



# International Journal of Fisheries and Aquatic Studies

ISSN: 2347-5129

(ICV-Poland) Impact Value: 5.62

(GIF) Impact Factor: 0.549

IJFAS 2016; 4(6): 101-107

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www.fisheriesjournal.com

Received: 14-09-2016

Accepted: 15-10-2016

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## Diversity of fishes, Crustaceans and Molluscs of Puthuvypeen of Ernakulam District, Kerala, South India

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### Abstract

Puthuvypeen is an upcoming major Industrial area in Kochi in the Indian state of Kerala. Given its close proximity to the Kochi city and to the international sea route Puthuvypeen has attracted many investment projects in the near past. Further, of late, Government of Kerala decided to set up a mega oceanarium project together with a Marine Biological Research Centre at Puthuvypeen with the objective of imparting awareness on the marine resources of the Arabian Sea. Though the development projects contribute to advancements in the social and economic fronts and overall growth of the region, they may also bring in adverse effects on the environmental quality, if adequate precautions are not taken to prevent them. A comprehensive database on the baseline environmental characteristics is a pre-requisite for an integrated assessment of environmental impacts, if any, with respect to pre-construction, construction and post-construction phases of the projects. The present study which forms part of a larger integrated study was meant to collect information on fin fishes and shell fishes of the area with a view to act as a baseline data for future studies on the impact of the projects on the aquatic environment. In the present study 57 species of fin fishes, 19 species of crustaceans and 11 species of molluscs were found to occur in the area.

**Keywords:** Puthuvypeen, faunal diversity, fishes, crustaceans, molluscs

### 1. Introduction

Puthuvypeen (also called puthu vype) is an upcoming major Industrial area in Kochi in the Indian state of Kerala<sup>[1]</sup>. It is a western suburb of Kochi (colonial name: Cochin) City and is a part of Vypin Island which is 24 km long and 2.6 km wide. Vypin island has a total area of 87.85 km<sup>2</sup><sup>[2]</sup>. The island is situated on the western side of Ernakulam District with Kodungallur Strait on the North, Cochin backwaters and Cochin Port on the South, River Periyar and Kochi city on the East and Arabian Sea on the West. The island is connected to the city by three bridges known as "Goshree" Bridges. The ecology of Vypeen island is unique, endowed with large canals extending over 50 km and a network of small canals emerging there from<sup>[3]</sup>. The population of Vypeen is estimated at more than 2 lakhs, with one among the highest density of population in the world (more than 2200 people per km<sup>2</sup>).

Given its close proximity to the Kochi city and to the international sea route Puthuvypeen has attracted huge investment projects in the near past like the Liquefied Natural Gas (LNG) Terminal, Bunkering Terminal, Single Buoy Mooring, Ship Repair Complex, to name a few. It is perhaps one of the fastest growing industrial areas in the state of Kerala. Puthuvype Beach, though a less visited beach at present is also one of the very beautiful beaches which is expected to be developed for tourism and the local administration is making a lot of efforts to promote this place as a highly sought after tourist destination.

Recently Government of Kerala decided to set up a mega oceanarium project together with a Marine Biological Research Centre at Puthuvypeen with the objective of imparting awareness on the marine resources of the Arabian Sea. The oceanarium development project, proposed at Puthuvypeen forms the country's first such initiative. It has been conceived as an 'infotainment' facility serving the dual objective of information and entertainment. The proposed development site for the Oceanarium project, spread over an area of 50 acres (Block No.10, Survey. No 238), is located in Puthuvypeen Village of Kochi Taluk in Ernakulam District.

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Though the development projects (fig.1) contribute to advancement in the social and economic fronts and overall growth of the region, they may also bring in adverse effects on the environmental quality, if adequate precautions are not taken. When stress in such projects is laid on providing benefits to the stakeholders, quality of the project environment is invariably overlooked. This, as felt in many instances, may result into severe landscape changes, degradation of land, water and soil quality, loss of vegetation and habitats, endangered fauna, imbalances in ecosystems, socio-economic and cultural instability, among many other undesirable repercussions. It will ultimately lead to a stressed ecosystem that does not contain the full complement of species and interrelationships that would normally prevail. Therefore, there is a pertinent need to carefully evaluate the prevailing environmental conditions of the development area and surroundings prior to the implementation of the development projects. A comprehensive database on the baseline environmental characteristics is a pre-requisite for an integrated assessment of environmental impacts, if any, with respect to pre-construction, construction and post-construction phases of the various projects. The present study which forms part of a larger integrated study was meant to make an inventory of fishes, crustaceans and molluscs of the area with a view to act as a baseline data for future studies on the impact of the projects on them.



Fig 1: The sites for the various development projects.

There are many studies on the fishes of Vembanad lake which adjoin the study area viz., the whole lake [4, 5, 6, 7] or selected sections of the lake [8, 9, 10, 11]. However no studies are known to exist on the diversity of fish and shellfish populations specifically of Puthuvypeen area. Studies are also lacking on the fishes and shell fishes of canals which are connected to the lake and freshwater bodies which are not connected to the lake.

## 2. Materials and Methods

Information on the fishes and shell fishes of Puthuvypeen was collected through field studies during March 2013 to February 2014. Data was collected from fishermen at sources which

were supplemented by those collected from local landing centres, during all months for the one year period, at least for 10 days a month. Fishermen in the area use principally Chinese nets, cast nets, shore seine, stake nets and gill nets for catching fish. Fishes and shell fishes brought from outside the study area were not considered. The area covering the development site of the Oceanarium and its surroundings, within a radius of 10 km was covered under the study (fig. 2). The area covered under the present study was located between the geographical coordinates of 09° 53' N and 10° 04' N latitudes and 76° 08' E and 76° 19' E longitudes (Survey of India Topographic sheets No. 58B/4, 58B/8, 58C/1 and 58C/5). The area belongs to the coastal tracts-lowlands of Kerala-with the altitudes being near to mean sea level. It is part of the Vembanad wetlands, a Ramsar site and being close to the sea it is prone to tidal inundations.



Fig 2: The study area.

Though the area also included a part of the adjacent sea, fishes and shell fishes caught in the sea did not come under the purview of the present study. However migratory forms which were caught in the backwaters coming under the geographical range of the present study were covered.

Fishes were mostly identified at the site of collection and the unidentified samples were preserved in 8% formalin and brought to the laboratory for species level identification following Day (1878) [12], Talwar and Jhingran (1991) [13], Jayaram (1999) [14], Munro (2000) [15] and Radhakrishnan (2006) [16]. Crustaceans and molluscs were identified with the help of FAO (1984) [17] and Fisher and Hureau (1985) [18] respectively.

## 3. Results

57 species of fin fishes belonging to 27 families, 19 species of crustaceans belonging to 7 families and 11 species of molluscs belonging to 7 families were found to occur in the study area (table 1). Information on species richness in different families of fishes, crustaceans and molluscs in the area are presented in figures 3, 4 and 5 respectively. As per the IUCN [20] list among the fin fishes one species (*Anguilla bicolor*) belonged to Near Threatened (NT) category and another species (*Hyporhamphus xanthopterus*) to Vulnerable (V) category. 17 species belonged to the category of Least Concern (LC), 2 species belonged to Data Deficient (DD) category and 36 species were not evaluated (NE). Of the crustaceans 3 species belonged to LC and 16 species to NE category. Among the molluscs 4 species belonged to LC and 7 to NE categories. One species (*Oreochromis mossambicus*) was an alien species.

**Table 1:** Fishes, crustaceans and molluscs found in the study area.

Sl. No.	Scientific name	Common name in English	Family	IUCN status
A.	Fishes			
1.	<i>Anchoviella indica</i> (Van Hasselt)	Indian anchovy	Engraulidae	NE
2.	<i>Thryssa malabarica</i> (Bloch)	Malabar thryssa	Engraulidae	NE
3.	<i>Anchoviella indica</i> (Van Hasselt)	Commerson's anchovy	Engraulidae	NE
4.	<i>Chanos chanos</i> (Forsk.)	Milk fish	Chanidae	NE
5.	<i>Tylosurus strongylurus</i> (Van Hasselt)	Round tail alligator gar	Belonidae	NE
6.	<i>Xenentodon cancila</i> (Hamilton- Buchanan)	Freshwater gar fish	Belonidae	LC
7.	<i>Hyporhamphus xanthopterus</i> (Valenciennes)	Red tipped half beak	Hemirhamphidae	VU
8.	<i>Mugil cephalus</i> Linnaeus	Grey mullet	Mugilidae	LC
9.	<i>Liza parsia</i> (Hamilton- Buchanan)	Gold spot mullet	Mugilidae	NE
10.	<i>L. macrolepis</i> (Smith)	Borneo mullet	Mugilidae	NE
11.	<i>L. dussumieri</i> (Valenciennes)	Dussumier's mullet	Mugilidae	NE
12.	<i>Polynemus indicus</i> Shaw	Indian tassel fish	Polynemidae	NE
13.	<i>Lates calcarifer</i> (Bloch)	Giant perch	Latidae	NE
14.	<i>Therapon jarbua</i> (Forsk.)	Crescent perch	Theraponidae	NE
15.	<i>Sillago sihama</i> (Forsk.)	Silver whiting	Sillaginidae	NE
16.	<i>Carangoides malabaricus</i> (Bloch)	Malabar trevally	Carangidae	NE
17.	<i>Caranx sexfasciatus</i> Quoy and Gaimard	Six banded trevally	Carangidae	LC
18.	<i>Megalaspis cordyla</i> (Linnaeus)	Torpedo trevally	Carangidae	NE
19.	<i>Mene maculata</i> (Bloch)	Moon fish	Menidae	NE
20.	<i>Lutjanus fulviflamma</i> (Forsk.)	One spot golden snapper	Lutianidae	NE
21.	<i>L. johni</i> (Bloch)	Moses perch	Lutianidae	NE
22.	<i>L. argentimaculatus</i> (Forsk.)	Red snapper	Lutianidae	NE
23.	<i>L. russelli</i> (Bleeker)	Russel's one spot snapper	Lutianidae	NE
24.	<i>Johnius dussumieri</i> (Cuvier)	Dussumier's silver jewfish	Sciaenidae	NE
25.	<i>Scatophagus argus</i> (Linnaeus)	Spotted butterflyfish	Scatophagidae	LC
26.	<i>Oreochromis mossambicus</i> (Peters)	Tilapia	Cichlidae	NE
27.	<i>Etroplus suratensis</i> (Bloch)	Pearl spot	Cichlidae	NE
28.	<i>E. maculatus</i> (Bloch)	Orange chromide	Cichlidae	NE
29.	<i>Megalops cyprinoides</i> (Broussonet)	Tarpon	Megalopidae	DD
30.	<i>Anodontostoma chacunda</i> (Hamilton- Buchanan)	Short nose gizzard shad	Clupeidae	NE
31.	<i>Sardinella longiceps</i> (Valenciennes)	Indian oil sardine	Clupeidae	LC
32.	<i>Kowala coval</i> (Cuvier)	White sardine	Clupeidae	NE
33.	<i>Nematalosa nasus</i> (Bloch)	Bloch's gizzard shad	Clupeidae	NE
34.	<i>Anguilla bicolor</i> McClelland	Level- finned eel	Anguillidae	NT
35.	<i>Macrones gulio</i> (Hamilton- Buchanan)	Long whiskered cat fish	Bagridae	NE
36.	<i>Pseudarius jella</i> (Day)	Small eye cat fish	Tachysuridae	NE
37.	<i>Tachysurus coelatus</i> (Valenciennes)	Engraved cat fish	Tachysuridae	NE
38.	<i>Tachysurus subrostratus</i> (Valenciennes)	Short nosed cat fish	Tachysuridae	NE
39.	<i>Tachysurus maculatus</i> (Thunberg)	Spotted cat fish	Tachysuridae	NE
40.	<i>Panchax lineatus</i> (Steindachner)	Striped top minnow	Cyprinodontidae	NE
41.	<i>P. panchax</i> (Arnold)	Lesser top minnow	Cyprinodontidae	NE
42.	<i>Ambassis dayi</i> Bleeker	Day's glassy perchlet	Ambassidae	LC
43.	<i>A. commersoni</i> Cuvier	Commerson's glassy perchlet	Ambassidae	NE
44.	<i>A. gymnocephalus</i> (Lacepede)	Naked head lassy perchlet	Ambassidae	LC
45.	<i>Parambassis thomassi</i> (Day)	Western Ghat glassy perchlet	Ambassidae	LC
46.	<i>Elops machnata</i> (Forsk.)	Giant herring	Elopidae	LC
47.	<i>Leiognathus equulus</i> (Forsk.)	Greater pony fish	Leiognathidae	LC
48.	<i>L. dussumieri</i> (Valenciennes)	Dussumier's pony fish	Leiognathidae	NE
49.	<i>Gerres filamentosus</i> Cuvier	Long rayed silver bidy	Gerridae	LC
50.	<i>Glossogobius giuris</i> (Hamilton- Buchanan)	Bar-eyed goby	Gobiidae	LC
51.	<i>Puntius sarana</i> ((Hamilton- Buchanan)	Olive barb	Cyprinidae	LC
52.	<i>P. filamentosus</i> (Valenciennes)	Filamented barb	Cyprinidae	LC
53.	<i>P. vittatus</i> Day	Striped barb	Cyprinidae	LC
54.	<i>P. ticto</i> (Hamilton- Buchanan)	Fire fin barb	Cyprinidae	NE
55.	<i>P. amphibius</i> (Valenciennes)	Scarlet-banded barb	Cyprinidae	DD
56.	<i>Rasbora daniconius</i> (Hamilton- Buchanan)	Slender rasbora	Cyprinidae	LC
57.	<i>Amblypharyngodon mola</i> (Hamilton)	Mola carplet	Cyprinidae	LC
B.	Crustaceans			
1.	<i>Fenneropenaeus indicus</i> (H. Milne Edwards)	Indian white prawn	Penaeidae	NE
2.	<i>Penaeus monodon</i> (Fabricius)	Black tiger prawn	Penaeidae	NE
3.	<i>P. semisulcatus</i> (De Haan)	Green tiger prawn	Penaeidae	NE
4.	<i>Metapenaeus dobsoni</i> (Miers)	Flower tail prawn	Penaeidae	NE
5.	<i>M. affinis</i> (H. Milne Edwards)	Brown shrimp	Penaeidae	NE
6.	<i>M. monoceros</i> (Fabricius)	Speckled shrimp	Penaeidae	NE
7.	<i>Macrobrachium rosenbergii</i> (De Man)	Giant freshwater prawn	Palaemonidae	LC

8.	<i>M. equidens</i> (Dana)	Rough river prawn	Palaemonidae	LC
9.	<i>M. idella</i> (Hilgendorf)	Slender river prawn	Palaemonidae	LC
10.	<i>Portunus pelagicus</i> (Linnaeus)	Reticulate crab	Portunidae	NE
11.	<i>Scylla serrata</i> (Forsskål)	Mangrove crab	Portunidae	NE
12.	<i>S. tranquibarica</i> (Fabricius)	Green mud crab	Portunidae	NE
13.	<i>Parasesarma plicatum</i> (Latreille)	Mud flat crab	Grapsidae	NE
14.	<i>Varuna litterata</i> (Fabricius)	Paddler crab	Grapsidae	NE
15.	<i>Uca inversa inversa</i> (Hoffmann)	Fiddler crab	Ocypodidae	NE
16.	<i>Uca virens</i> Salmon and Atsides	Green banded fiddler crab	Ocypodidae	
17.	<i>Neosarmatium smithi</i> (H. Milne Edwards)	Large mangrove crab	Pilumnidae	NE
18.	<i>N. malabaricum</i> (Henderson)	Sesarmid crab	Pilumnidae	NE
19.	<i>Balanus amphitrite</i> Darwin	Striped barnacle	Balanidae	NE
C.	<b>Molluscs</b>			
1.	<i>Meretrix meretrix</i> (Linnaeus)	Asiatic hard clam	Veneridae	NE
2.	<i>M. casta</i> (Gmelin)	Backwater clam	Veneridae	NE
3.	<i>Paphia malabarica</i> (Chemnitz)	Short neck clam	Veneridae	NE
4.	<i>Villorita cyprinoidea</i> Gray	Black clam	Cyrenidae	LC
5.	<i>Crassostrea madrasensis</i> (Preston)	Backwater oyster	Ostreidae	NE
6.	<i>Saccostrea cucullata</i> (Born)	Rock oyster	Ostreidae	NE
7.	<i>Bulla ampulla</i> Linnaeus	Bubble snail	Bullidae	NE
8.	<i>Telescopium telescopium</i> (Linnaeus)	Horn snail	Potamididae	LC
9.	<i>Perna viridis</i> (Linnaeus)	Green mussel	Mytilidae	NE
10.	<i>Pila globosa</i> (Swainson)	Fresh water snail	Ampullariidae	LC
11.	<i>Lamellidens marginalis</i> (Lamarck)	Indian freshwater mussel	Unionidae	LC

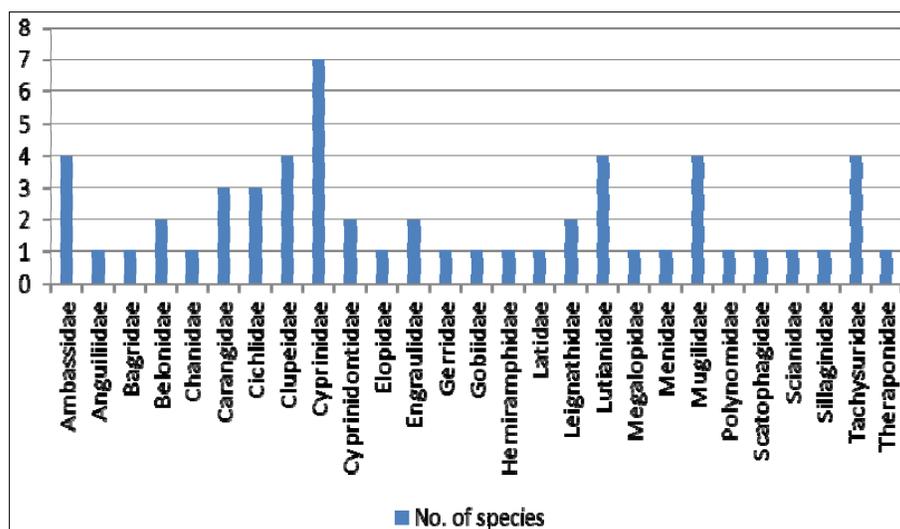


Fig 3: Species richness in different families of fishes in the study area.

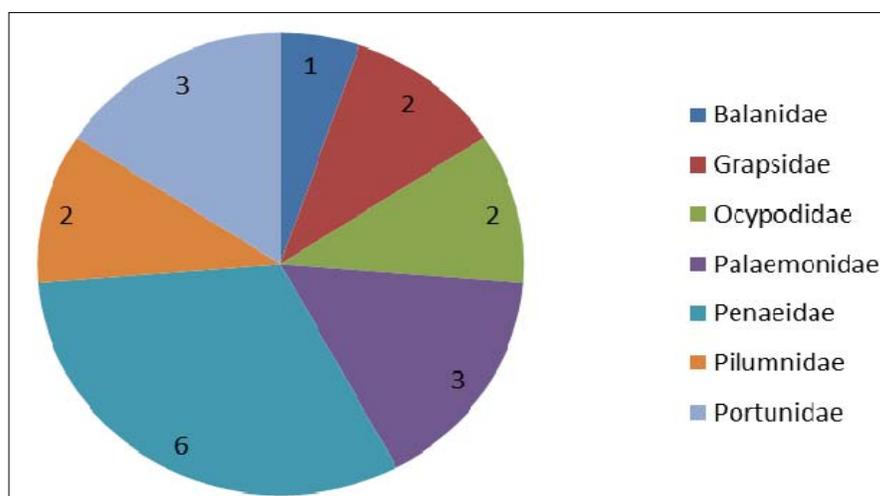


Fig 4: Species richness in different families of crustaceans in the study area.

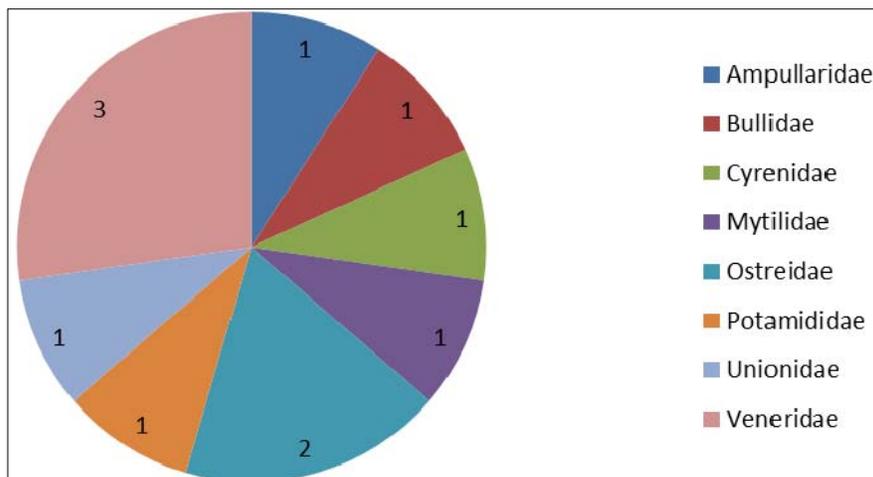


Fig 5: Species richness in different families of molluscs in the study area.

#### 4. Discussion

The study area has an impressive species richness of fin fishes and shell fishes, with 57 species of fin fishes belonging to 27 families, 19 species of crustaceans belonging to 7 families and 11 species of molluscs belonging to 8 families. Analysis of the results showed that the species assemblages in the study area are quite varied and included freshwater, brackish water and marine species. The list of fin fishes was dominated by family Cyprinidae (7) followed by Ambassidae (4), Clupeidae (4), Lutianidae (4), Mugilidae (4), Tachysuridae (4), Carangidae (3), Cichlidae (3), Belonidae (2), Cyprinodontidae (2), Engraulidae (2), Leignognathidae (2), Anguillidae (1), Bagridae (1), Chanidae (1), Elopidae (1), Gerridae (1), Gobiidae (1), Hemirhamphidae (1), Latidae (1), Megalopidae (1), Menidae (1), Polynemidae (1), Scatophagidae (1), Sciaenidae (1), Sillaginidae (1) and Theraponidae (1). These included intertidal fishes and diadromous fishes. The list had one species of fish exotic to the country, viz., *Oreochromis mossambicus*. A noteworthy observation was the presence of juveniles (50-70 mm) of Indian oil sardine (*Sardinella longiceps*), a true marine fish, in the backwaters. The list of crustaceans was dominated by family Penaeidae (6) followed by Palaemonidae (3), Portunidae (3), Grapsidae (2), Ocypodidae (2), Pilumnidae (2) and Balanidae (1). Similarly the list of molluscs was dominated by family Veneridae (3) followed by Ostreidae (2), Ampullariidae (1), Bullidae (1), Cyrenidae (1), Mytilidae (1) and Potamididae (1). No studies are known to exist on the diversity of fish and shellfish populations specifically of Puthuvypeen area. However there are a few studies on the fishes of Vembanad lake viz., the whole lake or selected sections in the lake.

Kurup (1982)<sup>[4]</sup> carried out a detailed investigation on the systematics, distribution and ecology of all fish species of the Vembanad lake during the period from October 1978 to September 1980. He has recorded 150 species of fishes belonging to 100 genera and 56 families from the Vembanad lake. Of this 43 species were found to be resident species and were available throughout the year, 74 species were classified as migrant species while 17 were vagrant species. Kurup and Samuel (1985)<sup>[5]</sup> and Kurup *et al.* (1989, 1993)<sup>[6, 7]</sup> also studied the fish and fisheries of the lake. Kurup *et al.* (1993)<sup>[7]</sup> have recorded 115 species of fishes belonging to 84 genera, 6 species of penaeid prawns, 4 species of palaemonid prawns and 3 species of crabs in Vembanad lake. ATREE (2009)<sup>[8]</sup> has reported 51 species of finfish representing 26 families and

35 genera, as well as 11 species of shell fish belonging to 6 families and 7 genera from the southern part of Vembanad. It included two species of critically endangered, four species of endangered and five species of vulnerable fish. Krishnakumar and Ranjan (2012)<sup>[9]</sup> have reported the results of Vembanad fish count (2008-2011) in which the authors have recorded 67 species of fishes belonging to 46 genera and 34 families. The list included 5 species of fishes exotic to the lake. Harikrishnan *et al.* (2011)<sup>[10]</sup> have studied the status of exploited fishery resources of Azhikode estuary, a part of Vembanad ecosystem. The authors have found thirty finfish species belonging to 18 families, 6 species of penaeid shrimps, 2 species of palaemonid prawns, 2 species of crabs and 4 species of bivalves to contribute to the exploited fishery of the region. In a recent study Asha *et al.* (2014)<sup>[11]</sup> have reported eighty species of fin fishes, five species of penaeid shrimps, three species of palaemonid prawns and two species of crabs in the lake, in which three species were classified vulnerable.

It may be mentioned here that except a few, most of the species reported in the earlier studies mentioned above were also recorded in the present study. However there are some notable absentees like the *Horabagrus brachysoma*, *Heteropneustes fossilis*, *Clarias dussumieri*, *Channa diplograma* etc. Though many stressors like habitat alterations, over exploitation, pollution, introduction of exotic fishes etc might have caused decline in fisheries of Vembanad lake and decline in abundance of particular species.<sup>[1, 20, 21, 22, 23]</sup> the present author is unable to make any claim of local extinction of fish species. According to Knight (2010)<sup>[24]</sup> and Knight and Remadevi (2010)<sup>[25]</sup> any claim on local extinction of fish species should be cautiously verified. Information on species obtained in the present study cannot directly be compared with those obtained in the earlier studies because of obvious difference in the study areas. It must be remembered that most of the studies discussed above covered a larger area viz., the entire Vembanad lake or most part of it. But the present study covered the downstream portion (northern part) of the lake and included connected canals and other inland water bodies in and around Puthuvypeen.

Observation of juveniles of Indian oil sardine (*Sardinella longiceps*) which is a true marine fish in the backwaters is not unexpected as such observations were made by some earlier workers in estuarine and backwater systems<sup>[5, 26, 27, 28, 29, 30]</sup>. Herre (1953)<sup>[31]</sup> has also observed the entry of *S. longiceps*

into the river mouths of Philippines.

Systematic biological inventories lay the foundation for understanding ecological and survival requirements for individual species within communities<sup>[32]</sup>. There is a general lack of scientific information regarding the occurrence and status of fish species in areas where large scale development projects are planned. The present study would serve as baseline information on fishes, crustaceans and molluscs that help to identify issues of conservation and management, in future.

## 5. Conclusion

The present study was conducted to make an inventory of fin fishes and shell fishes of Puthuvypeen, an upcoming major Industrial area in Kochi in the Indian state of Kerala. 58 species of fin fishes belonging to 27 families, 18 species of crustaceans belonging to 6 families and eleven species of molluscs belonging to six families were found to occur in the study area. Among fin fishes Cyprinidae was the most dominant family followed by Ambassidae, Clupeidae, Lutianidae, Mugilidae, Tachysuridae, Carangidae and Cichlidae.

The information collected in the present investigation are expected to act as a baseline data for future studies on the impact of the various development projects planned to be set up in this part of the country, on the aquatic environment.

## 6. Acknowledgement

The author is grateful to Government of Kerala for providing fund for the conduct of the study. The author is also grateful to the Director of Fisheries for the encouragement.

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