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BIODIVERSITY OF PONNANI ESTUARY, KERALA

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Abstract: The Bharathapuzha also known as Nila, Perar or Ponnanipuzha is the second longest river on the southwest coast of India. It originates at Kovittola Betta Kundra reserve forest of Tamil Nadu, in the Western Ghats at an elevation of 2336m above mean sea level. It flows through Coimbatore district of Tamil Nadu and Palakkad, Thrissur and Malapuram districts of Kerala and finally joins the Arabian Sea at Ponnani. Ponnani estuarine region is located between 10° 46' and 10° 48' and 75° 54' to 75° 56' .The estuary is open throughout the year and is the major fishing harbour in the Malappuram district. Ponnani estuary though supports a rich biological diversity it has been subjected to ecological degradation due to ever increasing human intervention. The increasing levels of siltation, pollution and over exploitation of resources are the major problems. This necessitates frequent monitoring of resources and estimation of sustainable utilization to ensure steady supply to the local people. The phytoplankton of this system consists of 29 genera belonging to three major groups, Bacillariophyceae, Chlorophyceae and Cyanophyceae. Among three plankton groups Chlrophyceae dominated followed by Bacillariophyceae and Cyanophyceae. The important benthic groups observed during the present study included Nematode, Annelids represented by Oligochaetes and Polychaetes, Crustaceans represented by Copepods, Ostracods and Amphipods, Insects represented mainly by Dipteran larvae and Molluscs by Bivalves and Gastropods. A total of 112 species of fishes belonging to 14 orders, 53 families and 80 genera were collected from the Ponnani estuary. T he fish diversity is found to be very high as reported from estuaries elsewhere in tropical and subtropical regions. There were 53 marine species and 41 marine and estuarine species. Nine species of prawns, ten species of crabs, three species of molluscs were collected during this study. The fishery of the edible crabs, *Scylla serrata* and *Portunus* spp. are well established in Ponnani. If the present rate of deterioration continues at Ponnani it would certainly affect natural populations which would reflect in capture fisheries. The large scale human intervention has resulted in biodiversity loss and changes in ecosystem functioning everywhere in the biosphere. Hence it is necessary to adopt measures for the conservation of this valuable ecosystem and its sustainable development and utilization.

Key words: Estuary, Phytoplankton, Zooplankton, Benthos, Fishes

INTRODUCTION

The estuarine systems of Kerala is formed of a chain of coastal ,brackish, myxohaline wetlands including lakes, lagoons, mud flats, tidal marshes and mangrove swamps. These systems those lie parallel to the coastline exert profound influence on the coastal fisheries as they are the nursery and breeding grounds of fish and shell fish species. These estuarine systems are also net exporters of organic matter that enhance and sustain coastal productivity. The estuarine system not only renders habitats for a unique assemblage of organisms and water fowls but also buffer flood damages, prevent salinity incursion and aid to recharge of ground water.

The Bharathapuzha also known as Nila, Perar or Ponnanipuzha is the second longest river on the southwest coast of India. It originates at Kovittola Betta Kundra reserve forest of Tamil Nadu, in the Western Ghats at an elevation of 2336m above mean sea level. It flows through Coimbatore district of Tamil Nadu and Palakkad, Thrissur and Malapuram districts of Kerala and finally joins the Arabian Sea at Ponnani. The river was often described as the cultural stream of Malabar. This river is intimately intertwined with the lives of more than 23, 00,000 people of the state of Kerala (Fig. 1).

Ponnani estuarine region is located between 10° 46' and 10° 48' and 75° 54' to 75° 56', the estuary is open throughout the year and is the major fishing harbour in the Malappuram district. Ponnani estuary supports a very rich Ichthyofauna, but it is subject to ecological degradation due to ever increasing human interventions. The flow of water is restricted due to the thick and profuse growth of vegetation chiefly comprised of aquatic grasses and weeds. The rampant growth of unwanted weeds poses a serious threat to the faunal communities. The estuarine system is exposed to tides from the Arabian Sea and hence the water is brackish almost throughout the year. Numerous works had been carried out in India in estuarine biology (George Thomas and Fernandez, 1997; Natarajan, 1998; Vijayalakshmi *et al*., 1998).In this paper plankton, benthos and nekton of Ponnani estuary is reported.

MATERIALS AND METHODS

Monthly samples were collected from April 1998 to March 1999. Samples were collected between 5 AM to 9 AM in the morning during the second week of every month.

Plankton samples were collected by towing the plankton net made of bolting silk .The upper diameter of the net is 28cm and the rod end is 3cm. The standard length of the net is 84cm. Immediately after collection the plankton samples were preserved with 4% formalin for further sorting and identification. The samples were allowed to stand in 100ml measuring jars for 24 hours; prior to measure the settling volume. The plankton concentrate was made up to 100ml and stirred homogeneously. 1 ml of the sample was transferred to the Sedgwick–Rafter counting cell with a wide mouthed pipette and examined under a compound microscope and counted. Plankton samples were sorted out and individual plankton was identified by using the key for plankton identification by Needham and Needham (1962).

Sediment samples for analysis of benthic fauna were taken by using a corer/Perspex tube and the samples were preserved in 4% formalin. Aliquots of sediment samples were washed and stirred thoroughly and the organic material was decanted. Then the samples were sieved through 0.5mm mesh sieves. Organisms visible to the naked eye were sorted and counted during the initial washing, the material retained in the sieve were preserved and stained in 10% neutralized formalin to which rose-Bengal dye was added. The sorted benthic organisms were identified and counted under a scientific microscope. Benthic organisms were identified up to their group level with the help of identification keys.

The nektonic forms mainly the fishes were collected by cast nets, gill nets and in some cases with the help of a special net made of mosquito net clothing. Fishes were also collected directly from the local fishermen engaged in fishing at the time of sampling. Local names, fishing practices and the number of fishes collected in each fishing operation were noted. All fishes were preserved in 10% formaldehyde solution. Color, maturity condition and standard length were noted in the field itself. Keys of Day (1865, 1878) Jayaram (1981, 1999) Fischer and Bianchi (1984) and Talwar and Jhingran (1991) were referred for confirmation of identification.

Molluscs were either handpicked or collected using scoop nets from all the stations. The live specimens were narcotized and preserved in 70% ethyl alcohol and the dry shells were washed, cleaned and kept in cotton-plugged glass vials. After preliminary identification following Subba Rao (1989), samples were sent to Molluscan section of Zoological Survey of India, Kolkotha for confirmation and identification by experts. Prawns and crabs were collected directly from collection sites either by using nets and by hand picking in the case of crabs. The specimens were preserved in 10% formaldehyde and identification was done later using standard textbooks/keys.

RESULTS AND DISCUSSION

Among the biotic components of an aquatic ecosystem, plankton community plays a significant role in the productivity and trophic balance of the system. The phytoplankton of this system consists of 29 genera belonging to three major groups, Bacillariophyceae, Chlorophyceae and Cyanophyceae. (Table 1.) Among three plankton groups Chlrophyceae dominated followed by Bacillariophyceae and Cyanophyceae.The seasonal variation and percentage composition of phytoplankton and zooplankton are shown in (Fig. 2 and 4).

Table 1. showing plankton community at Ponnani estuary

Chlorophyceae	***Bacillariophyceae***
Cladophora	*Asterionella*
Closterium	*Coscinodiscus*
Gonatozygon	*Cymbella*
Microspora	*Melosira*
Monostroma	*Navicula*
Oedogonium	*Nitzchia*
Pediastrum	*Stauroneis*
Spirogyra	*Surinella*
Ulothrix	*Synedra*
Zygnema	*Tabellaria*
Cyanophyceae	***Zooplankton***
Anacystis	*Nematoda*
Lyngbya	*Cladocera*
Nostoc	*Copepoda*
Oscillatoria	*Ostracoda*
Spirulina	*Chironomidae*
Diatoma	*Nauplii*
Frustulia	Water mite
Genicularia	
Gyrosigma	

The phytoplankton density was minimum during the month of April and maximum during the month of December. Seasonally phytoplankton was abundant in post monsoon followed by monsoon and pre monsoon seasons. The density of Chlorophyceae was maximum in December and this dominance was mainly caused by the abundance of *Spirogyra*. *Spirogyra* alone constituted 63.67% of green algae and *Zygnema* and *Gonatozygon* are other two dominant members of this group. *Ulothrix* also formed an important group and *Pediastrum*, *Closterium* and *Cladophora* were meagerly represented. Green algae were the most dominant group of phytoplankton during seven months except in April, May, June, July and September.

Bacillariophyceae formed the next dominant group with 34.46% and they were most abundant during the months of April, May, June, July and September. Diatoms followed the pattern as Chlorophyceae. They were most abundant during post monsoon season and least abundant during premonsoon season. *Navicula* was the dominant member of this group, which was observed in all months except in February and March. *Gyrosigma* constituted 22.08% followed by *Nitzschia* sp with 13.41%, forms like *Surinella*, *Asterionella, and Tabellaria* were poorly represented.

Among Blue greens, *Oscillatoria* sp. formed the dominant group with 44.13% and was present during nine months. *Lyngbya* and *Nostoc* were fairly represented with 25.41% and 20.91% respectively. *Spirulina* and *Anacystis* sp were the least represented members of Cyanophyceae. Blue green algae also were dominant during postmonsoon season and minimum during monsoon season.

Among zooplankton Copepods were dominant with 57.34% and nauplii larvae come next with 17.58%. The other groups observed in the order of abundance were Nematodes, Water mites, Ostracods, Chironomids and Cladocerans. Cladocerans were noticed only in June, Ostracods in January and Chironomids in September. Zooplankton was maximum in October and minimum in July.

The dominance of Bacillariophyceae at the estuarine zone was reported by Shibu (1991) in Paravur Lake, and Singh *et al.* (1999) in the

Table 2. List of Fishes collected from Ponnani estuary

1	Carcharhinus limbatus	57	Alepes djedaba
2	Scoliodon laticaudus	58	Carangoides ferdau
3	Sphyrna lewini	59	Carangoides hedlandensis
4	Megalops cyprinoides	60	Carangoides malabaricus
5	Anguilla bengalensis bengalensis	61	Carangoides praeustus
6	Muraenesox cinereus	62	Carangoides sexfasciatus
7	Lycodontis tile	63	Megalopsis cordyla
8	Hilsa ilisha	64	Scomberoides commersonianus
9	Escualosa thoracata	65	Apolectus niger
10	Herklotsichthys quadrimaculatus	66	Mene maculata
11	Sardinella dayi	67	Gazza minuta
12	Sardinella longiceps	68	Leiognathus bindus
13	Anodontostoma chacunda	69	Leiognathus blochii
14	Nematalosa nausus	70	Leiognathus brevirostris
15	Corica soborna	71	Leiognathus equula
16	Ilisha melastoma	72	Leiognathus splendens
17	Stolephorus commersoni	73	Pampus chinensis
18	Stolephorus indicus	74	Pseudorhombus elevatus
19	Thryssa dussumieri	75	Cynoglossus arel
20	Thryssa malabarica	76	Cynoglossus cynoglossus
21	Thryssa mystax	77	Cynoglossus lingua
22	Thryssa vitrirostris	78	Cynoglossus puncticeps
23	Chanos chanos	79	Paraplagusia bilineata
24	Puntius sarana subnasutus	80	Euryglossa orientalis
25	Arius arius	81	Chelonodon patoca
26	Arius cealatus	82	Secutor insidator
27	Arius maculatus	83	Lutjanus argentimaculatus
28	Mystus gulio	84	Lutjanus eherenbergii
29	Mystus montanus	85	Lutjanus fulviflamma
30	Mystus montanus	86	Gerres filamentosus
31	Bregmaceros maclellandi	87	Pomadasys argenteus
32	Pseudocryptes lanceolatus	88	Pomadasys maculatus
33	Sicyopterus griseus	89	Daysciaena albida
34	Eleotris fusca	90	Dendrophis russelli
35	Trypauchen vagina	91	Johnius russelli
36	Siganus canaliculatus	92	Otolithes ruber
37	Siganus javus	93	Monodactylus argenteus
38	Trichiurus lepturus	94	Drepane punctatus
39	Rastrelliger kanagurta	95	Scatophagus argus
40	Scomberomorus guttatus	96	Etroplus maculatus
41	Pampus argenteus	97	Etroplus suratensis
42	Hyporhamphus limbatus	98	Oreochromis mossambica
43	Hyporhamphus dussumieri	99	Liza macrolepis
44	Strongylura strongylura	100	Liza parsia
45	Microphis cuncalus	101	Liza tade
46	Scorpaenopsis leonina	102	Mugil cephalus
47	Grammoplites scaber	103	Sphyraena barracuda
48	Platycephalus indicus	104	Eleutheronema tetradactylum
49	Lates calcarifer	105	Polydactylus indicus
50	Ambassis commersoni	106	Acanthurus nigrofuscus
51	Ambassis gymnocephalus	107	Zebrasoma xanthurus
52	Epinephelus malabaricus	108	Callionymus fluviatilis
53	Epinephelus tauvina	109	Awaous gutum
54	Therapon jarbua	110	Glossogobius giuris
55	Sillago sihama	111	Oligolepis cylindriceps
56	Lactarius lactarius	112	Oxyurichthys tentacularis

Mandovi-Zuari estuarine system. Moderate temperature has been found to be favourable for the growth of phytoplankton (Bisht, 1993). This observation is in good agreement with the present study also. The maximum density of phytoplankton was coincided with the temperature between 18.9 to 30.2°C during postmonsoon season. Peak plankton abundance during postmonsoon was observed by Divakaran *et al.* (1982) and George Thomas 1995.

Benthic organisms constitute a critically important food chain between primary producers and higher trophic level organisms. They structurally alter the bottom habitat and regulate biogeochemical cycling of nutrients and other substances. Benthic invertebrates are particularly vulnerable to pollution and other environmental disturbances because of their limited mobility. As a result, they have been employed as indicators of the overall ecological health and the focus of many environmental impact studies.

Numerous factors affect benthic community diversity such as nature of sediment, water chemistry, temporal stability of abiotic factors, temperature, position of the trophic gradient and degree of eutrophication. Seven benthic groups were collected from Ponnani estuary. The important benthic groups observed during the present study included Nematode, Annelids represented by Oligochaetes and Polychaetes, Crustaceans represented by Copepods, Ostracods and Amphipods, Insects represented mainly by Dipteran larvae and Molluscs by Bivalves and Gastropods. The seasonal abundance and percentage composition of benthic groups are shown in (Fig.3 and5).

The main groups were represented by Polychaetes, Oligochaetes and Nematodes. Polychaetes were collected in samples all through the months except in August and formed 50.61% of the total benthic biota. Oligochaetes were observed during monsoon and early postmonsoon months. The next dominant group was Nematodes with 13.97%. Copepods constituted 8.82% and Amphipods were observed at this station in December with 2.73%. The monthly maximum was observed during April and minimum in August. Seasonal maximum was evident during premonsoon season with 46.89% of total abundance. Both monthly and seasonal peaks were contributed by the abundance of Polychaete worms. This increase in abundance was facilitated by the favourable conditions of salinity and temperature. Postmonsoon season also had more benthos, however, decrease in faunal abundance was observed during monsoon season. Polychaetes constituted the dominant component followed by Oligochaetes and Nematodes. The dominance of Polychaetes has been reported by Govindan *et al.* (1983). The dominance of Polychaetes was reported from Mandovi-Zuari estuarine system by Singh *et al.* (1999). Gopakumar and Kuttiyamma (1999) reported the dominance of Polychaetes in the Kayamkulam estuary. Sabu Thomas *et al.* (1999) reported the dominance of Polychaetes followed by Oligochaetes from Kuttanad wetlands. Heavy monsoon showers and consequent river discharge and resulting fluctuations in environmental variables may be the major factors governing benthic invertebrate abundance.

A total of 112 species of fishes belonging to 14 orders, 53 families and 80 genera were collected from the Ponnani estuary (Table 2)T he fish diversity is found to be very high as reported from estuaries elsewhere in tropical and subtropical regions. There were 53 marine species and 41 marine and estuarine species. Typically estuarine and freshwater forms were represented by 9 species each.

It is apparent that marine elements dominate the fish diversity in this estuary which could be justified by the fact that it is permanently connected to the sea and salinity is high almost throughout the year.

Typical marine species were rare and were adventitious visitors, among these *Megalapsis cordyla* and *Daysciaena albida* only formed significant fishery in the estuary. Among the 112 species collected over 90 species were commercially important (Talwar and Jhingran,1991). Clupeids(8species), anchovies(6), Carangids(8), Leognathids(7), Croakers(4), Mullets(4), Gobiids(6) and tongue soles (5) were the major groups. Among freshwater and estuarine species *Etroplus maculates* and *E.suratensis* and *Mystus gulio* contributed significantly to the fisheries.

Table 3. List of Arthropods and Molluscs collected from Ponnani estuary

No.	Crabs		Prawns		Molluscs
1	*Paratelphusa hydrodromus*	1	*Macrobrachium idella*	1	*Turricula janna*
2	*Matuta lunaris*	2	*M.scabriculum*	2	*Scapharca*
3	*Charybdis amboinensis*	3	*Metapenaeus brevicornis*	3	*inaequivalvis*
4	*Calappa lophos*	4	*M.dobsoni*		*Villorita cyprinoides*
5	*Scylla serrata*	5	*M. monoceros*		
6	*Portunus sanguinolentus*	6	*Parapenaeopsis stylifera*		
7	*Portunus pelagicus*	7	Penaeus indicus		
8	*Charbdis feriata*	8	*P. merguiensis*		
9	*Uca lacteal annulipes*	9	*P.monodon*		
10	*Dotilla myctiroides*				

Many species used estuaries as breeding and / or nursery grounds. The young ones of clupeids, milk fish, *Lates calcarifer*, *Ambassis spp, Gerres filamentosus, Scatophagus Argus*, cichlids, gobiids, mullets and flat fishes were collected during present study. Adults of *Anguilla bengalensis*, a catadromous species and *Hilsa ilisha* an anadromous species were collected.

Nine species of prawns, ten species of crabs, three species of molluscs were collected during this study (Table 3). In several estuaries of Kerala, bunding and prevention of saline water intrusion has led to the extinction of fishery of migratory species which depend mainly on both fresh and brackish water for the completion of their life cycle (Gopalan *et al.*, 1983). Since such barriers are absent in Ponnani estuary free migration of organisms from the sea and *vice versa* is facilitated. The fishery of the edible crabs, *Scylla serrata* and *Portunus* spp. are well established in Ponnani.

Biological wealth of an estuary reflects its health. Ponnani estuary though supports a rich biological diversity it has been subjected to ecological degradation due to ever increasing human intervention. The increasing levels of siltation, pollution and over exploitation of resources are the major problems (James, 1987).This necessitates frequent monitoring of resources and estimation of sustainable utilization to ensure steady supply to the local people.

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