J. Exp. Zool. India Vol. 20, No. 2, pp. 1103-1107, 2017 | www.connectjournals.com/jez | *ISSN 0972-0030*

SPECIES COMPOSITION AND HABITATS OF MACRO-BENTHIC CRUSTACEANS IN THE INTERTIDAL ZONES OF SUNDARBAN, WEST BENGAL, INDIA

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(Accepted 27 March 2017)

ABSTRACT : The macro-benthic crustacean diversity in the estuarine zones of Sundarban, West Bengal, India was studied for a period of six months (November, 2014 to April, 2015) in 21 sampling stations covering eastern, central and western zones of Sundarban. A total 20 species of crustaceans belonging to 3 orders, 9 families and 13 genera were recorded. The family Sesarmidae was dominated in number of taxa. The species recorded were *Uca acuta, Uca rosea, Uca lactea, Uca triangularis, Uca dussumieri, Thalassina anomala, Dotilla intermedia, Dotilla blanfordi, Dotillopsis brevitarsis, Sesarma chiromantes, Sesarmops impressum, Perisesarma bidens, Episesarma mederi, Sesarmoides longipes, Parasesarma plicatum, Metaplax intermedia, Clibanarius padavensis, Scylla serrata, Balanus* sp. and *Squilla* sp. Out of 20 species *Balanus* sp. was most abundant species followed by *Uca acuta*, *Thalassina anomala* and *Uca rosea* and the least abundant species were *Dotilla intermedia*, *Sesarma chiromantes* and *Squilla* sp. Species like *Uca acuta, Dotilla intermedia, Sesarma chiromantes, Sesarmops impressum* and *Squilla* sp. were found only in eastern zone. Major habitat of the species recorded was muddy substratum of littoral zone (42%). Other habitats include sandy substratum of littoral zone (5%), both muddy and sandy substrata of littoral zone (32%), hard substratum and populated by mangrove palm (5%), dead trees and stumps (5%) and mud flat (11%).

Key words : Species composition, habitat, macrobenthic crustaceans, Sundarban, India.

INTRODUCTION

The Indian Sundarbans are located between 21°32'– 22°40' N and 88°85'– 89°00' E, lying mainly within the North 24- Parganas and South 24- Parganas districts of the State of West Bengal, India. The mangrove forest area of Indian Sundarban has been estimated as 418,888 hectare (Sidhu, 1963). Mangrove ecosystem is one of the most productive ecosystems of tropical and subtropical regions of the world and serves as nursery, feeding and spawning grounds for commercial finfishes and shellfishes (Kumar, 2000). Its sediments are permanently or periodically inhabited by diverse assemblages of benthic organisms (Day *et al*, 1987). The macrobenthos namely polychaetes, molluscs, and crustaceans, play a major ecological role in the mangrove ecosystem (Warren and Underwood, 1986). They assist in the breakdown of particulate organic material by exposing them to microbes and their waste materials contain rich nutrients forming food for other consumers. Macrobenthic organisms are sensitive to anthropogenic disturbances, which can make them ideal bio-indicator of potential environmental impact. The mangrove habitat loss and degradation have posed major threats to a wide array of fauna. Monitoring of such faunal diversity and changes caused by natural or anthropogenic processes are, therefore, essential for resource management (Raut *et al*, 2005).

Crustaceans are the second most abundant and diversified organisms in the estuarine environment and integral part of estuarine food web and nutrient dynamics (Geetha and Nandan, 2014). Scattered reports was there on brachyuran crabs diversity (Khan *et al*, 2005; Roy and Nandi, 2007 and 2008; Pandya and Vachhrajani, 2013; Trivedi and Vachhrajani, 2012 and Trivedi *et al*, 2012) but limited works has been reported on overall crustaceans diversity in Indian waters (Geetha and Nandan, 2014; Mogalekar *et al*, 2015; Sahadevan, 2016; Kolhe and Mogalekar, 2017). In this context, the present study was carried out to record the species composition and habitats of macro-benthic crustaceans in the intertidal zones of Indian Sundarbans.

MATERIALS AND METHODS

A six months (November 2014 to April 2015) sample study was conducted to assess the habitat, diversity and density of macrobenthic crustaceans (those animals

retained on a 0.5 mm sieve) in outside the protected area of Indian Sundarbans. Total study area was divided into three zones *viz*. Eastern zone, Central zone and Western zone and from each zone seven sampling sites were taken randomly (Table 1). Three replicates for each station were maintained throughout the sampling. Samples were collected at morning on monthly basis during low tide. For the quantitative study, the sampling was made along transect (100 m for each station) from the low tidal mark. Further 1 m quadrat, constructed from nylon ribbon and bamboo sticks, was temporarily established along transect with three replicates for each station. The quadrat was pushed into the sediment and the enclosed deposit was searched first and the deep burrowing organisms were counted by observing their burrows (Khade and Mane, 2012) and then collected by digging the soil until the organism was not collected. The benthos in the sediment samples recovered after sieving through 0.5 mm mesh sieve. Faunal densities are given as the number of animals per m^2.

Table 1 : Details of each sampling station with respective location.

Zone	Station code	Name	Geographical Coordinates
Eastern	E1	Napitkhali	88°44'48.58"E; 22°13'40.275"N
	E2	Amtali, Taranagar	88°53'19.004"E; 22°14'48.447"N
	E3	Chimta	88°55'48.165"E; 22°15'28.449"N
	E4	Charalkhali, Kanaikhati	89°0'59.039"E; 22°17'52.156"N
	E5	Malekanghumti	89°0'48.335"E; 22°15'10.398"N
	E6	Jyotirampur	88°50'14.158"E; 22°8'8.129"N
	E7	Anpur	88°53'29.367"E; 22°6'48.651"N
Central	C1	Jharkhali	88°41'6.864"E; 22°1'24.492"N
	C2	Dabu	88°40'11.386"E; 22°12'26.368"N
	C3	Gopalgunj	88°37'51.765"E; 22°4'8.841"N
	C4	Bhubhaneswari	88°30'38.833"E; 21°56'8.652"N
	C5	Debipur	88°33'27.09"E; 21°54'52.911"N
	C6	Kishorimohanpur	88°31'11.306"E; 21°50'53.941"N
	C7	Jaganathchak	88°27'10.736"E; 21°54'39.167"N
Western	W1	Sibnagar	88°27'4.154"E; 21°47'40.814"N
	W2	Prentice	88°16'45.548"E; 21°46'43.128"N
	W3	Chandanpiri	88°18'27.299"E; 21°40'26.936"N
	W4	Henery	88°17'26.502"E; 21°35'4.133"N
	W5	Kankramari	88°12'20.86"E; 21°43'0.707"N
	W6	Chemaguri	88°8'57.024"E; 21°40'14.936"N
	W7	Mandirtala, Harinbari	88°4'10.748"E; 21°44'52.014"N

Soon after retrieval, the organisms were preserved in 5% formalin and brought to the laboratory, Department of Fisheries Resource Management, Faculty of Fishery Sciences, Kolkata for further identification. The sorted organisms were first segregated into different groups and then identified to specific, generic or other higher levels to the greatest extent possible with the help of standard taxonomic references (Dey, 2006; Chakraborty *et al*, 1986).

RESULTS AND DISCUSSION

In the present study, 20 species of crustaceans belonging to 9 families and 13 genera were recorded from Indian Sundarban. The species were represented by *Uca acuta*, *Uca rosea*, *Uca lactea*, *Uca triangularis*, *Uca dussumieri, Thalassina anomala, Dotilla intermedia, Dotilla blanfordi, Dotillopsis brevitarsis, Sesarma chiromantes, Sesarmops impressum, Perisesarma bidens, Episesarma mederi, Sesarmoides longipes, Parasesarma plicatum, Metaplax intermedia, Clibanarius padavensis, Scylla serrata, Balanus* sp. and *Squilla* sp. Occurrence of crustaceans in selected zones of Indian Sundarban along with their ICUN status are provided in Table 2. *Clibanarius padavensis* and *Scylla serrata* were found to be the most common species for all of the three zones. Species *Uca rosea* was very common in western zone and in eastern zone but absent in central zone. Species like *Uca acuta, Dotilla intermedia*, *Sesarma chiromantes, Sesarmops impressum* and *Squilla* sp. were found only in eastern zone.

Macro benthic crustacean diversity has been reported from different regions of India. Chakraborty *et al* (1986) reported 26 species of crabs belonging to 15 genera from mangrove ecosystem of Indian Sundarbans. Choudhury *et al* (1986) reported 26 species of crabs belonging to 15 genera in the intertidal mudflats of Sagar Island, Sunderbans, India. Satheeshkumar (2012) reported total 22 species of brachyuran crabs belonging to 12 genera

Table 2 : Occurrence of macrobenthic crustaceans in selected zones of Indian Sundarban.

Family	Scientific Name	IUCN status	Occurrence in zone		
			Western	Central	Eastern
Ocypodidae	*Uca acuta* (Stimpson, 1858)	DD	-	-	+
	Uca rosea (Tweedie, 1937)	DD	+++	-	++
	Uca lactea (De Haan, 1835)	DD	++	+	+
	Uca triangularis (A. Milne-Edwards, 1873)	DD	++	++	+
	Uca dussumieri (H. Milne Edwards, 1852)	DD	++	+	+
Thalassinidae	*Thalassina anomala* (Herbst, 1804)	DD	+	-	+
Dotillidae	*Dotilla intermedia* (de Man, 1888)	DD	-	-	+
	Dotilla blanfordi (Alcock, 1900)	DD	+	+	+
	Dotillopsis brevitarsis (de Man, 1888)	DD	+	+	+
Sesarmidae	*Sesarma chiromantes*	DD	-	-	+
	Sesarmops impressum (H. Milne Edwards, 1837)	DD	-	-	+
	Perisesarma bidens (De Haan, 1835)	DD	++	+	+
	Episesarma mederi (H. Milne Edwards, 1853)	DD	+	+	+
	Sesarmoides longipes (Krauss, 1843)	DD	++	++	+
	Parasesarma plicatum (Latreille, 1803)	DD	+	+	+
Varunidae	*Metaplax intermedia* (de Man, 1888)	DD	+	++	+
Diogenidae	*Clibanarius padavensis* (de Man, 1888)	DD	++	++	++
Portunidae	*Scylla serrata* (Forskal, 1775)	DD	++	++	++
Squillidae	*Squilla* sp.	DD	-	-	+
Balanidae	*Balanus* sp. (Brown, 1844)	DD	++	+	+

(+= Rare (Species were represented in 1 - 7 quadrates), ++= Common (Species were represented in 8 - 14 quadrates), +++= Very common (Species were represented in 14 - 21 quadrates), "= Species absent, DD= Data deficient).

and 5 families of Pondicherry coast, South east coast of India. Pawar (2012) reported 26 species of decapod crustaceans representing 18 genera and 12 families from mangrove ecosystem of Uran (Raigad) in Navi Mumbai along West coast of India. Kumar and Khan (2013) reported 22 crustaceans' species from 76 invertebrate taxa of Pondicherry mangroves, India. Pandya and Vachhrajani (2013) have made an observation on Brachyuran crab diversity of lower estuarine mud flats of Mahi River and reported 10 crab species belonging to eight genera and eight families from the downstream of the estuary and surrounding areas. Varadharajan *et al* (2013) observed crab diversity from Puducherry coast, south east coast of India with a total 47 species represented by 15 families and 23 genera. Beleem *et al* (2014) could found 22 species of crabs under 22 genera belonging to 11 families from Gulf of Kachchh Marine National Park. Geetha and Nandan (2014) reported thirty four species belonging to twenty seven families and thirty four genera of crustaceans in Cochin estuary, India. Mogalekar *et al* (2015) recorded 20 species of decapod crustaceans belonging to five family and ten genera from Vembanad Lake along west coast of India. Sahadevan (2016) could found 19 species of crustaceans belonging to 7 families in Puthuvypeen of Ernakulam District, Kerala, South India. Kolhe and Magalekar (2017) reported 24 species of decapods crustacean under 7 families and 13 genera from Ratnagiri coastal water of Maharashtra, India. The present findings are similar with the others work done on composition of macrobenthic crustaceans in different parts of the Indian waters.

Macrobenthos, the critical link in the marine food web, are the inhabitants of bottom of the water coloumn and are visible to naked eye. They perform various ecological functions. The play a key role in breakdown of particulate organic matter and export energy to higher trophic level and can potentially support off-shore and pelagic communities (Lee, 1997). The present study is corroborated with that of Macintosh and Ashton (2002) who stated that the family Sesarmidae, particularly the genus *Sesarma* is the most important, in species number and abundance in mangrove environment. Sesarmids crabs play an important role in the ecology of the mangroves through their selective destruction of propagules and huge consumption and breakdown of leaf litter (Robertson, 1986; Smith, 1987). Sesarmid crabs play a key role as a

Table 3 : Habitat wise species recorded in Indian Sundarban.

Group	Species	Habitat type
Crustaceans	*Uca acuta,* *Uca rosea* *Uca triangularis* *Uca dussumieri* *Dotillopsis brevitarsis* *Metaplax intermedia* *Scylla serrata* *Squilla* sp.	Muddy substratum of upper, middle or lower littoral zone.
	Uca lactea	Sandy substratum.
	Dotilla intermedia *Dotilla blanfordi*	Muddy and sandy mid and lower littoral zone.
	Thalassina anomala *Parasesarma plicatum*	Mid littoral zone.
	Sesarma chiromantes *Sesarmops impressum* *Perisesarma bidens* *Episesarma mederi*	Mid and upper littoral zone.
	Sesarmoides longipes	Hard substratum and populated by mangrove palm.
	Balanus sp.	Dead trees and stumps and mud flat.
	Clibanarius padavensis	Coastal area.

major link between primary and secondary production through the degradation of mangrove leaf litter (Ravichandran and Kannupandi, 2004). The family Ocypodidae was the second dominant family among crustaceans, which was recorded mostly during the sampling on the floor of the mangrove area. Robertson and Daniel (1989) stated that the crab communities of mangrove forests dominated by microphagus ocypodid species rather than the leaf-eating sesarmid crabs found in the other forest types.

Habitat wise distribution of respective species is mentioned in Table 3. Out of 20 species recorded 8 species was inhabited in muddy substratum of upper, middle or lower littoral zone, 4 species in mid and upper littoral zone and 2 species in muddy and sandy mid and lower littoral zone. Family wise distribution of crustaceans' species in Indian Sundarban depicted in Fig. 1 and observed that crab belongs to family Sesarmidae (6) represented maximum number of species followed by Ocypodidae (5) and Dotillidae (3). The species like *Uca acuta*, *Uca rosea*, *Uca triangularis*, *Uca dussumieri, Dotillopsis brevitarsis, Metaplax intermedia, Scylla serrata* and *Squilla* sp. were found to inhabit in muddy substratum of upper, middle or lower littoral zone as reported earlier by Chakraborty *et al* (1986) and Das and Nandi (1999). The sandy substratum preferred species was only *Uca lactea* while the species like *Dotilla intermedia* and

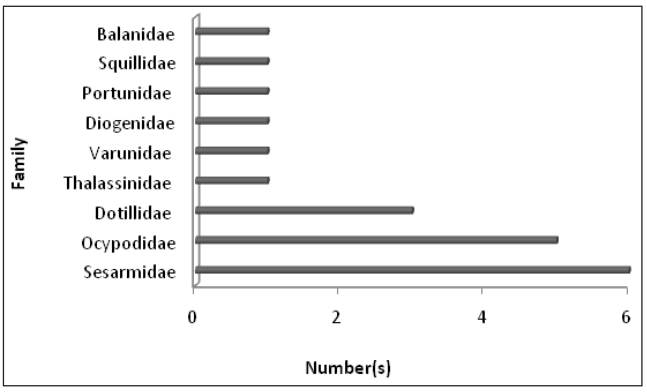

Fig. 1 : Family wise distribution of crustaceans' species in Indian Sundarban.

Dotilla blanfordi were recorded from both muddy and sandy regions of mid and lower littoral zone. The species *Thalassina anomala* and *Parasesarma plicatum* were found in the mid littoral zone but the species like *Sesarma chiromantes*, *Sesarmops impressum*, *Perisesarma bidens* and *Episesarma mederi* were observed in both mid and upper littoral zones. *Sesarmoides longipes* preferred hard substratum and populated by mangrove palm whereas the *Balanus* sp. preferred to live in dead trees and stumps and the species *Clibanarius padavensis* was recorded from the coastal area. Species *Scylla serrata* and *Squilla* sp. were preferred to live in bottom of the river and creek and mud flat respectively, which is in accordance with the previous findings (Chakraborty *et al*, 1986 and Reddy, 1995).

CONCLUSION

The present study provides baseline information of habitats and species composition of macrobenthic crustaceans in Indian Sundarban which would serve as a useful index for assessing the status, sustainable use and safeguarding the ecosystem.

ACKNOWLEDGEMENTS

The authors sincerely thank the Dean of Faculty of Fishery Sciences, West Bengal University of Animal and Fishery Sciences for constant support and National Centre for Sustainable Coastal Management (NCSCM) project for funding the total study work.

REFERENCES

Beleem I B, Yogeshkumar J S, Satyanarayana C, Venkataraman K and Kamboj R D (2014) Distribution of Marine Crabs from the Marine National Park, Gulf of Kachchh. *Sch. Acad. J. Biosci*. **2**(7), 419-427.

Chakraborty S K, Choudhury A and Deb M (1986) Decapoda Brachyura from Sunderbans mangrove estuarine complex, India. *J. Bengal Nat. Hist. Soc.* **5**(1), 55-68.

Choudhury A, Bhunia A B and Nandi S (1984) Preliminary survey on macrobenthos of Prentice Island, Sundarbans, West Bengal. *Records of the Zoological Survey of India* **81**(3&4), 81-92.

Das A K and Nandi N C (1999) Fauna of the Indian Sundarbans and their role in the Ecosystem, West Bengal, India. In: *Sundarbans Mangal*, edited by Guha Bakshi D N, Sanyal P and Naskar K R. Naya Prakash, Calcutta. pp. 417-427.

Day J W, Hall C A S, Kemp W M and Yanez-Arancibia A (1987) *Estuarine Ecology*. John Wiley and Sons, Brisbane. pp. 558.

Dey A (2006) *Handbook on Mangrove Associate Molluscs of Sundarbans.* Zoological Survey of India, Kolkata. pp. 1-96.

Geetha P N and Nandan S B (2014) Ecology, diversity and abundance of macrobenthic crustaceans in Cochin estuary, India. *Res. J. Recent Sci.* **3**(IVC-2014), 137-148.

Khan A S, Rafii S M and Lyla P S (2005) Brachyuran crab diversity in natural (Pitchavaram) and artificially developed mangroves (Vellar estuary). *Curr. Sci.* **88**(8), 1316-1324.

Kolhe S S and Mogalekar H S (2017) Decapod crustacean diversity of Ratnagiri coastal waters, Maharashtra, India. *J. Entomol. Zool. Stud.* **5**(3), 370-372.

Kumar P S and Khan A B (2013) The distribution and diversity of benthic macro-invertebrate fauna in Pondicherry mangroves, India. *Aquatic Biosystems* **9**(15), 1-18.

Kumar R S (2000) A review of biodiversity studies of soil dwelling organisms in Indian mangroves. *Zoos' Print J.* **15**(3), 221-227.

Lee S Y (1997) Potential tropic importance of the faecal material of the mangrove sesarmine crab. *Marine Ecology Progress Series* **159**, 275-284.

Macintosh D J and Ashton E C (2002) A Review of Mangrove Biodiversity Conservation and Management. *Denmark: Centre for Tropical Ecosystems Research* pp. 1- 86.

Mogalekar H S, Ansar C P, Golandaj A and Dinesh K (2015) Biodiversity of Decapod Crustacean in the Vembanad Lake at Panangad-Kumbalam Region of Kochi, Kerala. *Environ. Ecol.* **33**(4B), 1920-1923.

Pandya P J and Vachhrajani K D (2013) Brachyuran crab diversity of lower estuarine mud flats of Mahi River with new record of two species from Gujarat, India. *Arthropods* **2**(4), 242-250.

Pawar P R (2012) Diversity of decapod fauna from mangrove ecosystem of Uran (Raigad), Navi Mumbai, Maharashtra, West coast of India. *Indian J. Sci. Res*. **3**(1), 87-90.

Raut D, Ganesh T, Murty N V S S and Raman A V (2005) Macrobenthos of Kakinada Bay in the Godavari delta, East coast of India: comparing decadal changes. *Estuarine, Coastal and Shelf Science* **62**, 609–620.

Ravichandran S and Kannupandi T (2004) Biochemical changes in decomposing leaves and crabs of Pichavaram mangroves. *Biochem. Cell. Arch.* **4**, 79- 88.

Reddy K N (1995) Hermit crabs (Crustacea: Decapoda). Estuarine Ecosystem Series, Part 2. Hooghly-Matla Estuary. *Records of the Zoological Survey of India* **94**, 199-215.

Robertson A I (1986) Leaf-burying crabs: their influence on energy flow and export from mixed mangrove forests (*Rhizophora* spp.) in northeastern Australia. *J. Exp. Marine Biol. Ecol.* **102**, 237-248.

Robertson A I and Daniel A (1989) The influence of crabs on litter processing in high intertidal mangrove forests in tropical Australia. *Oecologia* **78**(2), 191-198.

Roy M K D and Nandi N C (2007) Brachyuran diversity in coastal ecosystems of Tamil Nadu. *J. Environ.Sociobiol.* **4**(2), 169-192.

Roy M K D and Nandi N C (2008) Checklist and distribution of Brachyuran crabs of West Bengal, India. *J. Environ. Sociobiol.* **5**(2), 191-214.

Sahadevan P (2016) Diversity of fishes, crustaceans and molluscs of Puthuvypeen of Ernakulam district, Kerala, South India. *Int. J. Fish.Aquatic Stud.* **4**(6), 101-107.

Satheeshkumar P and Khan A B (2012) Influence of environmental parameters on the distribution and diversity of molluscan composition in Pondicherry Mangroves, Southeast Coast of India. *Ocean Science J.* **47**(1), 61-71.

Sidhu S S (1963) Studies on Mangrove. *Proc.National Acad. Sci. India* **33**(b), 129-136.

Smith T J (1987) Seed predation in relation to tree dominance and distribution in mangrove forests. *Ecology* **68**, 266-273.

Trivedi J N and Vachhrajani K D (2012) New record of color morphs of brachyuran crab *Charybdis annulata* Fabricius, 1798 (Decapoda : Portunidae). *Arthropods* **1**(4), 129-135.

Trivedi J N, Gadhavi M K and Vachhrajani K D (2012) Diversity and habitat preference of brachyuran crabs in Gulf of Kutch, Gujarat, India. *Arthropods* **1**(1), 13-23.

Varadharajan D, Soundarapandian P and Pushparajan N (2013) The global science of crab biodiversity from Puducherry coast, south east coast of India. *Arthropods* **2**(1), 26-35.

Warren J H and Underwood A J (1986) Effects of burrowing crabs on the topography of mangroves swamps in New South Wales. *J. Exp. Marine Biol. Ecol.* **102**, 223-235.