



Ichthyofaunal diversity associated with different mangrove stations of Kannur in relation to environmental parameters

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Abstract

In Kerala, Kannur district is famous for Mangrove ecosystems. This study aims to compare the physio chemical parameters and fish diversity of Kavvai and Kunhimangalam Estuarine enclosed by mangrove vegetation in Pre-monsoon and postmonsoon seasons. Fishes were collected from fisherman. Water temperature, p H, Salinity, Dissolved oxygen were tested. In diversity study 56 species of fishes belonging to 35 families were identified. Number of fish species increased by postmonsoon in both regions. The Physiochemical parameters exhibit influence on the fish diversity. The pH, water temperature, salinity is negatively related with fish diversity and Dissolved oxygen shows a positive correlation with fish diversity. The present study shows the importance of Mangrove coastal Ecosystems in aquatic habitat.

Keywords: Ichthyofauna, physiochemical parameters, mangroves, Kannur

Introduction

Mangrove ecosystems are breeding grounds for various aquatic animals such as fish, crustaceans, crabs and mollusc. In Kerala, Kannur has 7.55 sq km of mangroves i.e. around 45% of Kerala's total mangrove forest cover. The mangroves of Kannur include *Avicenniamarina*, *Rhizophora mucronata*, *Avicennia officinalis*, *Excoecaria agallocha*, *Rhizophoraaapiculata*, *Bruguiera cylindrica*, *Kandelia candel* etc (Jaleel K A *et al* 2022) [20]. Fish is one of the faunas that make mangrove a place of refuge, foraging and breeding. Fishes inhabits mangroves with high species diversity. Fishes are one of the most important fauna directly or indirectly influencing human health and economy. The environmental parameters greatly affect the fish diversity as well as reproduction. Many of the mangroves are critical links in the complex food webs supporting biological function In these ecosystems (Sheaves, 2005) [48]. In the tropics, many people rely on resources provided by mangrove-dominated estuaries, such as fish production (Santos *et al* 2017) [25] whereby catches are directly related to mangrove area (HoquoMozumder *et al* 2018) [32] wood products and protection against natural disasters. Mangroves are critical habitats for fish and prawns: they are good nursery habitats (Martins *et al* 2018) [30] serve as feeding grounds, decrease predation risk for many fish species (Ley *et al* 1999) [27] and can enhance fish abundance of nearby coral reefs (R.E. Johannes 1998) [22]. However, small-scale fishing in mangroves is rarely regulated and therefore fish size and fish diversity may decrease in high-pressure fishing areas despite the presence of mangroves (Blaber 2013) [8]. Fishing operations, which depend on mangrove forests, support recreational and commercial activities, and coastal community subsistence (Hamilton *et al.*1989; Ronnback 1999) [19]. Mangroves also serve as nurseries, protecting juvenile fish from predators and provide refuge for many important species. Indian mangrove forests together have an estimated cover of 4662.56 km² and are located along the nine coastal states and three union territories (FSI, 2011). Among the coastal districts, Kannur hold the largest mangrove area in Kerala with about 32 Km².

Environmental parameters are the study of vegetation and its internal "social" relationships, not only classifications of faunal communities but also analysis of their structure, composition, successional relations, relationship with environmental factors, as well as comparison of different communities (Fujiwara, 1987) [17]. Apart from the details on the extent, there has no attempt to assess the status of mangrove areas in the State. Only few studies on the floral and faunal components and physical parameters of the ecosystem were initiated or completed. In tropical estuaries, spatial and seasonal fluctuations in salinity, water temperature and dissolved oxygen can be of major importance for variations in fish densities and biomass. In contrast, these environmental factors have less deterministic impact on spatiotemporal variations of fish community composition within tropical nonestuarine environments, except during the rainy seasons (Mwandya *et al.*, 2009) [34]. The present study deals with the ichthyofaunal diversity in associated with environmental parameters of two mangrove stations in Kannur, Kerala. The study of Ichthyofaunal diversity in mangrove can help us understand the distribution and abundance of fish species in these ecosystems as well as the ecological processes that govern their populations in different seasons. The main objectives of this study are to assess the ichthyofaunal fish species diversity of two different mangrove stations in Kannur, to analyse environmental parameters with special reference to ichthyofaunal diversity and evaluate ichthyofaunal diversity variation according to two different seasons.

Materials and methods

Study Area

This study aims to explore the Ichthyofaunal diversity of two mangrove stations Kavvayi and Kunimangalam (distance within 5 km) in Kannur, Kerala. This study was conducted in the post monsoon months of September - October 2023 and premonsoon months of April -May 2024. Two visits were conducted for the collection of samples in each month.

Site: 1

Kavvayi is a group of small and large islands near Payyanur in Kannur, located at the foot of the Ezhimala Hills, south of Valiyaparamba, Kerala’s third largest backwater system. Kavvayi is surrounded by mangrove forests and is abundant with fresh water fishes. The Kavvayi backwater (12.0929° N and 75.1677° E) is situated in the northern part of Kerala, in Kannur and Kasargod districts and has a permanent connection with the Arabian Sea on both in northern and southern side. At the northern side, it is joined to Arabian Sea with the river mouth at Azhithala, Nileswaram and in the south to the mouth of Palakkode River. There are seven islands in the Kavvayi backwaters, five (Kavvayi, Madakkal, Edayilekkad, Thekkekadand Vadakkekad) having human settlements and two (Kocha Thuruthi and Kurippad Thuruthi) are not inhabited

Site: 2

Kunhimangalam mangroves in Kannur district, the largest and least disturbed mangrove area in Kerala. Located at 12°.75’ North and 75°.13’ East, Kunhimangalam mangrove forests occurs at the confluence of Perumba River and Kavvayi Estuary. This place is known as ‘Kandal Gramam’ meaning ‘mangrove village’ as the area has luxuriant mangroves. The 50%of mangroves area in kunimangalam grama panchayat under the Wild Life Ttrust of India owner ship.

Collecting sample

With the aid of local fishermen and using a variety of nets, including gill nets, cast nets, and dragnets, fish were collected from two locations, in the Kavvayi mangrove station and kunimangalam mangroves station from September–October 2023 And April-May 2024 according to the post monsoon and pre-monsoon seasons. The time of collection was 6.30am to 8am time collected fishes were

photographed with Nikon Digital Camera. Specimens were examined in detail characters were measured and fishes were identified up to the species level, with the help of standard keys given by Day (1878) [12], Munro (1955) [33] Talwar and Jhingran (1991) Jayaram (1999) [21] and Fischer and Bianchi (1984) [15]

The water temperature was recorded by Hydrothermometer; pH Recorded by digital pH meter (Cystronics model 335); dissolved oxygen examined by Winkler’s method salinity of water recorded by Refractometer.

Data analysis

The relationship between fish diversity and temperature, dissolved Oxygen, salinity and pH were calculated by correlation analysis. Shannon Wiener diversity index, species richness was calculated. Correlations of fish diversity and Physiochemical parameters were analyzed Pearson’s Correlation coefficient by MS EXCEL

Result

Ichthyofaunal Diversity

The present study is on the four Physiochemical parameters of water sample and the Ichtyofaunal diversity in Premonsoon months (April, May 2024) to post monsoon months (September, October 2023) from site1 (Kavvayi) and site 2 (Kunhimangalam). A total 56 species of fishes belonging to 35 families, 15 order were collected from both sites during study period (Table 3) and taxonomic identification were done. The most dominant order was Perciformes followed by Silluriformes and Cleupeiformes. Cyprinids were dominant in the collection and Families Combridae, Dorosomatidae, Carangidae, Leognatidae, Cichlidae, Mugillidae, Lutjanida, Clupeidae, Silluridae, Platycephalidae, Engracilidae were represented by 2 and more than 2 species each and there were 23 families with single representative.

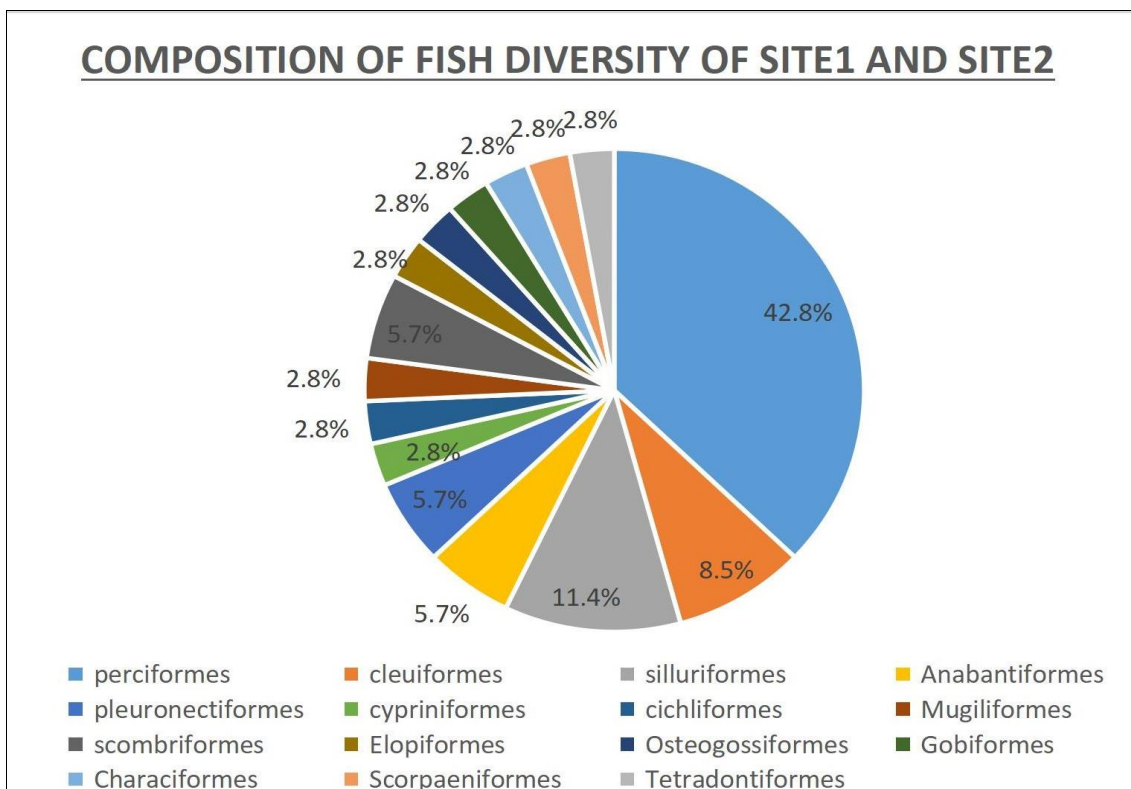


Fig 1: Composition of the fish community by order

The primary aim of the present study was to find out the Ichthyofaunal diversity of the site 1 and site 2. The data is presented in table 4. Distinct variation in distribution of fish diversity were observed. Diversity of fish was tremendously high during the Post monsoon season. Analysis of fish samples shows that the fish species composition of site 2 is very high (39 species) than site 1 (27 species) during post monsoon. During post monsoon the species composition of both sites quite similar. *Arius maculatus*, *Cynoglossus semifasciatus*, *Etroplus surstensis*, *Liza parsia*, are the common species in both sites during Pre and post monsoon.

Clarias batrachus, *Danio aequipinnatus*, *Danio malabaricus*, *Hypophthalmichthys molitrix*, *Valamugi spingleri*, *Wallago attu*, *Sardinella longiceps* are only seen in site 2 during post monsoon season.

Water Parameters

The Salinity, Dissolved oxygen, p H, Water temperature, were analysed. Result of physiochemical parameters during pre and post monsoon in site 1 and site 2 given in the table 1. The water quality of both sites was found to be varying along with the flow of each seasons.

Table 1: physio-chemical parameters of site 1 and site 2 during the study period

parameter	Pre-monsoon		Post monsoon	
	Site1	Site2	Site1	Site2
Water Temperature °C	30-35	31-33	25.8-30	26-29
p H	7.5-7.8	6.6-6.9	7.5-7.9	6.6-6.9
Salinity(ppt)	35-44	32-36	24-28	14-16
Dissolved oxygen(ppm)(DO)	6.5-6.7	6.4-6.5	6-7	6.8-7

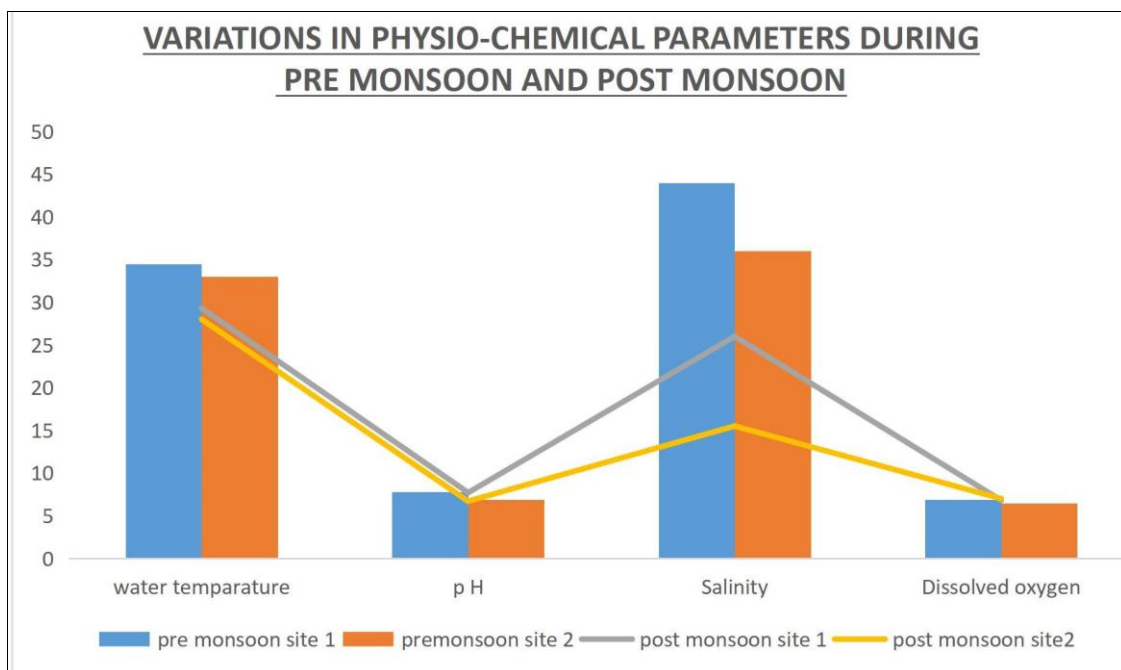


Fig 2: Variations in physio-chemical parameters during study period

The physio-chemical parameters of each sites showed difference in each season. Based on it the Temperature in site 1 is maximum during Pre-monsoon and minimum range in site 2 during post monsoon. pH of both sites ranges from 6.6 to 7.9. The Salinity is maximum in site 1 during Pre-monsoon and minimum in site 2 during Post monsoon.

Based on the analysis of Dissolved oxygen it gradually increases during Post monsoon season

Ichthyofaunal Diversity Indices Associated with Physio Chemical Parameter

Table :2 showing Shannon index associated with water parameters by correlation coefficient(r)

Fish Diversity	Shannon Index	P H, r value	Salinity, r value	Temparature, r value	DO,
Post monsoon site1	3.1354	7.7, -1	26, 26, -1	29.3, -1	6.8,
Post monsoon site2	3.2414	6.7, -1	15.5, -1	28, -1	7, 1
Pre-monsoon site1	2.7708	7.8, -1	44, -1	34.5, -1	6.9, 1
Pre-monsoon site 2	3.1353	6.9, -1	36, -1	33, -1	6.5, 1

Highest Shannon index value is 3.2414 which indicates the fish diversity of post monsoon season. PH, Salinity, Temperature are shows the negative correlation with fish diversity in both seasons, which means when p H, salinity and temperature decrease the the diversity will increase and vise versa. Only dissolved oxygen is positively related to the Ichthyofaunal diversity.

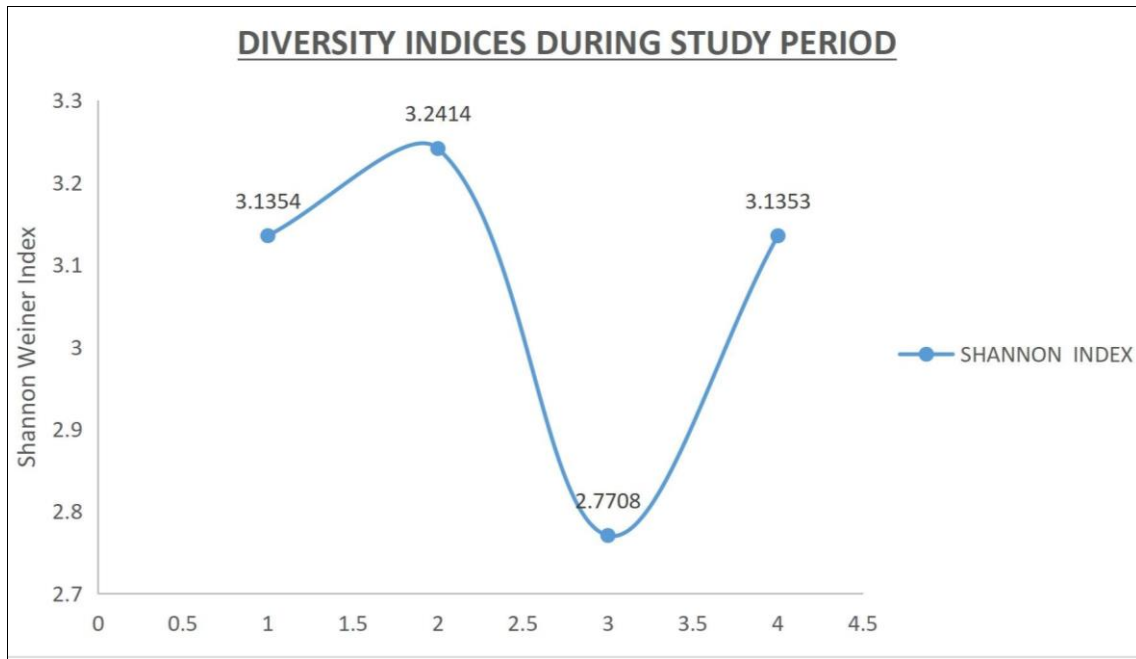


Fig 3: Showing diversity indices (Shannon Index) during pre and post monsoon in site 1 and site 2

Table 3: Checklist of fishes collected during study period

SI No	Scientific name	Family	Common name
1	<i>Acanthocybium solandri</i>	Scombridae	Wahoo fish
2	<i>Acanthopagrus berda</i>	Sparidae	Goldsilke seabream
3	<i>Ambassis ambassis</i>	Ambassidae	Common glass fish
4	<i>Anabas testudineus</i>	Anabantidae	Climbing gourami
5	<i>Anodontostoma chacunda</i>	Dorosomatidae	Chacunda gizzard shad
6	<i>Arius maculatus</i>	Ariidae	Spotted catfish
7	<i>Caranx ignobilis</i>	Carangidae	Giant trevally
8	<i>Catla catla</i>	Cyprinidae	Catla
9	<i>Chanos chanos</i>	Chanidae	milkfish
10	<i>Clarias batrachus</i>	Clariidae	Walking catfish
11	<i>Cynoglossus semifasciatus</i>	Cynoglossidae.	Gangetic tongue sole
12	<i>Danio aequipinnatus</i>	Cyprinidae	Giant Danio
13	<i>Danio malabaricus</i>	cyprinidae	Malabar danio
14	<i>Escualosa thoracata</i>	Dorosomatidae	White sardine
15	<i>Etroplus sursteneis</i>	Cichlidae	Green chromide
16	<i>Gazza minuta</i>	Leiognathidae	Tooth ponyfish
17	<i>Gerres filamentosus</i>	Gerreidae	Whipfin silverbidly
18	<i>Glossogobius giuris</i>	Gobiidae	Tank goby
19	<i>Garra mullya</i>	Cyprinidae	Sucker fish
20	<i>Hypophthalmichthys molitrix</i>	cyprinidae	Silver carp
21	<i>Johnius dussumieri</i>	Sciaenidae	sin croaker
22	<i>Labeo fimbriatus</i>	Cyprinidae	fringed-lipped peninsula car
23	<i>Labeo rohita</i>	Cyprinidae	Rohu
24	<i>Lates calcarifer</i>	Latidae	Barramundi
25	<i>Leognathus equulus</i>	Leiognathidae	Common ponyfish
26	<i>Liza parsia</i>	Mugilidae	goldspot mullet,
27	<i>Lutjanus argentimaculatus</i>	Lutjanidae	mangrove red snapper
28	<i>Lutjanus russelli</i>	Lutjanidae	Moses snapper,
29	<i>Megalops eyprinoides</i>	Megalopidae	Indo-Pacific tarpon
30	<i>Mugil cephalus</i>	Mugilidae	flathead grey mullet
31	<i>Mystus gulio</i>	Bagridae.	Long Whiskers Catfish,
32	<i>Nematalosa erabi</i>	Clupeidae	Bony bream
33	<i>Nematalosa nasus</i>	Clupeidae	ray-finned fishes
34	<i>Nemipterus japonicus</i>	Nemipteridae	threadfin bream,
35	<i>Notopterus notopterus</i>	Notopteridae	bronze featherback
36	<i>Oreochromis hiloticus</i>	Cichlidae	Tilapia
37	<i>Pampus argenteus</i>	Siluridae	silver pomfret
38	<i>Pellona ditchela</i>	Stromateidae	Toothed shad

39	<i>Piaractus brachypomus</i>	Serrasalminidae	red-bellied pacu,
40	<i>Platycephalus indicus</i>	Platycephalidae	Indian flathead,
41	<i>Pristolepis marginate</i>	Pristolepididae	Malabar Leaf-fish
42	<i>Psettodus erumei</i>	Psettodidae	Indian halibut
43	<i>Pseudetroplus maculatus</i>	Cichlidae	orange chromide
44	<i>Rastrelliger kanagurta</i>	Scombridae	Indian mackerel
45	<i>Sardinella gibbosa</i>	Dorosomatidae	goldstripe sardinella
46	<i>Sardinella longiceps</i>	Dorosomatidae	Indian oil sardine
47	<i>Scatophagus argus</i>	Scatophagidae	spotted scat
48	<i>Siganus guttatus</i>	Siganidae	orange-spotted spinefoot,
49	<i>Sillago sihama</i>	Sillaginidae	sand smelt
50	<i>Sorsogona tuberculata</i>	Platycephalidae	heart-headed flathead.
51	<i>Stolephorus indicus</i>	Engraulidae	Indian anchovy,
52	<i>Thryssa malabarica</i>	Engraulidae	Malabar anchovy
53	<i>Trachinotus blochii</i>	Carangidae	golden pompano,
54	<i>Triacanthus biaculeatus</i>	Triacanthidae	short-nosed tripod fish,
55	<i>Valamugi spigleri</i>	Mugilidae	Speigler's Grey Mullet
56	<i>Wallago attu</i>	Siluridae	Shark catfish,

Table 4: The variation in their distribution is compared according to the sites and season and tabulated in Table 4

SI No	Scientific name of fishes	Pre-monsoon season		Post monsoon season	
		Site 1	Site 2	Site 1	Site 2
1	<i>Acanthocybium solandri</i>		+		
2	<i>Acanthopagrus berda</i>			+	+
3	<i>Ambassis ambassis</i>			+	+
4	<i>Anabas testudineus</i>	+	+		
5	<i>Anodontostoma chacunda</i>			+	+
6	<i>Arius maculatus</i>	+	+	+	+
7	<i>Caranx ignobilis</i>			+	+
8	<i>Catla catla</i>		+		+
9	<i>Chanos chanos</i>		+		+
10	<i>Clarias batrachus</i>				+
11	<i>Cynoglossus semifasciatus</i>	+	+	+	+
12	<i>Danio aequipinnatus</i>				+
13	<i>Danio malabaricus</i>				+
14	<i>Escualosa thoracata</i>		+		
15	<i>Etroplus surstenesis</i>	+	+	+	+
16	<i>Gazza minuta</i>			+	+
17	<i>Gerres filamentosus</i>			+	+
18	<i>Glossogobius giuris</i>	+	+		+
19	<i>Garra mullya</i>				
20	<i>Hypophthalmichthys molitrix</i>				+
21	<i>Johnius dussumieri</i>			+	+
22	<i>Labeo fimbriatus</i>		+		+
23	<i>Labeo rohita</i>		+		+
24	<i>Lates callearifer</i>				+
25	<i>Leognathus equulus</i>	+	+		
26	<i>Liza parsia</i>	+	+	+	+
27	<i>Lutjanus argentimaculatus</i>		+	+	+
28	<i>Lutjanus russelli</i>		+		+
29	<i>Megalops eyprioides</i>			+	+
30	<i>Mugil cephalus</i>	+	+		+
31	<i>Mystus gulio</i>				+
32	<i>Nematalosa erabi</i>			+	+
33	<i>Nematalosa nasus</i>	+			+
34	<i>Nemipterus japonicus</i>		+		
35	<i>Notopterus notopterus</i>		+		
36	<i>Oreochromis hiloticus</i>	+	+		
37	<i>Pampus argenteus</i>			+	+
38	<i>Pellona dīrchela</i>			+	+
39	<i>Piaractus brachypomus</i>			+	+
40	<i>Platycephalus indicus</i>			+	+
41	<i>Pristolepis marginate</i>				
42	<i>Psettodus erumei</i>			+	+
43	<i>Pseudetroplus maculatus</i>	+	+		
44	<i>Rastrilliger kanagurta</i>		+		

Conclusion

- The present study shows that Ichthyofaunal diversity associated with different Mangrove stations of Kannur is in relation to environmental parameters and seasons
- The diversity indices employed in this study shows Kavvai and Kunhimangalam varies according to the seasons and water parameters.
- This study showed that total 56 species of fishes belonging to 35 families, 15 order were collected during study period. The most dominant order was Perciformes commonly known as perch-like fish.
- The maximum Shannon Weiner Index (3.2414) recorded in post monsoon season at Kunhimangalam (site2) which is rich mangrove area.
- *Liza parsia*, *Etroplus suratensis*, *Labeo rohita*, *Catla catla* are common fishes found during through study period.
- The study has demonstrated that there is a strong relationship between fish diversity, esturian physio-chemical characteristics and seasons.
- The minimum Shannon Weiner Index observed in Premonsoon season at Kavvai (site 1) During this period the water temperature reaches maximum ranged from 30 to 35°C which indicates the decreasing fish diversity during Pre-monsoon season
- The statistical analysis of this study showed that physio-chemical parameters observed in two sites were varied significantly between the sites with seasons.
- The water temperature, p H, Salinity increased in Pre-monsoon
- Dissolved oxygen increased in post monsoon which leads to increase in fish diversity
- The water temperature, p H, DO, Salinity were varied significantly between the sites during Pre-monsoon and Postmonsoon. and these physio –chemical parameters are negatively correlated with Fish diversity.
- Fish diversity is positively correlated with Dissolved Oxygen
- In Kavvai total number of fish species (27 species) increased in post monsoon than Pre-monsoon (15 species) In Kunhimangalam the total number of fish (39 species) also increased in post-monsoon due to low salinity and Water temperature.
- This study concludes that the Mangrove forests in Kannur were very productive in fish diversity

Recommendations

The continuous monitoring of fishes in Mangrove estuaries in Kannur and cataloguing the biodiversity in relation to physio-chemical parameters will aid in assessing in the consequences inflicted by climate change or seasonal variations.

Generation of Mangrove fishes baseline data in relation to physio-chemical parameters enable to adopt of management strategies towards conservation of fishes if essential.

It is mandatory to develop effective and sustainable conservation strategies such as establishment of “protected areas” or No take zones” as are practiced in other countries to ensure the conservation of Mangrove environment and natural heritage, to stop or minimize losses incurred through irresponsible fishery practices.

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