

Diversity and abundance of macro-benthic organisms at Jaffna Lagoon in relation to sediment quality parameters

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Abstract

Macro-benthic communities are considered to be an important group of animals for the functioning of aquatic ecosystems. The present study was undertaken to assess the total abundance and composition of macro-benthic categories (polychaetes, crustaceans, bivalves, gastropods and others) at different areas (mouth, middle, and head) of the Jaffna Lagoon during July to September, 2014. Sediment samples were collected from 10 randomly selected sites in the lagoon. The macro-benthos were separated by the wet-sieving method, identified visually and microscopically, and quantified. Sediment quality parameters were measured using standard methods. A total of 56 species of benthic invertebrates were found, belonging to 46 families, including 10 polychaetes, 8 crustaceans, 14 bivalves, and 14 gastropods. The total abundance of organisms varied from 4 to 1504 individuals per liter. The composition of polychaete families varied from 28-72% *Eunicidae*, 4-14% *Captitidae*, 3-14% *Paraonidae* and 1-11% *Goniadidae*. The composition of crustacean families varied from 1-37% *Cyproideidae*, 30-79% *Colomastigidae*, 1-13% *Ampeliscidae* and 1-13% *Aoridae*. Bivalve families were *Hemidonacidae* (52-58%), *Lucinidae* (10-20%), and *Veneridae* (10-24%). Gastropods were *Potamididae* (3 -60%) and *Trochidae* (24 -36%). Two-way ANOVA revealed no significant difference of total abundance of macro-benthic organisms in different areas of the lagoon, months that the samples were collected, and the interaction term (Area*Month) ($P > 0.05$), indicating that the macro-benthic organisms in Jaffna Lagoon have similar distributional patterns. This study provides baseline data of benthic organisms on diversity and abundance in Jaffna lagoon during the southwest monsoon.

Keywords: abundance, macro-benthic organisms, Jaffna Lagoon, sediment quality

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Introduction

Benthic organisms are important organisms for aquatic ecosystem as primary and secondary consumers (Dahanayaka and Wijeyaratne, 2006). Benthic organisms are very important as a food resource for a large number of predators including commercially important benthic fish and as primary material exchangers across the sediment-water interface (Bouguenec and Gaini, 1989). Macrobenthic abundance mainly depends on sediment characteristics such as salinity, organic matter content,

texture and the ability to construct permanent burrows in the substratum (Perkins, 1974). The studies on diversity and abundance of benthic communities and use of macro benthos, as indicator organisms of environmental conditions are rare in Sri Lankan lagoons except for the study conducted by Dahanayaka and Wijeyaratne (2006). Therefore, the present study was carried out to examine the abundance and composition of macro-benthic groups (polychaetes, crustaceans, bivalves, gastropods and others) in different areas (mouth, middle, and head) of the Jaffna Lagoon.

Materials and methods

Benthic samples were collected from 10 randomly selected sites in the Jaffna lagoon (Fig. 1) during July to September, 2014 using a Van Veen grab sampler and immediately fixed with 5% formalin and Rose Bengal Solution. At each sampling site, the depth and visibility (using Secchi disc) were measured manually and temperature, salinity, conductivity, pH and DO measured from Multiparameter (YSI 556, USA). Sediment quality parameters (texture, moisture, organic matter and inorganic carbon) were measured at the laboratory using standard methods. The benthic samples were subjected to wet sieving through 500 μm mesh sieve to separate the macro benthic organisms from sediments (Sutherland, 1997). The organisms retained in the sieve were collected, preserved in 5% formalin and identified as much as possible using different keys and guides. The number of organisms of each species was also recorded. The organic matter content of the benthic sediments at each site was determined using the method described by Williams (2001). The texture of sediment was determined as the approximate proportions of sand, silt and clay, using the method described by Brady and Weil (1999).



Figure 1: Map of the Jaffna lagoon showing sampling sites (L1 as Reference site, L2, L3 and L4 as Lagoon mouth, L5, L6 and L7 as Lagoon middle and L8, L9 and L10 as Lagoon head)

Results and discussion

Abundance of macro-benthos of the lagoon varied from 18 to 1504 indivi./l. with a overall median (n=27) of 542 indivi./l. Two-way ANOVA revealed no significant difference of total abundance of macro-benthic organisms for different areas of the lagoon, for months that the samples were collected, and for the interaction term (Area*Month) ($p > 0.05$; Table 1). Macro-benthic taxa indentified mainly up to family level on each site at Jaffna lagoon from July to September 2014. However, some taxa were identified up to genera or species level. Overall composition of macrobenthic organisms of Jaffna lagoon during the study were 7% polychaetes, 10% crustaceans, 46% bivalves, 34% gastropods and 3% other groups. A total of 56 species of benthic invertebrates were reported during the study. These species belonged to 46 families, including 10 polychaetes, 8 crustaceans, 14 bivalves, and 14 gastropods. The total abundance of organisms varied largely from 4 – 1504 individuals per liter. The composition of polychaete families varied from 28 -72% *Eunicidae*, 4 -14% *Captilidae*, 3-14% *Paraonidae* and 1-11% *Goniadidae*. The composition of crustacean families varied from 1-37% *Cyproideidae*, 30-79% *Colomastigidae*, 1-13% *Ampeliscidae*, and 1-13% *Aoridae*. Bivalve families were *Hemidonacidae* (52-58%), *Lucinidae* (10-20%), *Veneridae* (10-24%). Gastropods were *Potamididae* (3-60%) and *Trochidae* (24-36%).

Table 1: Summary of Two-way ANOVA for total abundance of macro-benthos between-Months (July-Sept. 2014) and areas (Lagoon Mouth, Lagoon Middle and Lagoon Head).

Source	df	Mean Square	F	Sig.
months	2	24786.704	0.086	0.918
area	2	40678.926	0.142	0.869
months * Area	4	108319.981	0.378	0.821
Error	18	286572.111		
Total	27			

(df = degrees of freedom, F = "F" value, p = the level of significance).

Two-way ANOVA revealed that there was no significant difference of total abundance of macro-benthic organisms at different areas of the lagoon, months that the samples were collected, and the interaction term (Area*Month) ($P > 0.05$). Bivariate correlation values denoted that there were significant correlations between polychaetes and others with conductivity, salinity and visibility. Polychaetes, bivalves and others are correlated with depth. Crustaceans, bivalves and gastropods are correlated with sand percentage. Polychaetes and crustaceans are correlated with clay percentage and moisture content. Polychaetes, gastropods and other groups are correlated with organic carbon.

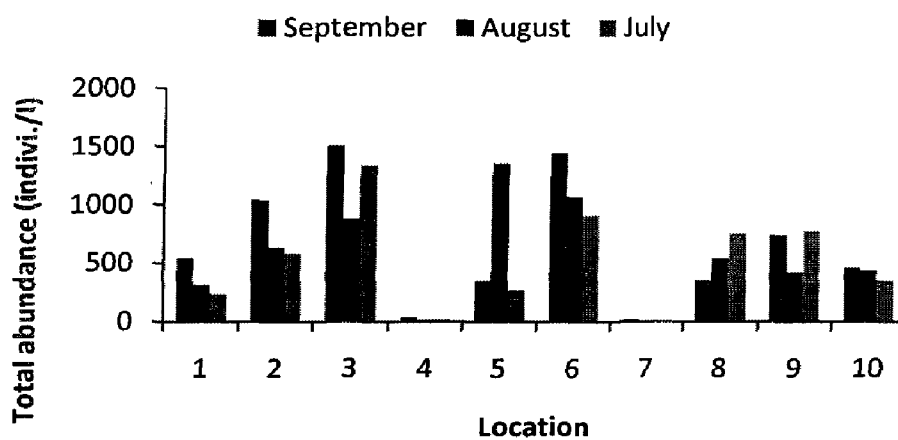


Figure2: Total abundance of macro-benthos in Jaffna Lagoon from July to September, 2014

Conclusion

The present study revealed that, there were no significant differences the abundance of macro benthic classes was changed location to location and time to time and it may be because of the changes of water and soil quality parameters. Bivalves and Gastropods were the dominant macro-benthic classes in this lagoon. Polychaets appeared to be more sensitive to changes in water quality parameters than the soil quality parameters while the abundance of bivalves and gastropods were comparatively associated with soil quality parameters. According to the presence of several indicator families in polychaets in this lagoon it can predict that the lagoon had been subjected pollution. Since the polychaets are the main food supply of many commercial fishes, it can predict that the content of macro benthic organisms in this lagoon may facilitate the local fishery in the lagoon and the nearby sea. This study was the first study in Jaffna

lagoon focused on macro-benthic organisms which provides baseline data important for future research.

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