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# STUDY OF THE SEASONAL ABUNDANCE AND OCCURRENCE OF MACROBENTHIC CRUSTACEANS IN MANGROVE SWAMPS OF SANDSPIT BACKWATERS, KARACHI

**Safia Khanam, Javed Mustaquim and Zarrien Ayub**

*Centre of Excellence in Marine Biology, University of Karachi, Karachi, Pakistan.*

**ABSTRACT**

The present study deals with the occurrence and abundance the macrobenthic crustacean fauna which was studied during the period of January to December 2006, from mangrove swamps of Sandspit backwaters. This is the first report related to the benthic crustaceans present up to a depth of 12-15 cm in sediments of mangroves. The study site was densely populated by *Avicennia marina*. Sediments for the study were collected using box corer from low, mid and high tidal zone of three different transects from mangrove swamps. Ten diverse groups of crustaceans were identified during the study. The most abundant crustacean included amphipods (20.44%) and *Balanus amphitrite* (65.70%). However, the hermit crab *Diogenes* sp (4.62 %) and brachyuran crab *Macrophthalmus depresses* (6.62 %) were also observed. The only penaeid shrimp *Metapenaeus monoceros* was observed in low density in all three transects as well as in all three tidal zones.

**KEYWORDS:** Mangrove, Macrobenthic crustaceans, Sandspit backwaters.

## INTRODUCTION

The term "mangrove" refers to an assemblage of tropical trees and shrubs that grows in the intertidal zone (Macnae, 1968). They are also called as 'tidal forests' or 'coastal wetlands'. Mangroves provide habitat to large number of animals, such as, birds, reptiles (crocodiles, lizards, snakes and turtles), mammals (monkeys, deer, raccoons, otters, dolphins, bats and tigers and numerous fish. Moreover, crustaceans, molluscs, polychaetes and other invertebrates are by far the most diverse and abundant group of animals found in mangrove ecosystem (Hutchings and Recher, 1983; Wilson, 1989; Edgar, 2000).Crustaceans form a large group of arthropods in the marine environment. They include barnacles, shrimps, lobsters and crabs. The most important group of animals in the mangrove ecosystem are crabs and they utilize every inch of the muddy habitat (Warner, 1969; Wilson, 1989).

Brachyuran crabs, gastropods, bivalves, hermit crabs, barnacles, polychaetes, sponges, tunicates and sipunculids make the main group of a mangrove's macrofaunal communities (Sasekumar, 1974; Frith *et al*., 1976; Along and Sasekumar, 1992; Guerreiro *et al*., 1996). The edible mangrove crabs live in deep burrows and come out of them for feeding usually at night. Leaf litter is used as an energy source during daytime. Crabs are also good fisheries resource to the near shore coastal people (Robertson, 1992).The hermit crabs and the mangrove crabs are the crustaceans that can climb a tree for defense from predators. The larvae of these crabs are the main food source for juvenile fishes living adjacent to the muddy habitat. Mangrove crabs, ocypods and hermit crabs are a good example of the muddy habitat. It is characteristically the only portunid crab found in mangrove habitat (Macnae, 1968).

Crustaceans are carnivorous, scavengers, deposit feeders, filter feeders and omnivorous. The crustaceans forms a major component of the benthic fauna with highest density and biomass in mangrove areas (Tirmizi *et al*., 1983) .Earlier Mustaquim and Rabbani (1976) studied portunid crab species from Karachi coast. There is a lack of macrobenthic faunal studies in Pakistan. Keeping in view, the importance of mangrove areas as a nursery ground, seasonal abundance and occurrence of crustaceans has been studied in this paper from Sandspit mangrove area.

## MATERIAL AND METHOD

**Sampling site:** The sampling site "mangrove backwater area" at Sandspit is the largest on the coast of Karachi and is located between latitudes 24° 50'34.7" N and longitudes 66° 53'08.2" E. It is covered by 400 ha of mangrove forest out of which 307 ha is dense and 93 ha consist of sparse forest. The Sandspit backwater is connected to the northern Arabian Sea through Karachi Harbor where the sea water enters the harbor from Southeast and travels through the Baba and Bhit islands. The tide on the coast of Karachi is semidiurnal and range at Karachi port is 2.3 m high (Tariq *et al*., 2002). It is densely populated by the mangrove species *Avicennia marina*.

The sampling area was divided into three transects lines. The first transect 1 was located just opposite to the shore laboratory, Centre of Excellence in Marine Biology, University of Karachi. The second transect was at a distance of 1.5 km away from transects 1 towards east and third transect was 1.5 km away from transects 2 or 3 km away from transects 1. Each transect stretched over three tidal zones, i.e., low tide level (LTL), mid tide level (MLT) and high tidal level (HTL).

**Sample collection:** Sediment samples were collected following the methods described by Sasekumar (1985) and Home and McIntyre (1971) for the benthic study of a mangrove ecosystem. Monthly 9 samples were taken for a period of one years from January to December 2006 during low tides. Three samples of sediment were collected from low, mid and high tidal zone from each transect using an iron box corer with the height 35cm and internal diameter of 0.045 $m^2$. The box corer was penetrated up to a depth of12-15 cm depending on the porosity of the sediment. The sediment samples were brought to the open side of Sandspit beach for washing and sieving.

**Sieving:** The contents of the box corer were emptied in plastic tubs and in order to break up the sediment, filtered seawater was added in the tub and stirred gently. The sediment was washed several times gently by adding filtered sea in order to soften the material and make it suitable for sieving. The macrobenthos are usually retained on 0.5 mm sieve (Thompson *et al*., 1993).

After sieving, all organisms, shell fragments and coarse sediment grains were transferred to plastic containers and were fixed in 10% formalin containing Rose Bengal. After fixation, the containers were well labelled and kept for further laboratory analysis and identification of specimens.

## RESULTS

During this study 10 crustaceans groups were identified (Table 1). Among the identified crustaceans, *Balanus amphitrite* (1906/$m^2$) was highly abundant species throughout the year. The second highest crustacean was amphipods (593/$m^2$). However, the abundance of the crab *Macropthalmus depresses*was (192/$m^2$). *Metapenaeus monoceros* was found to be the and isopods both showed very low occurrence (Table 1). The two hermit crabs were identified as *Diogenes* sp. (134/$m^2$) and *Pagurus* sp. (10/$m^2$), respectively. Other organisms included *Uca (Leptuca) annulipes)*, *Scylla serrata* and Tanaidaceans (Fig. 1).

Intertidal comparison of identified crustaceans indicated highest abundance of crustaceans in mid tidal zone as compared to high and low tidal zone (Fig. 2). Moreover, transect wise observations showed highest abundance in transect 1 while lowest in transect 3. Transect 1 was comparatively wider, larger and more exposed zone rather than the other two transects 1. This might have been one of the reasons rather than the effect of environmental factors such as salinity, temperature and the sediment characteristics.

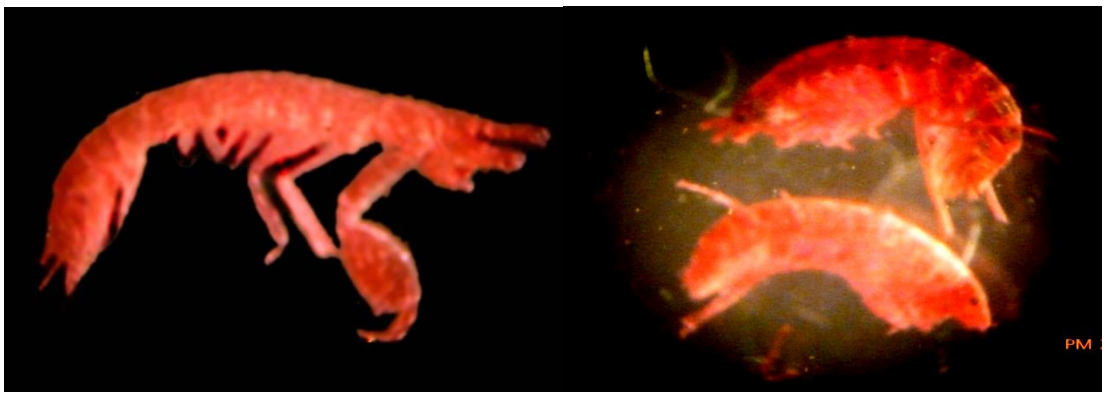
During Jan-Dec 2006, highest abundance has been observed in the mid tidal zone as compared to high tidal zone. However, low tidal zone showed less occurrence of crustacean. In the month of September and December, abundance of crustacean was high in low tidal zone and little less in the month of November mainly due to *Balanus amphitrite*. In mid tidal zone abundance of crustacean were high in month of June and November. While greater abundance of crustaceans has been observed in month of August (Fig. 2).

**Table 1. Composition of macrobenthic crustacean fauna.**

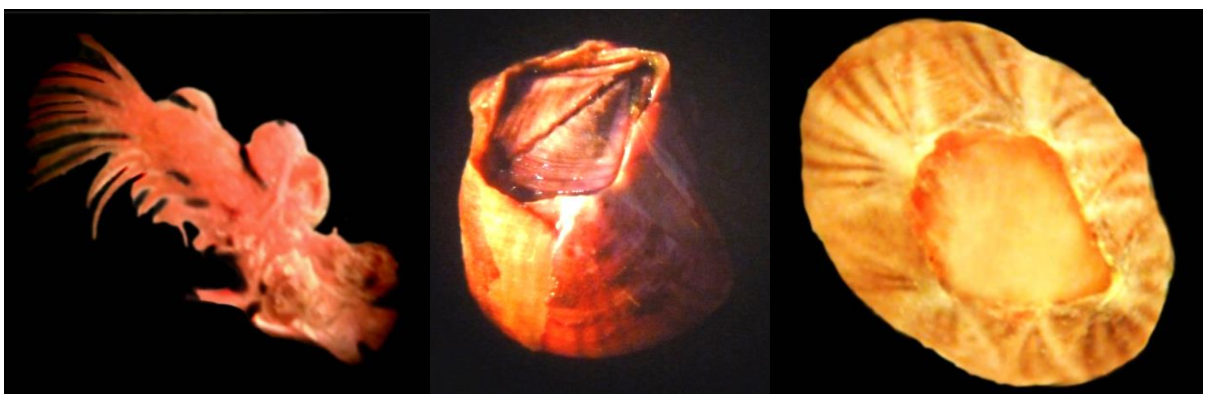
| ***Fauna*** | **Abundance** | **% Age** | **Occurrence** |
|---|---|---|---|
| *Amphipods* | 593.00 | 20.44 | +++ |
| *Balanus amphitrite* | 1906.00 | 65.70 | ++++ |
| *Hermit crab (Diogenes* sp.) | 134.00 | 4.62 | ++ |
| *Hermit crab (Pagurus* sp.) | 10.00 | 0.34 | + |
| *Isopods* | 18.00 | 0.62 | + |
| *Macrophthalmus depressus* | 192.00 | 6.62 | ++ |
| *Metapenaeus monoceros* | 5.00 | 0.17 | + |
| *Scylla serrata* | 9.00 | 0.31 | + |
| *Tanaidaceans* | 22.00 | 0.76 | + |
| *Uca (Leptuca )annulipes* | 12.00 | 0.41 | + |
| | 2901.00 | 100.00 | |

++++ = Very high; +++ = High; ++ = Moderate; + = Low

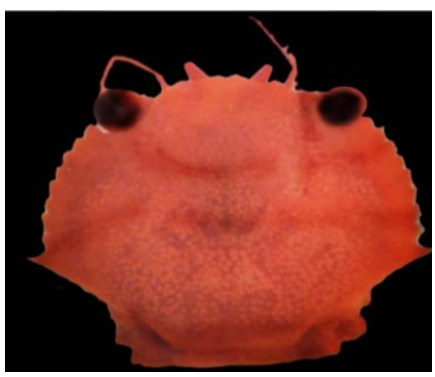
**Numeric abundance in three tidal zones and transects:** The overall estimation of numeric abundance in three tidal zones showed highest number of animals (1278 individuals $m^{-2}$), in mid tidal zone (Table 2) and lowest abundance was observed in low tidal zone 549 individuals / $m^{-2}$, respectively. The representations of macrofaunal crustaceans were observed in almost all three tidal zones except *Scylla serrata* not found in low tidal zone, *Pagurus* sp. not found in mid and tanaids were absent from high tidal zone. The most dominant crustacean, *Balanus amphitrite* showed highest abundance i.e., 800 individuals / $m^{-2}$. I n mid tide and lowest numeric abundance was observed in low tidal zone (324 / $m^{-2}$). Amphipods were the next abundant found in all three tidal zones with maximum density in mid tidal zone (383 individuals / $m^{-2}$) and lowest in low tidal zone (47 individuals / $m^{-2}$). However, the ocypodid crabs, *Macropthalmus depressus* showed dominance in low tidal 83 individuals / $m^2$) zone and *Uca (Leptuca) annulipes* were studied in greater numeric abundance in high tidal zone (and 7 individuals / $m^2$). Isopods were in greater density in the mid tidal zone (38 individuals / $m^2$). *Metapenaeus monoceros* was found in low density, alyhough they were observed in all three tidal zones. Crustacean fauna observed at the three transects studied at Sandspit backwaters showed variations in composition (Table 3). Maximum fauna was observed at Transect 1 (2181 individuals / / $m^2$), wheras the lowest at transect 3 (127 individuals / $m^2$). Variations in their composition was possibly due to that the Transect 1 was much more wider and open area as compared to other two transects.



**A. *Amphipods***



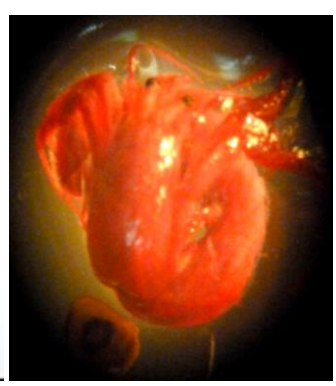
**B. *Balanus amphitrite***



**C. *Scylla serrata***

**D. *Macrophthalmus depressus***

**E. *Uca (Leptuca ) annulipes***



**F. *Hermit crabs Diogenes* sp. and *Pagurus* sp.**

Fig. 1. Macrobenthic Crustaceans of Sandspit backwaters.

**Table 2. Intertidal variations in the composition of macrobenthic crustaceans.**

| *Fauna* | Low tide | Mid tide | High tide |
|---|---|---|---|
| Amphipods | 47 | 383 | 163 |
| *Balanus amphitrite* | 324 | 800 | 782 |
| Hermit crab *(Diogenes* sp.) | 67 | 24 | 43 |
| Hermit crab *(Pagurus* sp.) | 9 | 0 | 1 |
| Isopods | 1 | 14 | 3 |
| *Macrophthalmus depressus* | 83 | 38 | 71 |
| *Metapenaeus monoceros* | 3 | 1 | 1 |
| *Scylla serrata* | 0 | 6 | 3 |
| Tanaidaceans | 11 | 11 | 0 |
| *Uca (Leptuca )annulipes* | 4 | 1 | 7 |
| | 549 | 1278 | 1074 |

**Table 3. Variation of crustacean fauna in the transects studied.**

| **Fauna** | **T1** | **T2** | **T3** |
|---|---|---|---|
| Amphipods | 481 | 110 | 2 |
| *Balanus amphitrite* | 1462 | 382 | 62 |
| Hermit crab *(Diogenes* sp.) | 104 | 16 | 14 |
| Hermit crab *(Pagurus* sp.) | 8 | 2 | 0 |
| Isopods | 9 | 7 | 2 |
| *Macrophthalmus depressus* | 102 | 52 | 38 |
| *Metapenaeus monoceros* | 1 | 3 | 1 |
| *Scylla serrata* | 1 | 3 | 5 |
| Tanaidaceans | 11 | 11 | 0 |
| *Uca (Leptuca) annulipes* | 2 | 7 | 3 |
| | **2181** | **593** | **127** |

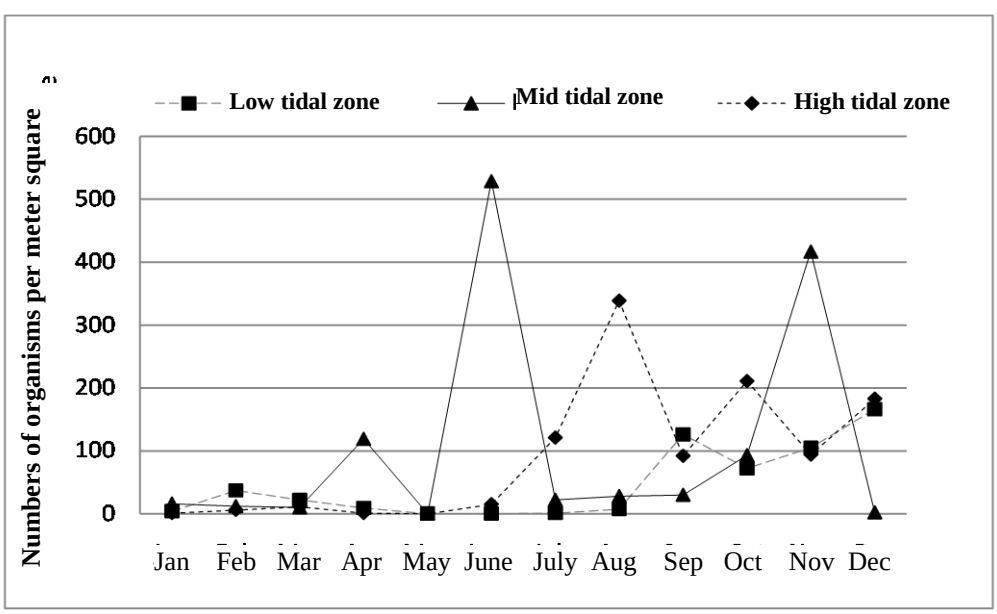



Fig. 2. Seasonal variation in abundance of crustacean during Jan-Dec. 2006.

## DISCUSSION

The Mangrove swamps of Sandspit backwater supports diverse assemblages of macro-benthic crustaceans that was retained on a 0.5 mm mesh sieve. The results reflecting variability and density in their composition. The crustacean from study site mainly comprises of amphipods, isopods, barnacles, crabs and hermit crabs particularly *Pagurus* sp. and *Diogenes* sp. Abundant species of crustaceans showed variations among the transects and intertidal stations. However, all the identified species from transects and intertidal zones have also been described earlier from other mangrove areas all over the world (Poore, 1982; 1992; Hutchings, 1999; Gladstone and Schreider, 2003).

The *Balanus amphitrite* was found to be the sole species and the most abundant crustacean fauna during the study. Barnacles can grow abundantly on mangrove roots and pneumatophores (Foster, 1982; Anderson *et al*., 1988; Bayliss, 1993; Ross and Underwood, 1997) and shows marked zonation (Baylisss, 1993) in mangrove areas with greater densities in mid-tidal zone than in the upper or low tidal zone (Kathiseran, 2000). Similarly, in present study, barnacles showed preference in mid tidal zone with maximum density 800 organisms / $m^2$. However, in lower tidal zone (324/$m^2$) and high tidal zone (782 / $m^2$) lower occurrence of barnacles has been observed.

In recent study amphipods were not further identified up to genus and species level owing to their smaller size (0.5-1.0 mm). Amphipods represented well in the three transects studied and were in maximum density in mid tidal zone (450 individuals / $m^{2)}$ and good representation was observed in the high tidal zone as well (230 individuals /$m^2$). Density was lower in low tidal zone (97 individuals/$m^2$). Presence of amphipods in good numbers indicates towards the tolerance of the sensitive group of Crustaceans. Tirmizi *et al*. (1983) reported crabs, amphipods and isopods as the permanent invertebrates of mangrove swamps of Sandspit backwaters.

Three species of crabs *Uca (*Leptuca*) annulipes* (Ocypodidae), *Macrophthalmus depressus* (Ocypodidae*)* and *Scylla serrata* (Portunidae) were found as 'resident crabs' of Sandspit backwaters. *Macrophthalmus depressus* was found to be the most populated crab observed in all the three intertidal zones and also in the three transects studied .The diversity observed is rich in low tidal zone 115 crabs / $m^2$ and a bit behind 113 crabs / $m^2$in high tidal zone and an intermediate occurrence in mid tidal zone (64 crabs / $m^2$). In the more landward , *Avicennia* zone, the species composition of the crab community remains constant whether the vegetation is intact or with no vegetation (Ruwa, 1997). Crabs are the most important group of animals in the mangrove ecosystems and they utilize every inch of the muddy habitat (Warner, 1969; Wilson, 1989). Trivedi *et al*. (2012) also reported that the *Macrophthalmus depressus*present in good density towards open mud flats as compared to sheltered mud flat from the Gulf of Kutch, Gujarat.

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