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Assessment of Ichthyo-faunal Diversity in Giriyampeta Estuary, Yanam (U.T.of Puducherry)

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ABSTRACT

The present investigation was conducted to study the Ecological Impact Assessment of Ichthyofaunal diversity in Giriyampeta Estuary,Yanam. The periodical Survey of Fishes revealed the presence of 36 species. Fishes belong to the order Clupeiformes ranked first among five Orders, Comprising 13 families which include 30 Species and the family Clupeidae exhibited the diversity of 7 Species . The abudance of Ichthyofauna varies with the seasons as Postmonsoon > Summer > Premonsoon > Monsoon. The Present study on Physico-Chemical parameters and diversity of Ichthyofauna would serve as frame of reference for future initiatives in studying Ecotourism and Management of the Estuary,Yanam.

INTRODUCTION

Estuaries are in a state of flux and dynamic in nature provides many ecological niches for diverse biota. The health status and biological diversity of the Indian estuarine system are deteriorating day by day through multi various man-made activities include dumping of enormous quantities of sewage in to the estuary has drastically reduced the population of the fishes. It has also caused considerable ecological balance and resulted in large-scale disappearance of their flora and fauna [1].

Giriyampeta Estuary is located on eastern side 10k.m away from Yanam (U.T of Puducherry) , chosen as the study area for the present investigation. Giriyampeta is one of the main fish landing areas of Yanam which is situated as a tiny pocket at the tail end of coromandal coast within 30sq.kms, near Kakinada in Andhra Pradesh. The Gautami-Godavari estuary is a drowned river mouth type of estuary characterized by numerous islands and Creeks that are separated from the main channel by sand , there is an alteration between shallow and deep areas in all parts of the estuary, ranging from 1to 16 m. The Estuary receives large quantity of fresh water laden with high volume of suspended materials during south east monsoon season.

The water quality and biological diversity of this estuarine area are deteriorating mainly due to rapid increase in human settlement, industrialization and sanitation practices. The effluents from sugar industries, paper industries, confectionaries and distilleries are discharged in to this estuarine area. It is assumed that the anthropogenic activities and the domestics sewages mixed in the estuary might have influenced the biodiversity of the estuarine system. Even though some biological and hydrographical studies in Gautami-Godavari estuarine ecosystems were carried out earlier [2] [3], detailed assessments of the faunal composition and physico-chemical characteristics were not reported till date. Therefore, the present investigation was undertaken to study the Ecological Impact Assessment on the Ichthyofaunal diversity in Giriyampeta Estuary with reference to Industrialisation and urbanisation.

MATERIALS AND METHODS

The periodical survey of the Ichthyofauna at Giriyampeta estuarine region, Yanam (U.T. of Puducherry) was conducted for a period of one year (from October 2007-September 2008). The shore waters of the Giriyampeta estuary was surveyed to understand the diversity and abundance of fishes, once in 30 days at fixed time (7.00A.M) during the study. Fishes were collected from the bottom catches in different selected sites through random netting. Fishes were also collected from the fish landing sites and fish markets of Giriyampeta Village.

Once the fishes were collected they were taken to the laboratory with utmost care. The fishes were sorted out and preserved in 6-10% formalin and identified [4] [5]. Further, Experts available in the centre for Advanced Study in Marine Biology, Portnovo, Dept.of Fisheries, Govt. of Puducherry and Fisheries Research station at Kakinada were consulted for the identification of fishes.

Monthly water samples were collected from the sites of Giriyampeta, Yanam, once at a fixed time (7.00 A.M) during the study period. Physico-chemical parameters like pH, Temperature, Salinity, Dissolved Oxygen were analyzed. The pH was measured using digital pH meter of Hanna make with ±0.1 point accuracy. Surface water samples were measured using a standard Centigrade Thermometer. Salinity and Dissolved oxygen of water samples were carried out by standard methods [6]. The changes in the physico-chemical parameters were recorded at monthly interval.

RESULTS

The data obtained in the number of species of Ichthyofauna, their composition and diversity at Giriyampeta estuary, Yanam, (U.T. of Puducherry) have been presented in Tables 1-4. The periodical survey of the Ichthyofauna at Giriyampeta estuary revealed the occurrence of 36 fish species belonging to Elasmobranchs and Actinopterygii. However, their composition is different in different seasons.

Of these 36 species of fishes, 2 species are Cartilaginous and the remaining 34 species are Teleosts. In general, the presence of fishes belong to the class Actinopterygii were found to be dominant in this estuary. The order Clupeiformes ranked first among the five orders, comprising families belonging to family Clupeidae, Cyprinidae, Trichuiridae, Engrulidsae, Chirocentridae, Stromatidae Scombridae, Mullidae, Anguillidae, Tachysuridae, Heteropneustidae, Mugilidae, and Carcharinidae.

The Clupeiformes exhibited the diversity of 30 species, collected from the estuary. Among the 13 families of order Clupeiforms, the species belonging to the family Clupeidae were found to be dominant by representing 7 different species viz., *Sardinella albella, Sardinella longiceps, Sardinella fimbriata, Sardinella gibbosa, Hilsa ilisha, Hilsa toil, Hilsa elongate.* The family ranked second among the Clupeiformes, is Cyprinidae comprising 5 species viz., *Cirrhinus mrigala, Cirrhinus reba, Labeo rohita, Labeo calbasu, Labeo bata.* The family Trichiuridae is represented by these species viz., *Trichuirus lepturus, Trichuirus savala, Lepturacanthus savala.*

Fishes belong to the families Engrulidae, Chirocentridae, Stromatidae, Scombridae and Mullidae have also been observed in the estuary and each family is represented 2 species each i.e. Anchoviella commersonii and Coilia dussumieri (Engrulidsae), Chirocentrus dorab and Chirocentrus nudus (Chirocentridae), Parastromateus niger and Pampus argenteus (Stromatidae), Scomberomorous guttatus and Rastrelliger kanagurta (Scombridae), Upeneus vittatus and Parupeneus indicus (Mullidae). The remaining five families of order Clupeiformes were also represented by a single species of each family. Viz; Tachysurus thalassius of Thachysuridae ; Anguilla bengalensis of Anguillae, Heteropneustes fossilis of Heteropneustidae, Mugil cephalus of Mugilidae and Caranx carangids of Carangidae. The estuary is also characterized by the presence of fishes belonging to the four Orders viz, Aulopiformes, Perciformes, Siluriformes and Pleuronectidae, each representing a single species: Harpodon nephereus (Syndontidae), Lates calcarifer (Centropomidae), Arius thalassinus (Ariidae), and Cynoglossus macrolepidotus (Cynoglossidae), respectively.

The Giriyampeta estuary supports a good fishery. The fish catches are estimated to be about 391Metric tons per year, the species composition being carps (24%), mullets (16%), catfishes (8.9%), Elasmobranchs (7.9%), Pomfrets (5.7%), Mackerels (4.4%), Anchovies (4.05%), Chirocentrus (3.2%), Scianids (2.9%), Hilsa ilisha (2.1%), Ribbon fish (3.4%), Sardines (2.1%), Thrissocles (1.5%), Eels (1.9%) and Carangids (1.49%).

The data obtained on the Temperature, pH, Salinity and Dissolved Oxygen have been presented in Figs 1-4. In general, the temperature varied between 26.6º C -32º C during summer, 26.8º C-27.4º C in monsoon, 27.1º C-28.4º C in postmonsoon and 23.2º C-24.0º C in winter periods.(Fig.1).

In the present investigation, the pH value ranged from 6.3-8.0.The maximum value of pH was 8.4 recorded in summer and minimum 6.3 was seen during monsoon periods.(Fig.2)

The salinity of the surface water of Giriyampeta estuary ranged from 3.2‰ - 35.2‰ A high value of 35.2 ‰ (ppm) was recorded in summer and low value of salinity 3.2‰ was noted in the monsoon.(Fig.3)

Fig.4 depicts the data on Dissolved Oxygen (DO) content of estuarine water, Giriyampeta, and the value ranges from 3.8- 12.6 mg/l. In general, the DO content varies between 3.8-4.89mg/l in monsoon; 5.01 to 5.30 mg/l in summer; 9.60-12.6mg/l in winter and 5.3-10.4mg/l in post monsoon.

Table.1:Diversity of Ichthyofauna in Giriyampeta Estuary, Yanam.

Taxon	Number of Species
SuperClass: Pisces	
Class: Chondrichthyes	
SubClass: Elasmobranchii	
Order: Selachii	
Family: Carcharinidae	1
Order: Lamniformes	
Family: Lamidae	1
Class: Osteichthyes	
SubClass: Actinopterygii	
Order: Clupeiformes	
Family: Clupeidae	7
Family: Cyprinidae	5
Family: Trichuiridae	3
Family: Engrulidsae	2
Family: Chirocentridae	2
Family: Stromatidae	2
Family: Scombridae	2
Family: Mullidae	2
Family: Anguillidae	1
Family: Tachysuridae	1
Family: Heteropneustidae	1
Family: Mugilidae	1
Family: Carangidae	1
Taxon	Number of Species
Order: Aulopiformes	
Family: Syndontidae	1
Order: Perciformes	
Family: Centropomidae	1
Order: Siluriformes	
Family: Ariidae	1
Order: Pleuronectiformes	
Family: Cynoglossidae	1

Table.2: Ichthyo-Faunal composition in Giriyampeta Estuary, Yanam.

Superclass	**:**	**Gnathostomata**
Class	:	Chondrichthyes
Subclass	:	Elasmobranchii
Order	:	Selachii
Family	:	**Carcharinidae**
Genus	:	*Scoliodan*
1.	:	Scoliodan sorrakowah
Order	:	Lamniformes
Suborder	:	Lamnoidei
Family	:	**Lamidae**
Subfamily	:	Lamninae
Genus	:	*Isurus*
2.	:	*Isurus oxyrinchus*
Class	:	Osteichthyes
Subclass	:	Actinopterygii

Order	:	Clupeiformes
Suborder	:	Clupeoidei
Family	:	**Clupeidae**
Subfamily	:	Clupeinal
Genus	:	*Sardinella*
3.	:	*Sardinella albella*
4.	:	*S. longiceps*
5.	:	*S. fimbriata*
6.	:	*S. gibbosa*
Subfamily	:	Alosinae
Genus	:	*Hilsa*
7.	:	*Hilsa ilisha*
8.	:	*H. toil*
9.	:	*H. elongate*
Family	:	**Engrulidsae**
Genus	:	*Anchoviella*
10.	:	*Anchoviella commersonii*
Genus	:	*Coilia*
11.	:	*Coilia dussumieri*
Family	:	**Chirocentridae**
Genus	:	*Chirocentrus*
12.	:	Chirocentrus dorab
13.	:	C. nudus
Family	:	**Tachysuridae**
Genus	:	*Tachysurus*
14.	:	*Tachysurus thalassinus*
Family	:	***Anguillidae***
Genus	:	*Anguilla*
15.	:	*Anguilla bengalensis*
Family	:	***Mullidae***
Genus	:	*Upeneus*
16.	:	*Upeneus vittatus*
Genus	:	*Parupeneus*
17.	:	*Parupeneus indicus*
Family	:	***Trichuiridae***
Genus	:	*Trichuirus*
18.	:	*Trichuirus lepturus*
19.	:	*T. savala*
Genus	:	*Lepturacanthus*
20.	:	*L. savala*
Family	:	***Cyprinidae***
Subfamily	:	*Cyprininae*
Genus	:	*Cirrhinus*
21.	:	*Cirrhinus mrigala*
22.	:	*C. reba*
Genus	:	*Labeo*
23.	:	*Labeo rohita*
24.	:	*L. calbasu*
25.	:	*L. bata*
Family	:	***Heteropneustidae***
Genus	:	*Heteropneustes*
26.	:	*Heteropneustes fossilis*
Family	:	***Mugilidae***
Genus	:	*Mugil*
27.		*Mugil cephalus*
Family	:	***Carangidae***
Genus	:	*Caranx*

28.	:	*Caranx carangus*
Family	:	***Stromatidae***
Genus	:	*Parastromateus*
29.	:	*Parastromateus niger*
Genus	:	*Pampus*
30.	:	*Pampus argenteus*
Family	:	***Scombridae***
Subfamily	:	*Scomberomorniae*
Genus	:	*Scomberomorous*
31.	:	*Scomberomorous guttatus*
Subfamily	:	*Scombrinae*
Genus	:	*Rastrelliger*
32.	:	*Rastrelliger kanagurta*
Class	:	*Actinopterygii*
Order	:	*Aulopiformes*
Family	:	***Syndontidae***
33.	:	*Harpadon nehereus*
Order	:	*Perciformes*
Family	:	***Centropomidae***
34.	:	*Lates calcarifer*
Order	:	*Siluriformes*
Family	:	***Ariidae***
35.	:	*Arius thalassinus*
Order	:	*Pleuronectiformes*
Family	:	***Cynoglossidae***
36	:	*Cynoglossus macrolepidotus*

Table.3: Compositon of Actinopterygii in Giriyampeta Estuary Yanam.

Taxa	Percentage
Oder: Clupeiformes	88.23
Order: Aulopiformes	2.94
Order: Perciformes	2.94
Order: Siluriformes	2.94
Order: Pleuronectiformes	2.94

Table 4: Composition of fishes belong to different families of order Clupeiformes

Taxa	Percentage
Family: Clupeidae	23.33
Family: Cyprinidae	16.66
Family: Trichuiridae	10
Family: Engrulidsae	6.66
Family: Chirocentridae	6.66
Family: Stromatidae	6.66
Family: Scombridae	6.66
Family: Mullidae	6.66
Family: Anguillidae	3.33
Family: Tachysuridae	3.33
Family: Heteropneustidae	3.33
Family: Mugilidae	3.33
Family: Carangidae	3.33

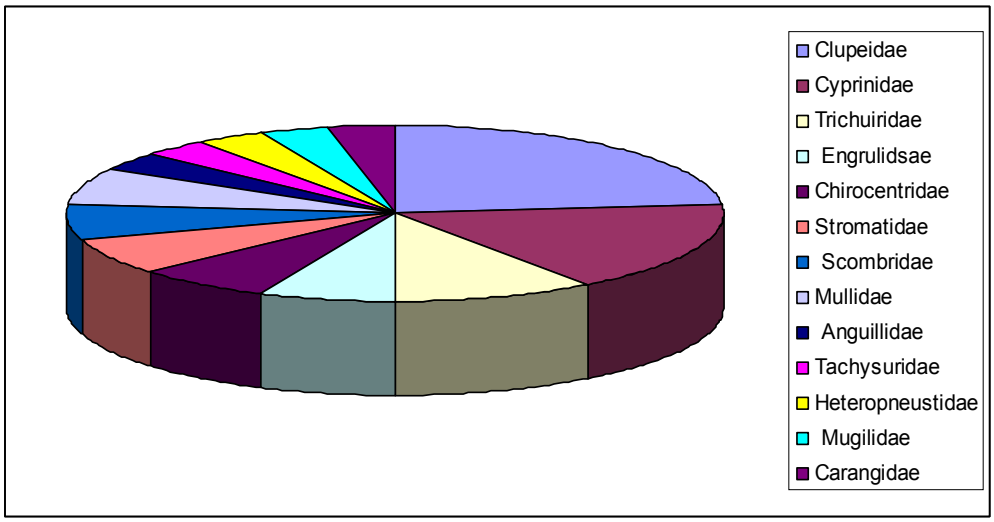


Fig: 1 ***Monthly variations of Temperature in water samples recorded at Giriyampeta Estuary from October 2007 to September 2008.***

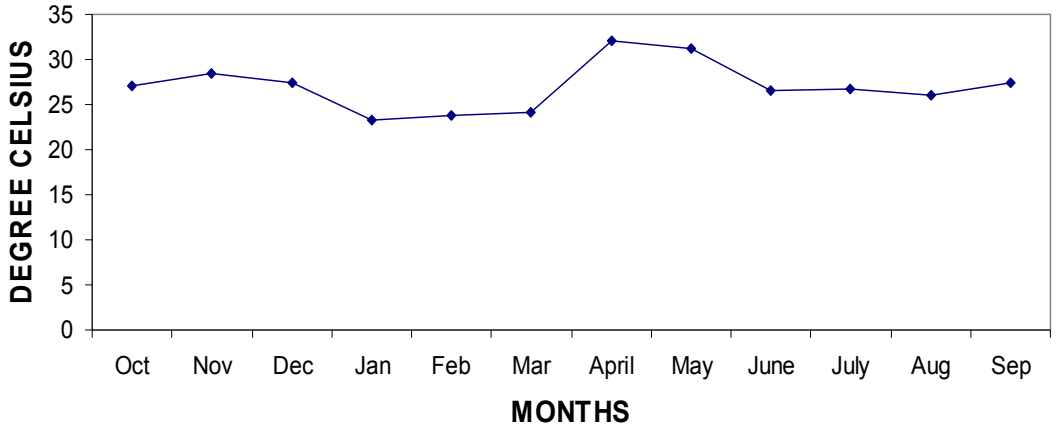


Fig:2 ***Monthly variations of pH in water samples recorded at Giriyampeta Estuary, Yanam from October 2007-September2008***

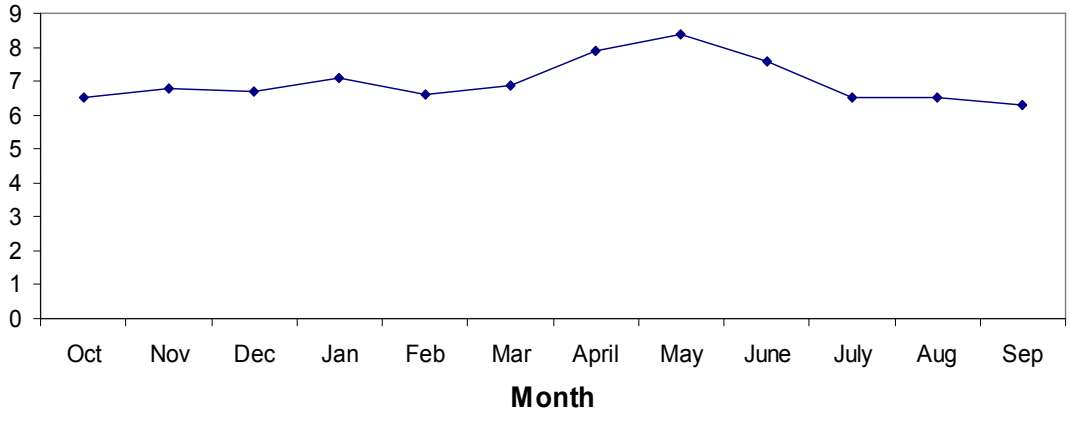


Fig:3 ***Monthly variations of Salinity in water samples recorded at Giriyampeta Estuary from October 2007 to September 2008.***

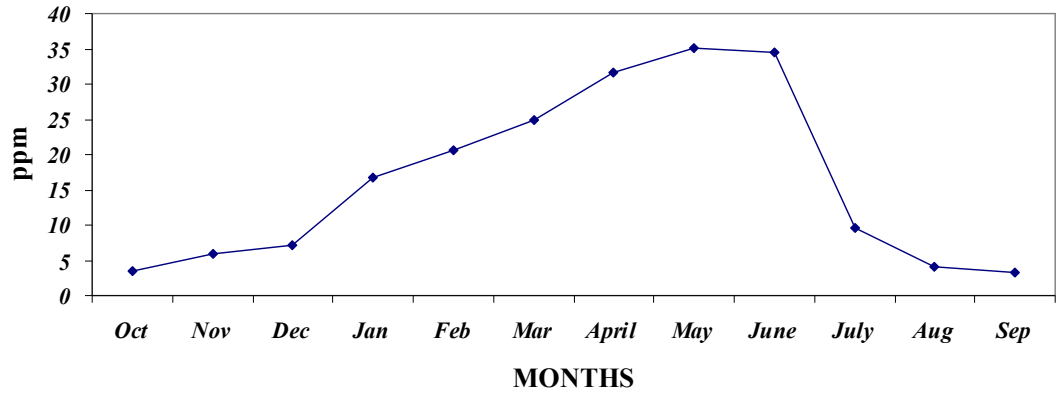
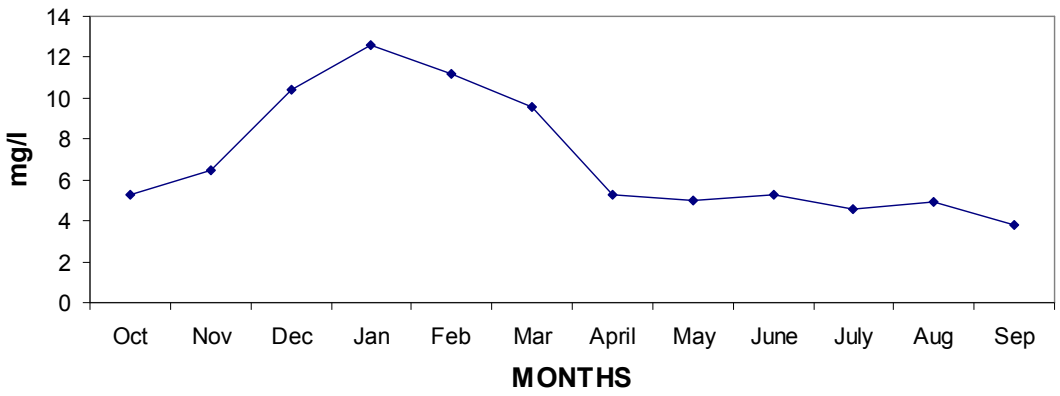


Fig:4 ***Monthly variations of Dissolved Oxygen in water samples recorded at Giriyampeta Estuary from October 2007 to September 2008.***



DISCUSSION

Fishes form the most diverse and protean group of vertebrates; fishes are a treasured source both in terms of utility as food and as material for scientific study [7]. Fish populations in estuaries can be abundant with a wide variety of species. Much of the abundance is seasonal as marine fish more into the estuary to breed, and having used the estuary as a nursery the young fish grow and move out to sea again. Young fish utilize estuaries and near shore marine areas as nursery areas in order to benefit from the availability of food and perhaps also to gain protection from predators.

In general, Gautami-Godavari estuary supports good fishery. The estuary behaves like a salt wedge type during (July) river discharge, mixed type during less (September) river discharge and partially mixed type during minimal (February) river discharge [8].

The species of fishes displayed a well pronounced seasonal variation in their abundance and composition. The periodical survey of the Ichtyofauna at Giriyampeta estuary revealed the presence of 36 species of fishes belonging to 15 families and 21 genera. Of these, the order Clupeiformes ranked first among the five orders.

The order clupeiformes was dominant with 15 species. In general, marine fishes were found to be dominant during summer (April to early June) (premonsoon) which may be attributed to breeding and feeding grounds for the migratory fishes. With the onset of south-west monsoon, heavy influx of freshwater occurs in the estuary in early July developing a fresh water isotatic habitat consequently, the high floods during monsoon (July-September) changes the entire system.

Further, the carps, mullets and catfishes were the major estuarine landings of Gautami-Godavari estuary. The abundance of Elasmobranches, Mackerels and Anchovies were also seen in the

Giriyampeta estuary. Fishery statistics of Gautami-Godavari estuary reveals an overall decline in the total landing. This may be due to the establishment of paper industries, distilleries and confectionaries in the Giriyampeta village in the Yanam (U.T. of Puducherry). These discharges of untreated effluents and anthropogenic activities would have affected the estuarine waters of Giriyampeta and caused rapid decline in a Ichthyofaunal diversity.

The present study reveals that the diversity of 36 species of fishes in the Giriyampeta estuary. However, less abundance of fishes noticed during the survey. A decline in the total landings of the fishes may be attributed towards the industrialization and urbanization which affected the pristine purity of the estuarine ecosystem. The diversity of fishes in the present study reflects the relationship between the faunal abundance and environmental parameters. Among the physiochemical variables, salinity is considered to be an important limiting factor in the distribution of fauna in the benthic region of the estuary and marine ecosystems.

The data on the salinity of the surface water of Giriyampeta estuary reveals the seasonal variations in salinity. The observed high salinity values during summer compared to other seasons in the present investigation, may be due to low rain fall and rise in atmospheric temperature resulting in the evaporation of surface water [9] [10].Prabha devi and Ayyakannu [11] reported that the salinity (surface/bottom) and total fauna had significant positive correlation. A sudden fall of total fauna and numbers was noticed in monsoon, which then gradually built up in the subsequent months. In the present investigation, a high population of fishes species during postmonsoon and low relative density in monsoon is in agreement with the previous study of Ansari [12] from Vembanad lake. The author suggested that the reduction in the number of animals was due to runoff and reduced salinity during monsoon. The present study also revealed that the increased abundance of fishes in post monsoon followed by summer and decreased during monsoon followed by pre monsoon may be due to salinity content of the water.

The temperature in a normal estuary is known to be initially controlled by the sea and the river and their proportions in the mixture at different states of tides [13] and is therefore, a function of temperature of the entering stream and the sea together with tidal states [14]. While the atmospheric temperature is known to influence the temperature of the water in the Gautami-Godavari [15] and Vellar Estuary [16], tides are known to do so in the Mandovi and Zuari Estuaries [13,14].Our findings are in agreement with the early report of Govindasamy and Azariah [17] who suggested that the surface water temperature was high during the summer season because solar radiation and clear sky enhanced the atmospheric temperature whereas during monsoon season rainfall and cloudy skies brought down the water temperatures to the minimum.

A perusal of the data obtained in the present study reveals that the seasonal variation in water temperature was not found to have any influence on the abundance and distribution of the fish species. The present study is in consistent with the earlier report of Kurian [18] who suggested that the temperature was not important factors that affect the diversity of fauna in Cochin waters.

In the present study, pH was quite lower in monsoon season as compared to winter (stable phase) and summer (drought phase). The value of pH in different seasons observed in the present investigation is consistent with the earlier report of Somasekar [19] . The higher pH value observed in post monsoon in the estuarine water of Giriyampeta, may be due to the influence of sea water penetration and biological activity. The low value of pH during monsoon season observed in the present study might be due to the influence of fresh water influx and decomposition of organic matter carried by flood waters into the reverine system[20] [21]. According to Day [13], higher pH during summer and a part of rainy season, indicate its dependence on photosynthetic activity.

DO is very essential for metabolism of all aquatic organisms that possess aerobic respiratory biochemistry. The higher values of oxygen during monsoon are associated with rise in phytoplankton population. The high concentration of DO in surface waters indicates the prominence of production over the factors such as inclusion of seawater during high tide and fresh water flow during south west monsoon season [22]. A general decline in the level of oxygen in summer months was attributable to increase in the temperature and salinity of the water as in the Vasishta-Godavari estuary [23] and the Mandovi and Zovari estuaries[24,25].The higher values of DO in monsoon and lower content in summer in the present investigation show the inverse relationship between temperature and DO content. Our study is in agreement with the report of previous investigations [26] [27].

The DO content of the surface water observed in the present work was showing a relationship with the abundance of fishes. The DO content was higher monsoon while the macrobenthic animals were less in numbers. The study of Prabha Devi,L., and Ayakannu,K.,[11] on the macrobenthos of Buckingam canal showed that that the river runoff resulting in the sudden reduction in salinity and heavy turbulence of bottom sediment are the important factors responsible for the reduction of benthic animals. Moreover, the DO of the water was negatively correlated with the abundance of fauna. According to Ansari [12] the enrichment of DO does not found to have any effect on the fauna in the Vemband lake. The high values of DO during monsoon and decline in fish species in the present study reflects that the DO did not have any influence on the faunal abundance.

The Present investigation on the physico-chemical parameters and their influence on the Ichthyo-faunal distribution in the Giriyampeta estuary reveals that the estuarine environment is largely influenced by the annual cycle of monsoon rains, prevalent during July-September of every year and the study would serve as a frame of reference for future initiatives in studying ecotourism and management of the estuary, Yanam, (U.T. of Puducherry).

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