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Research Paper

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Biodiversity of Punnakayal Mangroves, SE coast, India

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ABSTRACT

From the biodiversity study it is evident that the Punnakayal estuarine waters and the mangrove area are an abode for a rich diversity of benthic species such as molluscs and crustaceans. They are also a nursery ground for juvenile fishes, crabs, shrimps and lobsters. Biological assemblages viz., Mangrove vegetation, Zoo' & Phytoplankton, Macroalgae, Eggs & larvae, Crustaceans, Molluscs, Fish and Avifauna were also found to be abundant. In the present survey 17 species of phytoplankton belonging to 13 genera, 6 species of seaweeds belonging to 5 genera, 6 species of salt marsh plants belonging to 4 genera, 4 species of mangroves belonging to 3 genera, 12 species of zooplankton belonging to 10 genera, 4 species of crabs belonging to 2 genera, 3 species of shrimps belonging to 1 genus, 8 species of gastropods belonging to 8 genera and 2 species of bivalves belonging to 1 genus were recorded. Juveniles of crabs, shrimps, mollusks and fishes were present in abundance.

Introduction

Mangroves are among the most productive and biologically diverse ecosystems in the world. They act as feeding and breeding ground for insects, crustaceans, molluscs, fishes, amphibians, reptiles, and mammals. They are also nesting sites for common, migratory and rare birds. These areas have great potential for captive and culture fisheries because of the rich nutrient load and the abundance of ready-to-use particulate organic matter for the juvenile stock. It is a storehouse of medicinal compounds and has the potential to support apiary. Past instances have proved that their presence in coastline acts as a biological shield and saves lives and property during natural hazards such as tsunamis, cyclones, storm surges and erosion. Moreover, the socio-economics of the mangrove ecosystem adjoining population, mainly the fisher-folk is greatly dependant on the ecosystem. The Punnakayal mangrove ecosystem is one such in the confluence of R.Thamirabarani in the Arabian Sea.

Review of Research in the Punnakayal area

Piecemeal research has been conducted concerning the biodiversity of Punnakayal mangroves and scientific documentation is meager.

Venkatraman et al., (1958) have made preliminary observations on prawn catches of Punnakayal mangroves and have reported it to be moderate.

Rao et al., (1988) have reported molluscan shell deposits along Punnakayal-Vallinokkam coast and their possible use in the lime industry.

Marichamy and Rajapackiam (2001) have reported juveniles of the crab Scylla sp. available as wild resources for culture in the Punnakayal mangroves.

Senthikumar and Patterson (2002) have reported coliphages from the mangrove environment of Punnakayal. They have also described coliphages as indicator of sewage pollution in the area.

Jayaseeli and Murugan (2002) have the presence of stunted Avicennia sp. However, this study is indicative and not comprehensive.

Anthony et al., (2004) have reported high counts of Staphylococcos aureus in the shrimps of Punnakayal.

Materials and methods

Phytoplankton

Phytoplankton samples were collected from the surface water at different stations. Hundred litres of seawater was concentrated to 250ml by filtering through 20µ mesh-sized plankton net. For the quantitative estimation a Sedgewick Rafter Counting Cell was used. Phytoplankton samples were identified up to species level under binocular microscope following standard monographs. (Husted,1930 ; Pergallo, 1965; Newell and Newell, 1988).

Zooplankton

Zooplankton samples were collected by surface haul by using Heron-Tranter plankton net with a mesh size of 300µ for 10 minutes at 1 nautical mile per hour boat speed. The number of zooplankton in the samples was counted by using a Sedgewick Rafter Counting Cell. Zooplankton was identified under binocular microscope by referring standard manuals (Wickstead, 1965).

Benthos

The sediment samples pre stained with Rose Bengal were sieved through 1mm and 63µ mesh sieves by adding copious amount of water for separating macro and meio benthic fauna respectively. The numerical density and biomass were estimated and the results were expressed per m2 area of the sea bottom.

Fishery

Fishery assessment was made by collecting landing statistics from Punnakayal fish landing center by the inspection of boats and landings. Questionnaire method was employed to collect data through interview. The local fishermen were interviewed on aspects of fisheries.

Mangrove Vegetation

Mangrove studies were carried out during the low tide when all the stands are well exposed. In each station, perpendicular to the waterfront, in a straight line 3 plots of 10 ×10 m was laid at every 50 m interval. In each plot the total number of trees was counted. For all trees in the plot, tree height and girth at breast height (GBH) was measured. Similarly canopy index (CI) was calculated.

Biodiversity of Punnakayal Mangrove ecosystem

Species diversity of mangroves

Biodiversity survey was conducted in Punnakayal mangroves and the record of flora and fauna have been tabulated in Tables 2-6 and Fig. 8 &9 under respective headings.

In the survey of Punnakayal mangrove area, four species of mangroves belonging to 3 genera viz., Avicennia marina, A. officinalis, Rhizophora mucronata and Acanthus illicifolius were recorded. Out of the three recorded, two species belong to Aviceniaceae and one to Rhizophoriaceae. Acanthus illicifolius is a new record from the Punnakayal area. Earlier Jayaseeli and Murugan (2002) have recorded only Avicennia marina from Punnakayal.

The mangroves are found as thick vegetation at certain places and at some places it is found sparse and patchy. Avicennia marina and A .officinalis dominate the species composition. R.mucoronata does not seem to be a part of the natural vegetation. It is planted by the Tamilnadu Forest Department and

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some Non-Governmental Organization as a restoration measure. The rate of survival of the above species is minimal while investigating the scars of plantation and the number of individuals survived. The tidal amplitude of the estuary is about 1.5 m at the mouth and 1 m in the inner estuary. So the mangrove area is properly inundated by the tides but the freshwater inflow is minimal. This may be one of the reasons for the lesser species abundance and the stunted growth of trees in this area. However impact of atmospheric pollutants, if any is not taken into account. The trees measured around 2-3m in height and the GBH ranged between 20-30 cms (Table 2). Acanthus illicifolius is found very rarely throughout the mangrove area.

Table 2: Mangroves at Punnakayal

	Site no	Nos.m^{-1}	Average height	Average GBH (cm)
Avicennia marina	1	+	2-3m	20-30
	2	+		
	3	+		
	4	+		
	5	+		
A. officinalis	1	+	2-3m	20-30
	2	+		
	3	+		
	4	+		
	5	+		
Acanthus illicifolius	1	-	0.5-1m	-
	2	-		
	3	+		
	4	+		
	5	-		
Rhizophora mucronata	1	+	0.5-1m	-
	2	-		
	3	-		
	4	-		
	5	+		

Phytoplankton

A total of 17 species of phytoplankton belonging to 13 genera were recorded from the 7 stations selected along the Punnakayal mangrove region throughout the study period (Table 3). All the species were evenly distributed throughout the stations and all through the different seasons. There were no remarkable variation in the species distribution and composition between different stations selected and during different seasons. However Thallasiothrix, Rhizosolenia and Cossinodiscus were the dominant forms.

Table 3: Checklist of phytoplankton at Punnakayal

Phytoplankton species	Diversity at stations (nosx10.l^{-1})							
	1	2	3	4	5	6	7	8
Cyclotella striata	+	+	+	+	+	+	-	+
Skeletonema costatum	+	+	-	-	+	+	-	-
Coscinodiscus centralize	+	-	-	+	+	-	+	+
Coscinodiscus gigas	+	+	+	-	-	+	+	-
Coscinodiscus radiatus	+	+	+	+	+	+	+	+
Rhizosolenia styliformis	+	-	-	-	-	+	-	-
Rhizosolenia alata	-	-	-	-	-	-	-	-
Triceratium favus	+	+	-	+	+	-	-	+
Odontella mobiliensis	-	+	+	+	+	+	+	
Thalassionema nitzschioides	+	-	-	-	-	+	+	+
Thalassionema lineatum	+	-	+	-	-	-	+	
Thalassiothrix frauenfeldii	+	+	+	+	+	+	+	+
Pleurosigma elongatum	+	-	+	+	+	-	+	+
Noctiluca scintillans	-	+	+	-	-	+	-	-
Nitzschia closterium	+	-	+	+	+	-	-	+
Ceratium tripos	+	+	+	+	+	+	+	-
Calothrix sp	+	-	-	-	-	+	+	-
Total species	14	9	10	9	10	11	10	8

Zooplankton

All through the study period, a total of 12 of zooplankton species belonging to 10 genera were collected (Table 4). The zooplankton collections were dominated by copepods and eggs and larvae of fish, crabs and lobsters. The distribution was even throughout the different seasons and at different stations. The dominant presence of larvae in the region denotes that the region is highly productive and acts as a breeding and feeding ground for juvenile fishes, shrimps, crabs and other crustaceans.

Table: 4 Checklist of Zooplankton at Punnakayal

Zooplankton	Stations							
	ST1	ST2	ST3	ST4	ST5	ST6	ST7	ST8
Copepods								
Acrocalanus sp.	+	-	+	+	-	-	-	+
Corycaeus danae	+	+	+	+	+	+	+	+
Oithona sp.	-	-	-	-	-	-	-	-
Acartia sp.	-	-	-	-	+	+	+	+
Paracalanus sp.	+	+	+	+	+	+	+	+
Centropages sp.	-	-	+	+	-	-	-	-
Macrosetella sp.	-	-	-	+	-	+	-	-
Cheatognaths	-	-	-	-	-	-	-	-
Sagitta sp.	+	+	-	-	-	-	+	+
Cladocera	-	-	-	-	-	-	-	-
Evadne sp.	+	+	-	-	-	-	+	+
Macroplankton	-	-	-	-	-	-	-	-
Aurelia sp.	-	-	-	-	-	-	-	-
Jelly fish	-	-	-	-	+	-	-	+
Developmental stages	-	-	-	-	-	-	-	-
Gastropod larvae	+	+	-	+	+	-	+	+
Lamellibranch larvae	+	+	-	+	+	-	+	+
Fish egg & Fish larvae	-	-	-	+	-	-	-	+
Stomatopod larvae	-	-	-	-	-	-	-	-
Brachyuran megalopa	-	-	+	-	+	+	-	+
Pontellid nauplii	-	-	+	+	-	-	-	+
Penaeid nauplii	+	+	-	+	+	+	+	+
Copepod nauplii	+	-	-	-	-	-	-	-
Zoea larvae	+	+	+	+	-	+	-	+
Lucifer henseni	-	-	+	-	-	-	+	-
Mysis stage	+	-	-	+	+	+	+	+
Polychaete larvae	-	-	-	-	+	-	-	+
Total number of species	11	8	8	12	10	8	10	16

The abundance of phyto and zooplankton was more in the mangrove zones. Gradually increasing from February to May more number of cells with maximum number in May and then declinity was found to the trend in the density of phyto and zooplankters. The results are shown in Figures 8 & 9.

Figure 8: Biomass of phytoplankton recorded during Feb 2010 to Jan 2011

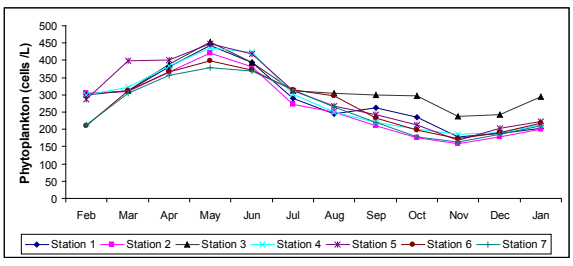
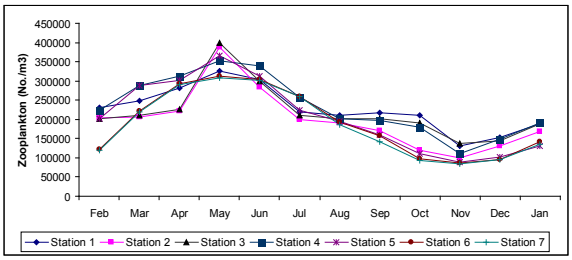


Figure 9: Biomass of zooplankton recorded during Feb 2010 to Jan 2011



Seaweeds

The seaweed diversity in the Punnakayal region was represented by 6 species belonging to 5 genera viz., Acanthophora spicifera, Enteromorpha compressa, Chaetomorpha linoids, C. aerea, Hypnea valentiae and Pachynema valoniopsis. The seaweeds did not have a station-wise distribution and were collected from the inter-tidal area of the Punnakayal estuary.

Seagrasses

One species of seagrass viz., Halophila ovalis was recorded from the Punnakayal intertidal area.

Salt marsh vegetation

A total of 6 species of saltmarsh plants viz., Lippia nudiflora, Salicornia brachiata, Sesuvium portulacastrum, Suaeda maritima, S. monoica, S. nudiflora belonging to 4 genera were recorded from the inter-tidal area of Punnakayal. They are represented in Plate 1. Earlier, Jayaseeli and Murugan (2002) have recorded two species viz., Suaeda sp., and Salicornia sp., from this region.

Crustaceans

4 species of crabs belonging to 2 genera and 3 species of shrimps belonging to 1 genus were identified from the Punnakayal area during the survey (Table 6).

Table 6: Checklist of crustaceans at Punnakayal

Crustaceans	Diversity at stations						
	1	2	3	4	5	6	7
Crabs							
Portunus sanguinolentus	-	-	+	++	-	+	-
P. pelagicus	++	+	+	+	++	++	-
Scylla serrata	-	-	++	++	++	+	-
S. tranquebarica	+	-	+	+	-	-	-
Shrimps							-
Penaeus indicus	+	+	+	+	+	+	-
P. semisulcatus	+	+	+	+	+	+	-
P. monodon	+	+	+	+	+	+	-

- Absent + Present ++ Abundant

Molluscs

8 species of gastropods belonging to 8 genera and 2 species of bivalves belonging to 1 genus were identified during the study period (Table 7).

Table 7: Checklist of molluscs at Punnakayal

Molluscs	Diversity at stations						
	1	2	3	4	5	6	7
Gastropod							++
Cerithium morus	+	+	+	+	+	+	-
Drupa margatigola	+	++	+	+	+	+	-
Trochus radiatus	+	+	++	+	-	+	-
Harpulina lapponica	+	+	++	+	+	+	-
Agaronia nebulosa	+	++	+	+	+	+	-
Strombus marginatus	++	+	+	+	+	+	-
Tonna dolium	+	+	+	+	++	++	-
Turbo bruneus	+	++	+	++	+	++	-
Bivalves							-
Donax faba	+	++	+	++	+	++	-
D. spinosus	+	+	++	+	++	++	-

-Absent +Sparce ++Abundant

From the biodiversity study it is evident that the Punnakayal estuarine waters and the mangrove area are an abode for a rich diversity of benthic species such as molluscs and crustaceans. They are also a nursery ground for juvenile fishes, crabs, shrimps and lobsters. They accommodate a moderate diversity of seaweeds and a representative one species of seagrass.

Presently the Biodiversity of Punnakayal estuarine complex is not under any threat due to the alterations in the physicochemical characteristics and the heavy metal concentrations are also found to be well within limits of a nominal coastal ecosystem. However the atmospheric impact has not been documented given the stunted growth of the mangroves in this region. Also, regular monitoring of the ecosystem is much warranted as the area is surrounded by industries, salt pans and anthropogenic interference.

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