Pakistan Journal of Marine Sciences, Vol. 18(1&2), 71-76, 2009.

ASSESSMENT OF DIVERSITY ASSOCIATED WITH ALGAL MATS AT SANDSPIT BACKWATER MANGROVE STAND

Sumera Farooq
Department of Zoology, University of Karachi, Karachi-75270.
e-mail: sfarooqu@uok.edu.pk

ABSTRACT: Mangrove forests are considered as second most productive ecosystem in the world. They provide habitat for a wide variety of fauna and flora. The green algal mats are the common feature of mangrove forests. The aim of this study was to find out the distribution of algal mats formed by *Cladophora coelothrix* in the mangrove forests and to analyze the diversity of associated organisms with these algal mats at Sandspit backwater mangrove stand. Variation in species number and density in algal mat at two stations were observed. The diversity of Microphytobenthos (MB) is comparatively higher in full grown mats at both sites. In decomposed mats the species number and density of both MB and macrobenthos decreased significantly. The occurrence of *C. coelothrix* mat and high number of MB abundance is related to the close proximity to water channels. From the management perspective, the results suggest that the abundance and diversity of macrofauna and abundance of microalgae may be useful as biological indicators to assess the environmental impact on mangrove habitat.

KEY WORDS: Mangroves, macroalgal mat, microphytobenthos, macrobenthic diversity.

INTRODUCTION

Pakistan has a 1050 km long coastline having many important geological, biological and ecological features. One of the most promising features of our coastline is the mangrove forests. Mangrove forests are considered as second most productive ecosystem in the world. They provide habitat for a wide variety of fauna and flora. A large number of invertebrate and vertebrate species inhabit mangrove swamps are dependent upon mangrove detritus (Wells, 1983) for nutrition, which is a basic energy source for the coastal and near shore food webs (Odum, 1970).

The green algal mats is a common feature of intertidal marine habitats particularly mud flats (Fletcher, 1996). Studies have shown that fast algal growth rates, biomass and increased photosynthetic rates are related to high nutrient availability (Lapointe, 1997; Schaffelke, 1999). Mangroves are reported to provide habitat for macroalgal assemblages that grow epiphytically on pneumatophores and prop roots, stems and other hard substrates (Zuccarello *et al*., 2001). Few studies on the diversity of macro and micro algae from mangrove forests of Pakistan are available (Saifullah and Taj, 1995; Shameel and Tanaka, 1992; Siddiqui *et al*., 2000). Only few reports on the diversity of flora and fauna associated with algal mats are available (Siddiqui, *et al*., 2000). The present work was designed to find out the distribution of algal mats and to analyze the diversity of macro-fauna associated with these algal mats at Sandspit backwater mangrove stand.

MATERIALS AND METHODS

The Sandspit backwater mangrove stand lies at Lat: 24° 48° N; Long: 66° 54° E and 20 km away from Karachi. Its northern site is dominated by mud flats and mangrove vegetation while on the south is the sandy belt. The backwater receives sea water through Manora Channel.

Regular surveys of mangrove stand at Sandspit backwater were carried out during October, 2007 to September, 2008 to record the sites for *Cladophora coelothrix* mats. Samples were collected in triplicates from algal mats growing on mangrove sediments and pneumatophores. The macro-algal mats were teased carefully to remove Polychaete worms which were narcotized and preserved in 70% alcohol. The remaining sample was fixed in known amount of 4% formalin for the analysis of micro and macro benthos. For microphytobenthos (MB) analysis, the preserved samples were diluted in distilled water, mixed and allowed to settle for 10 seconds. Three replicate samples were taken out immediately and placed in separate bottles. A known volume from each replicate sample was used to prepare a slide and observed under light microscope for the counting of microphytobenthos. At least three slides were counted from each replicate sample. Species richness, evenness and diversity indices were calculated to visualize the differences between stations.

RESULTS

1.1 Distribution of *Cladophora coelothrix*:

The detail survey of the study site shows that macroalgal mats formed by green alga *Cladophora coelothrix* have a restricted distribution. They were found to grow only at two localities (Station S1 and S2) at Sandspit backwater mangrove belt. Station 1(S1) was located near a wide channel just opposite the main Sandspit beach, whereas Station 2 (S2) was located near the Charikund channel. These algal mats start to appear in August and form full grown ball shape mats (FG) in October and November. The mats started to decompose (DM) in December and completely disappear in January.

1.2 Diversity and abundance in full grown (FG) algal mat:

The total number of species was comparatively higher at S1. Table 1 showed the total number of individuals and species, together with diversity indices values which are higher in FG at Station S1. The highest species count was obtained from station S1 (Fig. 1a and b). 35 species of Microphytobenthos were recorded from Station S1 (Fig. 1a). Among macro-benthos the total species of polychaetes at station S1 was higher as compare to other groups (Fig. 1b). Copepods were completely absent in the algal mats collected from station S2 (Fig. 1b).

The mean abundance of Microphytobenthos (MB) was higher in algal mats at station S1 as compare to S2 (Fig. 2a). In macro-benthos, nematodes showed higher abundance at both stations as compare to other observed groups (Fig. 2b). The mean abundance of all groups of macro-benthos was higher at station S1 (Fig. 2b).

Table 1. Diversity of associated organisms in algal mats at station S1 and S2. S=Total number of Species; N=Total abundance; d=Species richness; J'=Evenness; H'=Shannon diversity index.

	S	N	D	J'	H'
S1-FG	46	70	7.95	0.93	3.310
S2-FG	20	32	5.90	0.98	2.941
DM	13	19	4.43	0.99	2.198

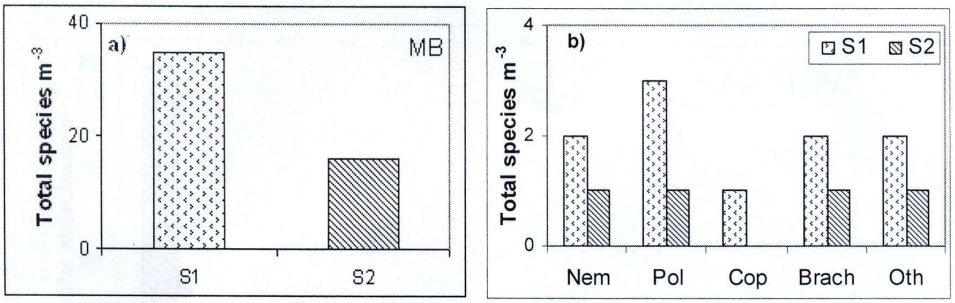

Fig. 1. Total number of macrobenthic species in full grown (FG) algal mat at station S1 and S2. a) Total species of microphytobenthos; b) Total species of macrobenthos in algal mats at Sandspit. Nem=Nematodes; Pol=Polychaetes; Cop=Copepods; Brach=Brachyurans; Oth=Other organisms.

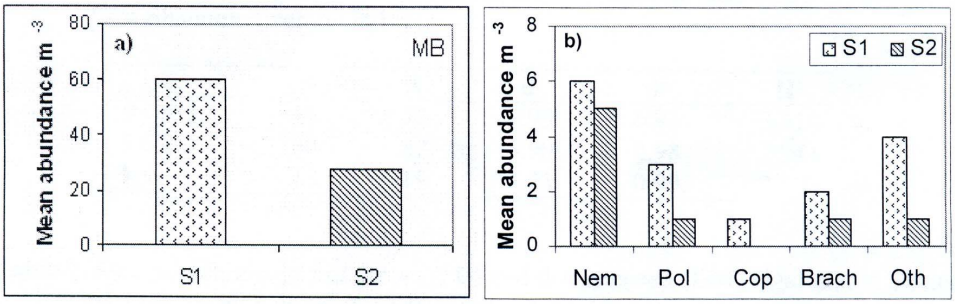

Fig. 2. Abundance of Microphytobenthos (a) and Macrobenthos (b) in full grown (FG) algal mats at Station S1 and S2. Nem=Nematodes; Pol=Polychaetes; Cop=Copepods; Brach=Brachyurans; Oth=Other organisms.

1.3 Comparison of associated organisms in FG and DM algal mat:

Table 1 shows the number of species recorded in the samples collected from full grown and decomposed algal mat at station S1. The highest species (37 species) were recorded for Microphytobenthos (MB) in full grown (FG) mat. Poychaetes, nematods and other organisms showed less species count as compare to MB in FG (full grown algal mat). Table 2 showed the species richness in FG and DM (decomposed) algal mats at station S1. Lowest species count was obtained from decomposed algal mat (N=13).

Polychaetes and copepods were entirely absent from decomposed algal mat.

Figure 3 shows the comparative abundance of observed organisms in FG and DM algal mats. The mean abundance of organisms was higher in full grown algal mat as compare to decomposed algal mat. However, only nematods showed higher abundance in decomposed algal mat (Fig. 3). Microphytobenthos (MB) showed dominance over macrofauna. Nematods, polychaetes, crabs and insects were also observed in the algal samples.

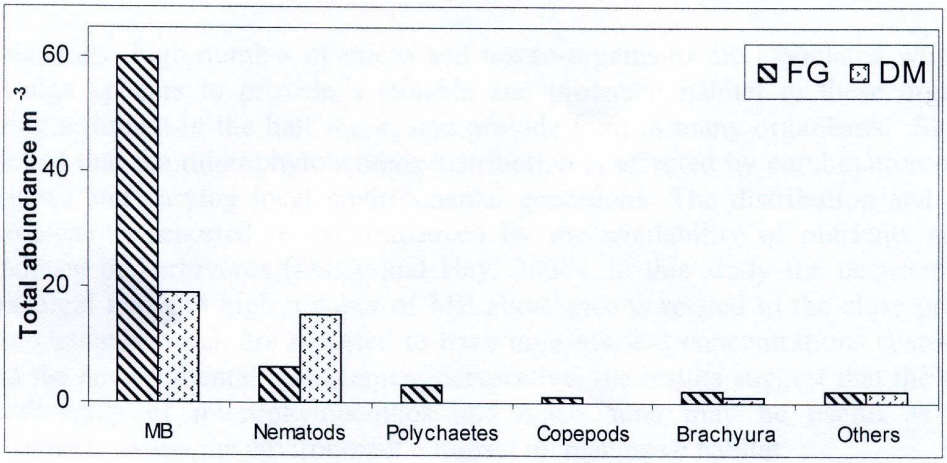

Fig. 3. Comparative abundance of floral and faunal groups in FG (full grown) and DM (decomposed) macro-algal mats.

Table 2. Species richness in full grown (FG) and decomposed (DM) algal mat at Station S1. Others include amphipods and insects.

	FG	DM
MB	35	9
Nematods	2	2
Polychaetes	3	0
Copepods	1	0
Brachyura	2	1
Others	3	1
Total	46	13

DISCUSSION

The macroalgal mats formed by *Cladophora coelothrix* appear to support high biological diversity. This alga has a restricted distribution in mangrove stand. They were found to grow only at two localities at Sandspit mangrove belt. Previously *C. coelothrix* was reported to form ball like mats only from station S1 (Siddiqui *et al*., 2000). However during this study the ball shape mats were also observed from other locality (station S2).

Siddiqui *et al.*, 2000 reported 38 species of Bacillariophytes and Cyanobacteria from the algal mats from station S1, whereas only 35 species were observed during this study.

In this study, high number of micro and macro-organisms are associated with this mat. This alga appears to provide a suitable and protected habitat to these organisms by holding sediment in the ball shape and provide food to many organisms. Studies have indicated that the microphytobenthos distribution is effected by combination of physical processes and varying local environmental conditions. The distribution and growth of macroalgae is reported to be influenced by the availability of nutrients and by the abundance of herbivores (Duffy and Hay, 2000). In this study the occurrence of ball shape algal mat and high number of MB abundance is related to the close proximity to water channels which are reported to have high nutrient concentrations (Farooq, 2004). From the environmental management perspective, the results suggest that the abundance and diversity of microphytobenthos and macrofauna may be useful as biological indicatiors to assess the environmental impact on mangrove habitat.

ACKNOWLEDGEMENT

The Author acknowledges the Dean of Science Project Research Grant, University of Karachi, for providing fund for this study.

REFERENCES

Farooq, S. 2004. Comparative study on the ecology of mangrove swamps of Pakistan. Ph.D. Thesis, Centre of Excellence in Marine Biology, University of Karachi, Pakistan.

Fletcher, R.L. 1996. The occurrence of green tides – a review. In: Schramm, W., Nienhuis, P.K. (Eds.), Marine Benthic Vegetation: recent Changes and the Effects of Eutrophication, Springer, Berlin, pp. 7-43.

Duffy, J.E. and M.E. Hay, 2000. Strong impacts of grazing amphipods on the organization of a benthic community. Ecological Monographs, 70(2): 237-263.

Lapointe, B.E. 1997. Nutrient thresholds for bottom-up control of macroalgal blooms on coral reefs in Jamaica and southeast Florida. Limnology and Oceanography, 42(5): 1119-1131.

Odum, W.E. 1970. Pathway of energy flow in a south Florida estuary. Ph.D. dissertation, University of Miami.

Saifullah, S.M. and G. Taj, 1995. Marine algal epiphytes on the pneumatophores of mangroves growing near Karachi, Pakistan. In: M.F. Thompson, N.M. Tirmizi (eds). The Arabian Sea, Living marine Resources and its environment. Proc. Of an Int. conf., Karachi, Pakistan. American Institute of Biol. Sci., Washington D.C. USA, pp. 393-400.

Schaffelke, B. 1999. Short-term nutrient pulses as tools to assess responses of coral reef macroalgae to enhanced nutrient availability. Marine Ecology Progress Series, 182: 305-310.

Shameel, M. and J. Tanaka, 1992. A preliminary checklist of marine algae from the coast and inshore waters of Pakistan. Cryptogamic fauna of Pakistan. *Na. Sci. Mus.*,

Tokyo, 1-64.

Siddiqui, P.J.A., S.N. Mansoor, Zaibunnisa, S. Hameed, S. Shafique, S. Farooq, R.A. Aziz and S. Saeed, 2000(a). Associated fauna and flora of macro-algal puffs inhabiting mangrove stands at Sandspit back waters, Karachi. *Pakistan Journal of Marine Biology*, 6(1): 43-53.

Wells, F.E. 1983. An analysis of marine invertebrate distribution in a mangrove swamp in north Western Australia. In: *Bull. Mar. Sci*., 33(3): 736-744.

Zuccarello, G.C., P.H. Yeates, J.T. Wright and J. Bartlett, 2001. Population structure and physiological differentiation of haplotypes of Caloglossa leprieurii (Rhodophyta) in a mangrove intertidal zone. *Journal of Phycology*. 37: 235-244.