



STUDIES ON ICHTHYOFAUNAL BIODIVERSITY IN RELATION WITH PHYSICO CHEMICAL VARIABLES OF KOLAVOI LAKE, CHENGALPET, TAMIL NADU

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ABSTRACT: Kolavoi Lake is perennial water resource for human consumption also helpful for the agriculture and fisheries in Chengalpet. The study were carried out for one year (April 2012-March 2013), and it was observed that the ichthyofauna belongs to 07 orders 10 families 14 genera and 18 species. Percentage contribution of species to families, Cyprinidae was most dominant constituting (31.5%) followed by Channidae and Siluridae constitute (10.5%) and Anguillidae, Notopteridae, Poecilidae, Anabatidae, Gobidae, Matacembilidae constituting (0.52%) of the total fish species. Various Physico-chemical parameters such, as water temperature, Dissolved oxygen, p^H and Alkalinity were at the ranges of 26.2 to 31.5°C, 7.2 mg/l to 10.5 mg/l, 6.51 to 8.32 and 47.80 to 65.84, respectively, which were suitable for growth of flora and stocking of fish diversity. Keeping a view that ichthyofaunal diversity of Kolavoi Lake is correlated to aquatic ecosystem.

Key words: Kolavoi Lake, Ichthyofaunal, Biodiversity, Physico-Chemical parameters

INTRODUCTION

Water is one of the most abundant compounds found in nature covering approximately three-fourths of surface of earth [1]. Water is the elixir of life, a precious gift of nature to the mankind and millions of other species living on the earth. It is fast becoming a scare commodity in most part of the world [2]. Lakes and freshwater resources are planets most important freshwater resources and provide innumerable benefits. They are used for domestic and irrigation purposes, and provide ecosystems for aquatic life especially fish, thereby functioning as a source of essential protein, and for significant elements of the world's biological diversity. They have important social and economic benefits as a result of tourism and recreation, and are culturally and aesthetically important for people throughout the world.

Biological production in any aquatic body gives direct correlation with its Physico - chemical status which can be used as tropic status and fisheries resource potential [3]. Life in aquatic environment is largely governed by Physico - chemical characteristics have enabled biota to develop many adaptations that improve sustained productivity and regulate Lake Metabolism [4]. Biodiversity is essential for stabilization of ecosystem and protection of overall environmental quality for understanding intrinsic work of all species on the earth [5]. Fish biodiversity of lake essentially represent the fish faunal diversity and their abundance. Lake conserves a rich variety of fish species which support the commercial fishery [6-8]. Some other workers also worked on the ichthyofauna and relation to physicochemical variables in various water bodies of the country [9-12]. The objectives of the present study were to document the fish species diversity in relation to Physico-chemical characteristics of water and suggest appropriate conservation and management strategies.

MATERIALS AND METHODS

Study Area

Kolavoi Lake is situated in the Chengalpet 58 Km away from the Chennai city. It is one of the largest lakes situated about 200 m on the north east of Chengalpet and close to Pulipakkam village, running parallel to the national highway (Fig- 1). This lake receives water from 12 tanks and the surplus flows into Palar, Neenjal and Madura rivers.

It is one of the biggest water bodies with 894 hectares and a maximum depth of 4.5 meters. Presently 17 villages are benefiting from this lake. It has many species of plants and animals. The total capacity of the tank is 476.69 Mct, with one filling. The large numbers of edible fish species are available. At present approximately 350 Kg of fishes are harvested by fishermen per day. Lake water has been used for agriculture, recreation and fishing activities.



Figure 1: Satellite image showing a study area – Kolavoi Lake, Chengalpet

The study was carried out for one year from April 2012 – March 2013. Three sampling stations were fixed in this lake. The specimens were collected using various types of fishing gears such as cast nets (16 mm, 18 mm, 22 mm), gill nets (32 mm, 38 mm, 64 mm, 78 mm), drag nets (4 mm, 15×3 meters) scoop nets and other local contrivances. The collected fish samples were preserved in 10% formalin. These fish samples were brought to Department of Zoology, Sir Theagaraya College, Chennai. The detail examination and identification of species were used to standard literatures [11, 13-15]. For, further identification the specimen has sent to Zoological Survey of India (ZSI), Southern regional centre, Chennai. Water samples were collected between 8 A.M to 10 A.M and transported to the laboratory immediately for further analysis. Water temperatures was measured at the time of sampling using mercury thermometer, p^H was measured with standard p^H meter (Global DPH 500), while other parameters were analyzed in the laboratory according to the methods suggested by [16-17].

RESULTS AND DISCUSSION

The analyzed Physico-chemical parameters were tabulated to understand the water quality. Similarly the variations in the fish fauna were observed and level of significance was made to understand the correlation between them. A comparative study of these parameters has done to understand the seasonal fluctuations. The details of three sampling stations are tabulated as (Table: 1 & Fig: 1, Table: 2 & Fig: 2, Table: 3 & Fig: 3).

Table I: Physico-chemical parameters of Kolavoi Lake in Station-I

Month	Temperature°C	Dissolved oxygen (mg/l)	pH	Alkalinity (mg/l)
April 2012	31.5	7.4	8.25	61.72
May	30.2	7.5	8.32	52.10
June	30.0	7.2	7.32	56.31
July	29.0	8.2	7.18	51.25
August	28.2	8.7	6.51	53.12
September	27.1	7.8	7.48	54.31
October	27.5	9.4	7.40	49.70
November	26.2	10.5	7.57	51.12
December	26.5	8.8	7.51	50.10
January 2013	28.7	9.2	7.92	53.31
February	30.1	8.3	7.72	53.21
March	28.0	8.6	7.51	54.60

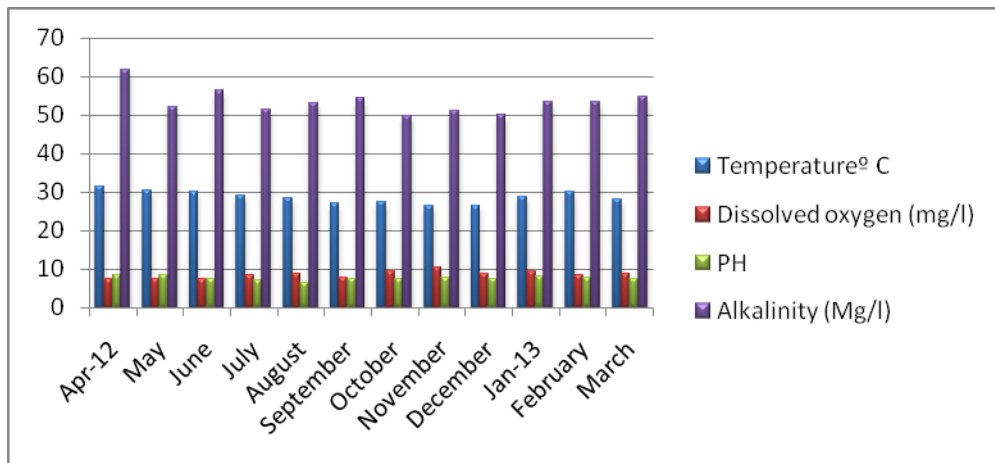


Figure 2: Showing the Physico-chemical parameters in Kolavoi Lake in Station-I

Table 2: Physico-chemical parameters in Kolavoi Lake in Station-II

Month	Temperature °C	Dissolved oxygen (mg/l)	pH	Alkalinity (mg/l)
April 2012	30.8	7.6	7.81	61.32
May	30.4	7.8	8.21	62.51
June	30.0	7.3	8.16	65.84
July	28.0	7.4	7.40	61.72
August	30.0	8.5	7.60	55.52
September	29.4	8.3	7.50	54.79
October	28.0	8.8	7.72	52.32
November	27.5	10.2	7.10	51.41
December	27.0	9.6	7.25	59.51
January 2013	30.4	9.4	7.22	57.10
February	28.1	8.7	7.72	57.20
March	29.0	9.2	7.30	59.10

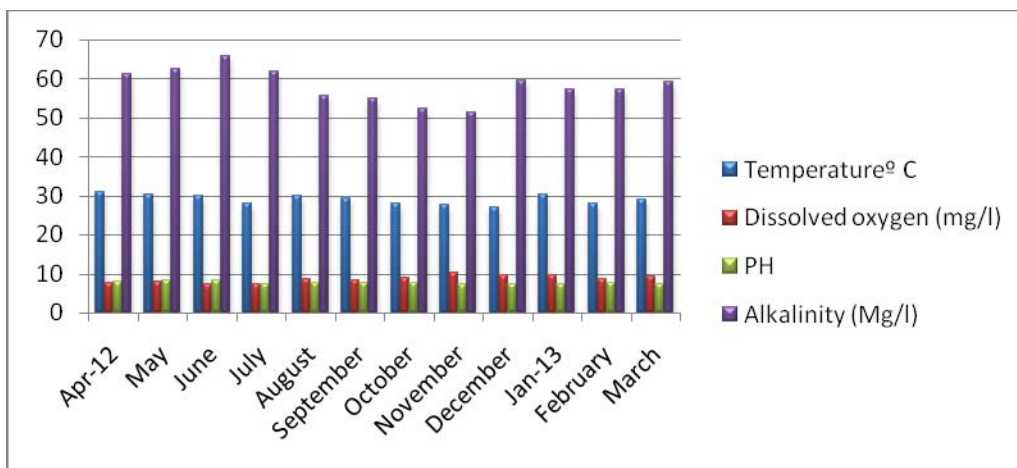


Figure 3: Showing the Physico-chemical parameters in Kolavoi Lake in Station-II

Table 3: Physico-chemical parameters in Kolavoi Lake in Station-III

Month	Temperature °C	Dissolved oxygen (mg/l)	pH	Alkalinity (mg/l)
April 2012	30.5	8.2	7.92	61.91
May	30.2	8.4	8.15	62.52
June	30.4	7.6	7.86	62.41
July	29.8	9.4	7.95	50.12
August	29.0	7.6	7.50	54.42
September	30.0	8.0	7.87	54.41
October	26.0	9.7	7.46	47.80
November	29.0	8.8	6.51	50.10
December	27.7	9.5	7.55	46.32
January 2013	28.5	9.7	7.86	61.41
February	27.6	8.5	7.92	55.21
March	26.2	8.2	7.60	59.10

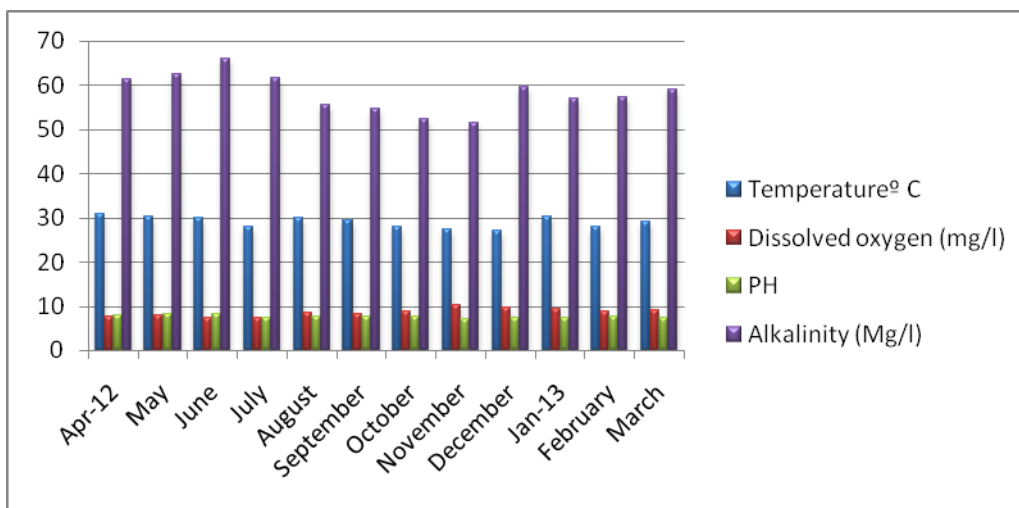


Figure 4: Showing the Physico-chemical parameters in Kolavoi Lake in Station-III

Temperature

Temperature is one of the most important physical parameters, which controls the physiological activities and distribution of biota. Water bodies are naturally shows changes of temperature in seasonally and daily. However, man made changes to stream water temperature so will affect fishes ability to reproduce. Many lakes and rivers exhibit vertical temperature gradients. In the present study, the water temperature variations from station-I (26.2-31.5°C), station-II (27-30.8°C) and (26-30.5°C) were recorded in station-III. The maximum temperature (31.5°C) were recorded in the month of April (summer), and minimum (26°C) in the month of October (Monsoon). The high temperature recorded during summer at both stations I and II could be attributed to the high solar radiation. The low temperatures were observed during monsoon and early post monsoon season may be attributed to the monsoonal rain, cloudy sky and cold weather conditions [18].

Dissolved Oxygen

Oxygen is an important eco-chemical parameter which is essential for the metabolism of all aquatic aerobically respired biota. Dissolved oxygen in water indicates water quality and diversity of living things. The dissolved oxygen concentrations ranged from (7.2-10.5 mg/l) station-I (7.4-10.2 mg/l) station-II and (7.6-9.8 mg/l) station-III. The minimum value (7.6 mg/l) was recorded during the summer and the maximum value (9.8 mg/l) during monsoon season at Kolavoi Lake. Free carbon di oxide bear inverse relationship with dissolved oxygen and its value increased in monsoon season while decreased in summer.

In general, higher oxygen concentration coincided with active nutrients [19-20]. In addition to this, atmospheric inputs would have also increased the dissolved oxygen concentration in water [21]. A good synchronization between temperature and dissolved oxygen was seen. Temperature showed a significant inverse relationship has also been observed.

pH

pH is an alkaline values ranged from (7.40-8.32) station-I, (7.10-8.21) station-II and (6.51-8.15) station-III. The maximum p^H value (8.25) was recorded in the month of April (summer) and minimum value (6.51) in the month of November (monsoon). Most of chemical and biochemical reactions are influenced by the p^H . The reduced rate of photosynthetic activities reduces the assimilation of carbon di-oxide and bicarbonates which are ultimately responsible for increase in p^H , the low oxygen values coincided with high temperature during the summer month [22]. The factors like atmospheric temperature bring about changes the p^H of water. The higher p^H values observed suggests that carbon di-oxide, carbon-bicarbonate equilibrium is affected more due to change in Physico-chemical condition [23].

Alkalinity

In total alkalinity ranged from station-I (50.10-61.72 mg/l), station-II (51.4-65.8 mg/l) and station-III (46.32-62.91 mg/l) respectively. The maximum value (65.84 mg/l) was recorded in the month of June (summer) and minimum value (46.32 mg/l) in the month of December (monsoon). The alkalinity was maximum value in April (summer) due to increase bicarbonates in the water. [24] Also reported similar results that it was maximum in summer and minimum in monsoon due to high photosynthetic rate.

Table 4: List of Fish fauna Recorded from the Kolavoi Lake, Chengalpet

S.No	Name of the fish	Common name
1	<i>Catla catla</i>	Catla
2	<i>Labeo rohita</i>	Rohu
3	<i>Cirrhinus mrigala</i>	Mrigal
4	<i>Punitus dorsalis</i>	Salkendai
5	<i>Punitus sophore</i>	Kullakendai
6	<i>Gambusia affinis</i>	Kosumeen
7	<i>Notopterus notopterus</i>	Sottavala
8	<i>Anabas testeudineus</i>	Panangkottai
9	<i>Channa punctatus</i>	Koravai
10	<i>Channa striatus</i>	Viral
11	<i>Glossogobius giuris</i>	Uluvai
12	<i>Etroplus maculates</i>	Sellakasumeen
13	<i>Etroplus suratensis</i>	Sethakendai
14	<i>Tilapia mossambica</i>	Silapi
15	<i>Heteropnestus fossilis</i>	Theali
16	<i>Mystus vittatus</i>	Keluthi
17	<i>Margnathus pancalus</i>	Aara
18	<i>Anguilla bicolar</i>	Vilangu

Fish Fauna

The observed results confirmed the Kolavoi Lake has rich in fish biodiversity. Totally 18 species were recorded in this lake. The scientific, common and local names of the species, along with order and family, commercial value and availability were illustrated in (Table-4). In respect of ichthyofaunal diversity, out of 18 species belonging to 7 orders and 10 families were identified from all the three stations.

During the entire study period the order Cypriniformes was observed the more abundant including two families Cyprinidae (5 species) and Cichilidae (3 species). Family Cyprinidae viz, *Catla catla*, *Labeo rohita*, *Cirrhinus mrigala*, *Punitus sophore*, *Punitus dorsalis* were recorded. Last 2 species represented by genus *Punitus* was the dominant of followed by major carps (*Catla catla*, *Labeo rohita*, *Cirrhinus mrigala*) and family Cichilidae (*Etroplus suratensis*, *Etroplus maculatus*, and *Tilapia mossambica*).

The above discussed fish species where the major composition of ichthyofaunal biodiversity of this lake. Other species such as *Anguilla bicolor*, *Anabas testeudinus*, *Channa punctatus*, *Channa striatus*, *Mystus vittatus*, *Heteropneustus fossilis*, *Notopterus notopterus* are economically important but this fish species are illegally exploited by the people of this area. Abundance of fish species in this lake were represented in (Table-5). Among all the recorded fish species a maximum available in *Tilapia mossambica* and *Mystus vittatus*, *Heteropneustus fossilis*, *Catla catla*, *Channa punctatus* were found to be the least one. The family Cyprinidae is dominant of 5 species (31.5%) over all the reported families, because the members of Cyprinidae family were very fast growing; they are cultivable species, possess more food values and the availability of fish seeds is also comparatively high. These fish can tolerate various Physico-chemical conditions of water body. It has more weight so economically beneficial for fishermen. But other family as Channidae (10.5%) and Cichilidae (10.5%) Anguillidae, Notopteridae, Poecilidae, Anabatidae, Gobidae, Matakembilidae with one species each (0.52%) (Table-6 and Figure-5).

The composition of various fishes in Kolavoi lake shows the major carp fish group were the most dominant of 14.28% followed by exotic fish 12.88%, minor group 6.48%, Miscellaneous group 2.34%, Murrells group 1.44%, catfish group 0.86% respectively. The economic importance of fishes and their families are shown in (Table-7).

Table 5: Fish species abundance and relative abundance

Family	Genus	Species	Abundance	Relative abundance
Anguillidae	<i>Anguilla</i>	<i>Anguilla bicolor</i>	14	0.86
Cyprinidae	<i>Catla</i>	<i>Catla catla</i>	12	2.60
	<i>Labeo</i>	<i>Labeo rohita</i>	18	1.73
	<i>Cirhinus</i>	<i>Cirhinus mrigala</i>	13	2.60
	<i>Punitus</i>	<i>Punitus sophore</i>	31	6.72
	<i>Punitus</i>	<i>Punitus dorsalis</i>	46	9.97
Notopteridae	<i>Notopterus</i>	<i>Notopterus notopterus</i>	32	6.94
Poecilidae	<i>Gambusia</i>	<i>Gambusia affinis</i>	17	1.51
Anabatidae	<i>Anabas</i>	<i>Anabas testeudinus</i>	15	2.60
Channidae	<i>Channa</i>	<i>Channa punctatus</i>	15	1.08
	<i>Channa</i>	<i>Channa striatus</i>	17	1.51
Gobidae	<i>Glossogobius</i>	<i>Glossogobius giuris</i>	21	4.55
Cichilidae	<i>Etroplus</i>	<i>Etroplus suratensis</i>	92	.19.9
	<i>Etroplus</i>	<i>Etroplus maculatus</i>	46	9.97
	<i>Tilapia</i>	<i>Tilapia mossambica</i>	108	23.4
Bagridae	<i>Mystus</i>	<i>Mystus vittatus</i>	16	1.30
Saccobranchidae	<i>Heteropneustus</i>	<i>Heteropneustus fossilis</i>	12	2.60

Table 6: Percentage occurrence of fish species of Kolavoi Lake, Chengalpet

S.No	Family	Genus	% contribution of genera to families	Species	% of contribution of species to families
1	Anguillidae	1	0.05	1	0.52
2	Cyprinidae	6	0.33	6	31.5
3	Notopteridae	1	0.05	1	0.52
4	Poecilidae	1	0.05	1	0.52
5	Anabatidae	1	0.05	1	0.52
6	Channidae	2	0.11	2	10.5
7	Gobidae	1	0.05	1	0.52
8	Cichilidae	2	0.11	3	1.57
9	Siluridae	2	0.11	2	10.5
10	Matakembilidae	1	0.05	1	0.52

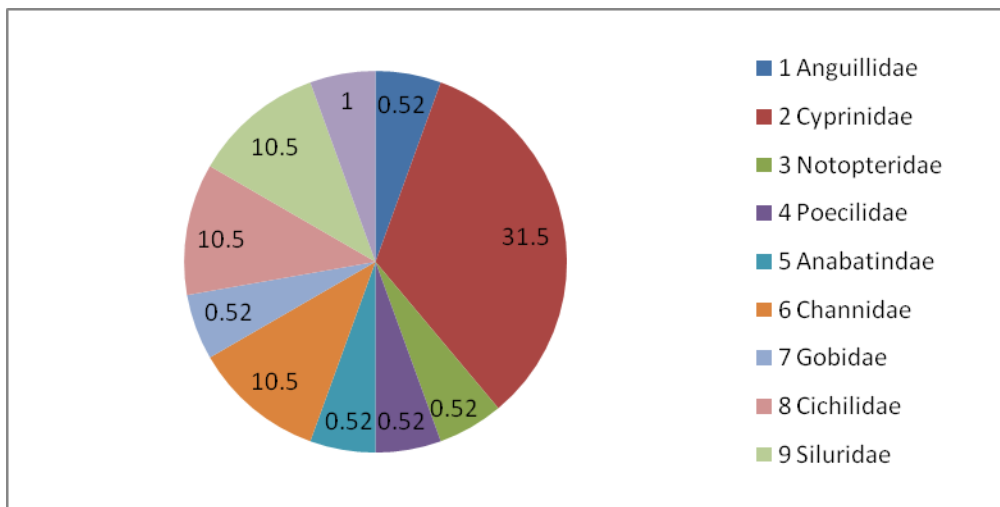


Figure 5: Percentage occurrence of fish species of Kolavoi Lake, Chengalpet

Table 7: Groups of fish, Economic value and percentage of fish groups in Kolavoi Lake, Chengalpet

S.No	Fish group	Name of Fish	Economic Value	Percentage of Fish groups
1	Major group	<i>Catla catla</i>	FD	14.28
		<i>Labeo rohita</i>	FD	
		<i>Cirrhinus mrigala</i>	FD	
2	Catfish	<i>Heteropneustus fossilis</i>	PF	1.86
		<i>Mystus vittatus</i>	PF	
3	Murrels	<i>Channa striatus</i>	PF, LV	1.44
		<i>Channa punctatus</i>	PF, LV	
4	Exotic	<i>Cyprinus carpio</i>	FD	12.88
		<i>Tilapia mossambica</i>	FD	
		<i>Etroplus suratensis</i>	FD	
		<i>Etroplus maculates</i>	FD	
		<i>Gambusia affinis</i>	LV	
5	Miscellaneous	<i>Glossogobius giuris</i>	LV, FD	2.34
		<i>Anabas testeudinus</i>	LV, FD	
		<i>Macragnathus pancalus</i>	PF	
6	Minor group	<i>Punitus sophore</i>	FD	6.48
		<i>Punitus dorsalis</i>	FD	
		<i>Notopterus notopterus</i>	PF	
		<i>Anguila bicolor</i>	PF	

1. LV- Larvivorous fish; 2. PF- Predatory, Food fish; 3. WF- Weed fish; 4. FD- Food fish

CONCLUSION

Totally 18 species belonging to 7 orders and 10 families are recorded from all the three stations. As well as the Physico-chemical parameters also recorded and influenced the fish productivity of this lake. Temperature, dissolved oxygen and alkalinity are higher in summer season and lower in monsoon season. The p^H value is higher in monsoon and lower in summer season. It concludes the lake has high fish diversity with good economic potential. To conserve and maintain the fish diversity, we have further need to assess water quality and anthropogenic activities to this lake, which should be controlled and encourage the establishment of fish farm.

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