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Distribution of molluscan fauna in the Karangad estuarine mangroves, South East Coast of India

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Abstract. A survey has been made during February 2010 to know the pattern of molluscan fauna in the mangroves located along the Karangad estuary. During the present investigation in the research area, 25 species of molluscs were recorded. They belong to 14 genera, 10 families and 5 orders. In the study area, 13 species of gastropods namely, *Cerithidea fluviatilis, Terebralia palustris, Cerithium citrinum, C. scabridum, C. obeliscus, Littorina scabra, L. undulata, Planaxis sulcatus, Drupa margariticola, D. heptagonalis, Thais rudolphi, T. bufo,* and *T. tissoti* and 12 species of bivalves – *Gafrarium tumidum, G. pectinatum, Crassostrea madrasensis, Mactra cuneata, Tellina ala, T. bruguieri, Saccostrea cucculata, Modiolus metcalfei, M. tulipa, M. trailli, Meretrix meretrix* and *M. casta* - were recorded.
Key Words: mangrove, malacofauna, Karangad estuary, molluscs, India.

Introduction. The word "mangrove" is formed by combination of the Portuguese word "mangue" and the English word "grove". Mangroves, salt-tolerant plants, occur in most tropical and subtropical regions of the world. This group of plants is very important to the ecosystem diversity because they protect the coastline from destruction (maintain the ecosystem diversity) and provide many resources for utilization in the forestry, fisheries, food, agricultural and medicinal industries. The mangrove ecosystems are highly productive intertidal forests distributed along the tropical coast and they stabilize the coastal zone from erosion and act as a buffer zone between land and sea. Mangroves preserve water quality and reduce pollution by filtering suspended material and assimilating dissolved nutrients (Bandaranayake et al 2002).

Mangroves are predominantly intertidal habitats that occur along sheltered and shallow water coastlines. Mangrove-derived detritus is an important food source for decomposer food webs including many macro invertebrates (Fratini et al 2000; Cannicci et al 2008). The Pichavaram ecosystem of east coast of India is an estuarine-mangrove complex and supports a wide variety of biological species (Kathiresan 2000). Interacting with aquatic, inshore, upstream and terrestrial ecosystems, they support a diverse marine, freshwater and terrestrial flora and fauna (Macintosh & Ashton 2002) providing habitats for the distribution of diverse animals (Hogarth 2001). As such, mangrove roots become home to terrestrial as well as marine plants, algae, invertebrates and vertebrates. Molluscs are abundant in the littoral zones of sea. Molluscan group namely gastropods and bivalves form 98% of the total population. Macrobenthos may be operationally separated in three groups, i.e., epifauna, infauna and arboreal. Epifauna refers to those invertebrates that live on various substrates such as lower tree trunks and the sediment surface, but which do not burrow in it. Infauna refers to burrowing invertebrates which live within the sediment and arboreal forms refer to those live attached to stems, roots of the mangrove vegetation.

Many studies were carried out on the ecology and faunal distribution of mangrove swamps of Indo-West Pacific region (Macnae 1968), Malaysia (Brown 1971), west Indies (Coomans 1969), and in the province of Pavia, Northern Italy and North Western Australian mangrove swamps (Wells 1983). Mangrove faunal assemblages of molluscs relatively poorly known compared to other components of mangrove ecosystem. The investigation on the faunal assemblage of the molluscan fauna of the mangrove forests situated at the mouths of the estuary on the east coast of India is scanty. A survey has been made during February 2010 to know the pattern of molluscan fauna in the mangroves located in the karangad estuary.

Materials and Methods

Karangad estuary is formed by the confluence of Kotai River with the sea on the Palk bay side at the southeast coast of India (Figure 1). The estuary lies between 9°38'42.1" N to 9°38'49.3" N and 78°57'54.2"E to 78°56'24.8" E. The width and depth of estuary ranges from 120m to 246m and from 1 to 2m respectively. This mangrove is bordered by two villages - Karangad and Pudukadu. The bottom of the estuary consists of clay, silt with admixture of sand and large amount of organic detritus.

The molluscan fauna of the extensive mangrove were collected by hand picking and the bivalve molluscs like mussels and oysters were collected by scrapping using knives from a known unit area of a quadrate ($0.5m^2$). The infauna forms was collected by digging the substratum as described by (Alfred 1997).The arboreal forms were collected from the roots, stems and other parts of the mangrove trees vertically at every 25 cm height by hand picking (Sasekumar 1974).

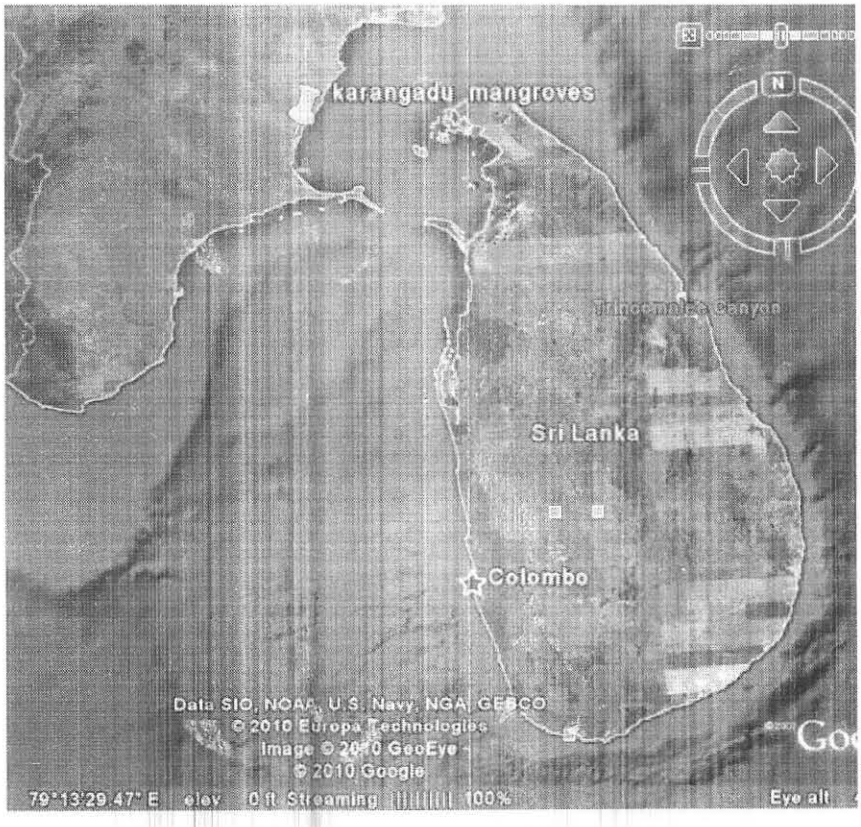

Figure 1. Location of Karangad estuarine mangroves.

Results and Discussions

A systematic list of molluscan fauna recorded in the karangad estuarine mangroves through out the study period is listed in Table 1.

Mangroves as Habitats for Molluscs. Molluscs can reach a high biomass in mangroves and they occupy very different levels of the ecosystem food web. Molluscs along with decapod crustaceans are the most well represented taxon of marine origin in mangrove forests (Plaziat 1984; Kathiresan & Bingham 2001). Molluscs dwell on the sediment surface or reside in burrows, others live on pneumatophores and lower tree trunks or prop-roots, burrow in decaying wood, or can even be found in the tree canopies (Sasekumar 1974; Ashton 1999). In mangroves, molluscs occupy all the levels of the food web, as predators, herbivores, detritivores and filter feeders. They are zoned both horizontally (i.e. along the sea-land axis) and vertically (i.e. at diverse heights from the ground) and include both mobile and sessile species. The presence of marine wood borers in the mangrove forest of Godavari estuary was reported by Ganapathi & Rao (1959). Studies on mangrove associated molluscan fauna of various Indian peninsular estuaries viz. Godavari and Krishna estuaries (Radhakrishnan & Janakiram 1975), Mahanadhi estuary (Subba Rao & Mookherjee 1975), Muriganga estuary, Sunderbans (Subba Rao et al 1983) have already been carried out. Murthy & Balaparameswara Rao (1977) carried out some works on the ecology of molluscs of the mangrove swamps in Machilipatnam. A survey on the investigation of malacofauna in the Pichavaram mangrove forest was done by Kasinathan & Shanmugam (1985). Hundred species of molluscs have been reported from mangroves areas of Andaman and Nicobar islands (Das & Roy 1989) and the mangrove fauna of Indian subcontinent (Dey 2006). A recent study on the malacofauna in Pondicherry mangroves was made by Khan et al 2008 and Kesavan et al 2009). Studies on molluscs overall consumption of mangrove litter in some Indo-Pacific mangrove forests using carbon and nitrogen stable isotope signatures and consequent contribution in nutrient dynamics was carried out by Bouillon et al (2002ab).

Gastropods and Bivalves. In mangrove ecosystem, gastropods contribute to entrap primary production within the food web by grazing fallen leaves and consuming mud (mainly formed by mangrove litter), bivalves are efficient filter feeders, able to capture suspended particles of various origins (Plaziat 1984; Kathiresan & Bingham 2001). Mud whelks consume significant amounts of fallen leaves in a Kenyan mangrove (five times the daily R. mucronata leaf production if fed ad libitum) was demonstrated by Fratini et al (2004). The impact of pollution in mangrove forests can be assessed based on the structure of the molluscan assemblages.

Mangrove roots and trunks represent zones of hard substrate colonised by fouling organisms e.g. Mussels and Oysters. Oysters, mussels and barnacles also foul mangrove roots and trunks (Pinto & Wignarajah 1980; Ross & Underwood 1997). Oyster and mussel form valuable fisheries in various parts of coastal India and are widely distributed in creeks, backwaters, bays and estuaries wherever hard substratum is found. The gastropod and bivalve molluscs are among the commonest epifaunal species that exist in the mangrove ecosystems. The epibenthic fauna includes primary and secondary consumers, and its impact on mangrove trees is considerable: barnacle assemblage can negatively affect root growth (Perry 1988) and heavy oyster cover can damage or break prop roots (Ellison & Farnsworth 1992, 2001). Gastropods and bivalves have a significant ecological role to play in the mangrove ecosystems and very little is known on their diversity of mangroves. Hence it is essential to document the biodiversity of ecosystems

In the present investigation, the recorded specimens were found to occur on mud banks, mud flats, mangrove forest, sandy muddy area swamps and hard substratum such as wooden poles and pillars. The oyster *Crassostrea madrasensis*, the clam *Meretrix casta* and the prosobranch gastropod *Cerethidia fluviatilis* and *Cerithium spp.* occurred by forming the beds in estuary. Oysters were found attached to wherever hard substratum is available such as wooden pole, wooden boat, mangrove stem, rock, brick, cement pillar or pole etc. Maximum number of species was collected from estuary banks and mud

flats. Most of the individuals were epifaunal and attached. *C. fluviatilis* were found to attach on to the mangrove stems and branches up to 1.0 meter height.

In the research area, the common species namely *T. palustris*; *C. scabridum*, *C. fluviatilis, C. obeliscus, Mactra spp. L. scabra, T. ala, C. citrinum, T. bruguieri, M. casta* and *L. undulata were* found to occur in the muddy substratum. Certain species of Cerithium such as *C. citrinum, C. obeliscus, Modiolus spp., C. madrasensis, C. fluviatilis, Drupa spp., Thais spp., and Littorina spp.* were found to occur on the stem and root system of mangroves. *Gafrarium spp.* was found more near the mouth of estuary. *C. madrasensis* was found more in the middle of estuary by forming bed while *M. casta* was found more in the upper stream of the estuary. *Cerethidia spp* and *Cerithium spp* were forming beds through out the estuary and were predominant among all molluscan fauna.

Table 1 - A systematic list of molluscan fauna recorded in the Karangad estuarine mangroves

Taxonomical classification of molluscan fauna			
S. No.	Class : Gastropoda	S. No.	Class : Pelecypoda (bivalvia)
1.	Order : Mesogastropoda Family : Potamididae Genus : *Cerithidea* Species: *C. fluviatilis* (Potiez & Michaud)	1.	Order : Eulamellibranchiata Family : Veneridae Genus : *Meretrix* Species: *M. meretrix* (Linnaeus)
2.	Order : Mesogastropoda Family : Potamididae Genus : *Terebralia* Species: *T. palustris* (Linne)	2.	Order : Eulamellibranchiata Family : Veneridae Genus : *Meretrix* Species: *M. casta* (Chemnitz
3.	Order : Mesogastropoda Family : Cerithiidae Genus : *Cerithium* Species: *C. citrinum* (Sowerby)	3.	Order : Mytiloida Family : Mytilidae Genus : *Modiolus* Species: *M. metcalfei* (Hanley)
4.	Order : Mesogastropoda Family : Cerithiidae Genus : *Cerithium* Species: *C. scabridum* (Philippi)	4.	Order : Mytiloida Family : Mytilidae Genus : *Modiolus* Species: *M. tulipa* (Lamarck)
5.	Order : Mesogastropoda Family : Cerithiidae Genus : *Cerithium* Species: *C. obeliscus* (Bruguiere)	5.	Order : Mytiloida Family : Mytilidae Genus : *Modiolus* Species: *M. traillii* (Reeve)
6.	Order : Mesogastropoda Family : Planaxidae Genus : *Planaxis* Species: *P. sulcatus* (Born)	6.	Order : Ostreoida Family : Ostreidae Genus : *Crassostrea* Species: *C. madrasensis* (Preston)
7.	Order : Neogastropoda Family : Muricidae Genus : *Drupa* Species: *D.margariticola* (Broderrip)	7.	Order : Ostreoida Family : Ostreidae Genus : *Saccostrea* Species: *S. cucculata* (Born)
8.	Order : Neogastropoda Family : Muricidae Genus : *Drupa* Species: *D. heptagonalis* (Reeve)	8.	Order : Eulamellibranchiata Family : Veneridae Genus : *Gafrarium* Species: *G. tumidum* (Roding)

9.	Order : Family: Genus : Species:	Neogastropoda Muricidae *Thais* *T. rudolphi* (Lamarck	9.	Order : Family : Genus : Species:	Eulamellibranchiata Veneridae *Gafrarium* *G .pectinatum* (Linne)
10.	Order : Family : Genus : Species:	Neogastropoda Muricidae *Thais* *T. bufo* (Lamarck)	10.	Order : Family : Genus : Species:	Eulamellibranchiata Mactridae *Mactra* *M. cuneata* (Chemnitz)
11.	Order : Family : Genus : Species:	Neogastropoda Muricidae *Thais* *T. tissoti* (Petit)	11.	Order : Family : Genus : Species:	Eulamellibranchiata Tellinidae *Tellina* *T. ala* (Hanley)
12.	Order : Family : Genus : Species:	Mesogastropoda Littorinidae *Littorina* *L.(Littorinopsis) scabra* (Linnaeus)	12.	Order : Family : Genus : Species:	Eulamellibranchiata Tellinidae *Tellina* *T. bruguieri* (Hanley)
13.	Order : Family : Genus : Species:	Mesogastropoda Littorinidae *Littorina* *L. undulata* (Gray)			

Conclusion. During the present study, 25 species of molluscs (13 gastropods and 12 bivalves) were recorded. They belong to 14 genera, 10 families and 5 orders. The oyster *Crassostrea madrasensis*, the clam *Meretrix casta* and the prosobranch gastropod *Cerethidia fluviatilis* and *Cerithium spp.* occurred by forming the beds in estuary. Maximum number of species was observed from mud flats along the mangroves. Oysters were found attached to wherever hard substratum is available. Cerethidia spp and Cerithium spp were found predominant among the observed fauna forming bed throughout the estuary.

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