A STUDY ON CHARACTERISTICS OF SEDIMENT FEATURE OF MANGROVE

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ABSTRACT*: This paperemphasize the major sediment characteristics of mangrove ecosystem. For this survey two locations such as Sarasaalai and Kapputhu were chosen. Grain-size distribution, physicochemical parameters and organic matter content of surface soil were analyzed. Mangrove soil were sampled in the second week each month from June 2016 to November 2016. Triplicate samples at each sites were collected by mud sampler. The pH, electrical conductivity and salinity of surface soil were measured by pH, electrical conductivity and salinity probe respectively. Dried soil sample were examined for organic matter content and grain-size distribution. In the month of September high amount of salinity and electrical conductivity were observed which are shown asimilar trend. Higher amount of organic matter was found in Sarasaalai mangrove region. The periodic re-suspension of sediments probably was largely responsible for the high organic matter in mangrove ecosystem. The soil is dominated by sandy sediment with mean grain-size of 0.05mm to 2mm.The present study would form a useful tool for further ecological assessment and monitoring of soil characteristics of Sarasaalai and Kapputhu mangroves.*

Keywords : Grain size**,** Mangrove, Organic matter**,** Physicochemical parameter, Sediment

1. INTRODUCTION

Mangrove ecosystems are highly productive tropical coastal ecosystems which have a potentially high impact on the carbonbudget of the tropical and global coastal zone. Mangrove sediments were extensively studied all around the world.Sediment is an integral and dynamic part of mangroves. Sediment originates from the weathering of minerals and soils and is susceptible to transport by the seasonal flooding.Sediments act as sinks and sources of contaminants in aquatic systems because of their variable physical and chemical properties.The majority of studies, however, have found that mangrove organic matter is exported and incorporated into coastal food webs only to a very limited extent (Lee,1995).

Grain-size distributions of loosely consolidated surface sediments tend to show significances between various locations.Within any sedimentary environment grain-size trends may be present, i.e spatial changes in a combination of several grain size parameters(Praveena et al.,2007).

This paper provides an overview of our current understanding of organic matter dynamics, grain-size distributions and some physicochemical properties of sediment in mangrove ecosystem

2. METHODOLOGY

A detailed study of characteristics sediment feature of mangrove has been carried out in the Sarasaalai(L1) and Kapputhu(L2) mangrove regions.

Figure 1. Sampling locations in Jaffna peninsula: L1-sarasaalai L2-kapputhu (Source: Google Earth).

The exact position of each sampling site was recorded using Global Positioning System (GPS). The Sarasaalai mangrove region is located in the longitude of 80°10.262'and latitude of 09°41.147'N. Kapputhu mangrove region is located in the longitude of 80°10.782'E and latitude of 09°44.017'N.In each locations, samples were collected in 3 sites with the 25m vertical distance.

Table 1. Details of selected locations

Sampling sites	**GPS Coordination**
L1S1	Longitude-80°10.421'E Latitude- 09°42.958'N
L1S2	Longitude- 80°10.409'E Latitude- 09°42.961'N
L1S3	Longitude- 80°10.398'E Latitude- 09°42.964'N
L2S1	Longitude- 80°10.782'E Latitude- 09°44.017'N
L2S2	Longitude- 80°10.795'E Latitude- 09°44.013'N
L2S3	Longitude- 80°10.806'E Latitude- 09°44.010'N

2.1 Sample collection

Mangrove soil were sampled in the second week each month from June 2016 to November 2016.

The sampling was done based on the accessibility to the mangrove forest. Mangrove surface soil were chosen for this study as this layer controls the exchange of

nutrientsbetween sediments and water.Triplicate samples at each sites were collected by mud sampler. In most of the case the sampling depth was between 5 and 10cm. 500 to 600 g of surface soil was obtained. By deploying the mud sampler up to the bottom, soil samples were collected horizontally.
The soil were kept in separate polythene bags during transportation to the laboratory. The physicochemical parameters (pH, electrical conductivity andsalinity) were measured on 1:2 soil to de-ionized water ratio extracts as soon as the samples reached the laboratory.The pH meter (Model-HI83141), electrical conductivity probe (Model-EE0011) and salinometer (Model- RHS-4ATC) were used to measure pH, electrical conductivity and salinity respectively.

2.2 Preparation of samples of dry sediment

The collected soil samples were placed in petty dishes and kept in Hot air Sterilizer (model number-YCO-010 Series), samples allowed to dry at 104°C for 5 hours.
For organic matter analysis, the crucible was weighed using electronic balance. From the collected dried mud samples, particular amount (approximately 5g) of soil sample was added in the crucible and total (crucible +soil sample) weight was measured. The crucible was incinerated at 600˚C for 5 hours in muffle furnace (model number-HD 230). Then crucible and sample weight were measured and from that weight loss was calculated.

The dried sub samples were crushed by mortar and pestle,100g mud sample was weighed by using electronic balance and sieved by using standard sieve (The mesh sizes are 2mm, 850µm, 600µm, 425µm, 250µm, 180µm, 150µm, 125µm, 53µm). The collected soil samples from each sieve were weighed using electronic balance.

2.3 Statistical analysis

All the water quality parameters were analyzed by using Microsoft Office Excel 2007.

3. RESULTS AND DISCUSSION

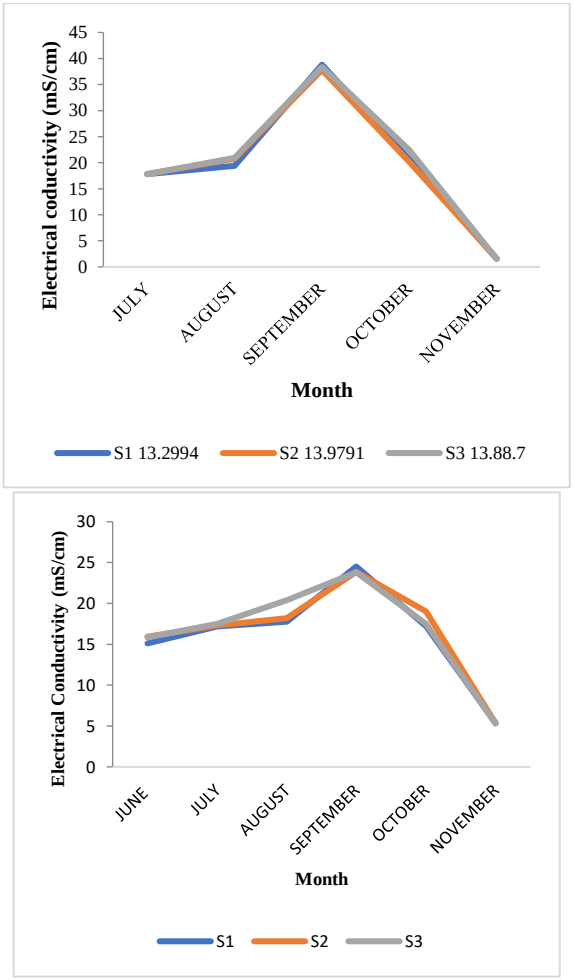

Figure 2. Scatter plot to show the change in electrical conductivity (EC) in L1and L2

During June to November, minimum EC in L1 is 1.5mS/cm and maximum is 38.13mS/cm, in L2 5.38mS/cm and 24.51mS/cm respectively (Figure 2). Salinity were positively correlated with EC in both locations. The conductivity levels will increase sharply owing to salinity increase. There is considerably higher EC found in all sites in September, indicating accumulation of salts. Conductivity showed the presence of an ion in the water and sediment.

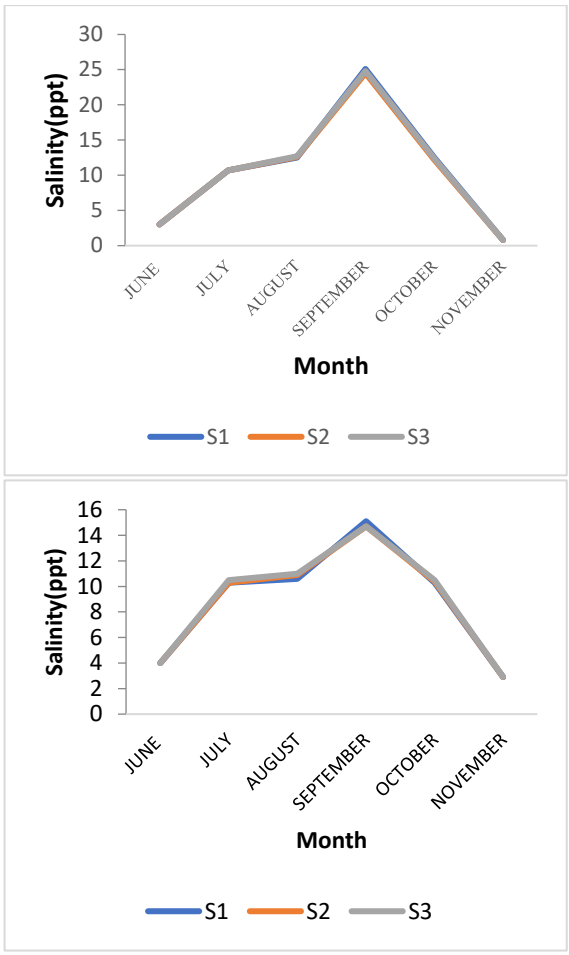

Figure 3. Scatter plot to show the change in salinity in L1 and L2

During June to November, minimum salinity in L1 is 0.8 ppt and maximum is 24.8 ppt, in L2 is 2.9 ppt and 15.1 ppt respectively (Figure 3). The lowest salinity values were observed in both locations in the monsoon season where the high variability, especially towards lower values, was related to strong rainfall events that enhanced towards the estuary mouth entrance. There is high contribution of seawater to mangrove sediments that controls the sediment chemistry.

The salinity is a limiting factor in the distribution of living organisms and its changes because the dilution and evaporation (Saravanakumar et al, 2008).

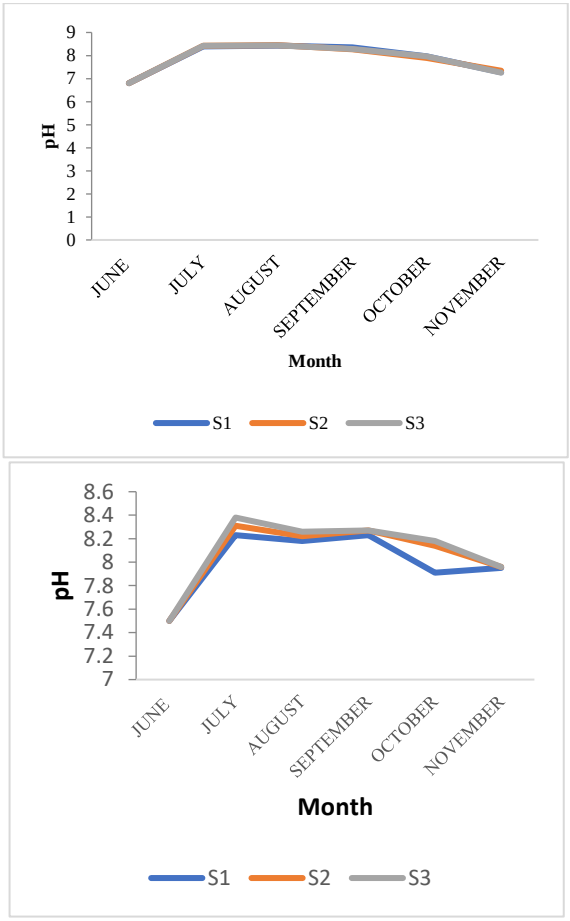

Figure 4. Scatter plot to show the change in pH in L1 and L2

From June to November in L1, the minimum pH is 6.8 and maximum pH is 8.45, in L2, minimum and maximum are 7.5 and 8.38 respectively. In L2, pH remains alkaline throughout the study period at all three sites (Figure 4).

The low pH is attributable to some factors such as the removal of CO_2 by photosynthesis through bicarbonate degradation, the dilution of mangrove water by rain, the decrease of the salinity and temperature, and the decomposition of organic material. The high pH values recorded during summer might be due to the influence of seawater penetration and high biological activity (Saravanakumar et al., 2008).

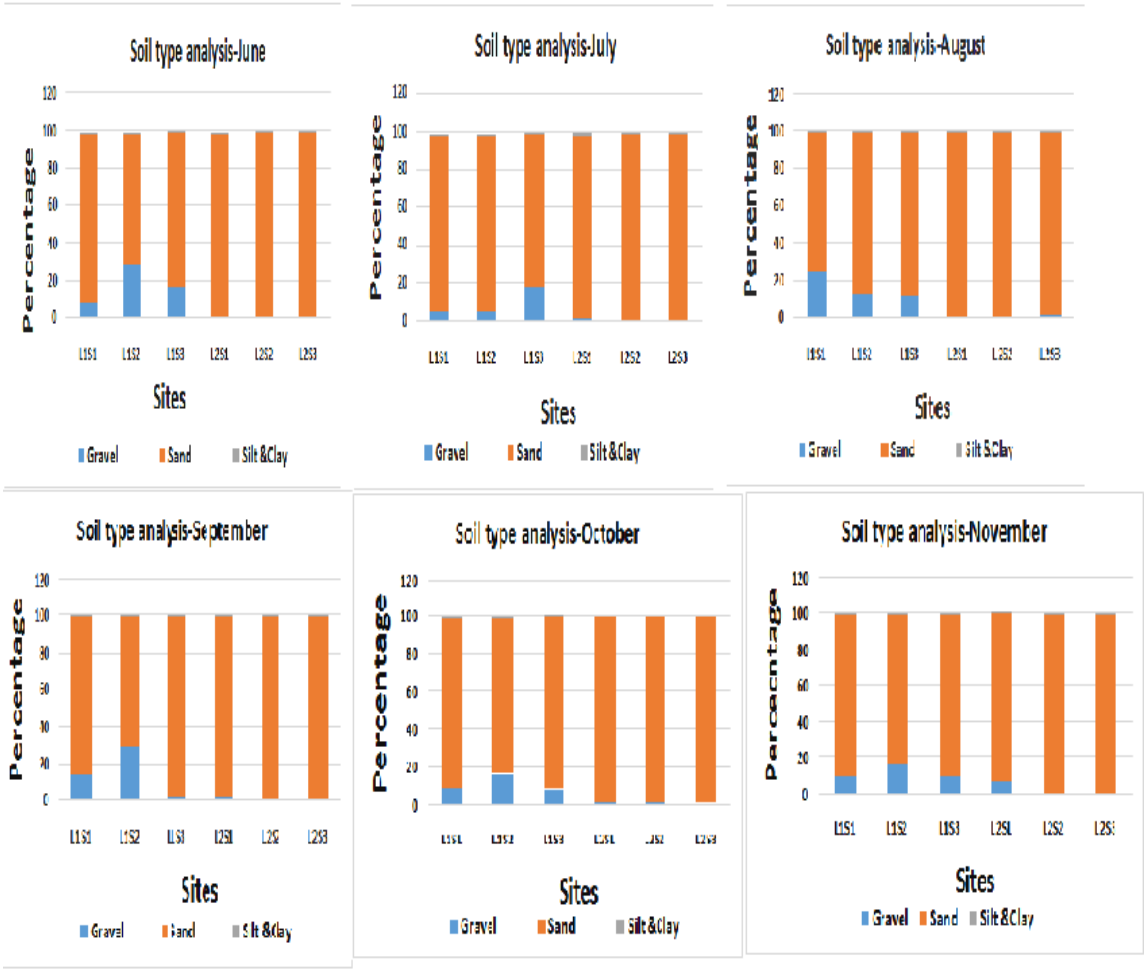

Figure 5. 2-D Column showing the percentage of soil types in 6 sites (L1S1,L1S2,L1S3,L2S1,L2S2,L2S3)

The soil is dominated by sandy sediment with mean grain-size of 0.05mm to 2mm. The mean size of gravel is 2mm to 75mm. Clay and silt is present relatively in low amount with the mean size of 0.002mm to 0. 05mm.The observed grain-size not only depend upon transport processes, but they are influenced also by sampling depth and density. The surface layer of L2 is almost covered by sandy sediment

The overall sand fraction in L1 ranged between 70.89%–90.27%, silt and clay between 0.16%–1.06% and gravel between 7.21%–27.48%. In L2 sand fraction ranged between 98.02%-98.84%, clay and silt between 0.42%-0.92%, and gravel between 0-0.2% (Figure 5).

Seasonally, both locations recorded higher fractions of sand during monsoon and summer. But in L1, the percentage of gravel is highly observed in October and November. Such differed combinations of sediment observed are mainly due to the transport of sediments from one place to another and back associated with the water flow. In general, sand is dominating in both mangrove regions.

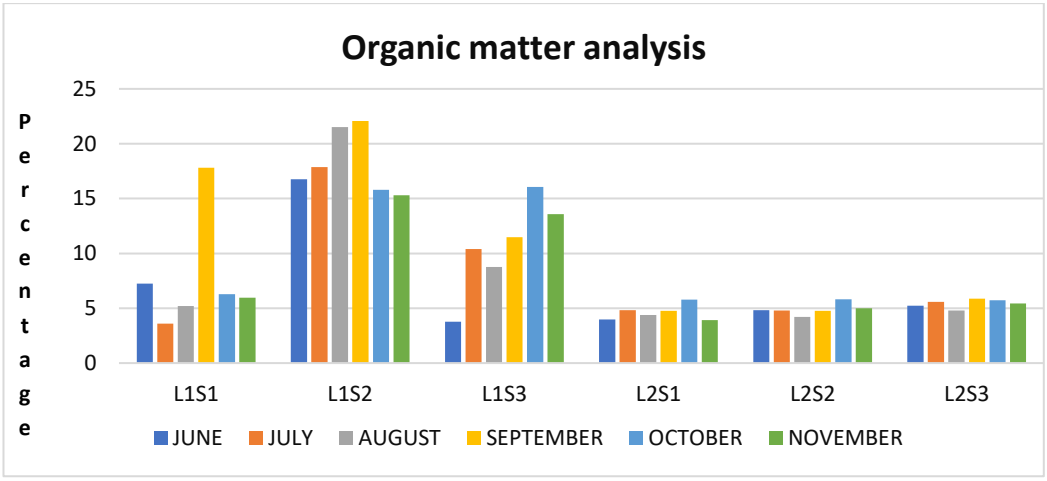

Figure 6. 2-D Column showing the percentage of organic matter

Organic matter distribution is associated with mangrove and hydrodynamic factors. It is well known that macro benthic communities in mangrove environment are influenced by the texture of the sediment in which they establish themselves and live (Manjappa et al, 2003) with the monsoon season being associated with much higher levels of nutrients and sediments than the dry season. There is a high percentage of organic matter observed in L1 with range of 3.6% to 22.07% than L2, which may cause due to runoff carried more nutrients to this location.Among the all 6 sites, in L1S2, higher amount of organic matter is observed with range of15.31% to 22.07% which may cause due to high accumulation of debris at that site than the other sites.

The periodic re-suspension of sediments probably was largely responsible for the high organic matter in mangrove eco system. During monsoon, terrestrial runoff contributed high levels of particulate matter to the environment.

4. CONCLUSION

There are limited studies on sediment characteristics of mangroves in Jaffna peninsula.This survey was conducted in Sarasaalai and Kapputhu region mangroves. pH, salinity and electrical conductivity are the major recorded physicochemical parameters. Salinity and electrical conductivity had shown a similar trend. In the month of September both are present in higher amount.Higher amount of organic matter is found in Sarasaalai mangrove region. Grain size is a characteristic sediment feature.In the surface sediment of mangrove, however sandy material is the major component of the sediments in both locations.Accumulation of sediments take place here, with the material being supplied mainly from flood during rainy season.There are many factors influencing the fluctuations in organic matter, physicochemical parameters and grain-size distribution such as geographical locations and anthropogenic activities.It is hoped that this case study will stimulate more interest in this type of research.The present study would form a useful tool for further ecological assessment and monitoring of soil characteristics of Sarasaalai and Kapputhu mangroves.

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