



ICHTHYODIVERSITY AND PHYSIO-CHEMICAL PARAMETERS OF PUZHAL LAKE FROM REDHILLS, CHENNAI, TAMIL NADU

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Abstract

Water, as the most important component of all organisms, is required for practically all biochemical actions in every way. Oceans, seas, lakes, rivers, ponds, estuaries, and other bodies of water cover over 75 percent of the earth's surface. Lakes, for example, are enormous bodies of slowly moving or still water that occupy a significant inland basin. Puzhal Lake, commonly known as Redhills Lake, is located in the Redhills neighborhood of Chennai, India. It was constructed in 1876. This lake was chosen in particular since it is a key source of water for the city of Chennai. The lake's water has previously been used for drinking and household purposes. The research was carried out to know about the pH, Turbidity, Electrical Conductivity, Alkalinity, Total Dissolved Solid, Total Hardness, Dissolved Oxygen, Chloride, Fluoride, Calcium, Magnesium, Nitrite, Nitrate, Sulphate, Phosphate, Nitrite, Nitrate, Sulphate, Phosphate, in addition, the study covers the area's biodiversity from 2019 to 2020. The work of determining the role of people in sustaining the lake's quality and biodiversity was completed.

Keywords: Ichthyodiversity, Physico-chemical parameter, Puzhal lake, Redhills.

1. INTRODUCTION

Water is one of nature's most abundant compounds, accounting for roughly three-quarters of the planet's surface (Beebi *et al.*, 2004). Water is the elixir of life, a priceless gift from nature to humanity and millions of other animals. Water is a valuable resource with a wide range of applications, including household, recreational, transportation, hydroelectric power, industrial, and commercial. It also promotes all forms of life and has an impact on people's health, lifestyles, and financial well-being (UNEP, Global environmental outlook, 2000). As a result of expanding human development activities, water quality has become a major global issue. As about 75% of the world's water is polluted, it's a major issue. The growing human population and their activities put additional strain on the supply of safe drinking water, particularly in developing countries (Pattanaik *et al.*, 2012).

Biodiversity is critical for ecosystem stabilizing and overall environmental quality protection, as well as for comprehending the intrinsic work of all species on the planet (Shivasankaran and Venkataramana, 2012). Freshwater fishes are the most diversified of all vertebrates on the planet. As a result, investigations are being carried out to build a tool for the protection of freshwater biodiversity (Moilanen *et al.*, 2008), and several methodologies and tactics have been presented. (Suski *et al.*, 2007). In the form of lakes, India has a diverse range of freshwater resources (10,551,201 ha) dispersed throughout several geo-climatic areas. (Panigrahy *et al.*, 2011 and Anonymous, 2017). Tamil Nadu has a diverse range of freshwater resources (3.08 lakh hectares) in the form of streams, rivers, canals (7400 kilometers), major reservoirs (52000 hectares), large or small irrigation tanks (98000 hectares), small lakes, and rural fishery demonstration tanks (158000 hectares), and cold water lakes and reservoirs (Mogaleka and Canciyal, 2018). Tamil Nadu possesses a diverse range of freshwater fish genetic resources, with 226 species representing 13 orders, 34 families, and 93 taxa, accounting for 22.30 percent of India's total freshwater fish diversity (Gopi *et al.*, 2017, Mogalekar and Jawahar, 2017). Lakes and freshwater resources are the most important freshwater resources on the globe, and they provide numerous advantages. They are utilized for domestic and irrigation reasons, as well as providing ecosystems for aquatic life, particularly fish, thereby serving as a

source of necessary protein and contributing to the world's biological diversity. As a result of tourism and recreation, they provide significant social and economic benefits, as well as cultural and aesthetic value to people all over the world. (Silambarasan *et al.*, 2014). However, due to unreasonable meddling and unsustainable development, most of the water bodies that form the major life support systems of many organisms are undergoing ecological deterioration today (Prasad *et al.*, 2009). Local farmers have used lake water for agricultural and irrigation reasons, as well as fish rearing. (Sukanthi and Ebanasar 2018).

The diversity and quantity of fish in a lake are essentially represented by their biodiversity. The lake supports commercial fishing by preserving a diverse range of fish species. Puzhal Lake, commonly known as Redhills Lake, is located in the Ponneri Taluk of Thiruvallur district, Tamil Nadu. It is one among the rain-fed lakes, along with Chembarabakkam and Porur lakes, from which water is collected for supply to Chennai. The lake's total capacity is 93 million.

2. MATERIAL AND METHOD

2.1.1 Sampling site

The Puzhal Lake in Redhills, Chennai, was chosen for study because it is one of the city's largest lakes. For the collection of sample water, three stations were identified. Station A, Station B, and Station C are the labels on the collection. The bank around the lake was thought to be abundantly rich in a diverse range of flora and fauna, allowing for the identification of numerous types of species in the area.

2.1.2 Collection of Sample

Water samples were taken at all three locations. The sample was collected using two polyethylene cans that had been cleansed, rinsed, and washed with deionized water before being rinsed with sample water several times. Around 9 a.m., a water quality assessment was conducted.

2.1.3. Analysis

The Sample thus collected were analyzed for several physicochemical parameters viz., Color, Odor, Temperature, Turbidity, Electricity conductivity (EC), pH, alkalinity, Total Dissolved Solids (TDS), Total Hardness (TH), Dissolved Oxygen (DO), Chloride, Fluoride, Calcium, Magnesium, Ammoniacal nitrogen, nitrate, Nitrite, Sulphate, and Phosphate using a standard protocol. (APHA, Standard Methods for the examination of water and wastewater, 21st ed. American Public Health Association, Washington, D.C.2005,55) (Deepa *et al.*,2016).

Table1. Parameters, Unit, and Method

Parameter for analysis	Unit	Method
Temperature	° C	Mercury – in – glass thermometer
Turbidity	NTU	Nephelometric method
Electrical Conductivity (EC)	µS / cm	Conductivity meter – Extech EC 150
pH	-	Systronic digital pH meter
Alkalinity		Acid titration method
Total Dissolved Salted (TDS)		Ion-selective method
Total Hardness (TH)		Titration method EDTA
Dissolved Oxygen (DO)		Winkler method
Chloride		Argentometric titration method
Fluoride		SPADNS - Spectrophotometric method
Calcium		Complexometric EDTA titration method
Magnesium		
Ammoniacal nitrogen	mg /L	Selective electrode method
Nitrate Nitrite Sulfate		Spectrophotometric method
Phosphate		Chloride Stannous method

2.1.4. Study area

The capital of Tamil Nadu is Chennai. Puzhal Lake is located near Redhills in Thiruvallur district at 13°09'60.00N, 80°10'10.50E. The Puzhal Lake is another prominent lake in Chennai, with an area of 18 square kilometers. This lake, also known as Red Hills Lake, was established in the year 1876. Currently, this lake offers a lovely environment and seclusion to its tourists, providing a welcome escape from the madness of Chennai. Over time, this lake brought various organisms to the house, including fish, mollusks, zooplankton, and phytoplankton.

2.2. METHODOLOGY

From December 2019 to February 2020, survey work on Puzhal Lake in the Thiruvallur district of Chennai was conducted. A sample collection was done for select species for further laboratory confirmation, and common fishes were recorded at the landing site.

2.2.1. Collection of Fish

During the study period, fish samples were collected from the fish landing centers with the help of skilled local fishermen using cast nets (dia. 3.7 m and 1.0 m) for collecting fish in shallow areas, monofilaments gill nets (vertical height 1.0 m - 1.5 m; length 100 m - 150 m), drag nets (vertical height 2.0 m), and a variety of traps. Sampling points were placed throughout the site to ensure that the entire region was covered. (Dhanalakshmi and Priyatharsini, 2015).

2.2.2. Laboratory Procedures

Before preservation, images were taken right away because formalin fades the color of the fish over time. Fish species that could not be identified on the scene were transported to the laboratory and preserved in a 10% formalin solution in a different specimen jar according to their size and fin spread. During the sampling period, two 10% formalin modifications were made. Smaller fish were thrown into the formalin solution right away.

2.2.3. Identification of Fish Species

All fish caught were identified to species level using standard taxonomic methods such as Jayaram's standard keys (Jayaram, K.C. (2010)), FAO identification sheets, ITIS (Integrated Taxonomic Information System) standard report (<http://www.itis.gov>), and other reference books. Inland Fishes of India and Adjacent Countries, Talwar and Jhingran (Talwar, P.K., and Jhingran, A.G., 1991). Day Francis (Francis, D. (1994) The Fishes of India, Jagminder. Book Agency, New Delhi.) and Shrivastava (Shrivastava, G. (1998) Fishes of U.P. and Bihar. 7th Edition, Vishwavidyalay Prakashan, Chowk Varanasi India Pub.) are among the authors.

3. RESULT AND DISCUSSION

3.1. PHYSICO-CHEMICAL WATER QUALITY PARAMETER

The physicochemical characteristics of the water body were determinants of its biogenic productivity. Various physical characteristics of the water body such as water temperature, transparency, turbidity, and total dissolved solids plays important role in the metabolism of the water body while chemical characteristics such as pH, dissolved oxygen, total alkalinity, hardness, nitrate-nitrogen, and phosphate phosphorus largely govern the productivity of water body (Jhingran, 1991 and Sharma, 2000). For water quality testing, water can be collected from several locations throughout the lake.

Table 2. Physico – Chemical water quality parameter of Lake Puzhal

S.no	physical and chemistry examination	Method of Testing	Permissible limit in the absence of alternate source	2020
1	Turbidity NT Units	APHA 23 rd Edition 2017 – 2130 B	5	10
2	Total dissolved solids mg / L	APHA 23 rd Edition 2017 – 2540 C	2000	305
3	Electrical Conductivity Micro mho / L	APHA 23 rd Edition 2017 – 2510 B	-	436
4	pH at 25° C	IS 3025 part 11 – 1983 – Reaffirmed 2017	6.5 – 8.5	7.67
6	Total Alkalinity as CaCO ₃ mg/L	IS 3025 part 23 – 1986 – Reaffirmed 2014	600	120
7	Total Hardness as CaCO ₃ mg/L	IS 3025 part 21 – 2009 – Reaffirmed 2014	600	110
8	Calcium as Ca mg / L	APHA 23 rd Edition 2017 – 3500 Ca B	200	31
9	Magnesium as Mg mg / L	APHA 23 rd Edition 2017 – 3500 Mg B	100	8
10	Sodium as Na mg /L	APHA 23 rd Edition 2017 – 3500 Na B	-	43

11	Potassium as K mg /L	APHA 23 rd Edition 2017 – 3500 K B	-	4
12	Iron as Fe mg /L	APHA 23 rd Edition 2017 – 3500 Fe B	1.0	0
13	Manganese as Mn mg /L	APHA 23 rd Edition 2017 – 3500 Mn B	0.3	0
14	Free Ammonia as NH ₃ mg / L	APHA 23 rd Edition 1989 – 4500 NH ₃ C	0.5	0
15	Nitrite as NO ₂ mg / L	APHA 23 rd Edition 2017 – 4500 NO ₂ B	-	0
16	Nitrate as NO ₃ mg / L	APHA 23 rd Edition 2017 – 3500 NO ₃ B	45	1
17	Chloride as Cl mg /L	IS 3025 part 32 – 1988 – Reaffirmed 2014	1000	33
18	Fluoride as F mg / L	APHA 23 rd Edition 2017 – 4500 F D	1.5	0.99
19	Sulfate as SO ₄ mg / L	IS 3025 part 24 – 1986 – Reaffirmed 2014	400	49
20	Phosphate as PO ₄ mg / L	APHA 23 rd Edition 2017 – 4500 P - D	-	0
21	Tidys Test 4 hrs as O ₂ mg/L	APHA 23 rd Edition 2017 – 4500 B	-	0.4

3.2. PHYSICAL EXAMINATION

3.2.1. Turbidity

Puzhal Lake has average turbidity of **10NTU**. In the absence of an alternate source, this was much beyond the acceptable limit of 5NTU and the permitted limit of 10NTU. Turbidity is an optical quality of a fluid that refers to the amount of light scattered or absorbed by it. Turbidity is caused by suspended solids and colloidal particles in water. It could be due to dredging-induced soil erosion or microorganism proliferation (Sciortino and Ravikumer, 1999).

3.2.2. Total Dissolved Solid (TDS)

Materials dissolved in water, such as bicarbonate, sulfate, phosphate, nitrate, calcium, magnesium, sodium, organic ions, and other ions, are included in TDS. These ions are necessary for aquatic life to survive. Urban and fertilizer run-off, wastewater and septic effluent, soil erosion, decomposing plants, and animals are all factors that affect the level of dissolved solids in a water body (Verma *et al.*, 2011). Puzhal Lake's total dissolved solids were discovered to be **305**.

3.2.3. Electrical Conductivity (EC)

Puzhal Lake's value was discovered to be **436mho/L**. The ability of an aqueous solution to transport electric current is expressed numerically as EC. The presence of ions, their overall concentration, mobility, valence, relative concentrations, and measurement temperature all influence this ability. Pre-monsoon high EC values could be due to the influx of large amounts of residential sewage, whereas low EC values could be owing to higher temperatures, water stabilization due to sedimentation, and increased salt concentrations due to discharged domestic sewage and organic matter in the lake (Gayathri, Latha *et al.*, 2013).

3.3. CHEMICAL EXAMINATION

3.3.1. pH

A range of 6.5 to 8.0 is preferred by the majority of aquatic species. Due to physiological stress, when pH falls outside of this range, diversity within the water body may decrease, resulting in reduced reproduction. Extremes in pH can create hazardous circumstances for aquatic life (Boman, Wilson *et al.*, 2008). At 25 degrees Celsius, the pH of Puzhal Lake did not exceed the desired level of **7.67**.

3.3.2. Alkalinity

Total alkalinity refers to the total amount of carbonates and bicarbonates in the water. Total alkalinity is determined by the amount of a material that raises the pH of water. The presence of very alkaline industrial wastewater and sewage is indicated by high levels of alkalinity. Increases in carbonate and bicarbonate levels, as well as an increase in alkalinity, may be caused by the decomposition of plants, living organisms, and organic waste in the water body (Wang, Lou *et al.*, 1999 to 2002). Puzhal Lake's alkalinity was found to be **120 mg/l**.

3.3.3. Total Hardness

The overall concentration of divalent cations in water, measured in milligrams per liter of equivalent total calcium and magnesium, is referred to as total hardness (Sharma, 2000). Calcium is usually found in the presence of 14 carbonate ions

(Jhingran, 1991). Magnesium is required for chlorophyll-bearing algae to flourish (Jhingran, 1991 and Sharma, 2000). Puzhal Lake's total hardness was found to be 110 mg/l. The ideal overall hardness level in water is 600 mg/l.

3.3.4. Calcium

During the post-monsoon and pre-monsoon seasons, calcium levels ranged from 39 to 65 mg/l. Calcium in water has a recommended limit of 75 mg/l and an allowed limit of 200 mg/l in the absence of another source (BIS. IS: 10500, Indian Standard for drinking water, Bureau of Indian Standards, New Delhi, India, 1991). Calcium is necessary for all living things since it is a component of cell walls and governs a variety of physiological activities in animals (Kumar and Qureshi, 2006). The calcium concentration of Puzhal Lake was found to be **31mg/l**. Puzhal Lake's average calcium concentration was found to be below the acceptable range.

3.3.5. Magnesium

The magnesium concentration in Puzhal Lake was below the allowed limit of **8 mg/l**. Magnesium is also a key mineral for a variety of cellular enzymatic transformations, including trans-phosphorylation, in algal, fungal, and bacterial cells (Kistan, Kanchana, 2015). Magnesium ions, together with calcium and other ions, contribute to the hardness of the water.

3.3.6. Ammoniacal nitrogen

During the post-monsoon season, ammoniacal nitrogen levels ranged from 0.49 mg/l to 0.85 mg/l. It can also be used to assess the condition of water in natural bodies like rivers and lakes, as well as man-made reservoirs (Manios and Stentiford, 2002). The microbial action of organic nitrogenous materials produces ammoniacal nitrogen, which is found in many groundwaters (NEERI. National Environmental Engineering Research Institute, 1986). The level of ammoniac nitrogen in Puzhal Lake was found to be **0mg/l**.

3.3.7. Nitrate

In the absence of an alternate source, the optimum limit for nitrate in drinking water is 45 mg/L, however, it can increase up to the maximum allowable limit of 100 mg/l (BIS. IS: 10500, Indian Standard for drinking water, 1991). Because nitrate is a result of aerobic degradation of organic nitrogenous materials, it is the most highly oxidized form of nitrogen compounds usually found in natural waterways. Fertilizers, rotting vegetable and animal debris, home and industrial effluents, and atmospheric washouts are all significant sources of nitrates (Gayathri and Latha *et al.*, 2013). It can cause respiratory and heart issues, as well as mortality, in severe situations. The nitrate concentration in Puzhal Lake was determined to be **1 mg/l**.

3.3.8. Nitrite

Because bacteria quickly convert nitrites to nitrates, the low nitrite content could be attributable to reduced freshwater input. Brown blood disease is a dangerous condition caused by nitrates in seafood. Nitrites also react directly with hemoglobin in human blood, forming methemoglobin, which impairs blood cells' ability to carry oxygen. This disorder, known as methemoglobinemia or blue-baby illness, is extremely dangerous in babies under three months of age. (US Environmental Protection Agency, 1986; Knepp and Arkin, 1973.) In Puzhal Lake, the nitrite levels were within acceptable standards. The Nitrite concentration in Puzhal Lake was discovered to be **0 mg / l**.

3.3.9. Phosphate

During the post-monsoon and pre-monsoon periods, phosphorus levels ranged from 0.01 to 0.04 mg/l. Phosphate is a nutrient for plant growth as well as a key component of plant and animal metabolism. It regulates the growth of algae and the primary productivity of plants. The highest phosphate levels reported during the pre-monsoon season could be attributed to detergents entering the lake as a result of clothes washing. The phosphorus level in Puzhal Lake was found to be **0 mg / l**, which is well within the allowed limit.

3.3.10. Sulfate

In the absence of an alternate source, the desired quantity of sulfate in drinking water is 200mg/l, but it can go up to 400mg/l (BIS, 1991). The concentration of sulfate in Puzhal Lake was below the legal limit. Fertilizers contain sulfate, which contributes to water pollution and raises sulfate concentrations in bodies of water. Water reactions with sulfate-containing rock, as well as biochemical and partly chemical oxidation of sulfides and other sulfur compounds, provide sulfate ions in surface water under natural settings (Singh, 1984). Sulfate concentrations in Puzhal Lake were found to be **49 mg/l**, significantly below the 400 mg/l allowed level.

3.3.11. Chloride

Excess chloride reduces the amount of dissolved oxygen in water, making it detrimental to aquatic species (Bomam and Wilson, 2008). The presence of a substantial amount of organic materials in the water suggests a high chloride content. The higher the chloride concentration in water, the more pollution of animal origin is present, and there is a direct link between chloride concentration and pollution levels. Excess chloride in the form of human feces and industrial wastes would lower the DO concentration of water, making it toxic to aquatic creatures (Naik and Purohit, 1997). Chloride levels in Puzhal lake water were significantly over the safe limit of **33 mg/l**.

3.3.11. Fluoride

The fluoride levels in Puzhal Lake remained consistent at **0.99 mg/l**. In the absence of another source, the desired limit for fluoride is 1.5 mg/l, whereas the highest allowable limit is 1.9 mg/l (BIS, 1991). Fluoride levels in Puzhal Lake were significantly below the legal limit. Fluoride is found in practically all water, the earth's crust, numerous minerals, and rocks,

among other places (Shah, Shilpkarand Acharya, 2008). Dental caries becomes a severe problem when levels drop, while dental fluorosis develops as levels rise (Sawyer and McCarty,1978)

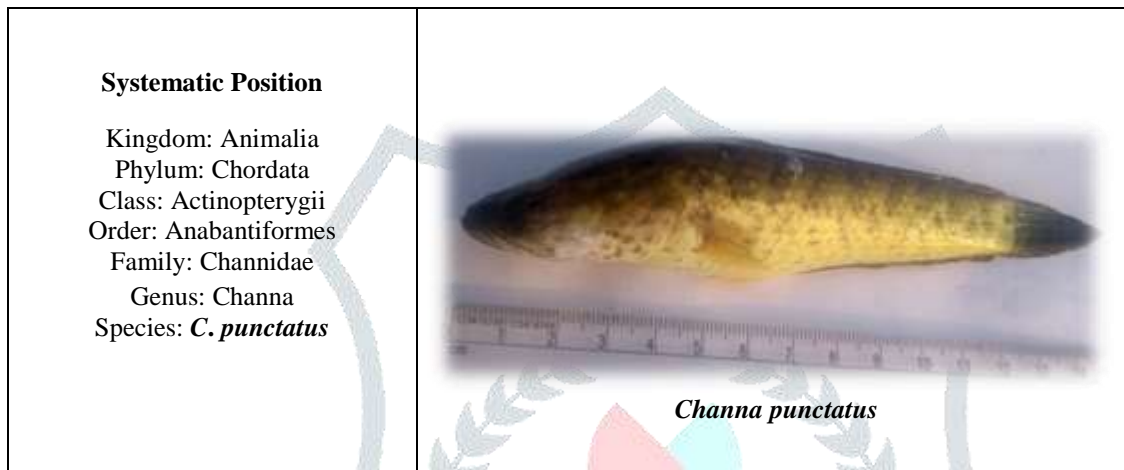
3.3.12. Magnesium

Magnesium levels ranged from 32 mg/L in the post-monsoon period to 57 mg/L in the pre-monsoon period. The magnesium concentration in Puzhal Lake was **0 mg/l**. Magnesium is also a key mineral for a variety of cellular enzymatic transformations, including trans-phosphorylation, in algal, fungal, and bacterial cells (Kistan, Kanchana and Ansari 2015). Magnesium ions, together with calcium and other ions, contribute to the hardness of the water.

4. ICHTHYO DIVERSITY

The findings confirmed that Puzhal Lake contains a diverse fish population. There were a total of **10** species found in this lake. The species' scientific, common, and local names, as well as the order and family, commercial value, and availability, were all depicted in the diagram The information would be presented as follows:

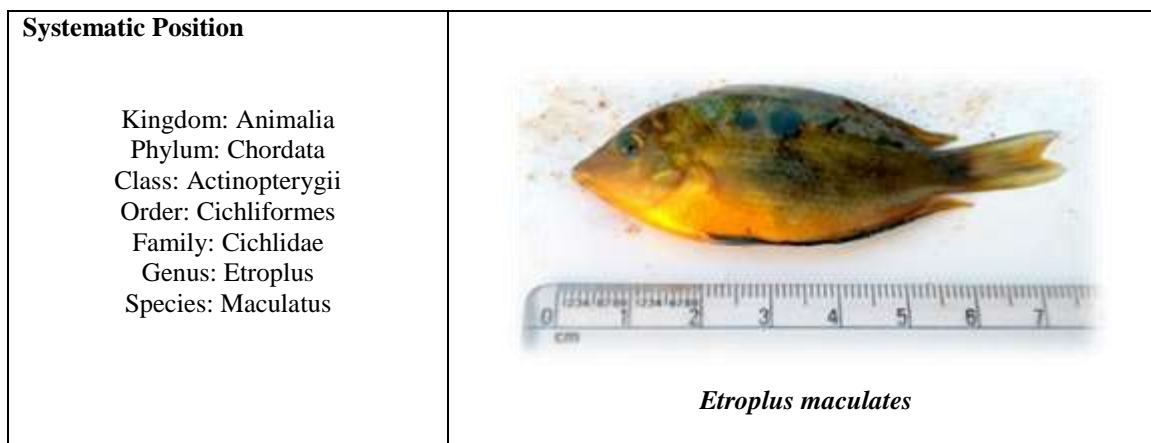
4.1. *Channa punctatus*



4.1.1. Habit and habitat:

Common in all types of water, including sewage-fed tanks, with or without weeds or phytoplankton blooms. Species abound in roadside nullahs and ditches as well. Food and feeding: Bottom feeders for highly carnivorous. The breeding season is from February to March. India: Uttar Pradesh, Uttaranchal, Punjab, Delhi, Madhya Pradesh, Jammu & Kashmir, Tamil Nadu (Chennai). Dark greenish-black throughout the dorsum, paler green on the sides, and paler on the abdomen. In clear water specimens, several subsequent bands or patches (typically 1 -11) can be seen. Curved above the 4th to 5th anal ray or after passing through 12 to 16 scales along the lateral line. Scales: 5-6 rows between the eyes and the angle of the preopercle, 4.5 rows between the dorsal fin and the lateral line, and more than 7 rows between the latter and the base of the ventrals. 12 to 13 Predorsals.

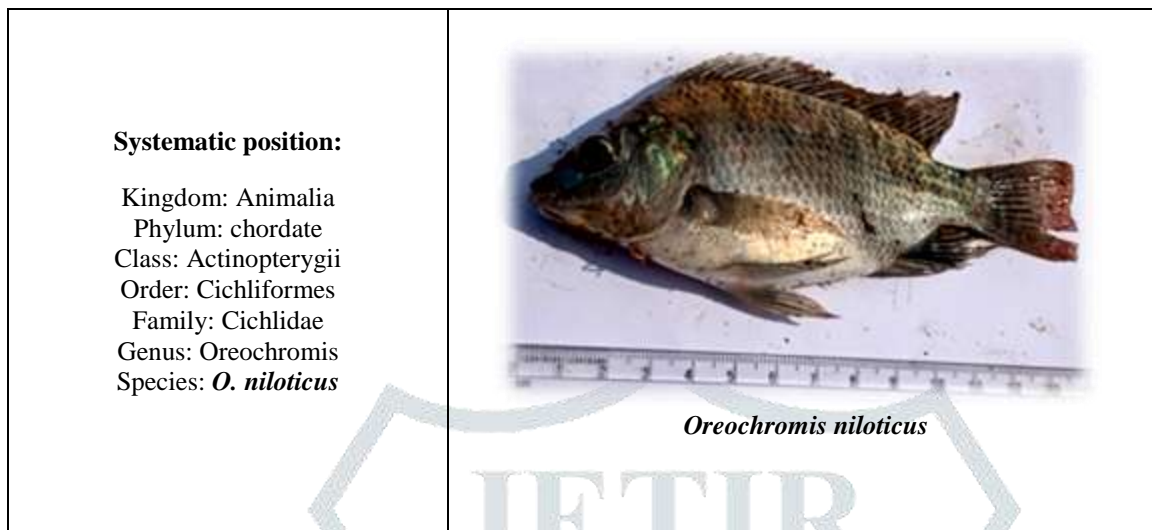
4.2. *Eetroplus maculates*



4.2.1. Habit and Habitat:

Found in rivers, ponds, and small streams. Zooplankton and algae provide food and nutrition. The Red Chromide or the Orange Chromide is the color. The breeding color is a bright yellow-orange with black patches on the flanks. A huge black blotch may be seen on the bottom half of the flank. Fins are either clear or black when paired. India and Sri Lanka are the countries in which it is distributed.

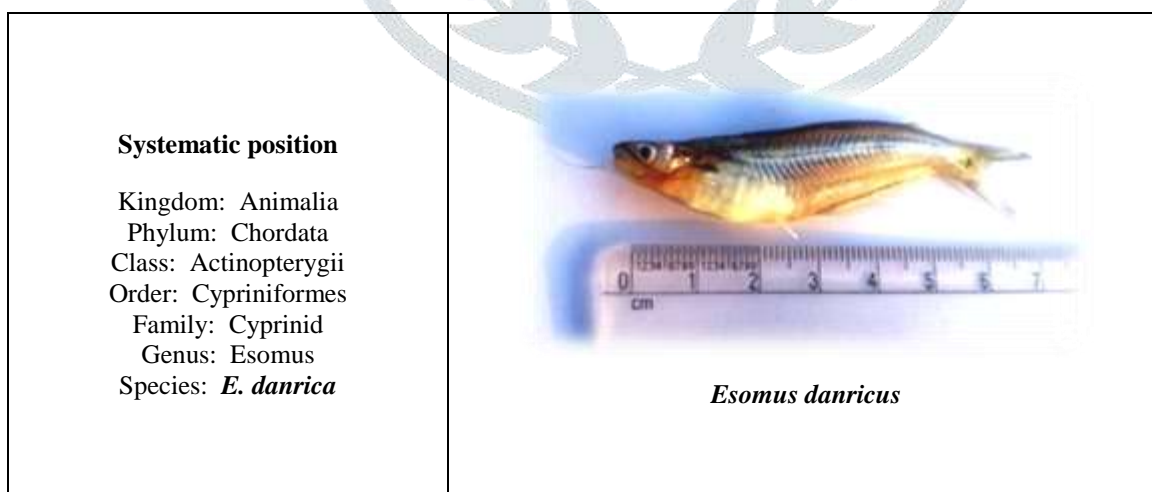
4.3. *Oreochromis niloticus*



4.3.1. Habitat and environment:

Rivers, streams, canals, lakes, and ponds are all examples of freshwater environments. The Nile tilapia can grow to be 60 cm (24 in) long and weigh more than 5 kg (11 lb). Males grow larger and faster than females, which is characteristic of tilapia. The overall color is brownish or greyish, with indistinct body banding and a vertically striped tail. Males get crimson, especially on their fins, when they are breeding. Herbivore nutrition and food.

4.4. *Esomus danricus*




4.4.1. Habit and habitat:

River, pond, and roadside ditches are all prevalent. It prefers shallow, peaceful water to live in. Omnivorous, surface-to-column feeder Later line: Absent. Predorsals scales are 16 -17. Barbless: Present Interorbital area of the head is flat. Mouth: Directly upward, obliquely. Lips: Missing Silvery below, greenish above. India: Uttar Pradesh, Uttaranchal, Punjab, Delhi, Madhya Pradesh, Jammu & Kashmir, Bengal, Tamil Nadu (Chennai).

4.5. *Oreochromis mossambicus*

4.5.1.

<p>Systematic position</p> <p>Kingdom: Animalia Phylum: Chordata Class: Actinopterygii Order: Cichliformes Family: Cichlidae Genus: <i>Oreochromis</i> Species: <i>O. mossambicus</i></p>	 <p style="text-align: center;"><i>Oreochromis mossambicus</i></p>
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Habitat and habitat:

Freshwater, brackish, benthopelagic, amphidromous Dorsal spines (total): 15–18; Dorsal soft rays (total): 10-13; Anal spines: 3; Anal soft rays: 7–12; Vertebrae: 28–31. Long snout; large scales on the forehead, starting with two between the eyes and continuing up to the dorsal fin. Distribution: India, South Africa


4.6. *Stolephorus indica*

<p>Systematic position:</p> <p>Kingdom: Animalia Phylum: Chordata Class: Actinopterygii Order: Cuneiforms Family: Engraulidae Genus: <i>Stolephorus</i> Species: <i>S. indicus</i></p>	 <p style="text-align: center;"><i>Stolephorus indica</i></p>
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4.6.1. Habit and habitat

It is a small schooling fish that can be found in depths of 20-50 meters in most tropical sections of the Indo-Pacific oceans, including Madagascar and Mauritius to the east and Australia to the west, and farther east to Samoa. Do not exceed 15.5 cm in length. It possesses 15 to 17 soft rays on the dorsal side and 18 to 21 soft rays on the anal side. On the belly, there are 2 to 6 little needle-like scutes. The tip of the maxilla is pointed, reaching the pre-front operculum's border. The body is a typical engraulid shape, with a light fleshy brown body and a silver stripe down the flank. Planktons are the main food source for Indian anchovies. Distribution: India, South Africa, Northern and Eastern coasts of Australia


4.7. *Puntius chola*

<p>Systematic position:</p> <p>Kingdom: Animalia Phylum: chordata Class: Actinopterygii Order: Cypriniformes Family: Cyprinidae Genus: Puntius Species: <i>P. chola</i></p>	 <p style="text-align: center;"><i>Puntius chola</i></p>
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4.7.1. Habit and habitat:

Slow-moving, stagnant waters with algae mats and plants are home to this species. They are calm and agile swimmers who move in loose shoals and are frequently combined with *Puntius sophore* and *p. ticto*. Food and Feeding: Algae, diatoms, plant pieces, and a little amount of sand and mud can be found in the gut contents. It is mostly a herbivore that feeds from the bottom of the column. They will occasionally descend to the bottom and thrust their snout into the sand, most likely to eat on the detritus that has accumulated there. Their sharp-edged teeth assist them in nibbling fragile sections of plants in mid-water. A monsoon breeder is a breeder that specializes in monsoons (July-August).


4.8. *Mystus (Mystus) vittatus*

<p>Systematic position:</p> <p>Kingdom: Animalia Phylum: Chordata Class: Actinopterygii Order: Siluriformes Family: Bagridae Genus: <i>Mystus</i> Species: <i>M. vittatus</i></p>	 <p style="text-align: center;"><i>Mystus (Mystus) vittatus</i></p>
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4.8.1. Habit and habitat:

Rivers, ponds, pools, irrigation channels, ditches, and roadside with or without aquatic vegetation are the most common habitats for tiny catfishes. Food and feeding: Carnivorous and highly predacious, feeding aggressively in bottom-column waters. Monsoon breeder is a breeder that specializes in monsoons (July-August) There is a lot of sexual dimorphisms. Males have a genital papilla, which is a protrusion at the genital aperture near the anal fin's origin. The genital papilla is present all year and grows in size during the breeding season. A spear-shaped thickening can also be seen along the lateral line of the caudal fin in males, practically extending up to the fork lying between the 7th and 9th ray. Uttaranchal, Punjab, Himachal Pradesh, Bengal, Rajasthan, Bihar, Assam, M.P., Orissa (Chilka Lake), Karnataka (Mysore), Kerala, Tamilnadu, Andhara Pradesh, Travancore, and the Coromandal Coast Pakistan, Bangladesh, Sri Lanka, Nepal, Myanmar, and Thailand are the countries involved.


4.9. *Macrogathus pancalus*

<p>Systematic position:</p> <p>Kingdom: Animalia Phylum: Chordata Class: Actinopterygii Order: Synbranchiformes Family: Mastacembelidae Genus: <i>Macrogathus</i> Species: <i>M. pancalus</i></p>	 <p><i>Macrogathus pancalus</i></p>
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4.9.1. Habit and habitat:

The barred spiny eel, sometimes known as the Indian spiny eel, is a tiny freshwater fish native to southern Asia. Freshwater, brackish water, and benthopelagic water. It's a pale brown color. They're carnivores. It's most common in slow, shallow rivers. Males are often thinner and smaller than females. It lives in the slow and shallow water of rivers in the plains and estuaries; it is never found over 336 meters. Canals, steam, beel, pond, and waterlogged field are all places where they can be found. It has been kept in aquaria by hobbyists, where it remains on the bottom and spawns in the upper water level. Several males may join in courtship as the slenderer and often smaller males seek the female.

4.10. *Macrogathus siemensis*

<p>Systematic position:</p> <p>Kingdom: Animalia Phylum: Chordata Class: Actinopterygii Order: Synbranchiformes Family: Mastacembelidae Genus: <i>Macrogathus</i> Species : <i>M. siemensis</i></p>	 <p><i>Macrogathus siemensis</i></p>
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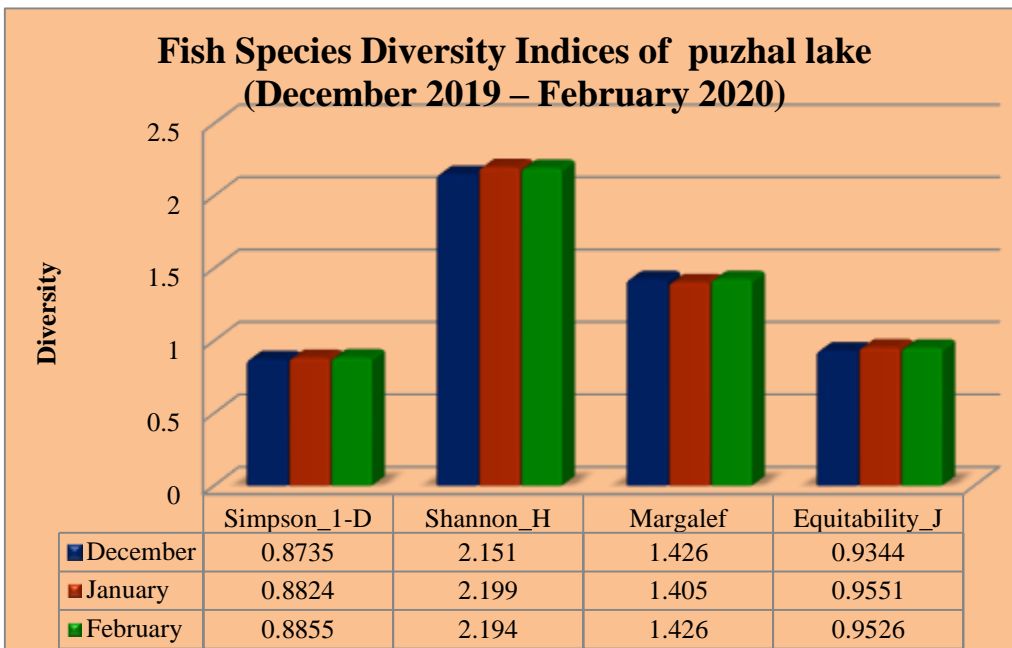
4.10.1. Habit and habitat:

Macrogathus siemensis has been known to grow up to 30 cm in length (12 in). The peacock eel or spiny peacock eel is the common name for the fish in aquariums. They have light brown color to them. Insects, crustaceans, and worms are fed by them. *M. siemensis* is a freshwater species that can be found along the water's edge. It can be found in Southeast Asian rivers. *Macrogathus siemensis* hides in the riverbed during the day and emerges at night to feed on insects, crustaceans, and worms. In India, Cambodia, Laos, Thailand, and Vietnam, the product is distributed.

Table 3: Fish Species Diversity Indices of Puzhal lake (December 2019 – February 2020)

Diversity	December	January	February
Taxa_S	10	10	10
Individuals	551	604	552
Simpson_1-D	0.8735	0.8824	0.8855
Shannon_H	2.151	2.199	2.194
Margalef	1.426	1.405	1.426
Equitability_J	0.9344	0.9551	0.9526

Chart 1: Fish Species Diversity Indices of Puzhal Lake (December 2019 – February 2020)



5. DISCUSSION

At Puzhal Lake, *Oreochromis mossambicus*, *Mystus vittatus*, and *Channa punctatus* have been spotted. These species are also mentioned in Anbalagan and Shivakumer's 2017 paper, A study on fish diversity in a freshwater lake in Tamil Nadu.

Puzhal Lake is home to *Channa punctatus*, *Etroplus maculatus*, *Mystus vittatus*, and *Macrognathus pancalus*. Silambarasan et al. (2014) found these species in Studies on Ichthyofaunal Biodiversity concerning Physic Chemical Variables of Kolavai Lake, Chengalpet, Tamil Nadu. They noticed a variety of fish species as well as physic and chemical data in the Kolavai Lake in Chengalpet.

Puzhal Lake is inhabited by *Esomus danricus*, *Channa punctatus*, *Oreochromis niloticus*, *Mystus vittatus*, and *Macrognathus pancalus*. Freshwater fish fauna of Tamil Nadu, India, by Mogalekar and Canciyal (2018) also mentions these species. He saw a variety of fish species.

Puzhal Lake is home to *Esomus danricus*, *Mystus vittatus*, *Macrognathus pancalus*, *Oreochromis mossambicus*, and *Channa punctatus*. These species are also mentioned in Ranjit Daniels and Rajagopal's 2003 book, Fish of Chempambakkam Lake- A Wetland on the outskirts of Chennai.

Puzhal Lake is home to *Esomus danrica*, *Oreochromis mossambicus*, *Oreochromis niloticus*, *Etroplus maculatus*, and *Channa punctatus*. Puzhal Lake is home to *Esomus danrica*, *Macrognathus pancalus*, *Etroplus maculatus*, *Oreochromis mossambicus*, and *Channa punctatus*. These species are also mentioned in Marry queen et al's 2017 paper, Study on a small collection of Pisces from Retteri Lake in Madhavaram, Tamil Nadu.

In Puzhal Lake, *Oreochromis mossambicus* and *Etroplus maculatus* have been spotted. These species were also noted in Radhakrishnan and Madhusoodana Kurup's 2010 study, Ichthyodiversity in Periyar Tiger Reserve, Kerala, India. Puzhal Lake is home to *Channa punctatus*, *Macrognathus pancalus*, and *Puntius chola*. Ramanujan, Manorama, and Dey (2010) published the Ichthyodiversity of Meghalaya India, which includes these species.

CONCLUSION

In Puzhal Lake, Redhills, Chennai, Tamil Nadu, ten species were discovered. These ten species are divided into different six orders and six families. In addition, physic-chemical parameters are measured in Puzhal Lake. All of the parameters are inside the limit, according to the parameter. WHO established the Standard Value. Fish production is also influenced by physicochemical parameters. The graph (Simpson, Shannon, Margalef, and Equitability) shows that the fish productivity in Puzhal Lake was not significantly different during the three months. Fishermen catch the fish for personal food, but they also have commercial value. Water is also used as a source of drinking purpose. The Puzhal Lake is one of the most beautiful bodies of water in Chennai.

Reference

- [1] Anonymous. (2017). Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture & Farmers Welfare, Government of India. 162p.
- [2] Anbalagan, R., and Sivakami, R. (2017). A Study on Fish Diversity in a Fresh Water Lake in Tamil Nadu, India. *International Journal Current Microbiology Applied Science*.6(5): 2561-2565.doi: <https://doi.org/10.20546/ijcmas.2017.603.290>.
- [3] Beebi, SK., Dadhich, A.S., and P. Arunakranti, (2004). Monitoring the Status of water Resources of Srungavarpukota Village area in Andhrapradesh. *National Environmental Pollution and Technology*, 3(3):303-306
- [4] BIS. IS: 10500, (1991). Indian Standard for drinking water, Bureau of Indian Standards, New Delhi, India.
- [5] Boman BJ, Wilson PC, Ontermma EA (2008). Understanding water quality parameters for citrus irrigation and drainage systems, Circular, University of Florida IFAS extension, 1406.
- [6] Deepa P, Raveen R., Venkatesan P., Arivoli S. and Samuel T, (2016). Seasonal Variations of Physicochemical parameters of Korattur Lake, Chennai, Tamil Nadu, India. *International Journal of Chemical Studies*, Vol. 4(3): 116-123.
- [7] Dhanalakshmi, B. and Priyatharsini, P. (2015) An Assessment of Fresh Water Piscine Diversity in Selected Wetlands in Coimbatore District, Tamilnadu, India—A Preliminary Study. *Open Access Library Journal*, 2: e2236. <http://dx.doi.org/10.4236/oalib.1102236>
- [8] Gayathri S, Latha N, Mohan MR (2013). Impact of climate change on water quality of Shoolkere lake, Bangalore. *Journal of Academia and Industrial Research*. 2(6):362-368.
- [9] Gopi, K.C., Mishra, S.S., Kosygin, L. (2017). Chapter 33. Pisces. In: Kailash Chandra, Gopi, K.C., Rao, D.V., Valarmathi, K., Alfred, J.R.B. (Eds.), *Current Status of Freshwater Faunal Diversity in India*. Zool. Surv. India, Kolkata. pp. 527-570.
- [10] Jayaram, K.C. (2010) *The Freshwater Fishes of the Indian Region*. 2nd Edition, Narendra Publishing House, Delhi, 616 p.
- [11] Jhingran, V.G., (1991). *Fish and fisheries of India*. Hindustan Publishing Corporation, India: 727.
- [12] Kistan A, Kanchana V, Ansari AT (2015). Analysis of Ambattur lake water quality with reference to physico-chemical aspects at Chennai, Tamil Nadu. *International Journal of Science and Research*.4(5):944-947.
- [13] Knepp, Arkin (1973). Ammonia toxicity levels and nitrate tolerance of channel catfish. *The Progressive Fish-Culturist*. 35:221
- [14] Kumar A, Qureshi TA, Parashar A, Patiyal RS (2006). Seasonal variation in physico-chemical characteristics of Ranjit Sagar reservoir, Jammu and Kashmir. *Journal of Ecophysiology and Occupational Health*. 6:1-5.
- [15] Mary Queen Soundaram.M, Martin.M and Thilak. J, (2017). Study on a small collection of Pisces from Retteri Lake in Madhavaram, Tamil Nadu. *International Journal of Fisheries and Aquatic Studies* 2017; 5(5): 07-12
- [16] Manios T, Stentiford EI, Millner PA (2002). The removal of NH₃-N from primary treated wastewater in subsurface reed beds using different substrates. *Journal of Environmental Science and Health*. Part A, Toxic/Hazardous Substances and Environmental Engineering.; 37(3):297-308.
- [17] Mogalekar, H.S., Jawahar, P., (2017). Freshwater fish fauna of Tamil Nadu, India. *Journal of Threatened Taxa*.
- [18] Mogalekar H.S and Canciyal.J (2018). Freshwater fish fauna of Tamil Nadu, India. *International academy of ecology and environmental science*, 2018, 8(4):213-230.
- [19] Moilanen A, Leathwick J, Elith J (2008). A method for spatial freshwater conservation prioritization. *Freshwater Biology*. 53:577-592.
- [20] Naik S, Purohit KM (1997). Status of water quality at Bondamunda of Rourkela industrial complex. Part I. Physico-chemical parameters. *Indian Journal of Environmental Protection*.; 18(5):346-353.
- [21] NEERI (1986). National Environmental Engineering Research Institute (NEERI), Manual on Water and Wastewater Analysis, Nagpur, India.
- [22] Prasad, D., Venkataramana, G. V. and Thomas, M. (2009). Fish diversity and its conservation in major wetlands of Mysore. *Journal of Environmental Biology*, 30: 713-718.
- [23] Pattanaik.S; M Das; D K Pattanaik; K K Rout; R B Panda (2012). *AJCER*, 5(1-2), 44-50.
- [24] Panigrahy, S., Patel, J.G., Murthy, T.V.R., Singh, T.S., (2011). Wetlands of India. Under the “National Wetland Inventory and Assessment” project Sponsored by Ministry of Environment and Forests, Govt. of India, SAC/ESPA/NWIA/BR/04/2011, 24p.
- [25] Radhakrishnan K.V. and Madhusoodana Kurup.B. (2010). Ichthyodiversity of Periyar Tiger Reserve, Kerala, India. *JoTT Communication* 2(10): 1192-1198.
- [26] Ramanujam S.N., Manorama M., and Dey S. (2010). Ichthyodiversity of Meghalaya: India
- [27] *Electronic Journal of Ichthyology* 2010 6(2): 15 – 26.
- [28] Ranjit Daniels R.J and Rajagopal. B (2004). Fishes of chempambakkam lake- A wetland in the outskirts of Chennai.
- [29] Sawyer, C. N., & McCarty, P. L. (1978). *Chemistry for Environmental Engineering* (3rd ed.). New York: McGraw-Hill Book Co.
- [30] Sharma, A.P., (2000). *Manual on fishery limnology*. G. B. Pant University of Agric. and Tech., Pantnagar: 1-115
- [31] Shah MC, Shilpkar PG, Acharya PB (2008). Ground water quality of Gandhinagar taluka, Gujarat, India. *E- Journal of Chemistry*. 5(3):435-446.
- [32] Shrivastava, G. (1998) *Fishes of U.P. and Bihar*. 7th Edition, Vishwavidyalay Prakashan, Chowk Varanasi India Pub.
- [33] Singh, S.R., Swarup, K., (1980). Studies on primary production in Suraha lake (Ballia, India). *International Review of Hydrobiology*. 65, 709-717.
- [34] Sukanthi K. M., & Ebanasar, J. (n.d.) (2013). seasonal dynamics of productivity of sulur lake of coimbatore district, Tamil nadu, India in relation to total dissolved solids, chloride and magnesium. *International journal of engineering sciences & research technology*,7(1), 508-518.

- [35] Shiva Shankar, P., and G.V. Venkataramana, (2012). Ichthyodiversity status with relation to water quality of Bhadara River, Western Ghats, Shimoga District, Karnataka. *Annals of biological research*, 3(10):4893-4903.
- [36] Silambarasan, K., Sujatha, K., Anitha Joice, A. and Senthilkumaar, P. (2014). Studies on Ichthyofaunal Biodiversity in Relation with Physico-Chemical Variables of Kolavoi Lake, Chengalpet, Tamil Nadu. *International Journal of Plant, Animal and Environmental Sciences* 4(4): 176-184.
- [37] Suski CD, Cooke SJ (2007). Conservation of aquatic resources through the use of freshwater protected areas: opportunities and challenges. *Biodiversity Conservation*.16:2015-2029.
- [38] Sciortino JA, Ravikumer R (1999). *Fishery Harbour Manual on the Prevention of Pollution - Bay of Bengal Programme*, BOBP/MAG/22, Madras, India.
- [39] Talwar, P.K. and Jhingran, A.G. (1991) *Inland Fishes of India and Adjacent Countries*. Oxford-IBH Publishing Co. Pvt. Ltd., New Delhi, 1158 p.
- [40] UNEP (2000). *Global Environmental Outlook*. United Nations Environment Programme, <http://www.unep.org/geo/geo2000.asp>
- [41] US EPA (1986). *Quality criteria for water*, U.S. Environmental Protection Agency, EPA#440/5-86-001.
- [42] Verma, S.R., Chaudhari, P.R., Singh, R.K., Wate, S.R., (2011). Studies on the ecology and trophic status of an urban lake at Nagpur city, India. *Rasayan Journal of Chemistry*. 4(3), 652-659.
- [43] Wang YS, Lou ZP, Sun CC, Wu ML, Han SH, (1999 to 2000). *Multivariate statistical analysis of water*.

