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Analysis of physicochemical parameters water samples from Cauvery River in Thanjavur district, Tamil Nadu

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Abstract
Aquatic ecosystem is the most diverse ecosystem in the world. The first life originated in the water and first organisms was also aquatic where water was the principal external as well as internal medium for organisms. Water is one of the most common and the large precious resources on world. Ground water resources have been contaminated by organic, inorganic and biological pollution. Therefore management of aquatic ecosystem in particular has become a main concern in the present years. Surface water samples were collected from Cauvery estuary are during the period of January 2016 to December 2016. The pH meter was used to determine the pH and Temprature, The Dissolved oxygen, silicate. Estimate of phosphate, Nitrate was handled**.** Based on the present study, it may be concluded that the physicochemical characters vary in each month according to the ecological influence.

Keywords: physiochemical, biological pollution, pH, temperature

Introduction
Aquatic ecosystem monitoring has been carried out in India based on either chemical or biological analysis. The chemical approach is useful in order to determine the levels of nutrients, metals, pesticides, (Tamizhazhagan & Pugazhendy, 2016a) [15] radioactive substances, etc., Aquatic ecosystem is the most diverse ecosystem in the world.

The soil is one topmost thin and composite layer of earth and it was made up of many things like weathered rock particles, decayed plant and animal matter with varying ratios of minerals, air, water and organic material (Kamaraj Yoganathan *et al*., 2017) [24]. The first life originated in the water and first organisms was also aquatic where water was the principal external as well as internal medium for organisms. Thus water is the most vital factor in the existence of all living organisms. Water covers about 71% of the earth of which more than 95% exists in gigantic oceans very less amount of water is contained in the rivers (0.00015%) and lakes (0.01%), which comprise the most valuable fresh water resources. Global aquatic ecosystems fall under two broad classes defined by salinity – freshwater ecosystem and the saltwater ecosystem. Freshwater ecosystems are inland waters that have low concentrations of salt. The salt-water ecosystem has a high concentration of salt content (averaging about 3.5%). The study of freshwater habitats is known as limnology phytoplankton taxonomic composition and in order lead to the eutrophication and algal blooms (Béthoux, De Madron, Nyffeler, & Tailliez, 2002; Piehler, Twomey, Hall, & Paerl, 2004) [2, 9]. Freshwater habitats can be further divided into two groups as lentic and lotic ecosystems based on the difference in the water residence time and the flow velocity.

Water quality is a major economic and environmental issue in developing countries. The quality of river systems these countries acceptable levels for many uses. Rivers due to their role in carrying of the municipal and industrial waste water and run off from agricultural land in their vast drainage basins is among the most vulnerable water bodies to pollution (Wang, Wang, Wu, Zhou, & Yang, 2010) [21]. Water quality parameters of pH, dissolved oxygen, temperature, and salinity changes in water quality parameters studied by (Tepe *et al*., 2004) [18]. Water quality degradation by various sources becomes an important issue around the world. Use of more land for agricultural purposes, soil salinization, increase in the use, and erosion have become problems threatening natural water source reported by (Zalidis, Stamatiadis, Takavakoglou, Eskridge, & Misopolinos, 2002) [22]. The evaluation of physical and chemical parameters of river Cauvery, Tiruchirappalli (Raja & Sethuraman, 2008) [10]. (Raja & Sethuraman, 2008) [10] Found seasonally variations in physico chemical parameters and diversity in the flora and fauna of the river, munneru, and temperature and Dissolved oxygen were to be the major controlling factors in the distribution of fish. The physicochemical parameters investigation (Halder *et al*., 2006) [4] made on Doyang reservoir in Nagaland, to propose an effective fishery management.

Freshwater mussels play a number of important roles in aquatic ecosystems. As sedentary suspension feeders, unionoids remove a variety of materials from the water column, including sediment, organic matter, bacteria, and phytoplankton. Siphoned material is either transferred to the mouth for digestion or sloughs off the gills and exits via the ventral margin of the shell (pseudofeces). Digested material is either used as fuel for various life processes or excreted as feces. The amount and rate of particulate matter removed from the water column and subsequent deposition of waste is largely dependent on temperature, particle concentration, flow regime, mussel size, and species (Vaughn & Hakenkamp, 2001) [20]. While the siphoning activities of mussels are often overlooked, they provide an integral resource link between pelagic and benthic habitats (Nalepa, Gardner, & Malczyk,

1991) [7]; (Howard & Cuffey, 2006) [5].
Mussels also interact with stream sediment. Burrowing behavior of unionids mixes sediment pore water, releasing nutrients and oxygenating substrates (Vaughn & Hakenkamp, 2001) [20]. Particularly dense assemblage of mussels may influence substrate stability and provide nutrients and microrefugia for benthic life (Vaughn & Hakenkamp, 2001; Zimmerman & de Szalay, 2007) [20]. Juvenile mussels have demonstrated the ability to pedal feed by sweeping their foot to collect food particles from sediment. Studies conducted by (Gatenby & Gawlinski, 1996) [3] documented the importance of sediment to the growth of juvenile Rainbow (*Villosa iris*). Researchers reported increasing shell growth and survival rates when algal diets were supplemented with a fine sediment substratum.

Materials and Methods

Samples were protected from direct sunlight and immediately transported to the laboratory of the Department of Zoology, Annamalai University. The samples were collected for a period of two years from January 2016 – December – 2016 from the Cauvery river. Tamil Nadu. The monthly rainfall data for the above period were obtained from the meteorological department at Thanjavur.
The water temperature was measured by using mercury filled Celsius thermometer with an accuracy of 0.5°C.The dissolved oxygen content of the bottom water was determined by Winklers method following the procedure of (Strickland & Parsons, 1972) [13] The pH of the water sample was determined by using digital pH meter.

Collection of Water Sample

Water samples are collected for a period of six months (March 2016 to Aug 2016) from the Cauvery, Thanjavur. The readings were taken on the physicochemical parameters such as Total rainfall, Humidity, wind velocity, water temperature, pH, salinity, dissolved oxygen; free CO2 for monthly interval regularly. The monthly variations in the rainfall are given in Fig.1 the maximum rainfall (8.2 mm) was recorded during November 2016. February and June received no rainfall. In September, minimum rainfall of (3.6mm) was recorded.
The water temperature was measured by using mercury filled Celsius thermometer with an accuracy of 0.5°C. The surface water temperature was measured by dipping thermometer directly on the water about the minute and reading was recorded. The pH is a measure of hydrogen ion concentration in fresh water and indicates how much water is acidic or basic. The water samples from the reservoir were collected and transferred to the beaker. The pH of the water sample was determined by using a digital pH meter. Salinity is the total concentration of dissolved ions in the freshwater fish culture. Mohr's titration method was adopted for determination of salinity (Apha, 1998) [1]. The standard Winkler's method was adopted (Strickland & Parsons, 1972) [13], for the estimation of dissolved oxygen in the experimental fish culture tank.
Free carbon-Di- oxide is liable to escape easily from the water sample and hence. The analysis was carried out immediately. The amount of Carbon dioxide was estimated according to the standard method (Apha, 1998) [1].

Table 1: Total rainfall, humidity and wind velocity of the Cauvery, Thanjavur, during January 2016 – December 2016

S. No	Month and Year	Total rainfall (mm)	Humidity (%)	Wind velocity (Km/h)
1	Jan-2016	3.9	95	6.3
2	February	0	97	7.5
3	March	0	70.6	9.1
4	April	0	69.6	12.5
5	May	0	69.2	15.1
6	June	7.9	69.1	9.7
7	July	8.2	73.2	10.6
8	August	4.2	70	8.6
9	September	3.38	72.7	10.7
10	October	4.2	69.2	13.5
11	November	8.2	70	7.2
12	December-2016	7.1	73.2	10.2

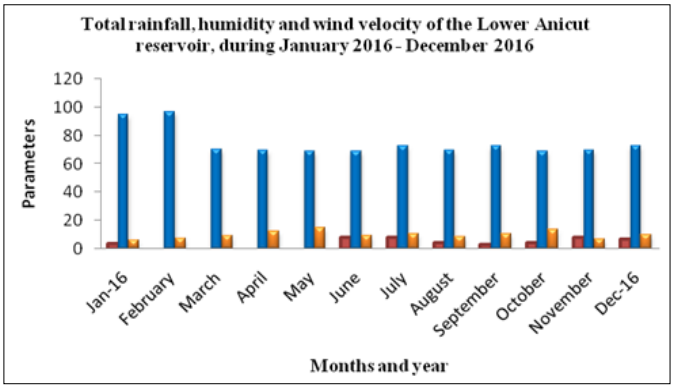

Fig 1: Total rainfall, humidity and wind velocity of the Cauvery river

Table 2: The Physico Chemical factors of Cauvery river during January 2016 December 2016

S. No	Month and Year	Temperature(°C) Surface water	pH	Salinity (ppt)	Dissolved O2 (ml/l	Free CO2 (mg/l)
1	Jan-16	31	8.6	0.14	4.2	0.004
2	February	30	7.2	0.15	4.8	0.002
3	March	32	8.2	0.18	5.7	0.006
4	April	29	8.7	0.16	4.9	0.003
5	May	30	8.8	0.17	5.8	0.005
6	June	31	8.7	0.18	5.8	0.002
7	July	29	6.9	0.12	5.6	0.004
8	August	24	7.2	0.12	4	0.004
9	September	32	7.8	0.16	5	0.005
10	October	30	7.2	0.12	5.2	0.002
11	November	26	8.6	0.11	4.6	0.003
12	December16	32	7.4	0.14	5.8	0.005

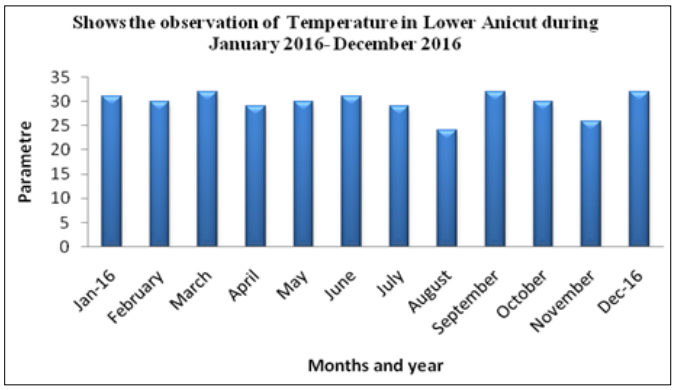

Fig 2: Shows the observation of Temperature in Cauvery river January 2016- December 2016

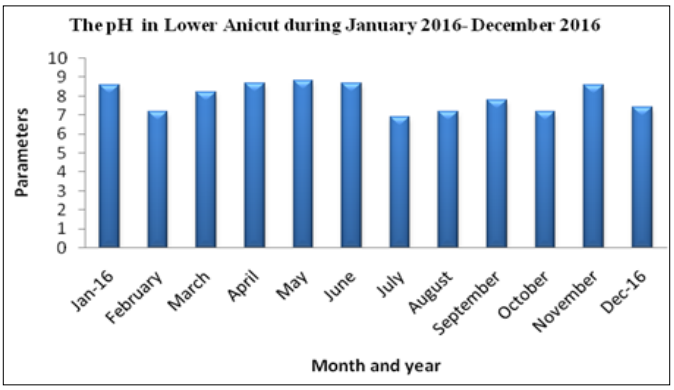

Fig 3: The pH in Gauvery river during January 2016- December 2016

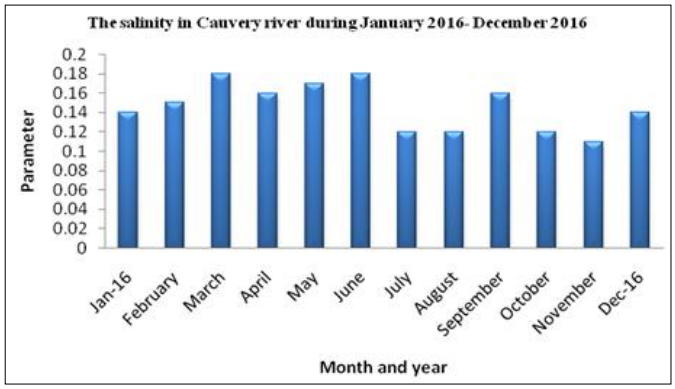

Fig 4: The salinity in Lower Anicut during January 2016- December 2016

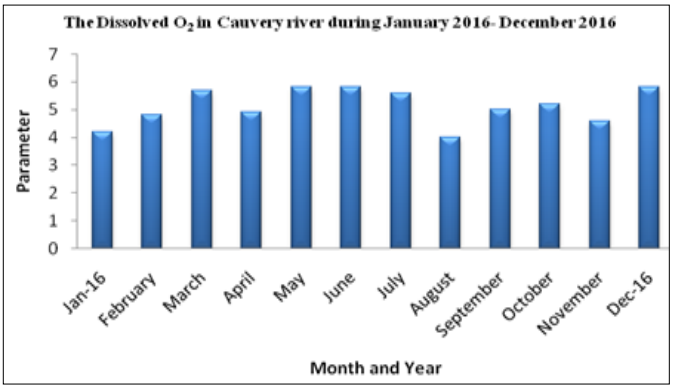

Fig 5: The Dissolved O_2 in Cauvery during January 2016- December 2016

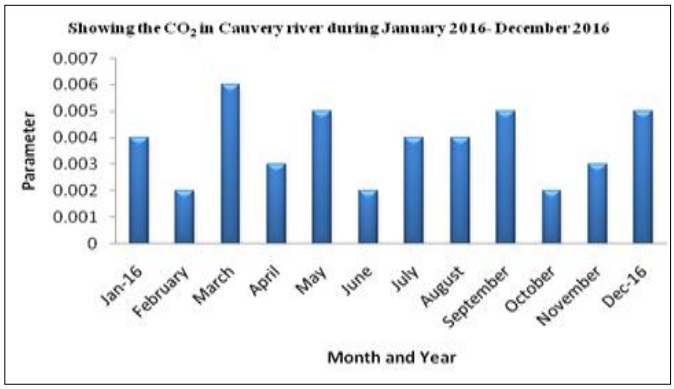

Fig 6: Showing the CO_2 in Cauvery river during January 2016- December 2016

Result

Total Rainfall, Humidity and Wind Velocity The total rainfall, Humidity and wind velocity were observed during the January 2016- December 2016. There are some seasonal variations to be recorded in these months depend upon on the ecological fluctuations. The results are showed in (Table 1and Fig 1).Temperature is an important physical factor, which influences the other hydrological parameters. The maximum water temperature (32°C) was recorded in the month of March 2016 - March 2014 and the minimum (24°C) was in August 2016 - June 2016. The observation indicates that the surface water temperature is lesser and closely associated with the humidity and moisture (Table 2 and Fig 2).

Seasonal variations in pH of freshwater were relatively small. The pH is an important hydrological factor. The hydrogen ion concentration was always found to be neutral and slightly above 7.0. The maximum level of pH (8.8) was recorded in May 2016 - October 2016 and minimum value of pH (7.0) was recorded in May 2016 (Table 2 and Fig 3).Salinity acts as a limiting factor in distribution of flora and fauna. The salinity of Cauvery River was recorded between 0.11 ppt and 0.18 ppt. It was found to be lower 0.11 ppt in November 2016 - August 2016 and higher 0.18 ppt in March 2016 - July 2016 (Table 2 and fig 4).

Dissolved oxygen is an important chemical factor for respiration which would get influenced by aquatic organisms. The fluctuation in the concentration of dissolved oxygen content varied from 4 ml/1 to 5.8 ml/1. The maximum value

of 5.8 ml / l was observed in May 2016 - May 2016 and a minimum value of 4 ml/laws observed in August 2016 (Table 2 and fig 5). Free carbon di oxide is also an important chemical factor which required for photosynthesis of all aquatic plants. In the present study, free carbon di oxide level slightly fluctuates during the observation period. It varied from 0.002 to 0.6mg/ lit (Table 2 and fig 6).

Discussion

The most common cause of water pollution in developing countries is domestic and industrial waste that is directly released into streams or ponds without treatment (Tamizhazhagan & Pugazhendy, 2015) [14]. As urbanization increases around the world, many of these reservoirs are being created to hinder in controlling runoff. Adversely human activities are directly or indirectly affect the environment (Tamizhazhagan & Pugazhendy, 2016b) [16]. There is considerable need for additional quantitative data and a better understanding of these small impoundments so they may be managed more effectively. Based on the present study, it may be concluded that the Physico - chemical characters vary in each month according to the ecological influence.

They filter suspended algae, bacteria (Tamizhazhagan, Pugazhendy, Sakthidasan, Revathi, & Baranitharan, 2016) [17], zooplankton, and sediment from the water. Much of the ingested material is released as feces or large undigested particles that sink to the bottom. Essentially, mussels filter small particles whose energy and nutrients are unavailable to most animals and convert them into larger particles that can be consumed by a large number of animals. Filtration rates depend on species, size, physiology, temperature, season, and food availability. Collectively, mussels can filter an enormous volume of water each year and may help reduce turbidity in some water bodies. Three examples illustrate the profound importance of mussels in aquatic environments.

In a one-half mile portion of the Ashuelot River downstream of a flood control dam, (Nedeau *et al*., 2008) [8] estimated that even if only 50 percent of the estimated population size of eastern elliptic were actively feeding, they would filter more than 1.5 million cubic feet of water each day. In typical summer flows of 50 cubic feet per second, this represented 35 percent of the total daily discharge that mussels filtered within one-half mile of the dam. Freshwater mussels in the tidal Hudson River in New York filtered nearly 5.3 million gallons of water per day, approximately equal to the daily freshwater discharge of the Hudson River during the summer (Strayer & Smith, 1996) [12].

An estimated three million mussels inhabiting a lake in Poland collectively filtered 79 percent of the lake's volume during the growing season and removed approximately 11.5 million tons of material from the water column, such as particulate nitrogen and phosphorus (Kasprzak, Waalkes, & Poirier, 1986) [6]. Mussels often comprise the greatest proportion of animal biomass (the sum of living tissue, including shells) in a water body. (Nedeau *et al*., 2008) [8] reported that mussels comprised more than 90 percent of the total animal biomass in a river in England—twice the biomass of the fish population.

This is typical of many water bodies in the Connecticut River watershed. In stable river segments, in the Connecticut River watershed, densities of all mussels combined can often exceed 100 animals per square meter; in some locations, densities have even exceeded 400 per square meter. In the Ashuelot River, (Nedeau *et al*., 2008) [8] quantitatively estimated a population of 1.12 million eastern elliptio within one-half mile of a flood control ellipticas with such high densities of mussels are usually dominated by a single species, the eastern elliptio. The high biomass and longevity of freshwater mussel populations make them important for long-term storage and release of calcium, phosphorus, nitrogen, and carbon. Mussels are an important source of food for aquatic predators and land-based scavengers, including river otters, muskrats, raccoons, and skunks. Flatworms, leeches, and crayfish eat small juveniles. Carp, sturgeon, catfish, sunfish, and suckers will eat juvenile mussels up to about an inch long. Gulls and shorebirds scavenge live or dead mussels when water levels are low and some waterfowl may consume juvenile mussels while feeding in shallow water of all the predators, muskrats are probably the most effective. Protozoans, flatworms, aquatic earthworms, leeches, midges, and water mites may live within the mantle or pallial cavity of mussels, and some parasites live within the body tissue itself, including trematodes (flukes), nematodes (roundworms), and some protozoans (Thorp & Covich, 1991) [19]. A striking example of the role that predators play in the ecology of mussels was observed in Sandy Brook, a tributary of the West Branch Farmington River (Nedeau *et al*., 2008) [8]. A large population of the eastern pearl shell was observed in June of 2007; several hundred mussels were largely confined to small isolated pools at densities greater than 100 per square meter. The opportunistic predator found this vulnerable mussel population at a time when water levels were low and feasted until the mussels were gone. This observation illustrates the importance of mussels as a food source for other animals, but also that even seemingly large mussel populations can be at risk if they occur in habitats that expose them to danger.

Mussels influence habitat and diversity of other benthic macro invertebrates (Howard & Cuffey, 2006; Spooner & Vaughn, 2006; Vaughn & Hakenkamp, 2001) [20, 5] their movement helps stir sediment and increase the exchange of oxygen and nutrients between the sediment and water.

Conclusion

As urbanization increases around the world, many of these reservoirs are being created to hinder in controlling runoff. There is considerable need for additional quantitative data and a better understanding of these small impoundments so they may be managed more effectively. Based on the present study, it may be concluded that the physicochemical characters vary in each month according to the ecological influence.

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