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Animal diversity in the mangrove forest at Bichitrapur of Balasore district, Odisha, India- A case study

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Abstract

The present work forms the preliminary study of ecosystem of Bichitrapur in Balasore district, though it covers a small area. A total 56 species of estuarine animals are found in the locality. They are normally mangrove associate animals, found in and over mangrove plants as borers or non-borers. These animals are either harmful to mangrove plants or opportunists by depending on mangroves for shelter or feeding. The dominating group in this mangrove is found to be the Molluscs, comprising 8 species of borers of mangrove-wood and 19 species as opportunistic epi-fauna. Crustaceans are the second diverse group in this ecosystem, represented by 13 species of crabs, 6 species of boring Isopods and a single species of Amphipod. The other epifaunal components comprise a few species of Cnidaria, Polychaetea, Echinoderm and some fishes, which are found on 7 species of mangrove plants in this ecosystem. But they seem to be non-specific to any mangrove plant species. An in-depth study of these faunal components in ecological viewpoints may provide pathway towards conservation and management of the mangrove ecosystems.

Keywords: Epi-Fauna, Habitat, In-Fauna, Mangrove Plants, Odisha

Introduction

Mangroves are heterogeneous group of plants that normally grow in the intertidal region, between the land and sea, in tropics and sub-tropics (Mandal and Nandi, 1989). The intertidal zone is usually characterized by highly changeable environmental factors, such as high degree of sedimentation, extreme temperature, coastal currents, tidal ebbs and flows, changing substrata etc. Mangrove ecosystems, fringing the estuaries and open sea-front of tropical and sub-tropical region, represent a transitional zone between marine and terrestrial biotopes, and thus form an integral part of the intertidal zone (Nagelkerkan et al., 2008). The prop-roots and pneumatophores of mangrove plants spread into the intertidal region and build a hard substratum in an otherwise made of soft sediment. As such, mangrove roots provide home to many terrestrial as well as marine plants, invertebrates and some vertebrates. Mangroves form a unique habitat for a wide range of species, which occur in high density. Mangroves are among the most productive ecosystems and constitute a variety of living resources which include a variety of aquatic organisms and plants. These specialized plants are also important to human beings for a number of reasons, including aquaculture, forestry, protection against storm surge and coastal erosion, as a source of firewood and building material and other local subsistence use. Estuarine habitats surrounding mangroves, in particular, are recognized as important drivers for near shore fish productivity, and of all the ecosystem of this planet estuaries have highest production value per hectare, and thus estuaries are very significant towards subsistence of many coastal communities. Mangrove ecosystems have great importance in terms of economic and ecological aspects as well. And, considering its importance and valuing the ecosystem services rendered, various conservation programs have been initiated worldwide to protect this fragile ecosystem.

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Mangroves occur in all maritime states of India: West Bengal, Odisha, Andhra Pradesh, Tamil Nadu, Puducherry, Kerala, Karnataka, Goa, Maharashtra, Gujarat, Daman-Diu, Andaman and Nicobar Islands, and few hectors in Lakshadweep (Minicoy Island). Several workers contributed to study of mangrove-associate fauna in different mangrove ecosystems of our country (Sundarbans - Mandal and Nandi (1989); Misra and Choudhury (1985); Dey (2006); Maharashtra - Parulekar (1994); Andamans - Dev Roy and Das (2000); Kerala - Sunil Kumar (2000); Radhakrishnan *et al.* (2006), Odisha- Mitra and Pattanayak (2013) and many others). There are some works on insect associates in Indian mangrove ecosystems available, but not included here in the purview of the present work. Some species of marine and estuarine fauna are well adapted to mangrove ecosystems. They may live in the soil substratum in and around mangrove plantation and use this ecosystem as feeding or nursery ground or as habitat for protection and living. These species are usually termed as mangrove-associate fauna.

During a faunal study in Bichitrapur mangroves in Balasore district of Odisha during 2016-2017, the authors observed some species of marine or estuarine fauna well adapted to live on the mangrove plants itself, they chose the leaf, trunk as well as prop-roots, as a shelter. Not only the living plants but also they occur even in the dead wood/log.

In order to document the living resources found in the mangrove wood as epi-fauna and also as wood borer the present communication aimed at establishing baseline information on the faunal diversity of mangrove plants other than insects in the said area.

Material and Methods

The Bichitrapur mangroves form a part of the Subarnarekha estuary. The River Subarnarekha is one of the major rivers along Odisha coast. After originating from the Ranchi plateau of Jharkhand state it runs about 477 kms through three states (Jharkhand, West Bengal and Odisha) and lastly drains into the Bay of Bengal at the north-eastern part of Odisha (21°34′- 21°37′ N and 87°20′- 87°27′ E), forming an estuarine system comprising mangrove trees and associate plants and shrubs around it, along with salt marshes, mudflats and sandy beaches as well (Figure 1).

From the main mouth of Subarnarekha River (Kirtania) to Talsari, an extensive saline wetland is developed over 11.5 sq. km areas. The entire wetland is usually flooded in every high tide. Tidal mudflat is also extensive over the region which provided an ideal ground for colonization of opportunist mangrove, which are dominated by *Avicennia officinalis* (Sada bain), *Avicinea alba* (kala bain) and *Acanthus ilicifolious*. Beside this *Aegialitis rotundifolia* (satai), *Ceriops tagal* (Garan), *Exoecaria agollacha* (Geon) and *Phoenix paludosa* (Hental) are also take part to form a mangrove vegetation (Pal, 2002).

Figure 1. Satellite Map showing the mangrove area of Bichitrapur (Courtsey: Google earth.com).

Tidal mudflat is criss-crossed by number of tidal creeks, tidal passes and inlets. The eastern part of the lagoonal flat is slightly higher than western part , thus the ordinary high tide waters of the winter periods does not reaches the western side of the lagoonal flat through the Talsari tidal channel link. A salt marsh area is developed in that area which is occupied by salt tolerant species like *Salicornia brachiata* (Brahmi sak), *Saudea maritima* (Giria sak), *Aeluropus logopoides* (Nona durba) and *Porteresia coarctata* (Dhani ghas) etc. (Pal, 2002). All these habitat types provide a mangrove habitat for ecological and biological studies.

Specimens were observed as well as photographed as it is found in the mangrove plants, the plant part are noted, specimens were collected and preserved in 70% Alcohol or in 10% Formalin after proper narcotisation, and attempts were made to identify all the collected specimens up to species level whenever possible. Observations and

collection of specimens were made on three different seasons (Pre-monsoon, monsoon and post-monsoon) during the study period.

Results and Discussions

A total 85 species of invertebrates and some arboreal fishes were collected from the different sections of the mangrove ecosystem occur along the Subarnarekha estuary, these are belongs to 9 phyla, 13 classes, 23 orders, 51 families and 68 genera (Mitra *et al*., 2010).

It is established that in Mangrove ecosystems, animal distribution and diversity cannot be described by considering tidal amplitude and expanses only, as is used to assess in case of shore animals. Because mangrove ecosystem consist of two main series zones, such as, horizontally from the landward mangroves towards the sea and vertically from the mangrove canopy down to the soil. Horizontal zone includes supra-littoral, littoral and sub-littoral areas and the vertical zone comprise several principal habitats, such as tree canopy, upper part of the mangrove tree, mangrove roots and lower part, mud surface, dead woods, creeks and bays.

In our observation, we only considered the species association with different parts of mangrove plants. So far, 56 species belonging to 6 phyla, 31 families and 43 genera are recorded from Bichitrapur mangroves. The most common macrofauna associated with the Indian mangroves are polychaetes, crustaceans and molluscs. In addition to this, sipunculids, nemerteans, actiniarians and gobiids are other common animals (Sunil Kumar, 2000, 2001). Since wood is an valuable and important forest product, any such damage impacts nation's resources and the exchequer very severely. However, on the positive side of it, these animals greatly help in material recycling and nutrient enrichment, thus occupying a place of pride in ecosystem dynamics.

The marine wood borers are placed in three families of Phylum Arthropoda, namely Sphaeromatidae, Limnoriidae and Cheluridae and two families of Phylum Mollusca, such as, Pholadidae and Teredinidae. Some other invertebrates, i.e., polychaetes, crabs, amphipods, molluscs and some blenniid fish are also found as wood-borers in living as well as dead mangrove wood. Economical significance attached to these families attracted many workers in the world to study taxonomic aspects of these animals. Although several works have been published in India on the marine wood borer faunal components occurring in marine habitat, very little information is available regarding the wood-boring community in the mangroves of India and that is true to Bichitrapur mangroves.

A total 15 species of wood-borers were recorded from this estuary, of which crustaceans represented by 7 species and molluscans by 8 species. Among the borers, family Teredinidae is most successful, and two species are found most abundant in this estuary, *Bactronophorus thoracites* and *Bankia rochi*; *Bankia campanellata*; *Martesia striata* and *Martesisa fragilis* are found in huge population in some dead or alive wood. *Spheroma terebrans* is the most common isopod found in this estuary. The distributions of the wood borers are not even in this estuary. Bichitrapur situated in the middle of Talsari and Kirtania and with dense mangroves hold the highest 14 species and in Kirtania it is only 8 species of molluscs to count (Table 1).

Some species of invertebrates as well as vertebrates are associated with different parts of mangroves, but not as wood-borer are also encountered in this study, and a total 41 species were found, of which phylum mollusca is dominated with 22 species, crustacean are the second most successful group with 12 species, whereas cnidarians and fishes are represented by with three species each. While two polychaetes are known, *Ophiactis modesta* Brock, 1889 is only representative of echinoderms in this environment. Some species are first time reported here from this estuary are marked with '*' (Table 2).

The present study reveals occurrence of a total of 56 species of estuarine fauna which are primarily associated with different portion of mangrove plants as borers or non-borers and some of those organisms cause harm to mangroves. All these species are found in all five species of mangroves, which are found in the mangroves of Bichitrapur. It seems that they are not a specific to any plant species, at least in this locality. A detailed study on biology of these species is essentially required in order to plan effective management and conservation of the mangrove ecosystem of this region.

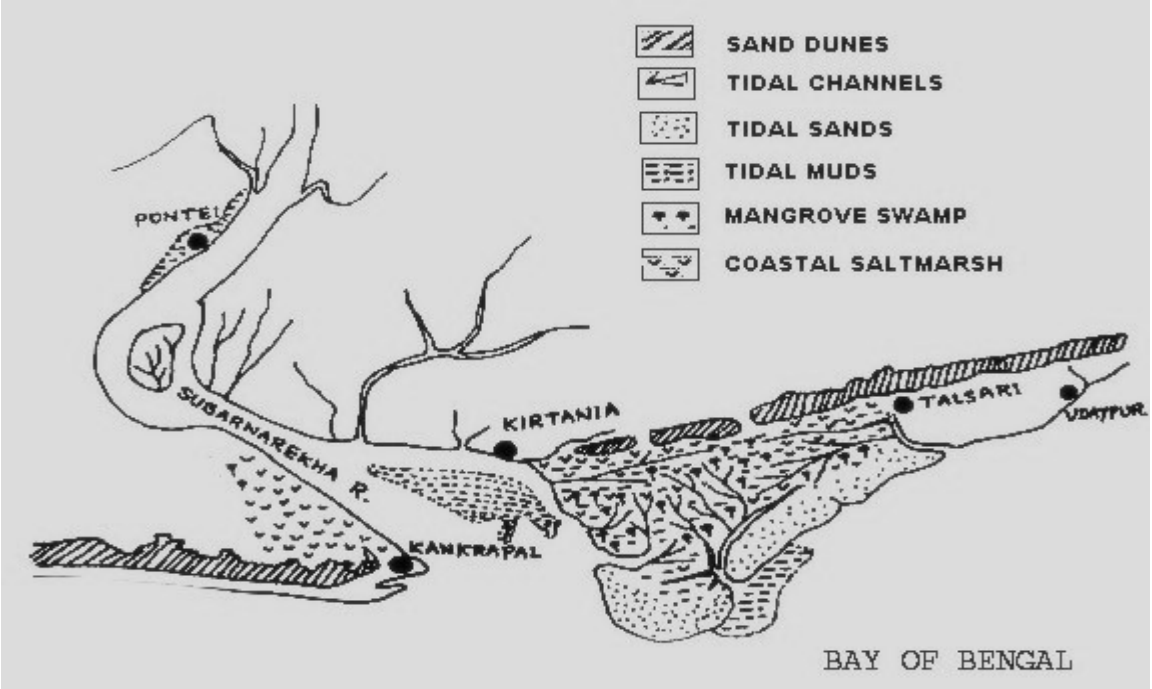

Figure 2. Mangrove area of Subarnarekha estuary at Bichitrapur.

Table 1. Species found in the mangrove as wood-borer (freshly dead and semi decomposed)

SYSTEMATIC LIST OF FAUNA	Talsari	Bichitrapur	Subarnapur	Kirtania
Phylum: ARTHROPODA Class: MALACOSTRACA Order: ISOPODA Family: SPHAEROMATIDAE				
*1. *Sphaeroma annandalei* Stebbing, 1911	+	+	+	-
*2. *Sphaeroma terebrans* Bate, 1866	-	+	+	-
*3. *Sphaeroma triste* Heller, 1868	+	-	-	-
*4. *Sphaeroma walkeri* Stebbing, 1905	+	-	-	+
Family: LIMNORIIDAE				
*5. *Limnoria indica* Becker and Kampf, 1958	+	+	+	+
*6. *Limnoria* sp.	-	+	-	-
Order: AMPHIPODA Family: CHELURIDAE				
*7. *Chelura* sp.	+	+	+	+
Phylum: MOLLUSCA Class: BIVALVIA Order: MYOIDA Family: PHOLADIDAE				
Subfamily: MARTESIINAE				
8. *Martesia fragilis* Verrill & Bush, 1898	+	+	+	+
9. *Martesia striata* (Linnaeus, 1758)	+	+	-	+

Family: TEREDINIDAE Subfamily: TEREDININAE				
10. *Bactronophorus thoracites* (Gould, 1856)	+	+	+	+
*11. *Teredo* sp.	-	+	+	-
Subfamily: BANKIINAE				
*12. *Bankia campanellata* Moll & Roch, 1931	+	+	+	+
*13. *Bankia nordi* Moll, 1935	+	+	+	-
*14. *Bankia rochi* Moll, 1931	+	+	+	-
15. *Bankia* sp.	+	+	-	-

*species recorded for the first time from Bichitrapur mangroves, Odisha

Table 2. Species found on different parts of the Mangroves plants at Bichitrapur

SYSTEMATIC LIST OF FAUNA	Bark of Tree Trunk	Leaves	Wooden holes	Roots
Phylum CNIDARIA Class HYDROZOA Order THECATA Family CAMPANULARIIDAE				
1. *Obelia bidentata* Clark, 1875				+
Family DIADUMENIDAE				
2. *Diadumene schilleriana* (Stoliczka, 1869)	+			+
3. *Diadumene lineata* (Verrill, 1869)				+
Phylum ANNELIDA Class POLYCHAETA Order AMPHINOMIDA Family AMPHINOMIDAE				
*4. *Amphinome rostrata* (Pallas, 1866)			+	
Family: NEREIDIDAE				
*5. *Perinereis nigropunctata* (Horst, 1889)			+	
Phylum ARTHROPODA Class CRUSTACEA Sub Class CIRRIPEDIA Order THORASICA Family BALANIDAE				
6. *Amphibalanus amphitrite* (Darwin, 1854)	+			+
Family TETRACTILIDAE				
7. *Tetraclita squamosa patellaris* Darwin, 1854	+			+
Family CHTHMALIDAE				
8. *Chthamalus malayensis* Pilsbry, 1916	+			+
*9. *Microeuraphia withersi* (Pilsbry, 1916)	+	+		
Family COENOBITIDAE				
10. *Coenobita cavipes* Stimpson, 1858	+			+

Family DIOGENIDAE				
11. *Clibanarius padavensis* de Man, 1888				+
12. *Clibanarius longitarsus* (De Haan, 1849)				+
Family VARUNIDAE				
13. *Varuna litterata* (Fabricius, 1798)	+			+
Family SESARMIDAE				
14. *Parasesarma plicatum* (Latreille, 1803)	+			+
15. *Episesarma versicolor* (Tweedie, 1940)				
16. *Metopograpsus messor* (Forsskal, 1775)	+			+
*17. *Metopograpsus latifrons* (White, 1847)	+			+
Family MENIPPIDAE				
18. *Epixanthus dentataus* (White, 1847)			+	
Phylum MOLLUSCA Class GASTROPODA Order ARCHAEOGASTROPODA Family NERITIDAE				
19. *Nerita balteata* Reeve, 1855	+		+	+
20. *Neripteron violaceum* (Gmelin, 1791)	+		+	+
21. *Neritina smithii* W. Wood, 1828	+			+
Order MESOGASTROPODA Family LITTORINIDAE				
22. *Littoraria melanostoma* (Gray, 1839)	+	+		
23. *Littoraria scabra* (Linnaeus, 1758)	+	+		
24. *Littoraria delicatula* (Nevill, 1885)		+		
Family POTAMIDIDAE				
25. *Cerithidea obtusa* (Lamarck, 1822)	+	+		
ORDER NEOGASTROPODA Family MURICIDAE				
26. *Indithais lacera* (Born, 1778)			+	+
Family COLUMBELLIDAE				
*27. *Pseudanachis basedowi* (Hedley, 1918)	+			
Subclass HETEROBRANCHIA Order SYSTELLOMMATOPHORA Family ONCHIDIIDAE				
28. *Peronina tenera* (Stoliczka, 1869)	+		+	+
29. *Platevindex tigrinum* (Stoliczka, 1869)	+		+	-
Order ELLOBIIDA Family ELLOBIIDAE				
30. *Cassidula nucleus* (Gmelin, 1791)	+			
31. *Pythia plicata* (Ferrusac, 1821)	+			

Subclass PTERIOMORPHIA Order MYTILOIDA Family MYTILIDAE				
32. *Brachidontes striatulus* (Hanley, 1843)	+			+
33. *Perna viridis* (Linnaeus, 1758)				+
Order OSTREOIDA Family OSTREIDAE				
34. *Magallana cuttackensis* (Newton & Smith, 1912)	+			+
35. *Saccostrea cucullata* (Born, 1778)	+			+
Family ANOMIIDAE				
36. *Enigmonia aenigmatica* (Holten, 1802)	+			+
37. *Anomia achaeus* Gray, 1850				
Phylum ECHINODERMATA Class OPHIUROIDEA Family OPHIACTIDAE				
38. *Ophiactis modesta* Brock, 1888	-	-	+	-
Phylum CORDATA Class ACTINOPTERI Order BLENNIFORMES Family BLENNIDAE				
*39. *Omobranchus zebra* (Bleeker, 1868)	-	-	+	-
*40. *Petroscirtes variabilis* Cantor, 1849	-	-	+	-
ORDER GOBIIFORMES				
Family GOBIDAE				
41. *Periophthalmus sp.*				+

*species recorded for the first time from Bichitrapur mangrove, Odisha

Figure 3. Sea anemone *Diadumene lineata* on the mangrove trunk.

Figure 4. *Coenobita cavipes* climbing on E*xocearia aggolacha*, mangrove.

Figure 5. *Balanus amhritrite* and *Nerita articulata* on the mangrove.

Figure 6. *Europila withersi* on the leaf of mangroves.

Figure 7. *Onchidium typhae* on the wooden hole of mangrove.

Figure 8. *Sphaeroma terebrans* and its juveniles colonize in wooden holes.

Figure 9. *Omobranchus zebra,* a blennid fish.

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