Studies on the physico-chemical characteristics of Ponneri Tank (Cholagangam) in Udayarpalayam Taluk Ariyalur District, Tamil Nadu, India

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Abstract: Monthly variation in physico-chemical characteristics of water was studied in Ponneri Tank (Cholagangam) of Udayarpalayam Taluk, Ariyalur District, Tamil Nadu, India, for a period of twelve months (January 2015 to December 2015). By using standard methods ten different physico-chemical parameters were analyzed. Water temperature varied from 25.63 to 31.67ºC, pH ranged from 6.97 to 8.13. Dissolved Oxygen content varied from 3.76 to 6.09 mg/L. Dissolved solids was varied in between 119.57 to 150.77 mg/L, Electrical Conductivity was recorded from 155.67 to 233.77ds/m. The alkalinity (32.83 to 52.83 mg/L), chloride (2.37 to 11.73 mg/L), nitrate (0.05 to 0.17 mg/L), phosphate (0.04 to 0.09) and silicate (8.23 to 22.37 mg/L) were also studied.

Index Terms: ***Physico-Chemical characteristics, Monthly Variations, Freshwater, Water Quality***

I. INTRODUCTION

Water is the most valuable natural resource on the earth, and it is essential for each and every living organisms. Our history is tied directly or indirectly to freshwater source such as lakes, rivers and estuaries. Human beings as well as other terrestrial and aquatic life forms are sensitive to any change in the quality of the water. Changes in the properties of total dissolved solid, pH and dissolved oxygen in question the the life of organisms. Natural weathering process and anthropogenic activities have a significant impact on water quality of nearby aquatic ecosystems. Rain fall tends to dissolve and carry away minerals and contaminants found in the soil and also from the atmosphere to the water bodies and ultimate the ocean[1].

Though water is the most abundant natural resource and it covers approximately ¾th of the earth's surface, many factors influence its availability. The desirable characteristics of water vary with endeavor use and the human's excessive interest with water for commercial, industrial or recreational insights. Water used for drinking purpose must be clear, free from turbidity, bacteria, foul odor and color. Civilization and subsequent industrialization lead to a great damage to our ecosystem and disturbed much the environment. Water bodies such as lakes and ponds also affected an alarming rate in major cities. Aquatic pollution has posed a serious challenge due to its effect on economic activities and it has a greater relevance in the context of developing countries like India[2].

Water quality is the determining factors not only on the success of an aquaculture operation, but who the other activities with the linked water bodies. The quality of water in any ecosystem provides significant information about the available resources for supporting life in that ecosystem and the life depend on the ecosystem. Good quality of water resources depends on a large number of physico-chemical parameters. Assessing and monitoring of these parameters is essential to identify the magnitude and source of any pollution load[3] and maintenance of the healthy ecosystem.

Water quality has an impact on the biotic diversity and biomass, energy and material cycles, tropical levels and rate of succession. In turns, it helps in planning exploitation, antipollution or conservation strategies. Monitoring the environment through the assessment of water quality should be a continuous process and regularly undertaken for a variety of purpose like testing suitability of water for agriculture, industrial, aquaculture, recreational and domestic use. In India several studies have been conducted to understand the physio-chemical properties of various water bodies including lotic ecosystem like rivers[4-6].

Freshwater resources need special care and attention for its sustainable use for present and future generations. Ensuring uninterrupted freshwater supply is a greater management and the world should face the challenges during upcoming development[7]. In the present study, an attempt was made to provide such

vital information of freshwater water bodies for future references. All the physico-chemical parameters were studied from Ponneri Tank (Cholagangam) in Udayarpalayam Taluk, Ariyalur District, Tamil Nadu, India from January 2015 to December 2015.

II MATERIALS AND METHODS

Water samples were collected from Ponneri Tank (Cholagangam) in Udayarpalayam Taluk, Ariyalur District, Tamil Nadu, India which is located at a latitude of 11° 18' North South, 79° 29' East West on Southern part of India. Two litre capacity plastic cans were used to collect surface water samples and kept immediately in an ice box and transported to the laboratory. The samples were analyzed every month from January 2015 to December 2015. Various physico-chemical parameters were analyzed by using standard methods[8]. Temperature: Water temperature of the tank water recorded by using Mercury field celcious thermometer. pH: The pH was determined by using Elico, model LI. 120 Digital pH meter. Dissolved oxygen: The Dissolved oxygen was determined by the modified Winkler's method[9]. Dissolved solids (DS): The dissolved solids were determined by Gravimetric method. Electrical conductivity: The conductivity was measured by using digital conductivity meter. The other parameters like, alkalinity was determined by visual titration method using methyl orange and phenolphthalein as indicator, chloride was estimated by silver nitrate method while phosphate estimated stannous chloride method. The nitrate and silicate was determined by the Brucine method[8].

III RESULTS

Temperature: In the present study, the temperature of water fluctuated from 25.63 to 31.67ºC in Ponneri tank. It was found to be lower in the month of October and high in April 2015 (Table 1 and Fig. 1).

Table 1: Physico-chemical characteristics of Ponneri Tank (Cholagangam) in Udayarpalayam Taluk, Ariyalur District, Tamil Nadu, India (January 2015 to December 2015).

Month and Year	Temp. (°C)	pH	DO (mg/L)	Dissolved solids (mg/L)	EC (ds/m)	Alkalinity (mg/L)	Chloride (mg/L)	Nitrate (mg/L)	Phosphate (mg/L)	Silicate (mg/L)
Jan-12	28.53 ±0.15	7.76 ±0.15	4.60 ± 0.14	132.33 ± 1.53	189.46 ± 1.75	45.33± 1.53	4.47 ±0.15	0.13 ±0.06	0.07 ±0.01	20.66 ± 0.58
Feb-12	29.57 ±0.25	7.13 ±0.06	4.49 ± 0.18	144.33 ± 1.53	219.83 ± 2.02	40.33 ±2.08	4.27 ± 0.11	0.05 ± 0.01	0.04 ± 0.03	19.33 ± 0.58
Mar-12	30.47 ±0.25	7.07 ±0.15	4.28 ± 0.37	143.67 ± 2.31	220.83 ± 2.25	42.33 ±1.53	2.37 ± 0.06	0.11 ± 0.01	0.05 ± 0.01	19.03 ± 0.55
Apr-12	31.67 ±0.25	7.93 ±0.15	4.03 ± 0.12	145.67 ± 0.41	221.33 ± 3.05	44.53 ±0.50	4.17 ± 0.06	0.14 ± 0.01	0.07 ± 0.03	21.17 ± 0.76
May-12	30.83 ±0.35	8.13 ±0.06	3.76 ± 0.19	146.57 ± 2.06	224.57 ± 2.50	43.83 ±2.25	5.37 ± 0.21	0.13 ± 0.06	0.09 ± 0.03	21.20 ± 0.72
Jun-12	28.63 ±0.25	8.03 ±0.21	4.41 ± 0.38	150.77 ± 1.57	221.67 ± 2.52	43.97 ±1.30	5.67 ± 0.32	0.17 ± 0.03	0.07 ± 0.02	21.50 ± 0.86
Jul-12	28.63 ±0.74	7.57 ±0.21	4.77 ± 0.26	147.67 ± 1.53	233.77 ± 2.66	32.83 ±2.36	9.67 ± 1.53	0.16 ± 0.02	0.06 ± 0.01	22.37 ± 0.35
Aug-12	27.93 ±0.87	7.37 ±0.15	5.23 ± 0.12	138.33 ± 3.05	191.67 ± 2.52	34.83 ±1.75	11.73 ± 0.35	0.13 ± 0.01	0.06 ± 0.02	19.03 ± 0.38
Sep-12	26.33 ±0.15	8.08 ±0.17	5.62 ± 0.08	136.67 ± 2.08	184.23 ± 2.29	47.67 ±3.05	8.33 ± 0.21	0.11 ± 0.04	0.06 ± 0.03	17.87 ± 0.65
Oct-12	25.63 ±0.21	7.57 ±0.21	5.69 ± 0.15	130.57 ± 3.23	171.33 ± 4.04	52.57 ±0.25	5.83 ± 0.32	0.07 ± 0.02	0.06 ± 0.02	11.93 ± 0.81
Nov-	26.47	6.97	6.09	127.67	163.57	51.33	10.67	0.11	0.08	10.47

| 12 | ±0.30 | ±0.21 | ± 0.04 | ± 1.15 | ± 1.25 | ±1.05 | ± 0.57 | ± 0.01 | ± 0.04 | ± 0.15 |
| Dec-12 | 28.43 ±0.21 | 7.17 ±0.35 | 5.55 ± 0.11 | 119.57 ± 2.89 | 155.67 ± 2.52 | 52.83 ±0.25 | 6.37 ±0.47 | 0.12 ± 0.01 | 0.09 ± 0.02 | 8.23 ± 0.35 |

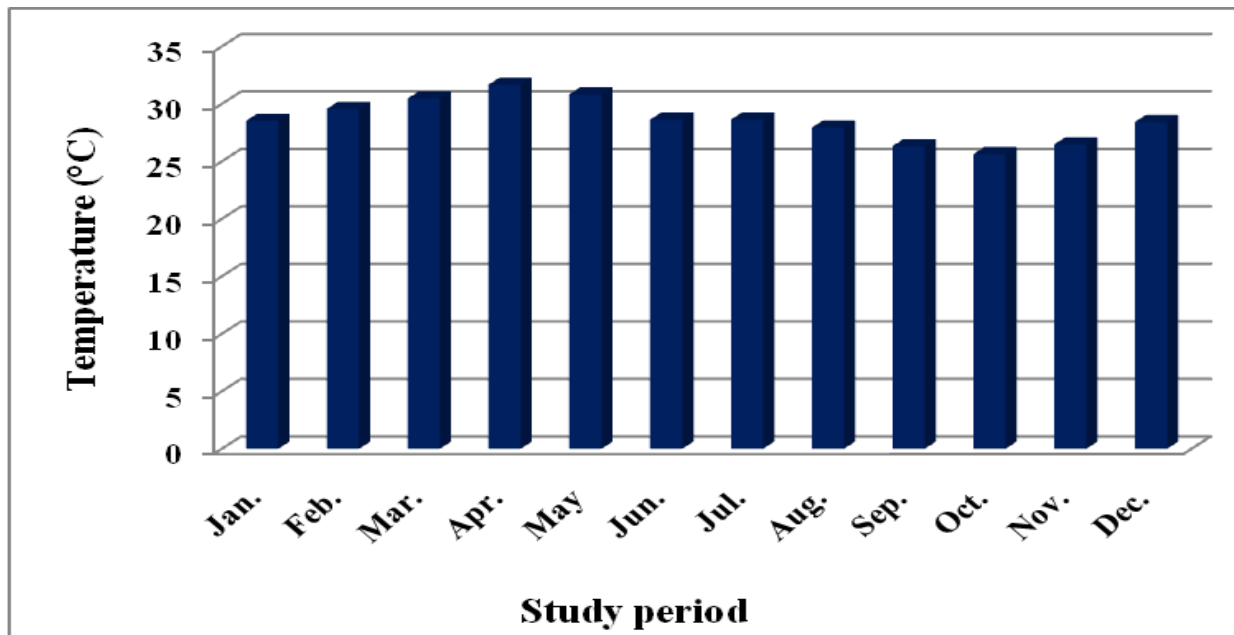Each value is the mean ± S.D. of three observations

Figure1. Monthly variations (from 2015 January to 2015 December) of water temperature (^{0}C) in the Ponneri tank.

 pH: It is another important biological parameter and the pH of the water samples showed an alkaline range throughout the entire study period. It was found to be minimum (6.97) in November and maximum (8.13) in May (Fig. 2).
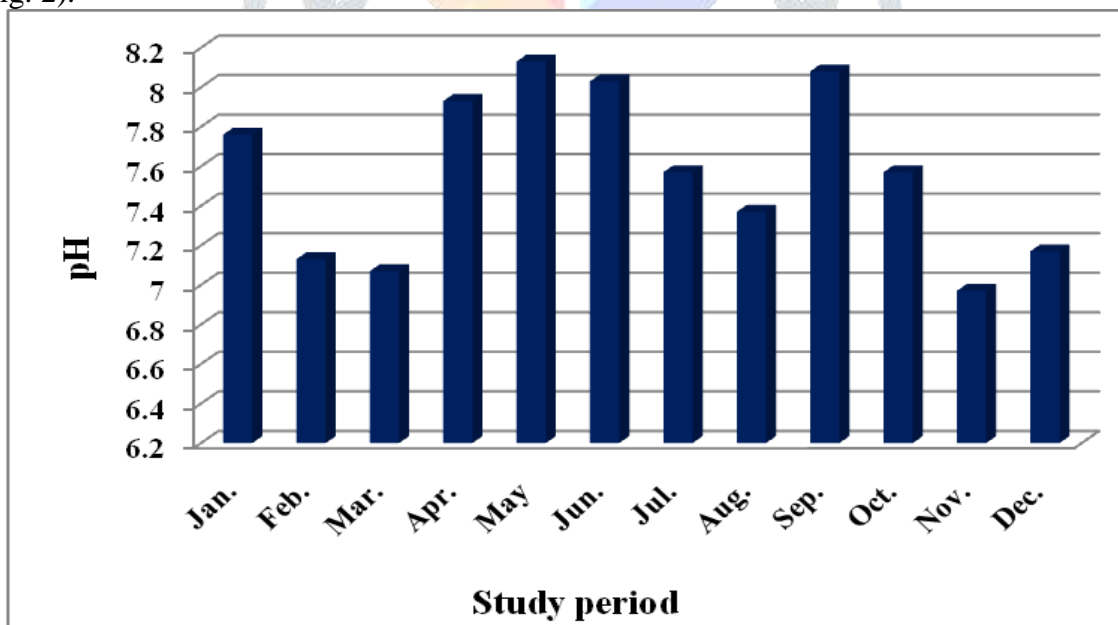
Figure 2. Monthly variations (from 2015 January to 2015 December) of pH in the Ponneri tank water samples.

DO: The dissolved oxygen is important biological factor. The dissolved oxygen content of the Ponneri tank water is in the range between 3.76 to 6.09 mg/L. It was found to be low in the month of May and high in the month of November (Fig. 3).
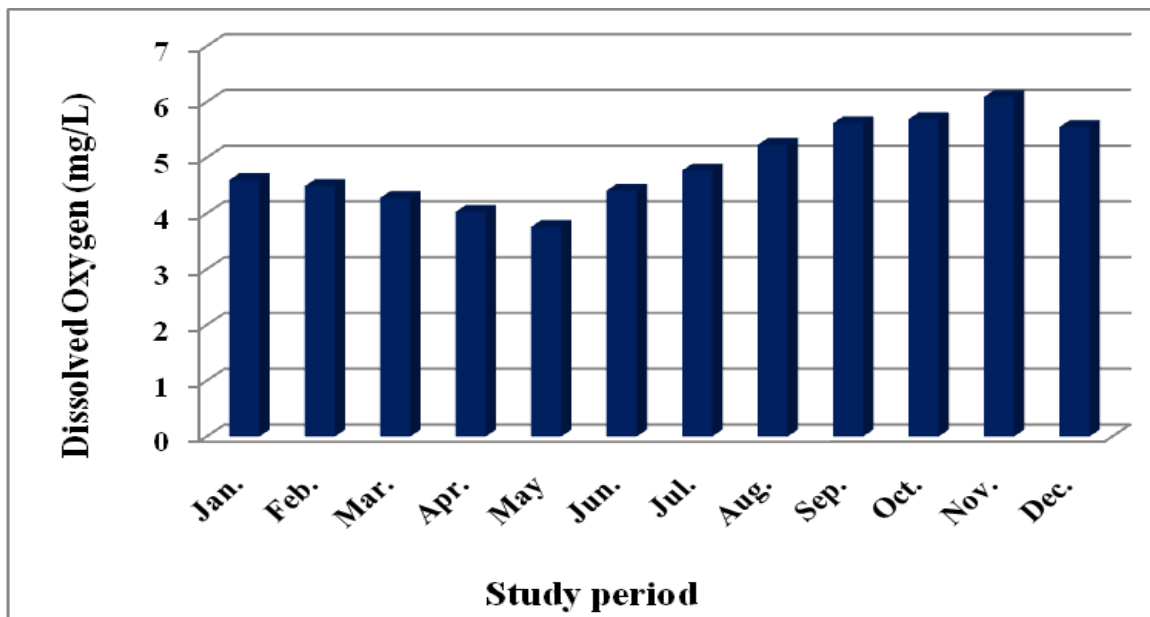
Fig. 3. Monthly variations (from 2015 January to 2015 December) of dissolved oxygen in the Ponneri tank water samples.

Dissolved solids: The dissolved solids of the water samples varied from 119.57 to 150.77 mg/L with a minimum value noted in the month of December and highest value reported in the month of June (Fig. 4).
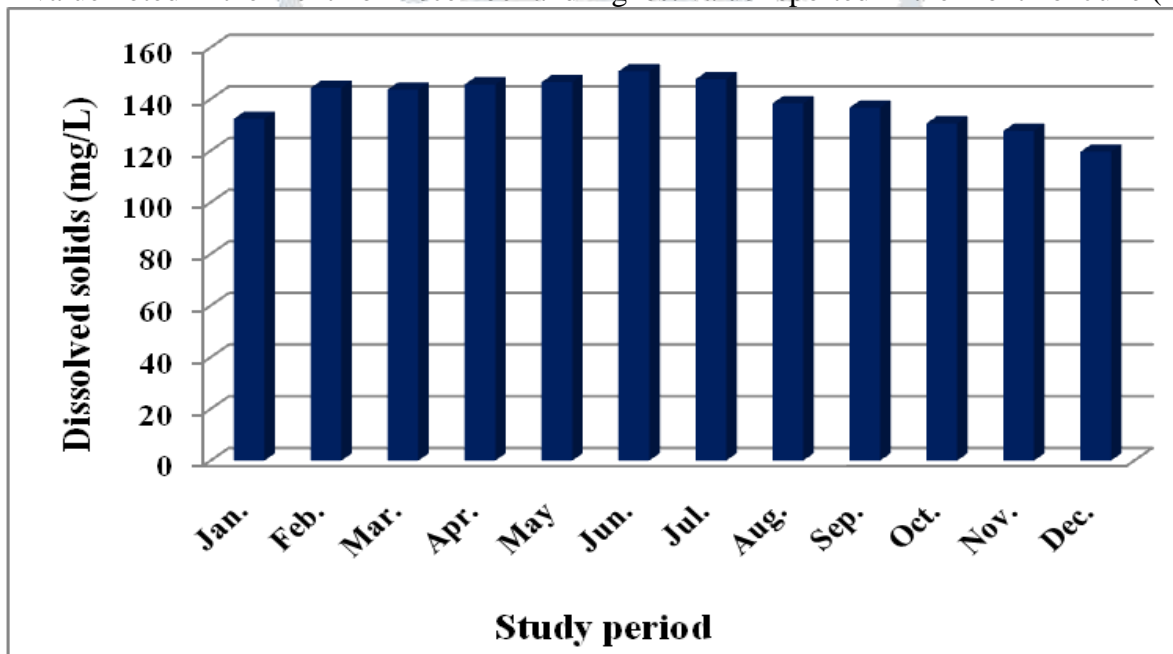

Figure 4. Monthly variations (from 2015 January to 2015 December) of dissolved solids (mg/L) in the Ponneri tank water samples.

The electrical conductivity of the water sample varied from 155.67 to 233.77 ds/m. It was found to be high in July and low in the month of December (Fig. 5).
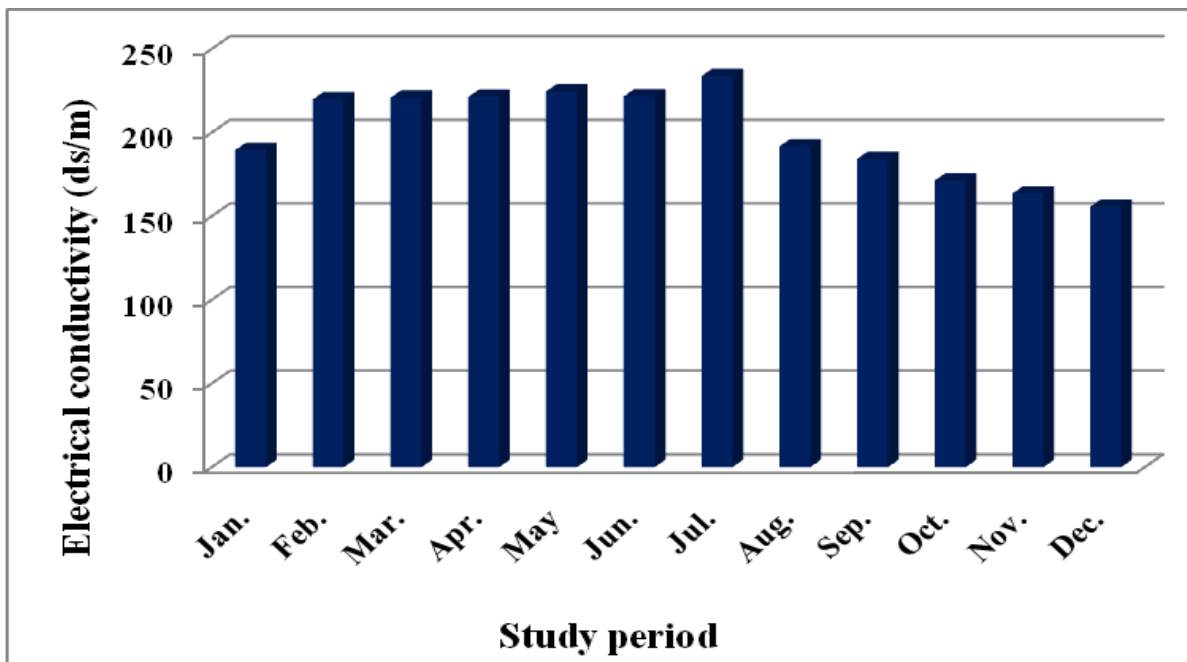
Figure 5. Monthly variations (from 2015 January to 2015 December) of electrical conductivity in the Ponneri tank water samples.

Alkalinity: Alkalinity fluctuated from 32.83 to 52.83 mg/L. It was found to be low in the month of July and high in the month of December (Fig. 6).
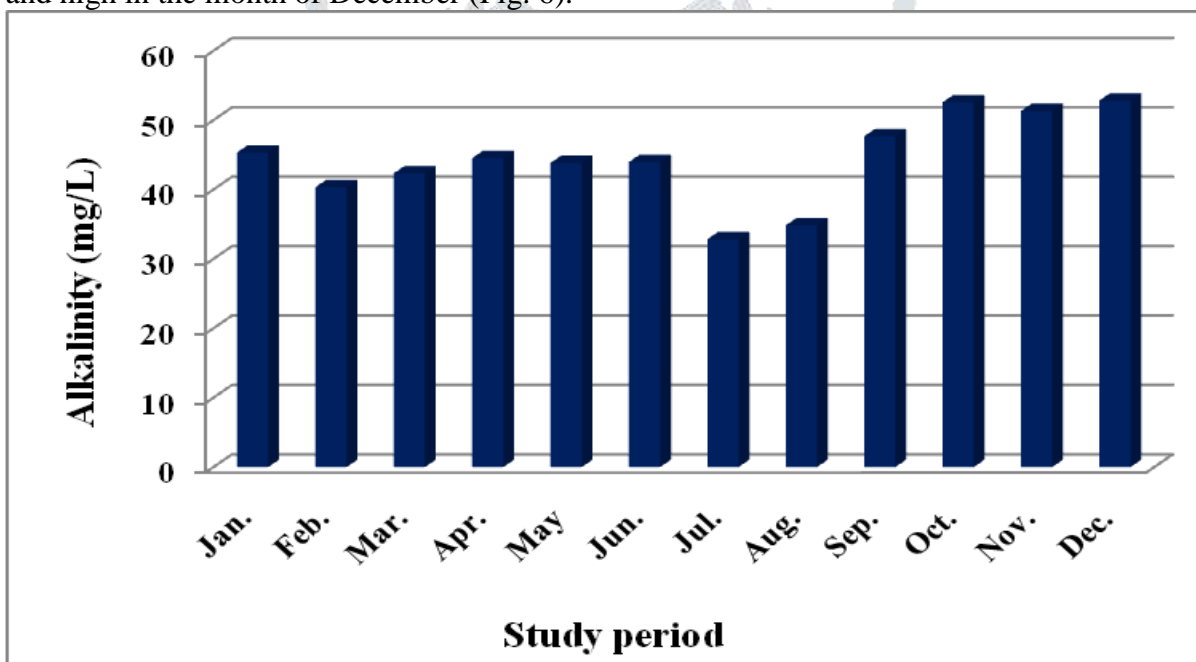

Figure 6: Monthly variations (from 2015 January to 2015 December) of alkalinity (mg/L) in the Ponneri tank water samples.

Chloride: The chloride content ranged from 2.37 to 11.73 mg/L. The lowest value was noted in March and highest was recorded in August (Fig. 7).
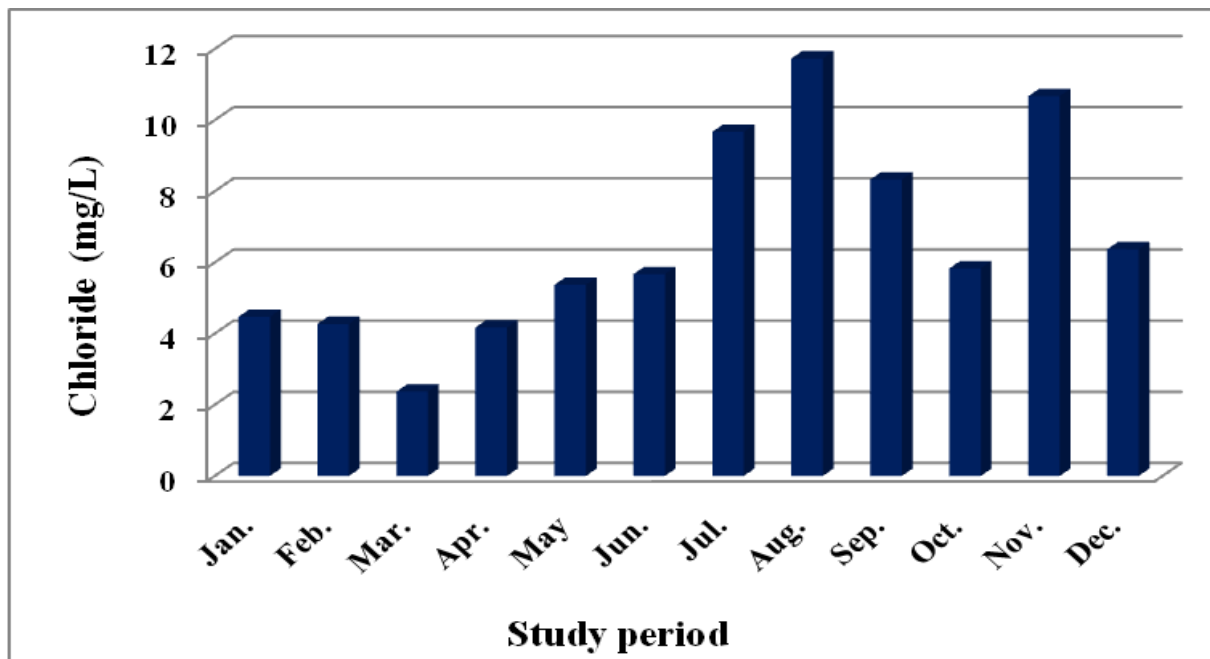
Figure 7: Monthly variations (from 2015 January to 2015 December) of chloride (mg/L) in the Ponneri tank water samples.

Nitrate: Nitrate content was fluctuated from 0.05 to 0.17 mg/L. It was found to be low in February and high) in June (Fig. 8). Phosphate: The amount of phosphate present in the given water sample ranged in between 0.04 to 0.09 mg/L. It was found to be low in the month of February and high in the month of December (Fig. 9).
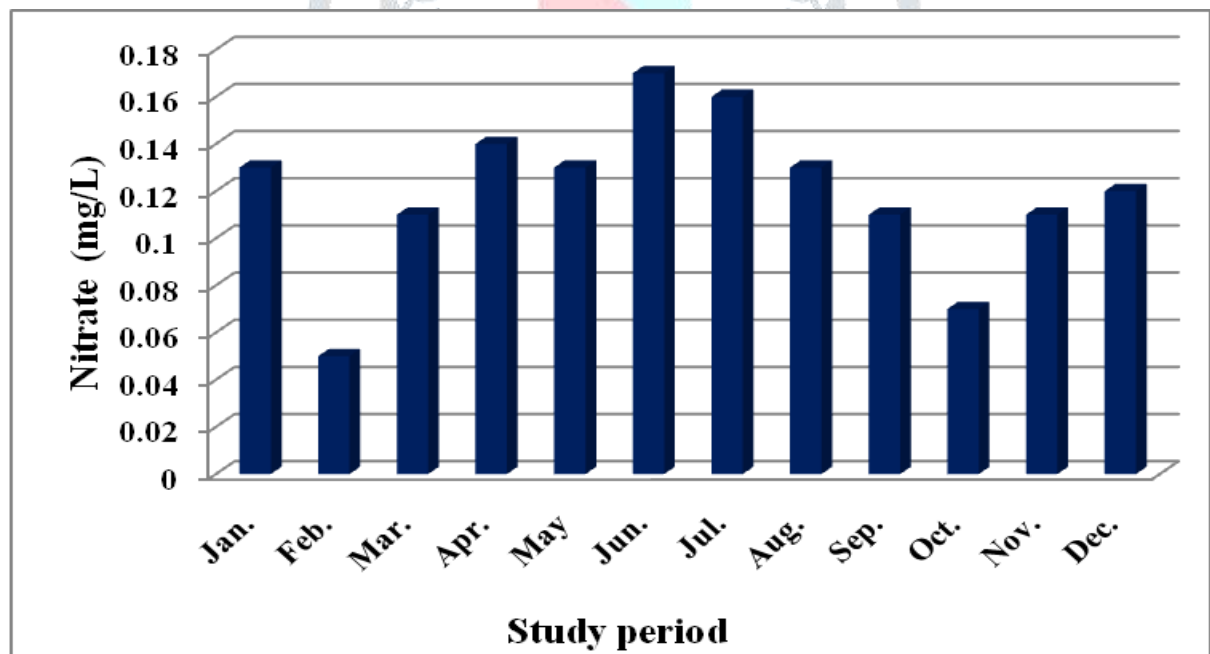

Figure8. Monthly variations (from 2015 January to 2015 December) of nitrate (mg/L) in the Ponneri tank water samples.
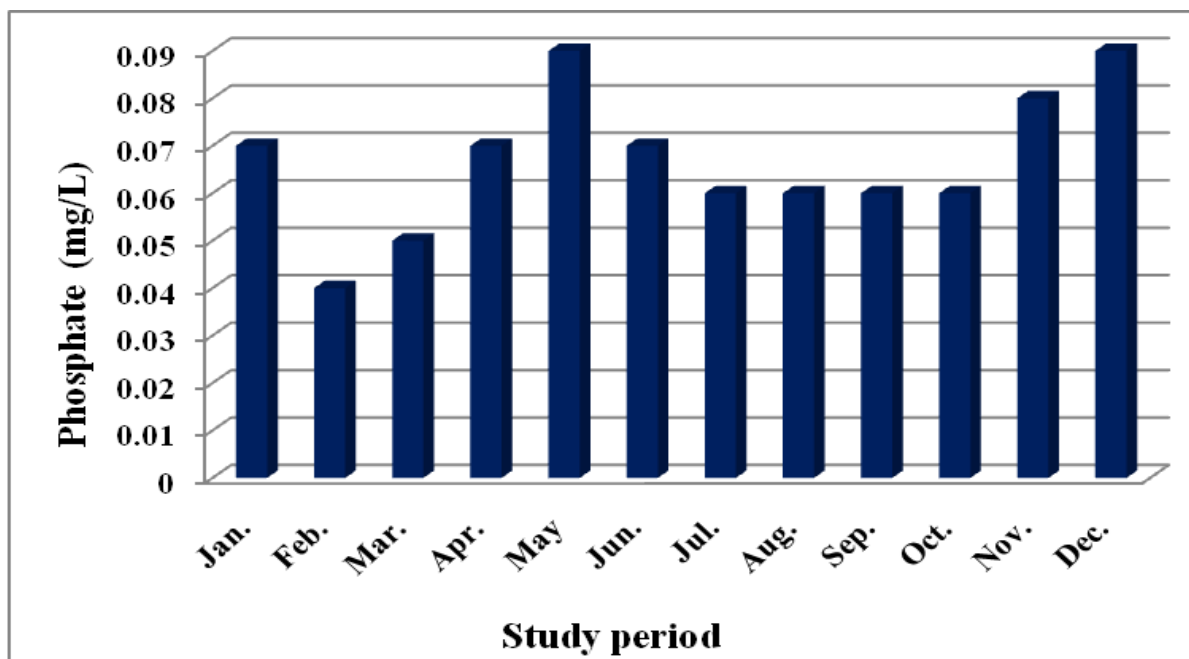
Figure 9. Monthly variations (from 2015 January to 2015 December) of phosphate (mg/L) in the Ponneri tank water samples.

Silicate: The silicate content ranged between 8.23 to 22.37 mg/L. Minimum was recorded in the month of December and maximum in the month of July during the study period of January 2102 to December 2015 (Fig. 10).
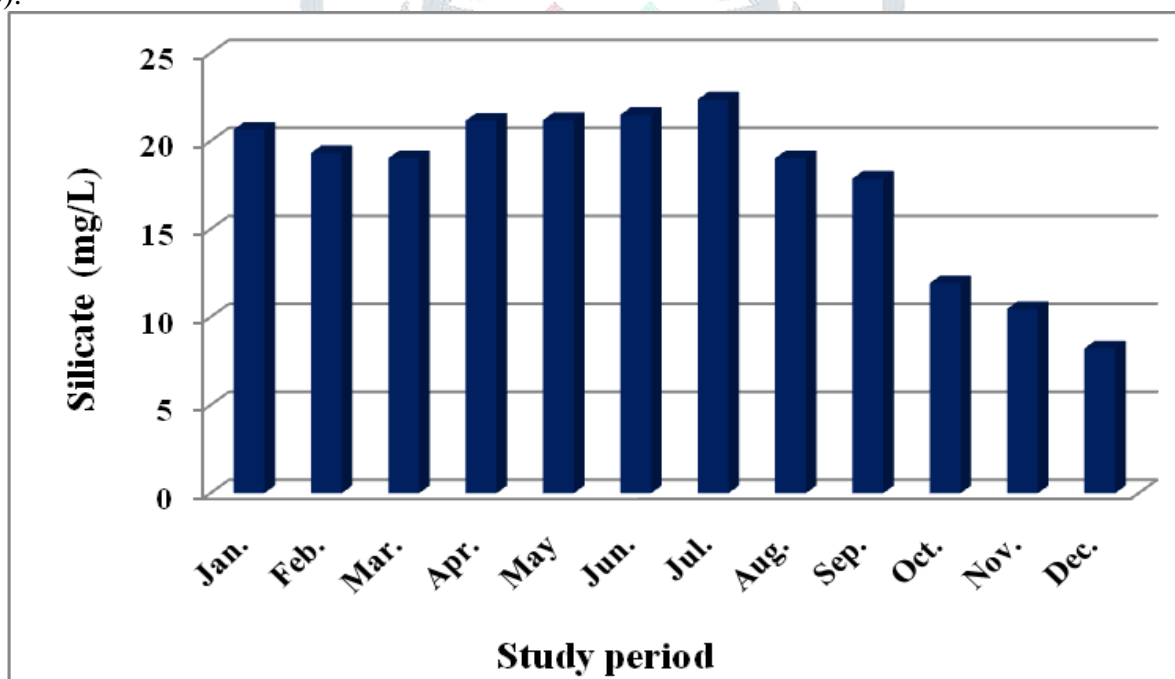

Figure 10: Monthly variations (from 2015 January to 2015 December) of silicate (mg/L) in the Ponneri tank water samples.

IV DISCUSSION

Physico-chemical parameters such as temperature, pH, dissolved oxygen, dissolved solids, electrical conductivity, alkalinity, chloride, nitrate, phosphate and silicate of the freshwater tank was studied and from the values obtained and these parameters have significant fluctuations that may be due to changes and the flow of water during the course of study. In freshwater habitat, the water characteristics are mainly influenced by rainfall, humidity, wind action etc. A reflection of the health of an aquatic ecosystem is the physico-chemical characteristics of water. After studying the physico-chemical parameters Almati reservoir Hulyal and Kaliwal[10] recommended the water that is suitable for irrigation and pisciculture. Though the

temperature of water may not be important in temperature tolerant aquatic life, in polluted water bodies temperature has an profound effect on the dissolved oxygen (DO)[11]. Temperature and salinity were low during monsoon and high during summer season in the Agniar estuary was reported earlier[12]. Turbidity of water is as a result of by suspended and colloidal matter such as clay silts, finely divided organic and inorganic matter, plankton and other microscopic organisms. Thommai Arockia Gaspar and Lakshman[13] reported the monsoon time the level of turbidity is very high due to water bodies receiving rain water run-off.

In the Ponneri tank water the value of pH was recorded in the range between 6.97 and 8.13 where the pH was maximum in summer due to high decomposition activities of biotic (aquatic organism) and abiotic (physical and chemical) factors, and minimum in monsoon season due to dilution of water by rainfall and water from the other sources[14]. Similar results were also observed by Sharma *et al*.[15]. In general, the pH of natural water bodies lies in between 6 and 8.5, and a deviation from that 4.5 and 9.5 are generally hazardous to aquatic organisms[16]. The minimum was recorded December, the monsoon season and the maximum was observed in June, summer season in this present study supports the findings of earlier observation in the east coast water[17].

A similar study by Anand and Kumarasamy[18] in Kottakudi estuary reported the dissolved oxygen was varied between 3.5 to 7.2 ml/L. Minimum dissolved oxygen was recorded during summer (June) and maximum in monsoon (December). The amount of dissolved oxygen present in water is controlled by various factors such as rainfall, temperature, photosynthesis by phytoplankton and salinity. Dissolved oxygen content was high during monsoon period in the study could be due to the influx of freshwater during the monsoon and present low salinity. The DO was found to be low in summer and high during monsoon season in other water body is reported (i.e. Agniyar estuary[12]).

Garg *et al*.[19] reported the TDS of Ram Sagar reservoir which is ranged from 166.37 to 239 mg/L. In Mahagaon reservoir, Sawant and Chavan[20] recorded the maximum total dissolved solid during summer season 172.66 mg/L owing to evaporation of water that results in concentration of salts in the water. Tamot *et al*.[21] reported that the alkalinity ranged from 90 to 160 mg/L in Halali reservoir and the reservoir water is considered as nutrient rich. Sugunan[22] reported that alkalinity value of an Indian reservoir (Halali Madhya Pradesh) ranged from 40 to 240 mg/L.

Chloride is a common component of most waters and is useful to fish in maintaining their osmotic balance, chloride is the same element found in the form of a salt and chlorine is a gas which is added in water as a disinfectant to control harmful bacteria, both have dramatically different chemical properties. Chloride is the most common inorganic anion present in water[23]. Increase in dilution may be responsible for relative lower values in rainy seasons[24]. The levels of chloride in water bodies are found to increase. The chloride content normally increases as the mineral content increases[25].

Studies on the nitrate content by Sankar Narayan Sinha and Mrinal Biswas[26] noted in a Kalyani lake in West Bengal, where the content of nitrate between 0.80 and 1.82 mg/L with the mean value of 1.14 mg/L. In the present study, the maximum and minimum values were recorded during June and February respectively. Maximum value of phosphate (0.46 mg/L) was recorded in summer season due to the high growth rate of algae, aquatic plants and decay of vegetation[14], which is reported earlier by Madhusudhana Rao et al.[27]. The minimum value (0.13 mg/L) was recorded in winter season. Qureshimatva Umerfaruq and Solanki[28] have reported that the value of phosphate was lowered in winter season compared to pre-monsoon and monsoon season due to increase in uptake of phosphate for the luxuriant growth of macrophytes in Bibi lake at Ahmadabad. According to Patra[29] silicate content of water correlates with salinity of water and a higher silicate content was recorded where the salinity area is less.

V CONCLUSION

Various physico-chemical parameters of Ponneri Tank (Cholagangam) water were studied. The data which showed, the physico-chemical properties of the freshwater was within the permissible limits of Indian standards. Thus, it can be concluded that the variations of water quality parameters not much different from the standard values in the Ponneri Tank (Cholagangam). It is recommended to take necessary care to keep the condition as such and prevent any type of deterioration of water quality.

VI ACKNOWLEDGEMENT

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