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THE DIVERSITY OF CRABS IN SOME MANGROVE FORESTS OF KARACHI, PAKISTAN

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ABSTRACT

Pakistan has enormous coastal resources along its southern border. Due to the geographical position and climatic condition, the coastal area of the country is known as one of the highly productive areas of the world. Along the coastal belt there is a chain of unique mangrove forests which consists of distinctive ecosystem. A survey was conducted in three different mangrove forests located at Sandspit, Port Qasim and Agra Taj during March 2008 to August 2009 with a view to assess the status of crab in these areas. The study was conducted on the distribution and species diversity. A total of ten species of crabs were recorded from the area namely *Uca sp., Uca annulipes, Uca urvelli, Macropthalmus depressus, Metapograpsus thukuhar, Scylla serreta, Sesarma lanatum, Sesarma plicatum, Sesarma sp. and Heteropanope glabra* belonging to four families Ocypodidae, Mennipidae, Portunidae, Grapsidae and Pilumnidae. The small crab species *Heteropanope glabra* was highly abundant species of mangrove forests while *Sesarma lanatum* was found to be rare in all the localities. The results showed Sandspit area to have highest values of diversity indices the species richness (1.92), Diversity (2.13), Evenness (0.92) and least value of dominance (0.09) compared with other localities. Morphometric measurements showed that *Scylla serrata* grows to relatively higher carapace area8.5 cm^2 whereas rest of the species possessed carapace length upto 1.1 cm.

Keywords: Sandspit, Port Qasim ,Agra Taj, *Heteropanope glabra, Scylla serrata*, diversity indices

INTRODUCTION

The coastal zone of Pakistan has the world's richest mangrove forests characterized by higher productivity and unique ecosystem. Crabs, the most advanced members of the phylum Arthropoda are the dominant fauna of this ecosystem because they are morphologically, physiologically and behaviorally well-adapted to their environment. True crabs belonging to the suborder brachyuran of the order Decapoda under class Crustacea show the greatest size range of all arthropods. Brachyuran crabs are the reputed decapods which form the major components of crustacean fauna in Sind mangroves. Tirmizi and Ghani (1983) have reported 16 species of crabs from Sind mangroves. Later Tirmizi (1983) included the description of mangrove crab while mentioning the crustacean fauna from Karachi mangroves. Brachyuran crabs reach their greatest diversity in tropical and temperate regions of the world (Rahman *et al*., 2008) play an important role in the food chain and marine ecosystem. According to Chhapgar, (1991) crabs play a significant role in the fishery wealth of many nations

It is often been reported that grapsoid crabs, play an important ecological role in mangrove ecosystems (reviewed in Lee, 1998). The removal and processing of mangrove leaves by crabs helps to trap the energy stored in these leaves within the mangal before the tide can carry them away (Lee, 1998; Skov & Hartnoll, 2002). Furthermore, their faecal material potentially contributes to secondary production via a coprophagous food chain (Lee, 1997; Gillikin *et al.*, 2001). *Perisesarma* spp.was reported to have the highest biomass of mangrove crabs in certain forests (Ashton *et al.*, 2003).

However little is known about the mangrove crabs in Pakistan therefore a survey of the diversity of crabs from mangroves is necessary to prepare a full inventory of the species and their distribution pattern for management program of crab resources in Pakistan. The present investigation surveys the present status and diversity of crabs in the wetland ecosystem. This preliminary paper includes the diversity and the morphometric measurements of crab species. Hopefully the present study would contribute greatly to assess the status of crab in their respective mangrove areas with a view to help in the preparation of a crab resource management action plan for Pakistan.

MATERIALS AND METHODS

Three mangrove sites namely Sandspit, Port Qasim and Agra Taj were selected to collect samples during survey (March 2008 to August 2009). The Sampling was performed randomly during low tides . Speciemen were usually

preserved in 5-10% formalin in plastic containers and subsequently carried to the Laboratory to identify following the key of Shafi and Quddus (1982), Choudhury and Hafizuddin (1991) and Siddiqui and Zafar (2002). Sufficient specimens of different species were chosen for morphometric study. The carapace measurement was taken by using normal scale or vernier scale.

The diversity index (H') was computed using the popular Shannon & Weaver (1963) information theory function.

$$H' = -\sum_{i=1}^{S} p_i \ln p_i$$

Where p_i is the proportion of individuals belonging to the *i*-th species. Equitability or evenness (J) which describes the evenness of allotment of individuals among the species was calculated as the observed diversity as a proportion of maximal diversity. It was calculated in accordance with Pielou (1969) as:

$$J' = \frac{H'}{Hmax} = \frac{H'}{\log S}$$

Species richness or variety index (d) is the number of species as a function of the total number of individuals in the sample and was determined using the formula developed by Menhinick (1964) as follows:

$$d = \frac{S}{\sqrt{N}}$$

Where S is equals the number of species and N is the total number of individuals. Concentration of dominance (D) was computed using Simpson's index (1949) as follows:

$$D = \frac{\sum_{i=1}^{S} n_i(n_i - 1)}{N(N-1)},$$

Where, n_i is the number of individuals of *i*th species and N is the total number of individuals

RESULTS

A total of 10 species representing 6 genera and 4 families were recorded from the entire study areas (Table 1). All ten species including *Uca sp., Uca annulipes, Uca urvelli, Macropthalmus depressus, Scylla serreta, Metapograpsus thukuhar, Sesarma lanatum, Sesarma plicatum, Sesarma quadratum and Heteropanope glabra* were recorded from Sandspit while minimum (7) number of species *Uca sp., Macropthalmus depressus, Scylla serreta, Metapograpsus thukuhar, Sesarma lanatum, Sesarma plicatum* and *Heteropanope glabra* were collected from Port Qasim. The Agra Taj mangrove comprised of 8 species, *Uca* sp., *Uca annulipes, Uca urvelli, Macropthalmus depressus, Scylla serreta, Metapograpsus thukuhar, Sesarma plicatum* and *Heteropanope glabra.* The Five species *Macropthalmus depressus, Scylla serreta, Metapograpsus thukuhar, Sesarma plicatum* and *Heteropanope glabra* were found in all three locations. *Sesarma quadratum* found least abundant species because single specimen of this species was collected from only Sandspit during sampling period while two members of family Ocypodidae the *Uca urvelli* and the *Uca annulipes* were only recorded from Sandspit and Agra Taj. The other species *Sesarma lanatum* was collected from Port Qasim and Sandspit. Table1 indicates that The *Heteropanope* glabra a small sized crab is the most regularly occurring species found with high abundance in all sampling sites.

Size measurement

Table 2 represents the size of the recorded crab species. The two genus *Sesarma* and *Uca* are represented by their three species in which *Uca* sp. and *Sesarma plicatum* are the abundant species found throughout the locations. Among all recorded species *Scylla serrata* grows to relatively larger size having 3.4cm carapace length and 2.5cm carapace breadth ranked first. *Metapograpsus thukuhar* ranked next to *Scylla serrata* in carapace measurement. The size of the rarely found species *Sesarma quadratum* measures as 1.7x1.9cm. The others species reaching 1.1 cm in carapace length are very common in these mangrove areas of the Sindh coast.

Species diversity

Species richness is the number of different species in a given area. Among the three localities, Sandspit showed highest species richness (1.92) and diversity (2.13) while the equitability (evenness) was 0.92 which is lesser than other two areas. Agra Taj and Port Qasim (Table. 3) have similar species richness (0.93) Even though,

there was no difference in species richness and diversity between these two areas but there was notable difference in the uniformity of abundance in the assemblages of species. Dominance concentration which corresponds to lowest diversity as dominance and diversity are inversely related. The high dominance of was found at Port Qasim (0.14) is owing to awesome dominance of species while least was recorded in Sandspit (0.09) due to high values of species richness. The combined values of diversity, species richness, equitability (evenness) and dominance were 2.17, 1.07, 0.94 and ,0.11 respectively.

Table 1. Recorded crab species from three different areas of mangrove forest.

Species	Family	Number of specimen		
		L1	L2	L3
Uca sp.	Ocypodidae	4	5	1
Uca annulipes	Ocypodidae	2	0	4
Uca urvelli	Ocypodidae	4	0	2
Macropthalmus depressus	Ocypodidae	2	1	4
Scylla serreta	Portunidae	2	5	5
Metapograpsus thukuhar	Grapsidae	3	5	2
Sesarma lanatum	Grapsidae	0	2	5
Sesarma plicatum	Grapsidae	5	3	2
Sesarma quadratum	Grapsidae	0	0	1
Heteropanope glabra	Pilumnidae	9	7	1

Note: L1= Agra Taj L2=Port Qasim, L3= Sandspit, ,

Table 2. Size range of Crab species from three different areas of mangrove forest.

SPECIES	RANGES OF THE CARAPACE MEASUREMENTS (cm)		
	Agra Taj	**Port Qasim**	**Sandspit**
Uca sp.	0.8-1.1-1.0x1.1	0.5x0.3 -1.1x0.8	0.8x0.5
Uca annulipes	0.4x0.3-1.2x1.4	0	0.8x1.3x1.1x1.3
Uca urvelli	0.9x1.1-1.5x1.7	0	1.1x1.3-1.5x1.6
Macropthalmus depressus	0.5x0.7-1.0x1.4	0.7x1.1	0.9x0.5-1.5x2.0
Metapograpsus thukuhar	1.9x1.2-3.0x2.5	1.5x0.8-3.2x2.5	1.2x0.8-3.1x2.5
Scylla serreta	1.9x2.5-2.2x2.5	2.6x1-3.0x1.9	3.0x2.2-3.4x2.5
Sesarma lanatum	0	1.1x0.7-1.3x1	1.0x1.2-1.5x1.6
Sesarma plicatum	1.0x1.3-2.6x2.9	1.1x0.9-2.2x2.4	1.0x1.3-1.1x1.5
Sesarma quadratum	0	0	1.7x1.9
Heteropanope glabra	0.5x0.6-1.1x1.1	0.8x0.6-1.3x1.1	0.6x0.8

Table 3. Diversity of crab species of mangroves forests.

Diversity Indices	Agra Taj	Port Qasim	Sandspit	Combined
Diversity (H)	1.93	1.81	2.13	2.17
Equitability (evenness) (J)	0.93	0.93	0.92	0.94
Species richness (d1)	1.43	1.32	1.92	1.07
Dominance (D)	0.13	0.14	0.09	0.11

DISCUSSION

To a greater or lesser extent, the crabs are connected between land and sea due to the presence of mangrove forests. These forests provide better habitats, plant detritus and protection from the sun, which favor the presence and development of large populations of terrestrial and semi-terrestrial detrivorous decapods crustaceans (Crane, 1947; Mann, 1972). The results clearly showed that the value of species richness was higher at Sandspit while least number of species were recorded from Agra Tag and Port Qasim. According to Sapkota (2009) and Sapkota *et al.*,

(2009) lesser disturbance promotes species diversity, Sandspit area is under WWF and designated as Wetlands of International importance so considered as less human disturbed area whereas others two locations have varied degree of disturbance in these forest. The least number of species were recorded from Port Qasim which may be due to the fact that crab populations are restricted to the certain areas where channels are the most numerous, water level remains adequate all the year round and dense stands of *Avicennia marina* are found (Mann, 1972). In addition this area is located in the Southern part of Karachi is enormously contributing to the marine pollution by three major sources via shipping, steel Mills industry and Power Plants which are located around the mangrove forests (Personal observation). The Agra Taj is an extension of Sandspit mangrove belt; it receives domestic sewerage through Lyari river. Due to anthropogenic activity it is also considered as highly perturbed area. The deforestation rate is very high, wood is used for fuel and construction of huts and houses. These features have considerable impact on the distribution of the decapods crustacean fauna.

The results showed that *Uca* sp. and *Sesarma plicatum* are the highly abundant species found throughout the locations The absence of a tidal flooding during most of the year probably influences drastically the populations of fiddler crabs and their success towards the occupation and colonization of the area. Observations made in March 2008 to August 2009 confirmed this hypothesis. In July and August, unusually heavy rainfall which washed and opened the sand bar that had almost completely closed the inlet. The result of this was a prolongation of the period of open mouth and hence of tidal influence in the system (Personal observations). As a direct consequence, flats which are normally submerged at this time of the year were still subject to rhythmical tidal flooding and were therefore suitable for colonization by fiddler crabs. Indeed, dense populations of young *Uca species* observed on long narrow flats at the entrance of the channel at Port Qasim. Among all species of decapods crustaceans collected in the system, only *Sesarma quadratum* seems to have a restricted distribution.

From the data present in Table1 it may be noted that *Heteropanope glabra* is a small sized most regularly occurring species in our collections and is available all the years round. Its a small size helps it to invade the mangrove woods. The genus *Sesarma* is represented by three species in Sindh mangroves, i.e., *Sesarma plicatum, Sesarma lanatum, Sesarma quadratum* of these species *Sesarma plicatum* grows to relatively larger size, and specimen measuring over 3.0cm in carapace length are common The mud crab *S.serreta* is no doubt the most abundant and largest species of mangrove swamps. It was found hidden under the green sea weed mounds at low tides Borrows of this crab are numerous in the mid tidal zone of mangroves. Individuals reaching over 3.4x2.5cm in carapace length and breadth are found at Sandspit because domestic sewerage is dumped in this area. Another reason of high diversity is that domestic sewerage is rich in nutrients which increases the productivity of mangrove and hence enriches the fauna. *S.serreta* population is relatively more abundant in the mangroves of Sandspit, Agra Taj and Port Qasim.

CONCLUSION

This paper is an attempt to shed light towards understanding the diversity of mangrove crabs. It thus provides a useful frame work for organizing research on different aspects of faunal diversity of mangrove forests. It is concluded that the decline in the diversity of measures across the areas is the consequence of varied degree of perturbation.

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