(RESEARCH ARTICLE)

Analysis of physico-chemical parameters of a fresh water lake in Nizamabad District Telangana State

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Abstract

The present study was undertaken to study the physico-chemical parameters of fresh water bodies in Nizamabad district and after survey Ramadugu lake was selected. Lakes are the important water resources and used for several purposes. The water quality of all fresh water environments is assessed by the physico-chemical and biological parameters. The physico-chemical characteristics were studied and analyzed for a period of 1 year from March 2019 to February 2020.water samples were collected from four sampling stations of lake and were analyzed in the laboratory. Physico-chemical parameters such as Colour, Odour, Temperature, PH, TDS, Carbonates, Bicarbonates, Calcium, Magnesium, Total hardness, Total Solids, Chlorides, Nitrates, Nitrites, Sulphates, Silicates, Phosphates, BOD, COD, DO of lake were estimated throughout the year. Analysis was carried out by using the standard methods.

Keywords: Physico-chemical parameters; Ramadugu lake; Limnological analysis; Fresh water lake.

1. Introduction

Water is one of the most important natural resources and play vital role in the life processes. Water is necessary for the life and development of all living organisms on this planet. water content is around 70% which occupies three fourth of earth surface. Only 0.02% fresh water to satisfy our diverse needs comes from lakes, rivers and ponds. The property of water of dissolving and carrying suspension, a variety of chemicals, increased industrialization, human populations, agricultural fertilizer use and a variety of unhealthy plants are the undesirable consequences that water can easily become contaminated (Patil &Deshmukh et al., 2012) [1]. Lakes are inland water bodies have environmental significance as sources of surface and ground water recharge, maintain nutrient and energy exchange that support diversified aquatic life. The lakes are main source of drinking water and also for irrigation purposes, which are surrounded by rocky hills and paddy fields. The value of the water is lost for many uses when it gets altered in its physical, chemical and biological parameters (Rawal, 1978) [2]. The deterioration of water quality of fresh water resource is becoming faster which leads to a global problem (Mahananda et al., 2005) [3]. Fresh water lakes are the wealth of a nation, and the healthy aquatic ecosystem depends on the physical and biological qualities of a particular system (Thirupathaiah et al.,2012) [4]. The chemical and biological factors are interrelated and interdependent. The quality of water effects the species composition, abundance, productivity and physiological conditions and indigenous population of aquatic organisms (Wetzel R.G., 2001) [5]. Water quality is the characteristics of water which influence its beneficial use as well as the sustainability of ecosystem. The periodicity and density of phytoplankton is controlled by various complex factors. Sometimes a particular group of phytoplankton appears all of a sudden and multiplies in the water body under certain physicochemical conditions (Goel et al., 1992) [6]. Human health is directly linked with water quality. Clean and unpolluted water is essential for human life (UNEP, 1996) [7]. The quality of good water depends on many physico-chemical parameters. Several experts found that the majority of lakes are alkaline, especially in India (Philipose 1960, [8] Verma 1969a) [9]. Hence monitoring of these aquatic resources is crucial for sustainable

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management. Now this lake water is using for irrigation, domestic purpose, fishing and also to cultivate of paddy fields in and around the lake area by local people.

2. Materials and Methods

2.1. Study Area

The present study was carried out in fresh water lake, where water samples were collected from the Ramadugu lake of Nizamabad district for a period of one year, March 2019 to February 2020.

2.2. Geography of Study Area

Ramadugu lake is situated at Nizamabad district of Telangana state which lies between $18^0 40'$ and $19^0 00'$ North latitude and between $78^0 10'$ and $79^0 10'$ East longitude. Density is 321 km². The geographical area of the Nizamabad district is 7,956 sq. kms. The district is rich source of rivers, lakes, ponds and reservoirs. Ramadugu project is an existing medium irrigation project constructed across Pedda vagu, a tributary of Bheemgal River which ultimately joins into Godavari on the D/S of Sree Rama Sagar project. The project is located near Ramadugu village and Dharpally Mandal of Nizamabad district to irrigate an ayacut of 5000 Acres. The project work was commissioned in the year 1964. The Government have accorded administrative approval for modernization of Ramadugu Project. It is located at a distance of 20 kms from Nizamabad. This project is medium lake which gets filled during rains and is used for irrigation of Agricultural crops covering Dichpally, Dharpally, Jakranpally, Velpur and Bheemgal Mandal of Nizamabad District.

2.3. Water Sample Collection and Analysis

Water samples were collected every month on specific date from four sampling stations of lake. SI near rock hill, SII near paddy fields, SIII sluice and S IV near Pochamma temple which represent the entire lake. Surface Water samples have been collected from lake every month in precleaned 2L plastic cans between 8 am to 10 am in the morning hours in order to maintain uniformity for a period of one year from March 2019 to February 2020 at regular monthly intervals and examined for several physico-chemical characteristics on return to the laboratory on the same day. Some of the parameters are calculated at the collection point and other parameters were estimated in the lab. Prior to sample collection, all the sampling bottles were thoroughly washed, sun-dried and rinsed with the same water to be collected in the lake. The sampling water cans were labelled with dates and collection sites until analysis is completed. Separate sample with appropriate caution were collected for dissolved oxygen in 250ml BOD bottles and dissolved oxygen was fixed on the field by adding Winklers A and B solution immediately after collection. The temperature and P^H were recorded at the time of sample collection with the centigrade Thermometer and P^H was measured on the spot using P^H paper and later confirmed in the laboratory using digital P^H meter. The physico-chemical characteristics of the lake water like Total Hardness, Dissolved oxygen, BOD, COD, Organic matter, Total dissolved solids, carbonates Bicarbonates, Chlorides, Nitrates, Nitrites, silicates, phosphates, sulphates, Calcium and Magnesium were determined every month in laboratory as per standard methods suggested by Trivedy and Goel (1986)[10]. APHA (2005) [11].

3. Results and Discussion

3.1. Temperature

The surface water temperature is an important factor that regulates biological and chemical processes in the water ecosystem. Aquatic organisms from microbes to fish are dependent on certain temperature for their optimal health. Temperature affects oxygen content of water, photosynthetic rate by aquatic plants, metabolic activities of aquatic organisms. In locations with the aid of the thermometer, the temperature was noted. During the study water temperature ranges from $22.0^o c$ to $32.8^0 c$. The maximum temperature was recorded in the month of May during summer season was due to low water level, high temperature and clear atmosphere and minimum in the month of December during winter season. Similar results were reported by Vasumathi Reddy et al., (2009) [12]. Table No-1,Figure No-1 Indicating recorded data of Temperature.

3.2. pH

P^H is the measurement of H^+ ions concentration in a liquid. It is an important index of acidity and alkalinity. P^H was estimated by using pocket P^H meter at the spot in lake. In the present study it is recorded in the range of 7.1 to 8.4 at all stations and represents alkaline nature of the lake. The P^H values were maximum in the month of May during summer season and minimum in the August month during monsoon (rainy season). P^H levels before and after the monsoon were

high while in the monsoon levels were low due to diluting of upper estuary.P^H concentrations were altered with seasons (Ruth et al., 2013) [13]. Table No-1, Figure No-1 Indicating recorded data of pH

3.3. Total Hardness

Total hardness is the most important chemical parameter and is the capacity of water to react with detergents. The values of hardness ranges from 110 mg/l to 260 mg/l. The maximum value was recorded in the month of May during summer season and minimum value was recorded in the month of February. Presence of calcium and magnesium salts play role in the hardness of water. Total hardness was high during summer than monsoon and winter. Similar observations are according to Hujare (2008) [14]. Table No-2, Figure No-2 Indicating recorded data of T.H.

3.4. Dissolved Oxygen

DO is one of the most important on-site parameters that gives an indication of organic pollution in water body (Kaushik.et., al,2004) [15]. The amount of oxygen dissolved in reservoir is affected by temperature of water, salinity, water inflow and photosynthetic activity of algae and water plants. Dissolved oxygen is inversely proportionate to water pollution. Adequate DO value is an important parameter of safe water. The DO values varied in the range of 4 mg/l to 12 mg/l. The maximum value of dissolved oxygen in the month of August during monsoon and minimum value was recorded in the month of May during summer. Low DO in summer is due to high temperature, increase values of phytoplankton, decrease of photosynthetic activity, low water flow rate and less solubility of oxygen in water. Table No-1, Figure No-6 Indicating recorded data of D.O.

3.5. Biological Oxygen Demand

In the present study BOD values ranged from 3.5 mg/l to 8.0 mg/l maximum value recorded in summer season and minimum in monsoon and winter season. The reason for high BOD in summer was several microorganisms present in water body might have accelerated their metabolic activities with concentrated amount of organic matter and hence required more amount of oxygen and so the demand of oxygen increased (Verma et al., 2012) [16]. In unpolluted water BOD is lower and high in polluted waters. The estimation of physico-chemical parameters as per W.H.O. guidelines to civic authorities to modify sustainable techniques to enhance water quality. Table No-1, Figure No-5 Indicating recorded data of B.O.D.

3.6. Chemical Oxygen Demand

It is the measurement of all inorganic and organic chemicals to be oxidized in the water. The highest value 28.00 mg/l were observed in May months during summer and lowest values 12.11 mg/l in July during monsoon season. During the study period, the values of COD are found higher than BOD values. Estimation of COD along with BOD is helpful in indicating toxic conditions and the presence of nonbiodegradable substances in the water. These observations support the similar findings of (Sharma et al., 2010) [17]. Table No-1, Figure No-5 Indicating recorded data of C.O.D.

3.7. Organic Matter

The highest value recorded 2.6 mg/l in November during winter season and lowest values of 0.2 mg/l was recorded in August during rainy season. The values obtained during winter season were less than the summer season. Similar views were made by Gonzalves and Joshi (1946) [18]. The infusion of organic matter into lakes and ponds are in the form of external sources such as inflowing water from the areas outside the basin. Table No-1, Figure No-6 Indicating recorded data of O.M.

3.8. Total Dissolved Solids (TDS)

TDS is an important parameter in determining the water quality standards. TDS is an important parameter show impact on water quality. Water with more TDS value usually has disagreeable taste. TDS values fluctuates from 165.6 mg/l to 290.00mg/l. Maximum value was recorded in the month of July during monsoon season. It is due to heavy rainfall and minimum value was recorded in the month of April. TDS as suggested by W.H.O is 500mg/l (W.H.O. 1998) [19]. Table No-1, Figure No-2 Indicating recorded data of T.D.S.

3.9. Carbonates

Carbonates indicate temporary hardness of water. Carbonate is the prime contributor for maintaining P^H of a water body (Hegde et al., 2005) [20]. Higher carbonate value 29 mg/l observed in the study area in the month of May during summer and the lowest value 16 mg/l was recorded in October of winter season. Table No-1, Figure No-9 Indicating recorded data of Carbonates.

3.10. Bicarbonates

Bicarbonate serves an important role in water body. As high concentration of bicarbonates leads to alkaline P^H. The amount by bicarbonates recorded is 220mg/l which is highest in the month of June and lowest value is 116.34 mg/l in October due to inflow of fresh water and dissolution of calcium carbonate ions in the water. The maximum amount was recorded during summer season. high P^H value recorded in summer due to increase in bicarbonates. similar findings were reported by other researchers (Ramakrishnan et al., 1999) [21] . Table No-1,Figure No-3 Indicating recorded data of Bicarbonates.

3.11. Chlorides

The chlorides are one of the important parameters in assessing the water quality. The maximum value of 152.24 mg/l was recorded in the April month during summer season due to increase in temperature and minimum values of 104.26 mg/l was recorded in July and during monsoon season due to dilution of lake water with rain water the concentration of chlorides is found decreased. The higher the concentration of chlorides would reduce the DO content of water, which turns harmful to aquatic organisms (Deepa et al., 2016) [22]. Table No-1, Figure No-7 Indicating recorded data of Chlorides.

3.12. Phosphates

In the present study phosphates ranges from 0.2mg/l to 2.5 mg/l the maximum value was recorded in the month of August and minimum value in the month of October. Phosphates effect water quality. In natural water phosphorous is present in very small quantities. The high value of phosphate in August month might be due to surface water runoff, rain water came from agricultural fields mixed with influx water of the lake. Similar results reported by (Singare et al., 2013) [23]. Table No-1, Figure No-4 Indicating recorded data of Phosphates.

3.13. Sulphates

Sulphates are one of the major dissolved components in water. The highest value of 36.00 mg/l was recorded in the month of May during summer season and the lowest values of 22 mg/l in the September month was recorded during period of investigation. Sulphates are found in all-natural water, especially those with high salt content. Sulphates are always present adequate quantities in water to meet the high requirement for protein synthesis. (Cole, 1979) [24]. Table No-1, Figure No-7 Indicating recorded data of Sulphates.

3.14. Nitrates

Nitrate is an important nutrient which plays key role in deciding the productivity of aquatic ecosystem and accelerates growth of algae and macrophytes. Nitrates ranged between 0.58 to 1.14 mg/l. The maximum value was recorded in the month of June during rainy season and minimum in the month of December during the study period of lake. The high value of nitrate in June is mainly due to rains, surface runoff, agricultural runoff, decomposition of macrophytes. Excess number of nitrates in drinking water can create serious health problems to humans and also support the formation of blooms (Udama, 2014) [25]. Table No-1, Figure No-8 Indicating recorded data of Nitrates.

3.15. Nitrites

Nitrites were detected in traces in all sampling sites throughout the study period, but their levels spiked with the arrival of rains and due to influx of nitrogen rich flood water into the lakes from the large amount of contaminated sewage water. The maximum value of nitrites is 0.06 mg/l in the months of July and August of monsoon season and during the month of May and the lowest value is 0.02 mg/l in the month of December during winter season can be due to utilization by plankton and aquatic plants for metabolic activities Mary Kensa(2013) [26]. Table No-1, Figure No-8 Indicating recorded data of Nitrites.

3.16. Silicates

The presence of silica in freshwater can have a substantial impact on algal succession and productivity overall (Verma, 1969b) [27]. In the present study the value of silicates ranged between 1.52 to 3.67 mg/l. Silica is an important parameter that regulate diatoms growth. The high amount of silica is recorded in January during winter season and low amount during rainy season in the month of July. Table No-1, Figure No-9 Indicating recorded data of Silicates.

3.17. Calcium

The maximum value of calcium ranges from 36.75 mg/l in the month of August. The lowest values 25.12 mg/l in the month of December. In water ecosystem calcium serves as important micronutrient to many aquatic organisms. The

addition of sewage waste might be responsible for increase in the amount of calcium. The decrease in calcium may be due to absorption by living organisms. similar results were reported by (Uday kumar et al., 2006) [28]. Table No-1, Figure No-10 Indicating recorded data of Calcium.

3.18. Magnesium

The maximum value of 32.95 mg/l was recorded during summer season in the month of April and minimum value of 16.36 mg /l recorded in the month of November during winter season. Magnesium is frequently linked with calcium in water, but calcium concentrations remains generally higher than the magnesium (Venkatasubramani et al., 2007) [29] Considerable amount of magnesium influence water quality. Table No-1, Figure No-10 Indicating recorded data of Magnesium.

Table 1 Indicating Average Values of Physico-chemical Parameters in Ramadugu Lake

| Parameters	Winter (Oct, Nov, Dec, Jan)	Monsoon (Jun, Jul, Aug, Sep)	Summer (Feb, Mar, Apr, May)
Temperature(^{0}C)	21.8	21.57	28.6
pH	7.9	7.4	7.6
Total Hardness(mg/l)	204.5	178.7	148.5
Dissolved Oxygen(mg/l)	5.6	9.2	7.8
BOD(mg/l)	4.8	4.05	3.9
COD(mg/l)	18.37	10.75	11.2
Organic Matter(mg/l)	1.45	1.2	1.92
TDS(mg/l)	198.9	268.8	231.2
Carbonates(mg/l)	12.6	20.6	23.4
Bicarbonates(mg/l)	202.25	167.58	187.42
Chlorides(mg/l)	130.11	121.26	117.41
Phosphates(mg/l)	0.87	1.2	0.72
Sulphates(mg/l)	30.5	24.87	27.97
Nitrates(mg/l)	0.92	0.90	0.69
Nitrites(mg/l)	0.03	0.05	0.037
Silicates(mg/l)	2.42	2.29	3.37
Calcium(mg/l)	28.39	32.90	30.17
Magnesium(mg/l)	29.63	24.45	21.10
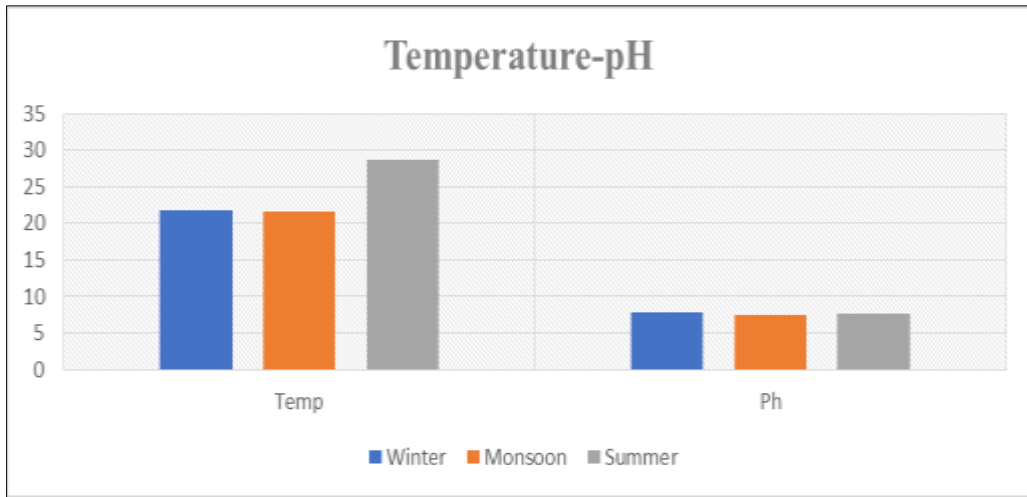
Figure 1 Indication of Temperature-Ph Graphical Data
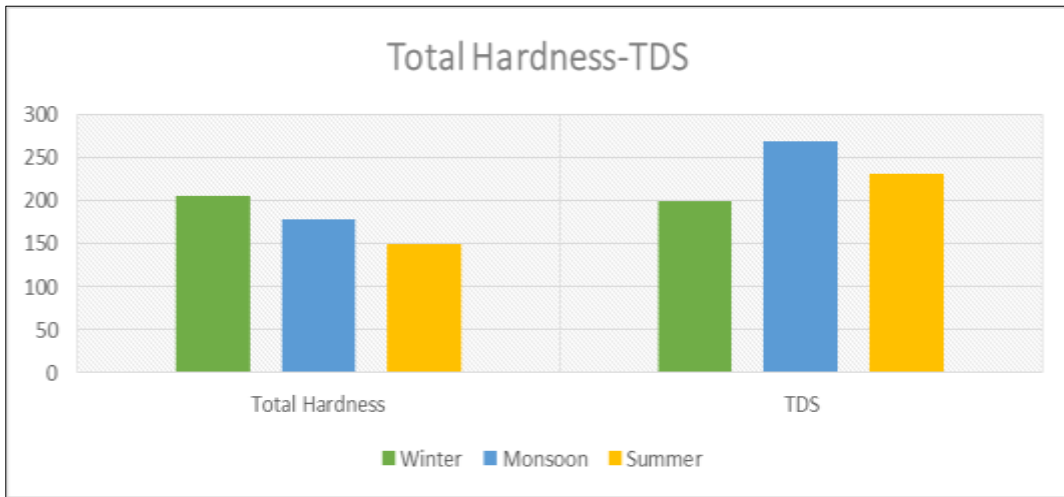

Figure 2 Indication of Total Hardness- Total Dissolved Solids
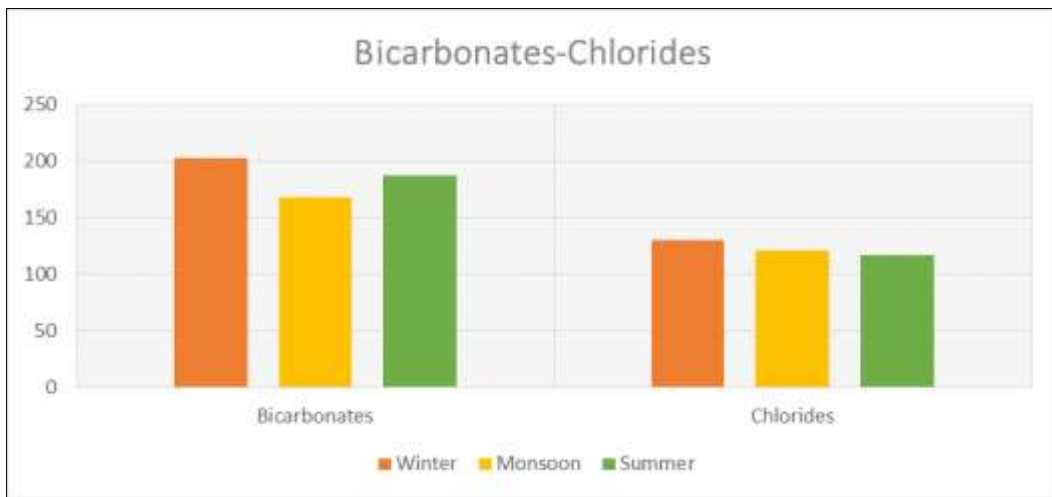

Figure 3 Indication of Bicarbonates- Chlorides
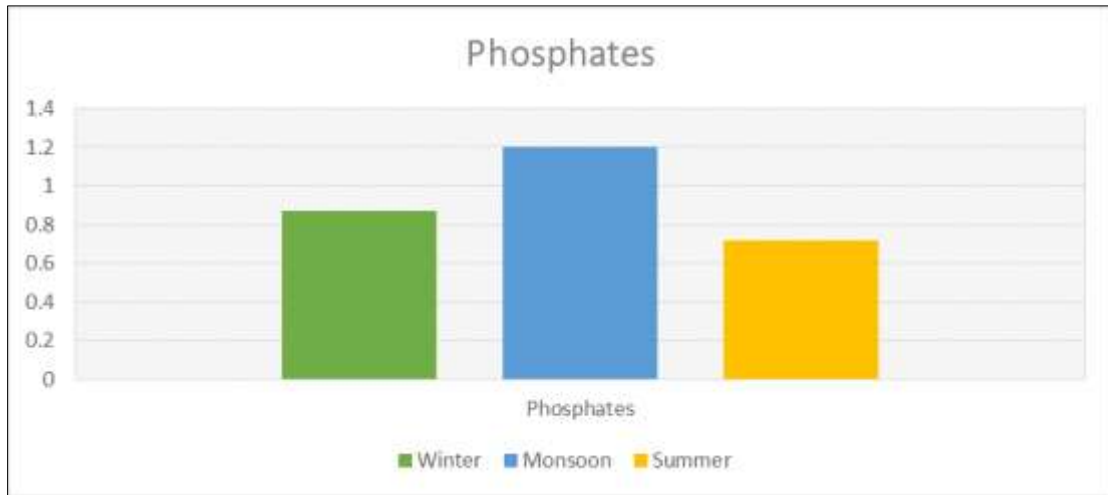
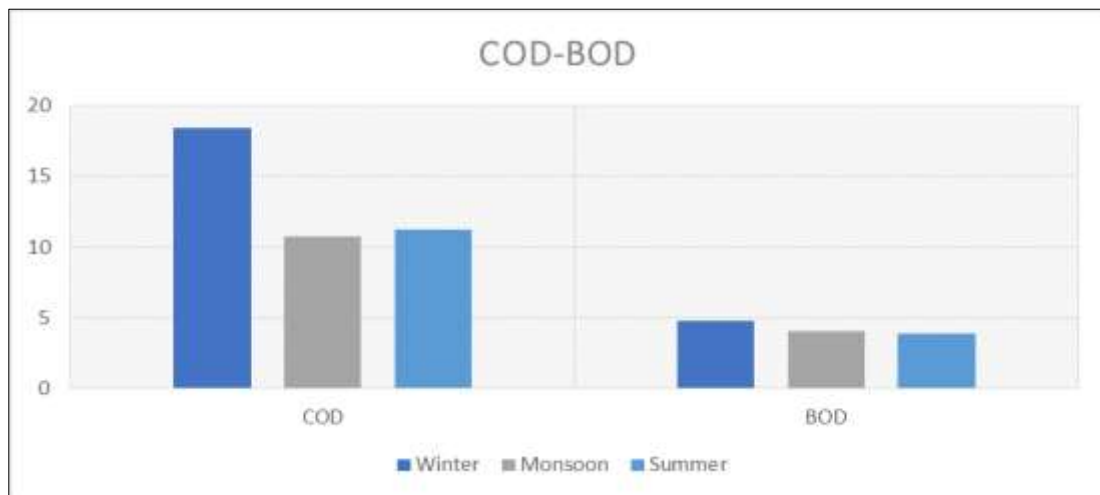**Figure 4** Indication of Phosphates

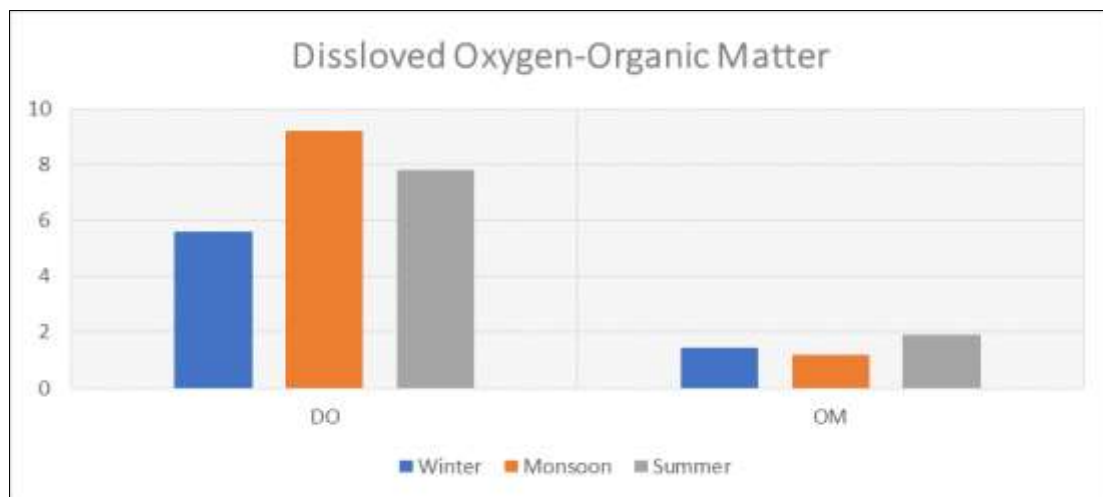**Figure 5** Indication of Chemical oxygen demand-Biological oxygen demand

Figure 6 Indication of Dissolved Oxygen- Organic Matter
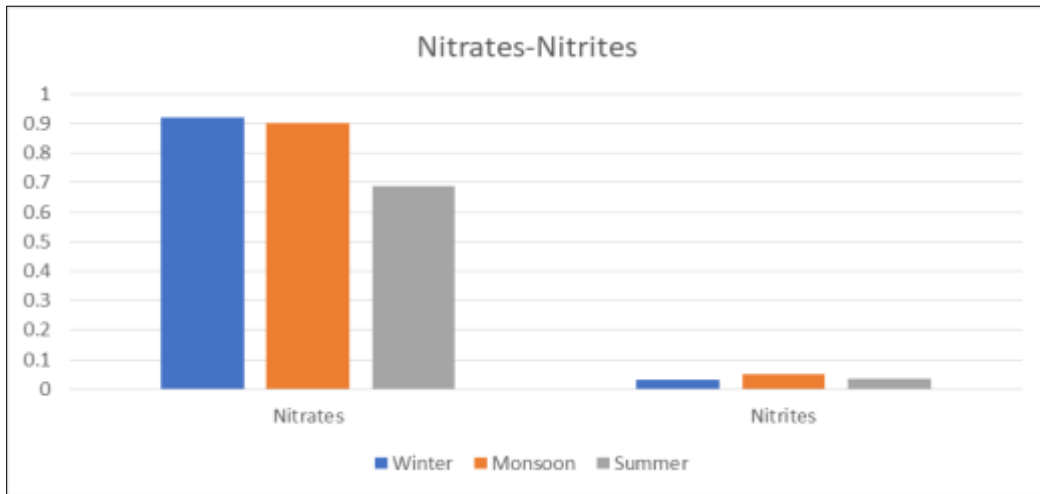
Figure 7 Indication of Chlorides- Sulphites

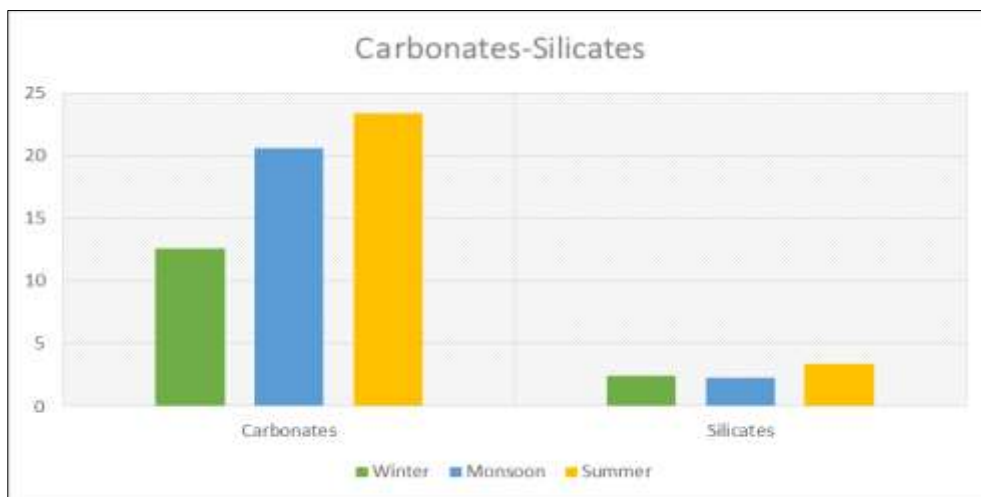**Figure 8** Indication of Nitrates-Nitrites

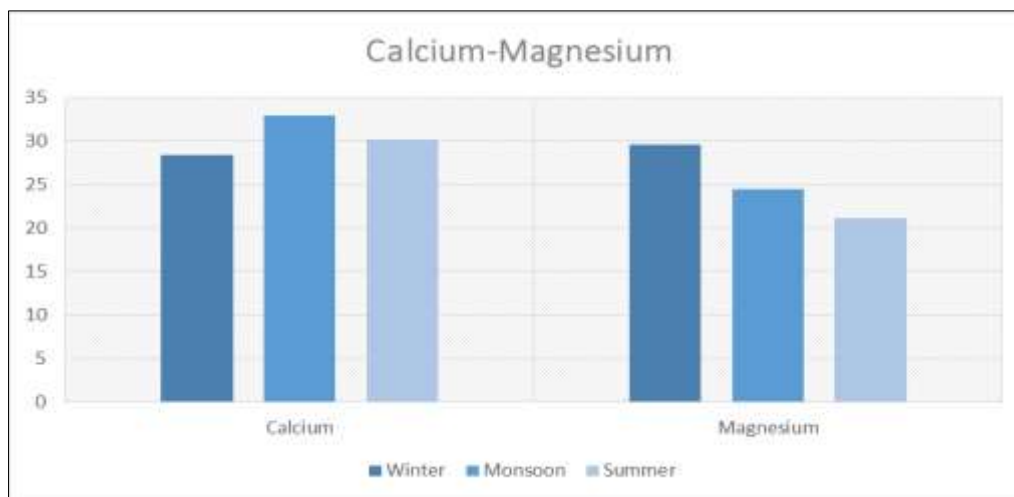**Figure 9** Indication of Carbonates-Silicates

Figure 10 Indication of Calcium- Magnesium

4. Conclusion

The analysis of Physico-chemical parameters on Ramadugu lake has indicated that most of the parameters were within the permissible limits given by W.H.O. Physico-chemical parameter analysis of the lake water showed seasonal variations throughout the study period. Lake water analysis revealed that values are generally higher in summer season. The results indicate that lake water is good condition and can be used for domestic and irrigation purposes.

Compliance with ethical standards

Acknowledgments

Disclosure of conflict of interest

The authors declare no conflict of interest.

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