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SEASONAL VARIATIONS OF PHYSICO-CHEMICAL CHARACTERISTICS IN VEERANAM LAKE CUDDALORE DISTRICT, TAMIL NADU, INDIA

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ABSTRACT

Seasonal variations of physico-chemical characteristics were carried out in Veeranam lake Kattumannarkovil in Cuddalore District, Tamil Nadu, India, for a period of twelve months (January 2017 to December 2017). Nine various physico-chemical parameters were analyzed by using standard methods (APHA, 1998). Water temperature varied from 28.55 to 32.52ºC, pH ranged from 7.23 to 8.28. Turbidity was varied between 26.48 to 40.38 cm and salinity was noted (0.07 to 0.16 ppt). Dissolved oxygen content varied from 4.71 to 5.71 mg/L, calcium (37.56 to 58.36 mg/L), phosphate (0.14 to 0.31), nitrate (0.21 to 0.29 mg/L) and ammonia (0.28 to 0.37 mg/L) also varied independently.

Key words: Physico-chemical characteristics, Seasonal variations, Freshwater, Water quality.

INTRODUCTION

Water is the most abundant as well as a critical resource in nature and covers approximately 3⁄4th of the earth's surface, although being so abundant many factors have contributed for its limitation. The desirable characteristics of water vary with endeavor use. Human's excessive interests related with water for their particular use, which may involve many uses like commercial, industrial or recreational insights. Water treasured used is for drinking purpose, which must be essentially clear, free from turbidity, bacteria, foul odor and color. The emergence of civilization and subsequent industrialization by humans has caused a great damage to our ecosystem and disturbed the environment. Lakes and ponds also affected, as most of the lakes in major cities have been polluted. Water pollution has posed a serious challenge due to its effect on economic activities. The problem of water pollution holds greater relevance in the context of a developing country like India (Mudasir Nabi Dar *et al.,* 2017). Water quality regulates biotic diversity and biomass, energy and material cycles, tropical levels and rate of succession. In turns, it helps in planning exploitation, anti pollution or conservation strategies. The environment monitoring through water quality assessment 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 purpose. Several studies have been conducted so for to understand the physio-chemical properties of rivers in India (Bhalerao, 2012; Pradeep *et al.,* 2012; Wan Mohd Khalik *et al.,* 2015). Water quality is the determining factor on the success or failure of an aquaculture operation. The quality of water in any ecosystem provides significant information about the available resources for supporting life in that 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 (Thirupathaiah *et al*., 2012). Freshwater resources need special care and attention to make its available sustainably for present and future generations. Water is a vital role in agriculture, aquaculture, industries and almost all other human activities. Ensuring uninterrupted fresh water supply is a greater challenge and the world should manage to face during upcoming deeds (Pankaj Malviya *et al*., 2015). In the present study was an attempt to provide such vital information for future references. All the physico-chemical parameters were studied from Veeranam lake Kattumannarkovil in Cuddalore District, Tamil Nadu, India for a period of January 2017 to December 2017.

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MATERIALS AND METHODS

Water samples were collected from Veeranam lake Kattumannarkovil in Cuddalore District, Tamil Nadu, India which is located at latitude 12° 83' North South, 79° 70' East West on Southern part of India. 2 litre capacity of plastic cans for physico-chemical samples 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 during January 2017 to December 2017.

The various physico-chemical parameters were analyzed by using standard methods (APHA, 1998). Temperature: In the present study water temperature of the lake water recorded by using Mercury field celcious thermometer. pH: The pH was determined by using Elico, model LI. 120 Digital pH meter. Turbidity: It can be determined by using turbidity meter. Dissolved oxygen: The Dissolved oxygen was determined by the modified Winkler's method (1888). Salinity: The salinity content was determined by Mohr's titration method. The other parameters like, calcium estimated by EDTA Titrimetric method, phosphate estimated stannous chloride method. The nitrate was determined by the Brucine method and ammonia was determined by the Nesslerization method (APHA, 1998).

RESULTS

In the present study, the water temperature fluctuated from 28.55 to 32.52ºC in Veeranam Lake. It was found to be low (28.55ºC) in the monsoon season and high (32.52ºC) in summer season (Table 1 and Fig. 1).Turbidity of the water samples depends on availability of either zooplankton or phytoplankton and suspended soiled particles. The transparency of the lake varied from 26.48 to 40.38 cm. It was found to be low (26.48 cm) in the monsoon season and high (40.38 cm) in the summer season (Fig. 2). pH is another important biological parameter. The pH of the water samples showed alkaline ranges throughout the study period. It varied from 7.23 to 8.28. It was found to be minimum (7.23) in post-monsoon season and maximum (8.28) in the summer season of study period (Fig. 3).The salinity content ranged from 0.07 to 0.16 ppt. It was found to be high (0.16 ppt) in summer season and low (0.07 ppt) was recorded in monsoon season (Fig. 4). The dissolved oxygen is important biological factor. The dissolved oxygen content ranged from 4.71 to 5.71 mg/L. It was found to be low (4.71 mg/L) in summer season and high (5.71 mg/L) in post-monsoon season (Fig. 5). Calcium content fluctuated from 37.56 to 58.36 mg/L. It was found to be low (37.56 mg/L) in monsoon season and high (58.36 mg/L) in summer season (Fig. 6).

The phosphate content ranged from 0.14 to 0.31 mg/L. It was found to be low (0.14 mg/L) in post-monsoon season and high (0.31 mg/L) in summer season (Fig. 7). Nitrate content was fluctuated from 0.21 to 0.29 mg/L. It was found to be low (0.21 mg/L) in post-monsoon season and high (0.29 mg/L) in summer season (Fig. 8).The ammonia content ranged between 0.28 to 0.37 mg/L. It was found to be low (0.28 mg/L) in monsoon and high (0.37 mg/L) in summer season during the study period of 2107 (Fig. 9). In the present investigation, physico–chemical parameters such as temperature, pH, turbidity, salinity, dissolved oxygen, calcium, phosphate, nitrate and ammonia of the freshwater lake showed significant fluctuation. This may be due to seasonal changes and the flow of water. Freshwater habitats are mainly controlled by rainfall, humidity, direction of wind etc. A reflection of the health of an aquatic ecosystem is the physico-chemical parameters. After studing the physico-chemical parameters Hulyal and Kaliwal, (2011) proved that the water is suitable for irrigation and pisciculture. Temperature of water may not be important in pure water because of the wide range of temperatures tolerance in aquatic life, but in polluted water temperature can have profound effects on dissolved oxygen (DO) (Kesalkar *et al.,* 2012).

Similarly temperature salinity was low during monsoon and high during summer season in the Agniar estuary (Sukumaran *et al*., 2013).

Table 1. Physico-chemical characteristics of Veeranam lake Kattumannarkovil (January 2017 to December 2017)

Parameters	Pre-monsoon	Monsoon	Post-monsoon	Summer
Temp. (°C)	30.53 ± 0.92	28.55 ± 1.89	29.34 ± 0.75	32.52 ± 0.88
Turbidity (cm)	36.41 ± 1.56	26.48 ± 1.71	28.09 ± 2.63	40.38 ± 4.24
pH	7.51 ± 0.26	7.24 ± 0.22	7.23 ± 0.12	8.28 ± 0.29
Salinity (ppt)	0.09 ± 0.02	0.07 ± 0.01	0.13 ± 0.02	0.16 ± 0.05
DO (mg/L)	5.17 ± 0.52	5.36 ± 0.68	5.71 ± 0.53	4.71 ± 0.46
Calcium (mg/L)	47.44 ± 2.01	37.56 ± 6.28	37.83 ± 4.44	58.36 ± 1.53
Phosphate (mg/L)	0.25 ± 0.03	0.16 ± 0.04	0.14 ± 0.01	0.31 ± 0.05
Nitrate (mg/L)	0.25 ± 0.08	0.28 ± 0.03	0.21 ± 0.04	0.29 ± 0.03
Ammonia (mg/L)	0.31 ± 0.08	0.28 ± 0.04	0.29 ± 0.01	0.37 ± 0.05

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

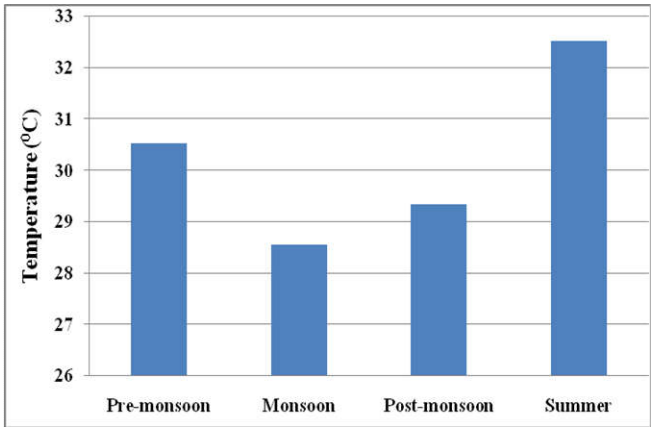

Fig. 1. Monthly variations of water temperature (^{0}C) in the Veeranam lake

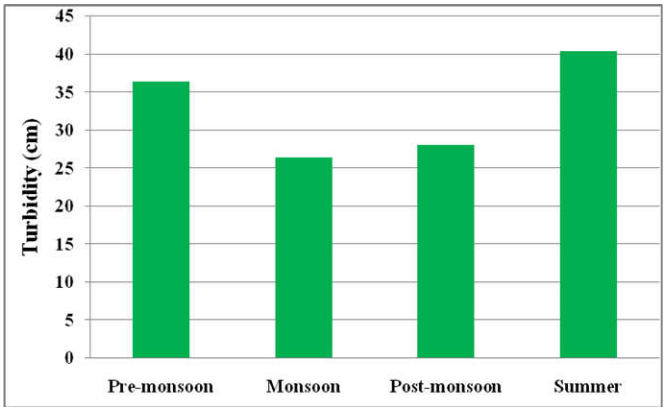

Fig. 2. Monthly variations ofwater turbidity (cm) in the Veeranam lake

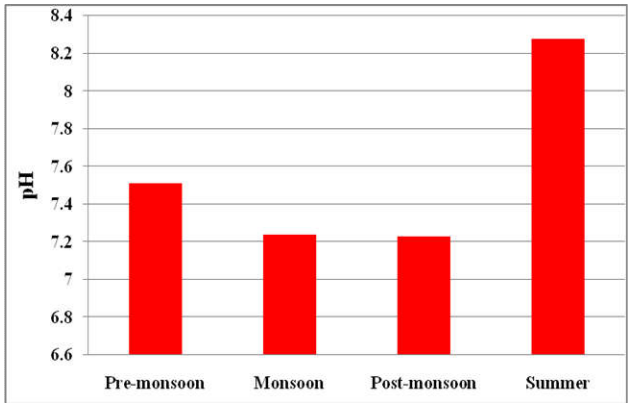

Fig. 3. Monthly variations of water pH in the Veeranam lake

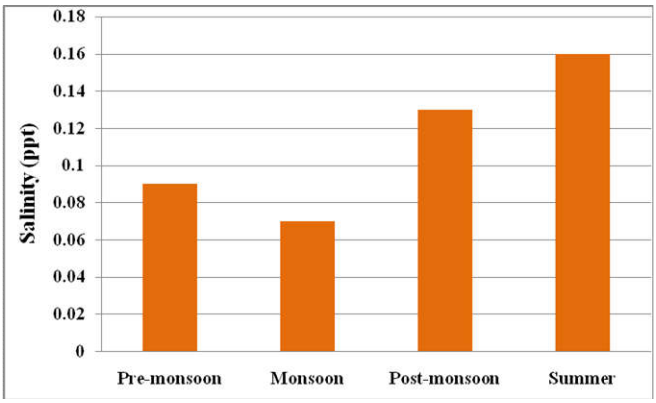

Fig. 4. Monthly variations of salinity (ppt) in the Veeranam lake water samples

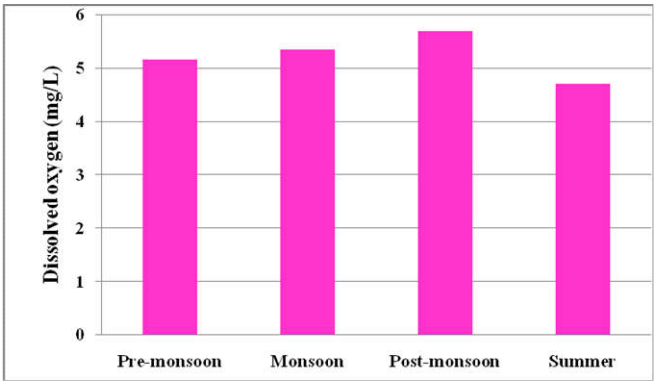

Fig. 5. Monthly variations of dissolved oxygen (mg/L) in the Veeranam lake

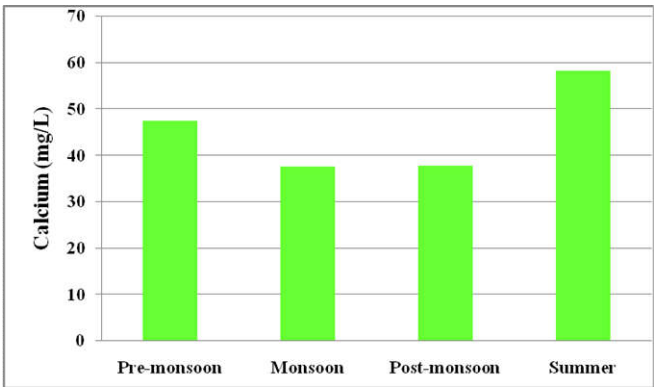

Fig. 6. Monthly variations of calcium (mg/L) in the Veeranam lake water samples

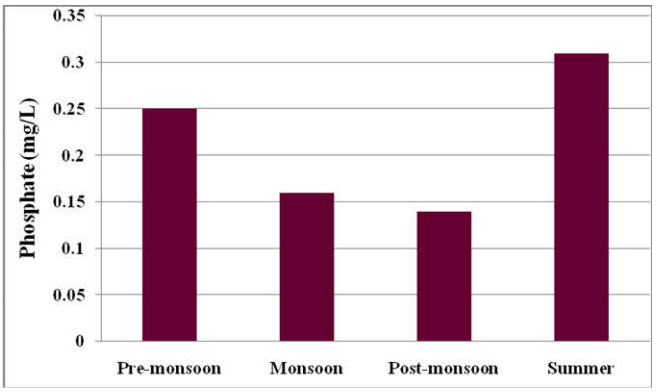

Fig.7. Monthly variations of phosphate (mg/L) in the Veeranam lake water samples

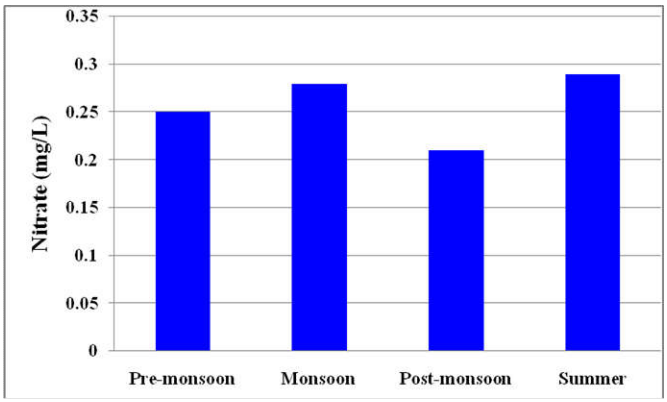

Fig.8. Monthly variations of nitrate (mg/L) in the Veeranam lake water samples

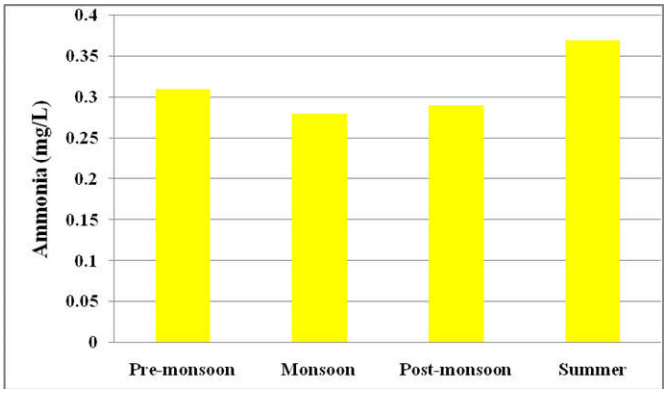

Fig.9. Monthly variations of ammonia (mg/L) in the Veeranam lake water samples

Turbidity in water is caused by suspended and colloidal matter such as clay, silts, finely divided organic and inorganic matter, plankton and other microscopic organism. Thommai Arockia Gaspar and Lakshman, (2014) reported that the monsoon time the level of turbidity is very high due to the estuary received rain water along with industrial waste and manmade waste. In summer, low level of turbidity was observed it may be due to the low level of inflow of fresh water. The value of pH concentration was recorded in the range between 8.05 and 6.5. The observed pH was maximum in summer season 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 (Mayavan Karthika *et al.,* 2017). Similar results were also observed by Sharma *et al.* RAMP (2016) described that the standards of pH lower 4.5 and greater than 9.5 are generally hazardous to aquatic life of organisms still less extreme pH values can affect growth, reproduction and other biological activities. The minimum was recorded December, monsoon season and the maximum was observed June, summer season (James Balgan Anand *et al*., 2015). Salinity is considered to be the basic and prime factor which may influence the physico-chemical parameters and distribution of flora and fauna in estuarine environment (Soundarapandian *et al*., 2009). Manikannan *et al.* (2011) recorded a maximum salinity value during the summer and lower values during the wet (monsoon) season, which is a result of the heavy rainfall. Maximum salinity was recorded in summer especially in the months of May and June and minimum during monsoon particularly in the month of December for both the stations. In general the salinity was

influenced by high temperatures of both atmospheric and water. During monsoon season, rainfall and freshwater inflow from the land were moderately reduced the salinity (Thirunavukkarasu *et al*., 2011 and Ananthan *et al*., 2012). Anand and Kumarasamy, (2013) noted that dissolved oxygen was varied between 3.5 and7.2 ml/L. Minimum dissolved oxygen was recorded during summer (June) and maximum in monsoon (December). It seemed to be controlled by various factors such as rainfall, temperature, phytoplankton photosynthesis and salinity. Dissolved oxygen content was high during monsoon period in the study area could be due to the influx of fresh water during the monsoon, higher solubility and low salinity. The DO was found to be low in summer and high during monsoon season in the Agniyar estuary (Sukumaran *et al*., 2013). Calcium is generally present in soil as carbonate and most important environmental, divalent salt in fish culture water. Fish can absorb calcium either from the water or from food. In the present study, calcium content maximum was recorded in summer and minimum was recorded in monsoon season. Similar trend was reported (Patra *et al.,* 2010). Calcium reached at peak in May and then show gradual decline was reported (Muhammad Naeem *et al.*, 2011). The highest value of calcium was recorded in summer (Tidame and Shinde, 2012). The maximum value of phosphate (0.46 mg/L) was recorded in summer season due to the high rate of algae, aquatic plants growth and decay of vegetation (Mayavan Karthika *et al.,* 2017). A similar report was also given by Madhusudhana Rao *et al*. (2014). The minimum values (0.13±0.05mg/L), (0.16 mg/L) were recorded in winter season. Qureshimatva Umerfaruq and Solanki (2015) have reported that the value of phosphate lowered in winter season compared to pre-monsoon and monsoon season due to increased uptake of phosphate for the luxuriant growth of macrophytes. Sankar Narayan Sinha and Mrinal Biswas, (2011) reported the nitrate content of lake water fluctuated between 0.80 and 1.82 mg/L with the mean value of 1.14 mg/L. The maximum and minimum concentrations were recorded during September and November respectively. Ammonia and nitrogen was observed maximum in the monsoon and post-monsoon seasons due to rainfall and the river runoff carrying large amount of detritus (Indirani *et al*., 2010). The highest ammonia concentration was recorded during the dry season (Kaniz Fatema *et al*., 2014) as a result result of steamming from low precipitation.

Conclusion

The present observation, the various physico-chemical parameters were noted Veeranam lake Kattumannarkovil in Cuddalore District, Tamil Nadu, India. The data which showed that the physico-chemical properties of the freshwater zone were significantly vary when compared with study period. Thus, it can be concluded that the variations of water quality parameters determine in the Veeranam lake Kattumannarkovil in Cuddalore District during the study period.

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