
Holothuroidea sp.			1
Number of Taxa	**25**	**23**	**22**

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Acknowledgements This study was made possible by funds and research facilities from University of Malaya and support from University Teknologi MARA.

REFERENCES

1. Chong, V.C. & A. Sasekumar. (2002). Fish communities and fisheries of Sungai Johor and Sungai Pulai Estuaries (Johor, Malaysia). *Malayan. Nat. J.*, 56(**3**): 279-302.
2. Chong, V.C., A. Sasekumar, M.U.C. Leh & R. D'Cruz. (1990). The fish and prawn communities of a Malaysian coastal mangrove system, with comparison to adjacent mudflats and inshore waters. *Est. Coast. Shelf Sci.* **31**: 703 –722.
3. Chong, V.C., A. Sasekumar & K.H. Lim. (1994). Distribution and abundance of prawns in a Malaysian mangrove ecosystem. In: Sudara, S., C.R. Wilkinson & L.M. Chou (eds.). Proc 3rd ASEAN-Australia Symp. Living Coastal Resources. Vol. **2**. Research Papers. pp. 437-445.
4. Sasekumar, A., M.U.C. Leh, V.C. Chong, R. D'Cruz & M.L. Audrey. (1989). The Sungai Pulai (Johor): A unique mangrove estuary. Proc. 12th Annual Seminar of the Malaysian Society of Marine Sciences, Kuala Lumpur. pp. 191-211.
5. Sasekumar, A., V.C. Chong, M.U.C. Leh & R. D'Cruz. (1992). Mangroves as a habitat for fish and prawns. *Hydrobiologia*, **247**: 195-207.
6. Singh, H.R. & A. Sasekumar. (1994). Distribution and abundance of marine catfish (Fam: Ariidae) in the Matang mangrove waters. In: Sudara, S., C.R. Wilkinson & L.M. Chou (eds.). Proc 3rd ASEAN-Australia Symp. Living Coastal Resources. Vol. **2**. Research Papers. pp. 471-477.
7. Singh, H.R. (2003). The biology of the estuarine catfishes (Fam: Ariidae) of the Matang Mangrove Ecosystem, Perak, Malaysia. PhD Thesis. Institute of Biological Sciences, University of Malaya. 334 p.
8. Norhayati, A. & A. Latiff. (2001). Biomass and species composition of a mangrove forest in Pulau Langkawi, Malaysia. *Malays. Appl. Biol.* 30(**1&2**): 75 – 80.
9. Chuang, S.H. (1961). On Malaysian shores. MWU Shosa, Singapore. 225 pp.
10. Berry, A.J. (1972). The natural history of the West Malaysian mangrove fauna. *Malay. Nat. J.* **25**: 135 – 162.
11. Chong, E.L. (1987). Macrofaunal distribution on a sandy shore. *Proc. 10th Annual Seminar Malay. Soc. Mar. Sci.* pp. 30 – 38.
12. Sasekumar, A. (1974). Distribution of macrofauna on a Malaysian mangrove shore. *J. Anim. Ecol.*, **43**: 51 – 69.
13. Sasekumar, A. (1980). The present state of mangrove ecosystem in Southeast Asiaa and the impact of pollution. South China Sea Fish. Dev. Coordinating Prog. (UNEP/FAO/SCS/80/94b).
14. Sasekumar, A. (1994). Meiofauna of a mangrove shore on the west coast of Peninsular Malaysia. *Raffles Bull. Zool.* 42(**4**): 901 – 915.
15. Zainal, Z.A. & A. Sasekumar. (1994). The macroinvertebrates in intact and cleared mangrove forest in Malaysia. In: Sudara, S., C.R. Wilkinson & L.M. Chou (eds.). Proc 3rd ASEAN-Australia Symp. Living Coastal Resources. Vol. **2**. Research Papers. pp. 433-436.
16. Berry, A.J. (1964). The natural history of the shore fauna of North Penang. *Malay. Nat. J.* 18(**2&3**): 81 – 103.
17. Campbell, N & J. Reece. (2002). Biology. 6th Edition. Benjamin Cummings.
18. Sarpedonti, V & A. Sasekumar (1996). The abundance of diatom species on a low shore mangrove forest, Sementa, Malaysia. Wallaceana, **77**: 21-26.