Sediment Accretion and Sedimentological Characteristics in a Tropical Estuarine Mangrove

Dept. of Civil Eng., Kagoshima University — Shahbudin Saad
Dept. of Sc. and Tech., Putra University of Malaysia — Lokman Husain
Dept. of Civil Eng., Kagoshima University — Toshiyuki Asano

1. INTRODUCTION

The understanding of sedimentary processes at various parts of mangrove areas is important because they influence environmental and other related processes. This aspect of sedimentology is very important to study because its directly related with the ability of the mangrove to maintain their position in an equilibrium stage in the coastal landscape. However, the sedimentary processes on Malaysian mangrove are not well studied. As a result, it is very difficult to describe its proper physical role in the environment. Realizing to this matter and having considered the potential of the mangrove in various aspects of the environment, research on sediment accretion and sediment characteristics must be considered vital. Detailed information concerning the sedimentological processes is important to coastal planners for the development of a proper planning guideline for mangrove. Thus this study attempts to gather physical data and information, especially on sediment accretion and sediments characteristics.

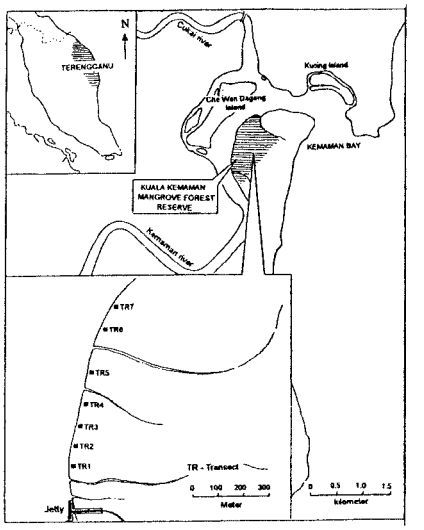

Figure 1 : Location of the Study Area

2. DESCRIPTION OF THE STUDY AREA

The study area is situated in the district of Kemaman (Lat. 4° 14' N, Long. 103° 25' E), approximately 170 km south of Kuala Terengganu (Figure 1). It is a mangrove forest reserve and occupied an area about 80.93 ha. Generally, the study area showed a gentle sloping profile seaward. The slope value ranges between 0.002 to 0.016. The slopes at the front mangrove (18 m from the water edge) of all transects are steeper compared to the other zones. The secondary data such as meteorological and runoff characteristics, rainfall, wind and tidal characteristics of the study area were also obtained.

3. MATERIALS AND METHODS

Generally, the study was conducted from September 1993 to August 1994 (first year) and from September 1994 to August 1995 (second year). The methodology applied in this work is based on measuring the thickness of a vertical sediment section divided by the time span necessary for its deposition and determining the sediment characteristics. Sediment grain size was analyzed using two different methods. Samples which consists of > 90% sand were analyzed using the dry sieving method. While samples having fine sediments > 10% were analyzed using the laser diffraction method. Samples were collected on a monthly interval basis during low tides. The grade scale characterized grain sizes in phi (Ø) units can be obtained by using the logarithmic transformation equation as follows: $\emptyset = -\log_2 d$, where d is the diameter of the grains in millimeters (mm).

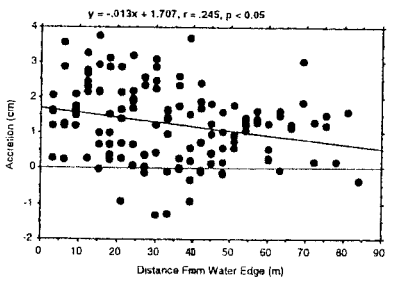

Figure 2: Accretion versus Distance from Mangrove Edge

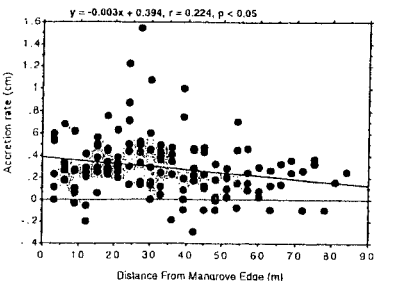

Figure 3 : Accretion versus Distance from Mangrove for the Monsoon Season

4. RESULTS AND DISCUSSION

The average accretion rate for the first and second year of study were found to be 0.66 cm/yr and 1.46 cm/yr respectively, while the average for the entire study period was 1.06 cm/yr. Accretion rate were found to be higher at the front mangrove and gradually becoming smaller towards the back mangrove. This trend was found to be true for both the monsoon and non-monsoon seasons (Figure 2, 3 and 4). Nevertheless, the accretion rate on the entire mangrove area was higher during the monsoon months compared to the non-monsoon months. The higher accretion at the front mangrove is related with the longer period of tidal submergence by the influence of high tide from estuary and rivers (Klien, 1986).

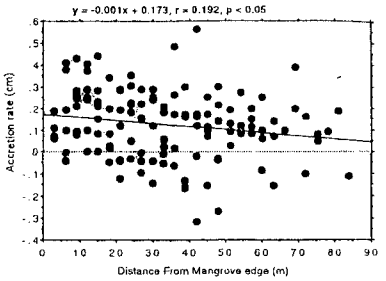

Figure 4 : Accretion versus Distance from Mangrove Edge for the Non-Monsoon Season

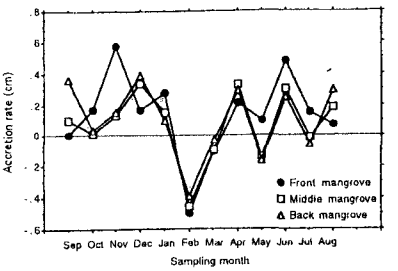

Figure 5 : Average Accretion (cm) for the Three Mangrove Zones

The front, middle and back mangrove showed the lowest accretion in February and high accretion in November and December (Figure 5). The high accretion rate during these months is probably caused by changes of hydrodynamic condition. The large amount of rainfall during these months is able to carry high concentration of suspended sediment to be deposited in the mangrove area. The low accretion in February is probably caused by the consolidation processes (Kennish, 1986).

Surface sediment of the Kemaman mangrove consists of sediment ranging from very fine sand to medium silt. This narrow size range may be due to a large amount of homogeneous sediment supplied by the two river sources; Kemaman river and Cukai river. Mean size is higher at the front compared to the back mangrove (Figure 6). The average of mean size of surface sediment was found to be 4.17 phi (coarse silt). The average of standard deviation, skewness and kurtosis of the surface sediment were 1.99 phi (poorly sorted), 0.05 (symmetrical) and 2.33 phi (very leptokurtic), respectively. While the parameters of mean size and skewness do not differ between the monsoon and non-monsoon seasons, the parameters of standard deviation and kurtosis tended to become better sorted and more peaked respectively during the monsoon season.

5. CONCLUSION

The higher accretion rates indicate that the Kemaman mangrove is still in the process of finding an equilibrium level with the major environmental forces affecting on it. The monsoon season indicates the role in supplying sediments to the mangrove area. It nevertheless has no significant impact on the sedimentological characteristics of the surface sediment.

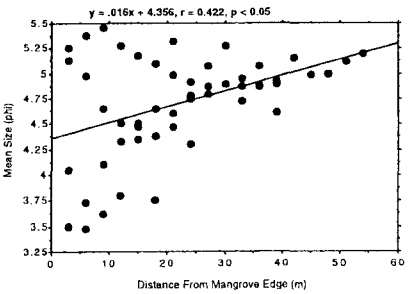

Figure 6 : Average of Mean Size versus Distance from Mangrove Edge

6. ACKNOWLEDGEMENT

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