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A Study of Physico - Chemical Parameters of Dindi Reservoir of Nalgonda District, Telangana

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Abstract

Living organisms need water for their growth and survival. Almost every aspect of life on our planet is governed by water. Discharge of toxic chemicals contaminate the water bodies with unwanted substances, which cause excessive algal growth and degrade the water quality. Water bodies such as ponds, reservoirs and lakes, contain plankton whose growth and distribution is influenced by and their physico chemical parameters. Zooplankton play a vital role in the maintenance of aquatic ecosystem and also are important intermediates in the food chain, and therefore, their survival and maintenance serve as good indicators of water pollution. Their successful growth and survival is dependent upon the various biotic and abiotic factors such as light , temperature, dissolved oxygen content etc. In the present study, a reservoir named Dindi was selected, to learn about the zooplankton population which serve as indicators to know about the pollution of this reservoir. This is reservoir is constructed across Dindi river located in Dindi, Nalgonda District, of Telangana India. Thirteen physico chemical parameters such as temperature, dissolved oxygen, pH etc were studied, during the period between 2011-2016. Fluctuations in dissolved oxygen, nitrates, sulphates were observed, which seem to impact the zooplankton of this reservoir. This study is first of its kind, on this reservoir, and gave us valuable insights regarding the pollution levels of this water body.

Freshwater is not only a finite resource but also essential for agriculture, industry and even human existence and without its inadequate quantity and quality, sustainable development will not be possible[5]. The deterioration of water quality of freshwater resource is becoming faster which leads to a global problem[7]. Dwivedi and Pandey[2] reported that industrial waste water, sewage and municipal wastes are being continuously added to water reservoirs which affect the physicochemical quality of water and also making them unfit for even use of livestock and other organisms. All these impurities result

in degradation of water quality, like bad taste, colour, odour, turbidity, hardness, corrosiveness, staining and frothing. Ponds which are relatively small in size are important part of our urban ecosystem, and they perform several environmental, social and economic functions, viz. as a source of drinking water, recharging groundwater, acting as sponges to control flooding, supporting biodiversity and providing livelihoods[8]. Natural water bodies may contain different types of impurities in the different forms, such as weathering of rocks and leaching of soils, dissolution of aerosol particles from the atmosphere and from several human activities[1]. Both the phytoplankton and zooplankton communities influence the water quality characteristics and are important components in the production of standing waters. The relationship between the physicochemical parameters and plankton production of water bodies was studied intensively by Kutama *et. al*.[4] and Hassan *et. al*.[3]. According to Thrope and Covich[9] the nutrient status and the physico-chemical parameters of water body play an important role in governing the production of plankton. Because of their short life cycle they respond quickly to changes in water surroundings e.g. water quality, such as pH, color, taste *etc.* therefore they are used as indicators of overall health or condition of their habitat. Zooplankton communities are highly sensitive to environmental variations, such as water temperature, light, chemistry (particularly pH, Oxygen, salinity, toxic contaminants and food availability such as algae and bacteria and predation by fishes as well as invertebrates. However, information in related to physicochemical parameters and planktonic fauna is very limited. So the present investigation attempts to study the, physicochemical parameters in a Dindi reservoir, of Nalgonda district, which may seems to impact the zooplankton of the waters. The reservoir was constructed across Dindi river which is a tributary of Krishna river. It is located in Dindi (V) & (M), Nalgonda District. It is located mid way between Hyderabad to Srisailam on Hyderabad Srisailam Highway. Physico-chemical characteristics of the samples (Three different seasons) in Dindi reservoir A total of fifteen Physico-chemical parameters of water viz., Temperature, pH, Dissolved Oxygen, Biological Oxygen Demand, Chemical Oxygen Demand, Free Carbon-Dioxide, Total Alkalinity, Conductivity, $CaCO_3$ Hardness, Total Suspended Solid, Total Dissolved Solid, Chloride, and Nitrite were determined.

In the present study, the water samples were collected between the years 2012-2016. the water samples were collected in appropriately labeled reagent sample bottle. They were brought to the zoology research laboratory located in the department of Zoology, University College for Women, Hyderabad, Telangana. The samples were carefully maintained and water samples were further proceeded for estimation of various physico- chemical parameters, as according to the standard protocols, outlined below.

All the parameters were analyzed following the standard methods, and by spectrophotometer SQ 118. pH was determined by pH meter (model ph 320, Merck, Germany). BOD was estimated by measuring the amount of dissolved oxygen consumed by the sample in 5 days at 20° C (APHA, 1989).

Total alkalinity : was measured by titrating 20 ml of water sample with 0.02(N) sulphuric acid using Phenolphthalein and Methyl Orange as an indicator (APHA, 1989). $CaCO_3$ hardness was measured by EDTA titrimetric method (APHA, 1989), where the water sample was titrated with 0.01M EDTA titrant using Ediochrome black T dye and sodium chloride as a dry powder indicator.

Total suspended solids : were obtained by filtering 250ml of sample water and weighing the dried residue left over the filter paper. Total dissolved solids were estimated as residue left after evaporation of filtered sample. **Chloride** was measured following Argentometric method (APHA, 1989), where 0.0141(N) Silver nitrate solution was used to titrate the water sample with potassium chromate indicator solution. **Nitrite** was estimated calorimetrically by developing a color with EDTA, sulphanilic acid, naphthylamine hydrochloride and sodium acetate (APHA, 1989).

pH is defined as the intensity of the acidic or basic character of a solution at a given temperature. pH is the negative logarithm of hydrogen ion concentration (pH=-log [H+]). The pH in water samples range of 7.0 to 7.85 and water and stated that the pH of water is important for the biotic communities as most of the plant and animal species can survive in narrow range of pH from slightly acidic to slightly alkaline condition. In study period *i.e.* September 2013 to August 2014 pH value ranged from 8.2 to 8.9. The maximum pH reported during summer was very low due to the water levels and concentration of nutrients in water and minimum was during monsoon due to the dilution of water by addition of rain water. *Electrical Conductivity.* To determine the specific electrical conductivity c, the electrolyte solution is placed in a measurement cell (length **L** and cross-section **A**). Then the resistance **R** of this cell is determined and the electrical conductivity is calculated using the following expression **The electrical conductivity**, an aliquot (1ml) of acidic wastewater was diluted to 50 ml with deionized water, and its pH was adjusted to 3.0 with sodium hydroxide. The measurements were carried out at a constant temperature of 20.0 ± 0.2°C. The tests were performed 5 times for each solution under these conditions. *Total hardness* is due to the presence of bicarbonates, chlorides and sulphates of calcium and magnesium ions. The total hardness of water is estimated by titrating the water sample against EDTA using Eriochrome Black-T (EBT) indicator. Initially EBT forms a weak EBT- Ca^{2+}/Mg^{2+} wine red colored complex with Ca^{2+}/Mg^{2+} ions present in the hard water. On addition of EDTA solution, Ca^{2+}/Mg^{2+} ions preferably forms a stable EDTA- Ca^{2+}/Mg^{2+} complex with EDTA leaving the free EBT indicator in solution which is steel blue in colour in the presence of ammonia buffer (mixture of ammonium chloride and ammonium hydroxide, pH 10). Eriochrome Black-T + Ca^{2+}/Mg^{2+} Eriochrome Black-T-Ca^{2+}/Mg^{2+} (Wine red) Eriochrome Black-T-Ca^{2+}/Mg^{2+} + EDTA EDTA-Ca^{2+}/Mg^{2+} + Eriochrome Black-T (Wine red) (Steel blue).

Sulphate Estimation: Filter the sample through filter paper (Whatman No. 1) and take 50 mL of filtrate in an Erlenmeyer flask. 2. Add 20 mL buffer solution and mix in stirring apparatus. While stirring, add 0.15 g

of barium chloride to the sample and stir the sample with the help of magnetic stirrer for about an hour. 3. Measure the absorbance against a distilled water blank (do not add barium chloride to it.) at 420 nm using spectrophotometer. Absorbance for the blank sample is taken to correct for sample color and turbidity. Process the standard solution of different strengths in similar way and record the absorbance for each solution. Plot a standard sulphate calibration curve on a graph paper from these absorbance values putting strengths (mg/L) on X-axis and absorbance at 420 nm on Y-axis. Fit a best-fit linear model to the data. Express equation as: Absorbance value= A+B× Sulphate concentration (in mg/L) Using the standard sulphate calibration curve (a linear-model; Equation 3), find out Sulphate concentration in the given unknown sample in mg/L. Sulphate concentration (mg SO42- /L) = (1000×mg SO42-)/(mL sample).

The physico-chemical parameters such as pH, electric conductivity, alkalinity, dissolved oxygen, total dissolve solid, calcium, magnesium, chloride, biological oxygen demand, nitrate and total hardness of water were analyzed for the water samples collected from the Thenam Cheruvu. These parameters were taken at the three different seasons wise (monsoon, winter and summer). All parameters with the mean value of the data with standard error were calculated as shown in the Tables, 1-5 and Figures, 1-5.

Our study, showed there were fluctuation observed over the time period, between, 2011-2015 all the physico chemical parameters studied. Temperature is the most important external factor and has a deep influence on an ecosystem. During the study, it was noted that the temperature varied from 18 to 28^{o}C in the surface water and fluctuates with the seasons. The pH value is alkaline in nature. The present findings are very close to the observations made in Krishna sager, Burdwan. The high content of the dissolved oxygen is an indication of the healthy ecosystem of a water body. Our findings have shown that there is moderate dissolved oxygen content of the Dindi reservoir. The hardness content is within the permissible limit with not much of fluctuations. Similarly, the total dissolved solids and alkalinity are less, which indicates marginal impact of pollution and buffer action of the water body except during monsoon due to runoff. The ionic components like chloride, calcium and magnesium are also within the tolerable range, except fluctuations in the chloride during winter and monsoon periods. The nutrient content such as phosphate is low in concentration throughout the study period except in summer period of 2011–2015. The nitrate, nitrite and ammonia concentrations were slightly high during monsoon period of 2011–2015, may be accountable from the fact of runoff. The overall physicochemical parameters were more or less similar in both the years, except minor fluctuations indicating that the reservoir is suitable for growth of zooplankton. Several scientists have reported that the main contributors to alkalinity in natural waters are bicarbonate, carbonate and hydroxide. The bicarbonate ions provide CO_2 to autotrophs for photosynthesis. According to Munawar[6] concentration of carbonates are influenced by free CO_2 concentrations in water. The optimum values of total alkalinity for obtaining higher fish production have reported

Table-1. Tables and Graphs
Physico- Chemical parameters in Dhindi Reservoir in 2011

Sl. No.	Parameters	Monsoon	Winter	Summer
1	Turbidity	27±1.6	18±1.13	9.8±1.44
2	Electrical conductivity at 25°C (Ω/cm)	5.65±0.44	4.21±0.09	4.5±0.91
3	pH	7.7±0.51	7.6±0.82	7.9±0.87
4	Magnesium (mg/L)	7.9±0.12	38±0.13	32±0.13
5	Dissolved Oxygen (mg/L)	4.3±0.99	4.6±0.31	4.5±0.05
6	Fluorides (mg/L)	0.32±0.02	1.2±0.82	0.94±0.06
7	Total Dissolve Solid (mg/L)	343±12.21	249±9.14	273±9.59
8	Total Alkalinity (mg/L)	149±1.11	211±12.55	208±7.1
9	Total Hardness (mg/L)	184±4.7	297±10.6	318±9.22
10	Calcium (mg/L)	65±9.42	88±5.88	76±4.19
11	Chloride (mg/L)	244±13.41	259±8.24	232±8.82
12	Nitrate (mg/L)	37±0.33	43±0.32	40±0.44
13	Sulphate	40±2.13	101±0.43	173±5.7

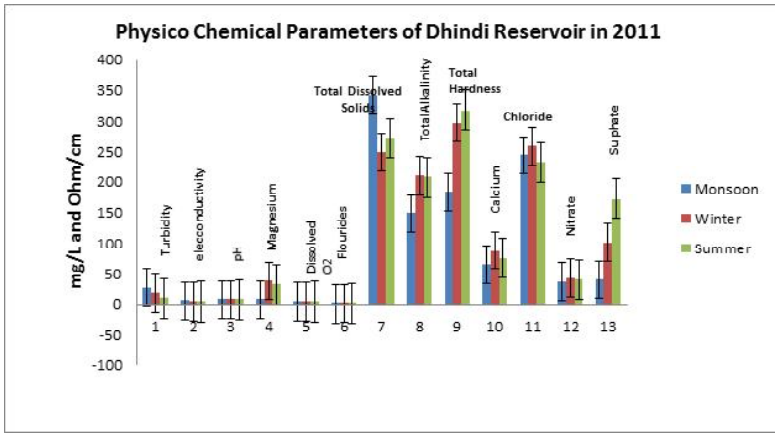

Fig-1

Legend of the graph

1	2	3	4	5	6	7	8	9	10
turbidity	Electro conductivity	pH	Magnesium	Dissolved O2	Fluorides	Total Dissolved solids	Total alkalinity	Total Hardness	Calcium

11	12	13
Chloride	Nitrate	Sulphate

THIS LEGEND IS THE SAME FOR ALL THE GRAPHS, from FIG-1 -Fig-6

Table-2 Physico- Chemical parameters in Dhindi Reservoir in 2013

Sl. No.	Parameters	Monsoon	Winter	Summer
1	Turbidity	26±0.31	11±0.81	10.7±0.46
2	Electrical conductivity at 25°C (Ω/cm)	5.4±0.6	4.21±0.2	4.01±0.03
3	pH	7.7±0.55	7.5±0.32	7.2±1.05
4	Magnesium (mg/L)	8±0.26	30±0.13	48±0.74
5	Dissolved Oxygen (mg/L)	3.3±0.08	4.5±0.44	4.1±0.91
6	Nitrate (mg/L)	22±0.1	43±0.21	48±0.76
7	Fluorides (mg/L)	0.32±0.05	1.2±0.09	0.94±0.06
8	Total Dissolve Solid (mg/L)	348±12.1	265±10.48	276±8.19
9	Total Alkalinity (mg/L)	142±4.66	231±6.9	208±12.03
10	Total Hardness (mg/L)	188±5.9	314±5.98	331±9.3
11	Calcium (mg/L)	76±1.2	85±6.66	84±3.43
12	Chloride (mg/L)	242±9.5	257±7.37	245±4.67
13	Sulphate	18±0.71	75±0.13	123±0.48

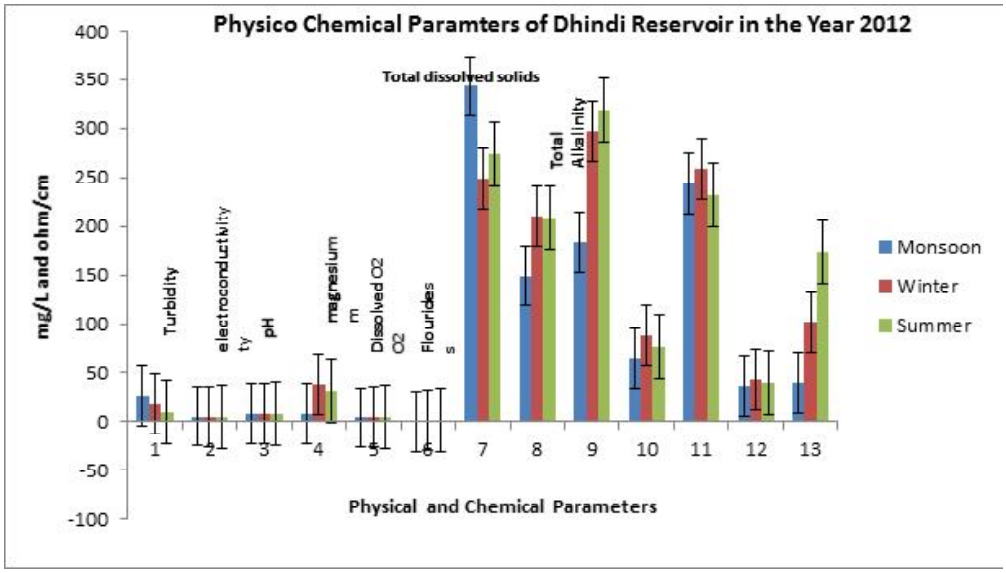

Fig-2.

Table-3. Physico- Chemical parameters in Dhindi Reservoir in 2013

Sl. No.	Parameters	Monsoon	Winter	Summer
1	Turbidity	27±0.09	13±0.11	10.7±0.29
2	Electrical conductivity at 25°C (Ω/cm)	5.16±0.44	4.5±0.32	4.9±0.06
3	pH	7.7±0.81	7.5±0.77	7.3±0.01
4	Magnesium (mg/L)	4±0.28	39±0.42	51±0.81
5	Dissolved Oxygen (mg/L)	3.3±0.08	5.8±0.61	4.1±0.99
6	Fluorides (mg/L)	0.39±0.04	1.7±0.09	1.4±0.05
7	Total Dissolve Solid (mg/L)	340±13.65	264±9.21	289±12.03
8	Total Alkalinity (mg/L)	142±5.31	211±10.92	211±7.11
9	Total Hardness (mg/L)	189±10.32	308±11.33	321±12.13
10	Calcium (mg/L)	52±2.32	89±9.24	81±0.42
11	Chloride (mg/L)	244±11.46	250±8.48	243±10.89
12	Nitrate (mg/L)	27±2.39	50±0.19	43±1.78
13	Sulphate	22±0.11	78±1.01	103±1.6

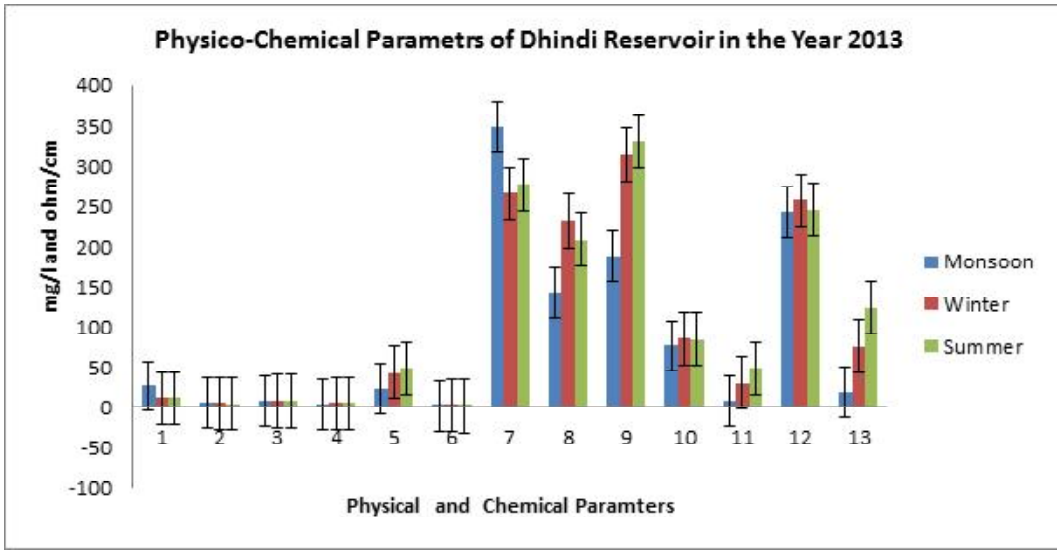

Fig-3.

Table-4. Physico- Chemical parameters in Dhindi Reservoir in 2014

Sl. No.	Parameters	Monsoon	Winter	Summer
1	Turbidity	21±0.38	16±0.22	10.7±0.52
2	Electrical conductivity at 25°C (Ω/cm)	5.4±0.89	4.5±0.66	4.8±0.92
3	pH	7.5±0.1	7.8±0.39	7.3±0.66
4	Magnesium (mg/L)	6±0.08	39±0.88	46±0.61
5	Dissolved Oxygen (mg/L)	3.3±0.08	4.1±0.91	4.5±0.21
6	Fluorides (mg/L)	0.33±0.009	1.9±0.09	0.91±0.01
7	Total Dissolve Solid (mg/L)	336±12.6	260±11.29	285±8.31
8	Total Alkalinity (mg/L)	146±7.21	211±9.18	228±10.87
9	Total Hardness (mg/L)	180±4.42	335±12.09	311±11.21
10	Calcium (mg/L)	60±0.55	88±1.42	97±1.69
11	Chloride (mg/L)	245±8.59	240±11.28	266±8.88
12	Nitrate (mg/L)	29±0.19	42±1.18	46±0.39
13	Sulphate	20±0.78	79±0.78	103±3.22

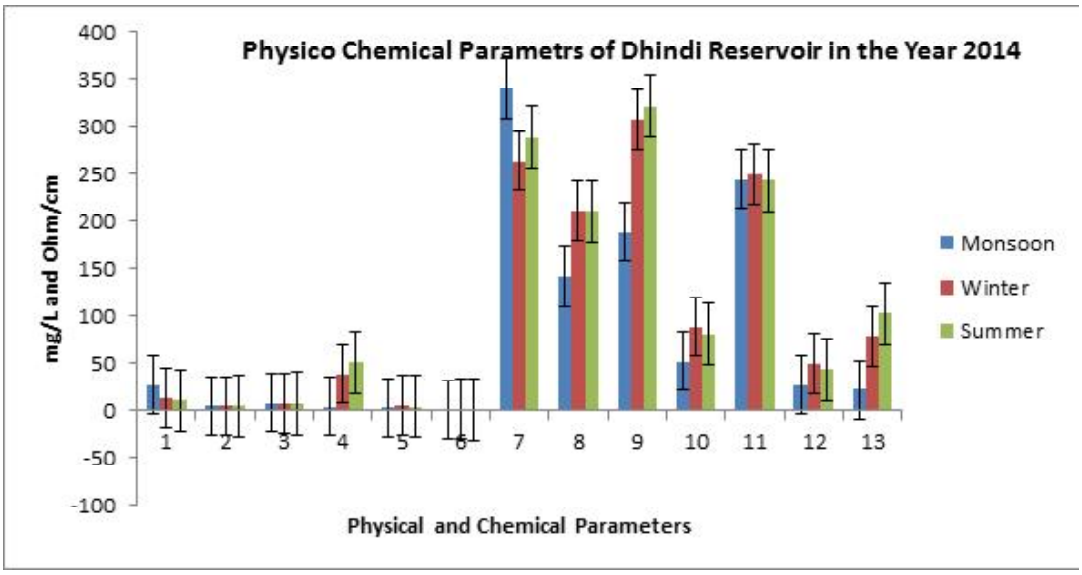

Fig.-4.

Table-5. Physico- Chemical parameters in Dhindi Reservoir in 2015

Sl. No.	Parameters	Monsoon	Winter	Summer
1	Turbidity	21±0.38	16±0.22	10.7±0.52
2	Electrical conductivity at 25°C (Ω/cm)	5.4±0.89	4.5±0.66	4.8±0.92
3	pH	7.5±0.1	7.8±0.39	7.3±0.66
4	Magnesium (mg/L)	6±0.08	39±0.88	46±0.61
5	Dissolved Oxygen (mg/L)	3.3±0.08	4.1±0.91	4.5±0.21
6	Fluorides (mg/L)	0.33±0.009	1.9±0.09	0.91±0.01
7	Total Dissolve Solid (mg/L)	336±12.6	260±11.29	285±8.31
8	Total Alkalinity (mg/L)	146±7.21	211±9.18	228±10.87
9	Total Hardness (mg/L)	180±4.42	335±12.09	311±11.21
10	Calcium (mg/L)	60±0.55	88±1.42	97±1.69
11	Chloride (mg/L)	245±8.59	240±11.28	266±8.88
12	Nitrate (mg/L)	29±0.19	42±1.18	46±0.39
13	Sulphate	20±0.78	79±0.78	103±3.22

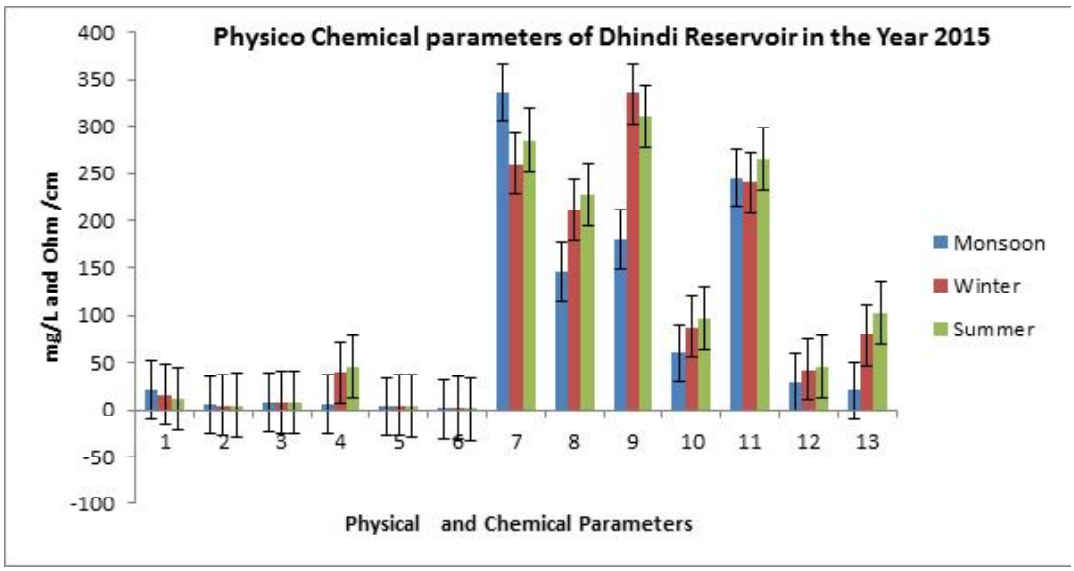

Fig.-5.

as 80-120 mg/l in fish ponds.Higher values of alkalinity (>300 ppm) have been reported to cause eutrophication. Hardness in water is due to the presence of dissolved salts of calcium and magnesium. It is unfit for drinking, bathing, washing and it also forms scales in boilers. Hence it is necessary to estimate the amount of hardness producing substances present in the water sample. Some of the samples have total dissolved solids, pH, alkalinity, total hardness, magnesium, calcium and dissolved oxygen values exceeding the permissible limits as prescribed by Indian standards. We noticed parameters such as electrical conductivity, chloride, nitrate and biological oxygen demand values are within permissible limits. This study showed that the water quality of Dindi reservoir remains as it is than it is the good ecosystem of the lake to survive the all the zooplankton and phytoplankton where they can act as bioindicators in all the water bodies. The government of Telangana such as TUDA, TMC and other civic organizations should take the action against releasing of domestic waste directly into the lake/ Dindi reservoir to make water bodies survival.

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