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Research Article

ANALYSIS OF PHYSICO-CHEMICAL PARAMETERS AND SEASON WISE VARIANCE OF PRIMARY PRODUCTIVITY OF GOGI LAKE, SHAHAPUR TALUK, YADIGR DISTRICT, KARNATAKA, INDIA

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Abstract: In the present research work an attempt systematic study of the physico-chemical water quality of Gogi Lake a freshwater body situated in Shahapur Taluk, Yadgir District, Karnataka, India. The research was carried out for a period of three seasons and ten different regions from the lake, during the period of June-2020 to May-2021. Monthly wise details were collected and represented seasonally. Different physico-chemical parameters like air temperature, water temperature, pH, electric conductivity, total dissolved solids, dissolved oxygen, turbidity, chloride, total alkalinity, total hardness, calcium, magnesium, free carbon dioxide, BOD, and COD were analyzed. In primary productivity, we measure energy available for the support of bioactivities in a system. Specifically, this study aims to determine the physico-chemical parameters and amount of primary productivity in Gogi lakes. Seasonal variation of primary productivity recorded as GPP, NPP, and CR. The results were shown the high productivity of Gogi Lake promotes the growth of organisms.

Keywords: *Water quality assessment, Physico-Chemical Parameters, Primary productivity, Ecosystem, Gogi Lake*

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Introduction

The freshwater resources on this planet are precious and limited. In order to survive on our planet, we depend on the environment. Freshwater quality is undergoing fundamental changes due to anthropogenic activities such as urbanization, industrialization, and intensive farming. A lot's land use can adversely affect its freshwater quality [1, 2]. The physicochemical water quality characteristics of any lake are influenced principally by natural and anthropogenic factors. Anthropogenic and natural factors influence the physicochemical water quality characteristics of lakes. Several natural factors contribute to hydrology, such as relief, rainfall, weathering, geology, catchment and atmospheric inputs, mixing of riverine freshwater with saline water, and climate variability [3]. For the production of food and the development of economics, water is an important factor in the functions of ecologically friendly organisms, human health, and ecosystem preservation. There is a great deal of importance to the health of drinking water. There are various chemical and microbiological pollutants in drinking water, which pollute its parameters. This contaminated water has the potential to cause severe health problems [4, 5]. Water has a better quality based on its physical, chemical, and biological characteristics. There is a small correlation between these parameters, and the significant one would provide information about water quality [6]. Water quality parameters are typically determined through monitoring, which is a conventional method. These methods require extensive sampling on the ground and expensive laboratory analysis, which are not time-efficient and can only be achieved in smaller areas [7]. An ecosystem's energy flow begins with plants and other autotrophic species converting sunlight into energy. As a result, primary production occurs in an ecosystem. This energy accumulates at a rate known as primary productivity. Hence, the gross primary production of energy is the total amount of energy accumulated [8].

A reservoir's primary production can help assess the potential for fish production of an aquatic ecosystem and better understand tropical status.

It is necessary to determine the reservoir's primary production to estimate its total biological activity. In order to understand both water quality and fisheries, it is vital to study primary production in lakes and reservoirs [9,10]. Abiotic and biotic factors influence primary production. Plankton diversity and water physico-chemical properties are affected by nutrient and dry matter enrichment in reservoirs. In order to define and study primary productivity, we need to look at Gross Primary Productivity (GPP), Net Primary Productivity (NPP), and Community Respiration (CR) [11].

Gogi is a place of historical importance. Located 85.3 km from Gulabraga University, Kalaburagi. The present study area is situated at Gogi, Shahapur taluk of Yadgir district. The district is bound on the west by Bijapur district, on the north by Gulbarga district of Karnataka, on the east by Maheboobnagar district of Telangana and on the south, by Raichur district of Karnataka. The average co-ordinates of the study area are 16°72' 58''N latitude and 76°74'19''E longitude with an elevation of 1609 ft. above the sea level.

The district falls below the Krishna River basin along with her tributary Bheema. Climatically the study area exhibits a high-temperature pattern with low rainfall and humidity and due to high temperature, the loss of surface water is very high. The lakes in the study region almost dry up, in summer but get filled up during the monsoon. That is also one of the fundamental causes for the loss of aquatic biodiversity in the Lake Ecosystem, while appearance-disappearance of the species is subject to seasonal changes. In response to increasing population growth, water consumption for domestic, industrial, and agricultural purposes is increasing, resulting in an insufficient supply of food to feed the nation. The research aimed to study Physio-Chemical parameters and primary productivity of the lake ecosystem was mainly carried out over one year, from June - 2020 to May -2021. The lake is a shelter for many bird species and another aquatic biodiversity with many aquatic plant species.

Materials and Methods

Study area and sample collection

The systematic study was carried out for Gogi Lake [Fig-1], a freshwater body situated in Shahapur Taluk, Yadgir District, Karnataka. The average coordinates of the study area are 16° 72'58''N latitude and 76° 74'19'' E longitude with an elevation of 1609 ft above sea level [12, 13].

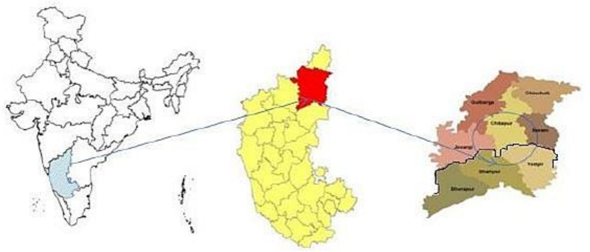


Fig-1 Location of the study area

The water sample was collected in 2 Litter pre-cleaned polythene bottles and transported to the laboratory for analysis of different types of Physico-chemical parameters. The water sample was collected for a period of two seasons, period of late June - 2020 to May-2021. The parameters such as atmospheric temperature, water temperature, pH, dissolved oxygen, turbidity EC, TDS, *etc*. were measured immediately on spot and, total alkalinity, total hardness, calcium, magnesium, chloride, biological oxygen demand and chemical oxygen demand were analyzed as per the standard analytical procedures prescribed [14, 15, 16].

Fig-2 Satellite view of the study area

Primary productivity analysis

The Primary productivities of the reservoir is determined by using the standard "Light and Dark bottle" method of Gardner and Gran (1927) at an interval of 30 days each month for one year from June 2020 to May-2021. The method of Gardner *et al*., (1927) is slightly modified by Vollenweider *et al*., (1974) and Wetzel *et al.,* (1971) to make it more suitable. The time of exposure (incubation period) in present study was for the period of 4 hours. The dissolved oxygen is estimated by the initial bottle and light and dark bottle method of Winkler [17].

The located net primary productivity (NPP), gross primary productivity (GPP), and community respiration (CR) in mg/m^3/hr were converted into gC/m^3/hr with the aid of multiplying those values with a factor of 0.375 as suggested by Benton and Werner (1972) and Parmar and Sharma (2018) [18,19,20].

Gross primary productivity (GPP): gC/m^3/hr.= DL-DD/hr. X 0.375

Net primary productivity (NPP): gC/m^3/hr.= DL-DI/hr. X 0.375

Community respiration (CR): gC/m^3/hr.= DI-DD/hr. X 0.375

Where,

DL-Dissolved oxygen in the light bottle in mg/L.

DD-Dissolved oxygen in a dark bottle in mg/L.

DI-Dissolved oxygen in the initial bottle in mg/L.

Hr-Duration of exposure (incubation period) in hrs.

Respiratory quotient = 0.375

Physico chemical statistical analysis

The statistical analysis was performed by Microsoft Office Excel packages 2007. Linear regression was used to detect the correlation coefficients between the average values of 15 physico-chemical parameters of Gogi Lake.

Results and discussion

Physico chemical analysis

The physico-chemical parameters of water like temperature, pH, electric conductivity, biological oxygen demand, dissolved oxygen, chemical oxygen demand, total alkalinity, carbonates, bicarbonates, calcium, magnesium, hardness, chlorides, sulphates, nutrients like nitrates and phosphates, turbidity and total dissolved solids are important to know the trophic nature of the water body. Water bodies are generally of three types oligotrophic, mesotrophic and eutrophic. Usually, mesotrophic water bodies are highly productive in nature. In the limnological study the consideration of physico-chemical factors contribute to making up of the specific ecosystems, which determined the trophic dynamics of the water body. It is necessary to know the physico-chemical properties of water to study the cultural practices of the fish in water bodies and the Average of Ten sampling station data of Gogi Lake values were shown in [Table-1] and [Fig-4,5 and 6].

The productivity of water sheets depends primarily on the physico-chemical and biological characteristics of water. These properties again depend on the nature of bottom soil and climatic conditions. Different physico-chemical parameters such as pH, electrical conductivity (EC), dissolved oxygen (DO), total alkalinity (TA), total hardness (TH), chloride (Cl), turbidity and total dissolved solids (TDS), biological oxygen demand (BOD), chemical oxygen demand (COD) of lake water were investigated during pre-monsoon, monsoon and post-monsoon period [21]. The groundwater was then evaluated for its suitability for drinking (as per BIS (1983) [22] and WHO (as per WHO, Intl. Std, 1993) [23].

Temperature °C

The temperature plays an important role in controlling the physico-chemical and biological parameters of water and is considered as one of the most important factors in the aquatic environment particularly for freshwater. The Air temperature was in the range of 24.3°C to 28.2°C and Water Temperature ranged between 21.1°C to 25.85°C observed the values were shown in [Table-1] and [Fig-4].

pH

The pH of water has a significant role in the survival of aquatic biota. The pH ranged from 7.2 to 8.0 from June-2020to May-2021were observed. The pre and post-monsoon seasons showed the high pH. The average pH recorded was 7.2 and 7.8 during June-2020 to May - 2021 the values were shown in [Table-1] and [Fig-3].

The pH of the water is mainly due to carbonates, bicarbonates and partially hydroxides. Carbonates and bicarbonates along with free CO_2 and carbonic acid form four species of inorganic carbon of the freshwater carbonic system. Their interaction with water molecules results in the displacement of H+ and OH-ions and the manifestation of a specific pH at which, the relative concentration of H_2CO_3, HCO_3- and CO_2-were fixed.

Electric conductivity (µS/cm)

The conductivity ranged from 515.2 µS/cm to 981.2 µS/cm was recorded. The lowest value is in the month of September-2020 the highest value is in the month of February-2021. The maximum conductivity was noticed in the pre-monsoon (917.825 µS/cm) period and the minimum was in the monsoon period (636.525 µS/cm) the results were shown in [Fig-3]. It has been found that EC between 20 and 1500 µs/cm is suitable for aquaculture. The higher value of EC happened due to the decomposition of macrophytes, dead animals and evaporation.

The conductivity of water depends on ions present in the water. The conductivity reflects the nutrient status of the water and the distribution of macrophytes. Minimum conductivity may be due to dilution of water, because of monsoon rains and utilization of ions by the residing community of the reservoir. Higher values of conductivity were recorded, which may be due to decomposition of macrophytes, dead animals present in the reservoir, evaporation and evapotranspiration of the reservoir. Electrical conductivity has a significant positive correlation with free carbon dioxide, bicarbonate, alkalinity, potassium and phosphate and a negative correlation with dissolved oxygen carbonate alkalinity and nitrates.

Table-1 *Average of ten sampling station data of Gogi Lake*

SN	Parameters	20-Jun	20-Jul	20-Aug	20-Sep	20-Oct	20-Nov	20-Dec	21-Jan	21-Feb	21-Mar	21-Apr	21-May
1	Air temperature ˚C	25.3	24.6	28.2	27.45	27.15	25.4	26.45	25.2	24.3	25.3	25.32	24.5
2	Water Temperature ˚C	24.15	23.6	25.85	25.1	25.05	24.5	24.4	24	21.1	23.15	23.4	23.3
3	pH	7.6	7.28	6.82	7.38	7.46	7.57	7.65	7.912	7.835	7.8	7.61	7.92
4	DO mg/L	6.3	5.94	6.194	6.97	7.333	5.216	6.888	6.104	7.319	7.038	6.107	6.952
5	Turbidity (JTU)	8.3	10.25	7.025	7.015	6.975	8.86	8.96	9.57	7.6	7.725	7.135	8.07
6	BOD mg/L	2.663	2.233	5.033	4.313	5.502	2.398	4.22	3.689	3.538	3.506	3.302	3.466
7	Electric conductivity µS/cm	977.2	543.4	510.3	515.2	517.6	547.5	716	864.3	951.3	981.2	881.8	857
8	Total Dissolve Solids.ppm	489.5	271.2	293.9	260.2	261.5	288.7	331.6	420.4	492.5	487.6	443.1	453.9
9	Total Alkalinity mg/L	418.4	349.41	515.7	273.9	227.6	348.1	317.1	393.5	449.3	450.4	489.2	458.4
10	Total Hardness mg/L	141.6	138.54	209	209	141.9	161	173.2	158.5	180.8	174.7	166.4	174.5
11	Calcium mg/L	37.66	40.76	36.33	42.81	42.57	41.44	46.54	53.26	47.97	49.18	46.95	51.81
12	Magnesium mg/L	25.77	23.88	25.68	19.21	18.09	28.79	29.64	24.99	32.3	30.56	29.1	29.83
13	Free carbon dioxide mg/L	20.47	16	16.71	13.68	18.64	15.52	12.71	9	16.13	16.36	15.6	14.52
14	Chloride mg/L	152.6	145.54	140.492	96.06	95.33	112.68	130.7	149.4	160.2	173.3	160.2	142.1
15	COD mg/L	120.8	100.8	108.2	105.8	99.2	74.6	115.6	96.43	110.6	176	179.2	132.4

Table-2 *The Average values of seasonal variation NPP, GPP, CR(gC/m³/hr.)*

Seasons	Months	Net Primary Productivity (gC/m³/hr.)	Gross Primary Productivity (gC/m³/hr.)	Community Respiration (gC/m³/hr.)
Monsoon	20-Jun	0.155	0.299	0.121
	July	0.156	0.257	0.14
	Aug	0.189	0.275	0.085
	Sep	0.106	0.199	0.101
Mean		0.151	0.257	0.117
Post monsoon	Oct	0.101	0.223	0.122
	Nov	0.119	0.255	0.138
	Dec	0.109	0.129	0.133
	21-Jan	0.102	0.24	0.117
Mean		0.107	0.212	0.128
Pre monsoon	Feb	0.034	0.201	0.107
	March	0.061	0.169	0.105
	April	0.17	0.257	0.086
	May	0.113	0.253	0.14
Mean		0.094	0.22	0.109
Minimum		April -2020: 0.17 gC/m³/hr.	December -2020: 0.129 gC/m³/hr.	August - 2020:0.085 gC/m³/hr.
Maximum		March -2020 : 0.061 gC/m³/hr.	July -2020: 0.299 gC/m³/hr.	July - 2020: 0.14 gC/m³/hr.

Table-3 *Correlation coefficients between the average values of target physico-chemical parameters of Gogi Lake*

Parameters	Air Temperature⁰C	Water Temperature ⁰C	pH	Electric conductivity JTU µS/cm	Total Dissolved Solids (PPM)	DO mg/l	Turbidity (JTU)	Chloride mg/l	Total Alkalinity mg/l	Total Hardness mg/l	Calcium mg/l	Magnesium mg/l	Free carbon dioxide mg/l	BOD mg/l	COD mg/l
Air temperature ˚C	1	0.984	0.711	0.982	0.947	0.977	0.593	0.749	0.569	0.08	0.053	0.998	0.006	0.245	0.82
Water Temperature ˚C	0.984	1	0.594	0.999	0.988	0.999	0.71	0.847	0.688	0.16	0.122	0.974	0.001	0.358	0.904
pH	0.711	0.594	1	0.586	0.488	0.568	0.094	0.212	0.081	0.075	0.106	0.745	0.362	0.002	0.288
Electric conductivity µS/cm	0.982	0.999	0.586	1	0.99	0.999	0.717	0.853	0.695	0.166	0.127	0.971	0.002	0.366	0.909
Total Dissolve Solids (ppm)	0.947	0.988	0.488	0.99	1	0.993	0.801	0.915	0.782	0.245	0.2	0.93	0.022	0.463	0.957
DO mg/L	0.977	0.999	0.568	0.999	0.993	1	0.734	0.866	0.713	0.18	0.14	0.965	0.005	0.384	0.919
Turbidity (JTU)	0.593	0.71	0.094	0.717	0.801	0.734	1	0.972	0.999	0.69	0.638	0.555	0.33	0.875	0.936
Chloride mg/L	0.749	0.847	0.212	0.853	0.915	0.866	0.972	1	0.964	0.527	0.473	0.715	0.185	0.746	0.992
Total Alkalinity mg/ l	0.569	0.688	0.081	0.695	0.782	0.713	0.999	0.964	1	0.711	0.661	0.532	0.352	0.89	0.924
Total Hardness mg/l	0.08	0.16	0.075	0.166	0.245	0.18	0.69	0.527	0.711	1	0.997	0.061	0.87	0.948	0.44
Calcium mg/l	0.053	0.122	0.106	0.127	0.2	0.14	0.638	0.473	0.661	0.997	1	0.038	0.904	0.921	0.386
Magnesium mg/l	0.998	0.974	0.745	0.971	0.93	0.965	0.555	0.715	0.532	0.061	0.038	1	0.013	0.214	0.791
Free carbondioxidemg/l	0.006	0.001	0.362	0.002	0.022	0.005	0.33	0.185	0.352	0.87	0.904	0.013	1	0.683	0.122
BOD mg/l	0.245	0.358	0.002	0.366	0.463	0.384	0.875	0.746	0.89	0.948	0.921	0.214	0.683	1	0.666
COD mg/l	0.82	0.904	0.288	0.909	0.957	0.919	0.936	0.992	0.924	0.44	0.386	0.791	0.122	0.666	1

*Note: Indicates that the correlation is significant at $p < 0.01$ level; * indicates that the correlation is significant at $p < 0.05$ level.*

Total Dissolved Solids (ppm)

Total dissolved solids mainly consist of inorganic salts such as carbonates, bicarbonates, chlorides, sulphates, phosphates and nitrates of calcium, magnesium, sodium, potassium, iron, *etc.* and a small amount of organic matter. The average concentration of total dissolved solids in Gogi Lake water ranged from 492.5 to 260.2 ppm, The BIS permissible limit of 2,000 ppm and the average season wise variation data is pre-monsoon (469.275 ppm), monsoon (328.7 ppm), post monsoon (325.55 ppm).

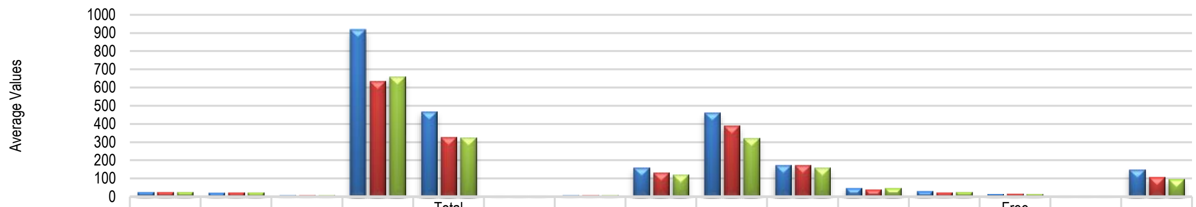
DO mg/L

The highest value of dissolved oxygen was recorded. The average values for the years were October - 2020 7.333 DO mg/L and July -2020 5.94 mg/L. And pre-monsoon months (6.854 mg/L), monsoon (6.351mg/L), post monsoon (6.38525 mg/L) during the period of June - 2020 to May-2021. The results were shown in [Table-1] and [Fig-3]. The lower values of dissolved oxygen in monsoon season and higher values in pre-monsoon were due to the surficial water of the reservoir during monsoon months, subjected to wind-generated turbulence and resultant mixing of surface and surface water layers.

Thus, in monsoon months, there establish oxygen equilibrium between the water and air. This is not disturbed by the vertical gradient of phytoplanktons or bacterial populations. The pollution stress is increased in water bodies due to the enrichment of nutrients and the decline of dissolved oxygen. The presence of pollutants like organic wastes caused rapid depletion of dissolved oxygen. Substances like NH_3, Nitrates, H_2S and oxidisable inorganic substances also decrease the dissolved oxygen in water [24].

Turbidity (JTU)

The turbidity of water can be related to the expression of an optical property and reflects the intensity of light scattered by the particles present in the water. The turbidity ranged from 6.975 JTU to 10.25 JTU. The maximum turbidity was recorded in the month of July-2020 and the minimum was recorded in the month of October-2020 and seasonally fluctuated turbidity.as well Season variation pre monsoon (7.6325), monsoon (8.1475), post monsoon (8.59125) readings were observed.



	Air temperature °C	Water Temperature °C	pH	Electric conductivity (µS/cm)	Total Dissolved Solids (PPM)	DO mg/L	Turbidity (JTU)	Chloride mg/L	Total Alkalinity mg/ L	Total Hardness mg/L	Calcium mg/L	Magnesium mg/L	Free carbon daioxide mg/L	BOD mg/L	COD mg/L
Pre Monsoon	24.855	22.7375	7.79125	917.825	469.275	6.854	7.6325	158.95	461.825	174.1	48.97875	30.44825	15.65675	3.453	149.55
Monsoon	26.3875	24.675	7.27	636.525	328.7	6.351	8.1475	133.673	389.3525	174.535	39.39275	23.6395	16.715	3.5605	108.9
Post Monsoon	26.05	24.4875	7.648	661.35	325.55	6.38525	8.59125	122.0275	321.575	158.65	45.97	25.3805	13.96925	3.95225	96.4575

Fig-3 Analysis and comparison of pre monsoon, monsoon, post monsoon physico-chemical properties of Gogi Lake

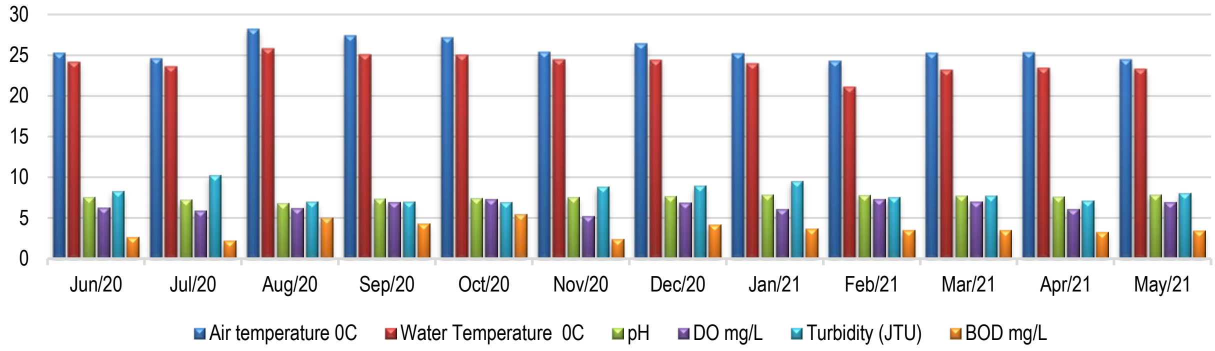


Fig-4 Analysis of month-wise average values of air temperature, water temperature, pH, DO, turbidity and BOD

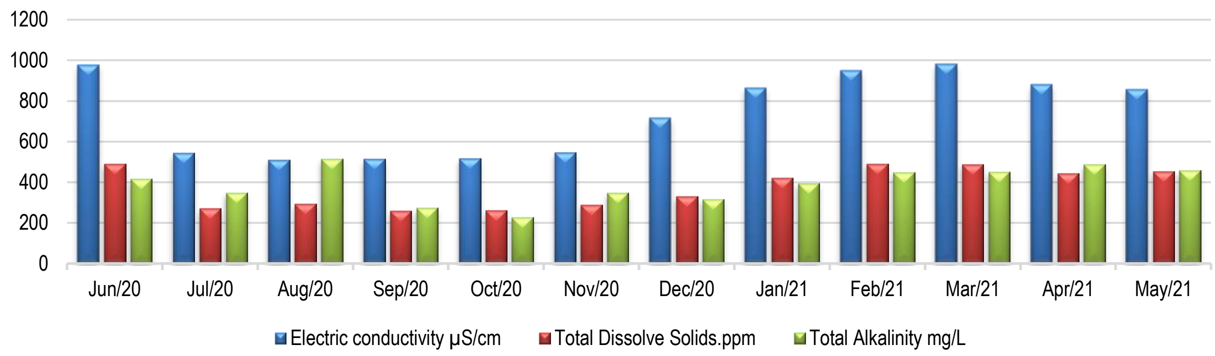


Fig-5 Analysis of month-wise average values of electric conductivity, total dissolved solids, total Alkalinity

Chloride mg/L

Salt deposits dissolving in water form ions (Cl^-) are primarily responsible for the presence of chlorides in natural waters. The presence of high concentrations may also be indicative of contamination due to sewage, industrial waste, or intrusion of seawater or another salty substance. Aquatic life relies heavily on inorganic anions. Metal pipes and structures as well as agricultural plants are adversely affected by high chloride contents. The monthly average chloride concentration of 95.33 mg/L between 173.3 mg/L was recorded, in the month of October-2020 minimum and maximum was recorded in March-2021. The highest value of chloride concentration was recorded in the pre-monsoon months (158.95 mg/L), monsoon (133.673 mg/L), post-monsoon (122.0275 mg/L) during 2020 [25].

Total alkalinity mg/L

The total alkalinity mg/L In rivers, measure of acid-neutralizing capacity, or buffering capacity. By removing H^+ ions from the water, alkaline compounds such as bicarbonates (baking soda is one), carbonates, and hydroxides lower the acidity of the water (increased pH). Typically, they do this by combining with H+ ions to form new compounds. The monthly average values range between 515.7 mg/L to 227.6 mg/L, the highest recorded in the month of August-2020 and the lowest in the month of October-2020 and the highest value of total alkalinity mg/L was recorded in pre-monsoon months (461.825 mg/L), monsoon (389.35mg/L), post monsoon (321.58 mg/L) during 2020 The results were showed in [Fig-7] [25].

Total Hardness mg/L

The total hardness of the water prevents lather formation with soap and increases the boiling point of water. The hardness of water mainly depends upon the amount of calcium or magnesium salt or both and it is an important criterion for determining the usability of water for domestic, drinking and many industrial supplies. In our findings, the value of hardness fluctuates between 209 mg/L to 138.5 mg/L, the height value is recorded in September-2020 and lowest recorded in July -2021 and Seasonal fluctuations of total hardness were recorded low during monsoon season and maximum during post-monsoon and pre-monsoon seasons. The recorded values are pre-monsoon (174.1 mg/L), monsoon (174.535mg/L), post monsoon (158.65mg/L) was observed.

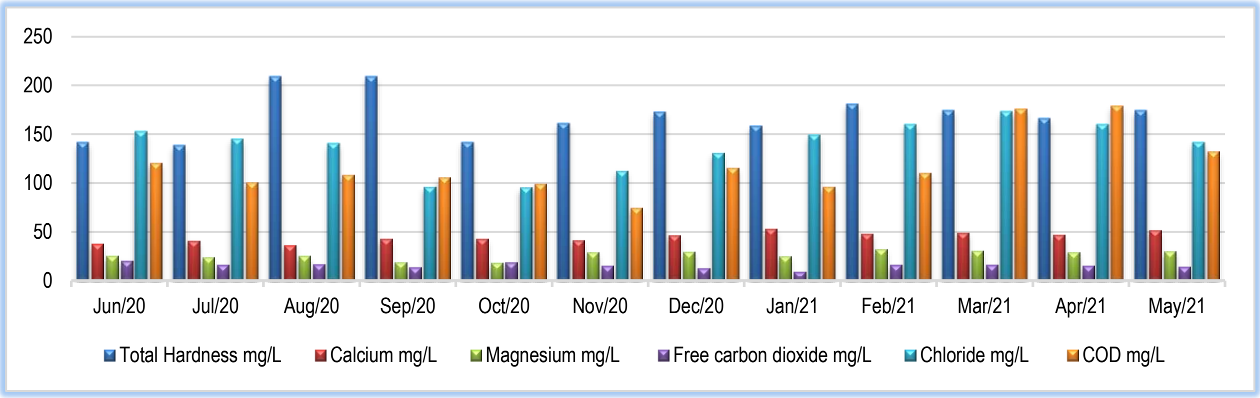
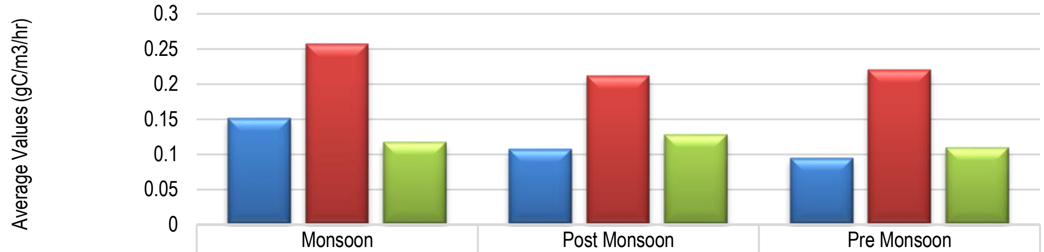


Fig-6 Analysis of month-wise average values of total Hardness, Calcium, Magnesium, Free carbon dioxide, chloride, COD



	Monsoon	Post Monsoon	Pre Monsoon
Net Primary Productivity (gC/m3/hr)	0.151	0.107	0.094
Gross Primary Productivity (gC/m3/hr)	0.257	0.212	0.22
Community Respiration (gC/m3/hr)	0.117	0.128	0.109

Fig-7 Seasonal variations in GPP, NPP and CR ($gC/m^3/hr$) Gogi Lake

Calcium mg/L

All aquatic organisms require calcium, which is commonly found in all water bodies. Average values for the year recorded highest 53.26 mg/L in the month of January-2021 and lowest was recorded 36.33 mg/L in the month of Aug-2020 and the highest value of calcium was recorded in the pre monsoon (48.98 mg/L), monsoon (39.39 mg/L) and post monsoon (45.97 mg/L).

Magnesium mg/L

Magnesium is found in various salt and minerals, frequently in association with iron compounds. Magnesium is a vital micronutrient for both plants and animals. Magnesium is often associated with calcium in all kinds of water. The average values for the year were recorded highest 32.31 mg/L in the month of February-2021 and the lowest was recorded 18.1 mg/L in the month of October-2020 and the highest value of calcium was recorded in the pre-monsoon (30.45 mg/L), monsoon (23.64 mg/L), and post monsoon (25.38 mg/L) [26].

Free Carbon Dioxide mg/L

Biological respiration, inflowing groundwater, decomposition of organic matter, and combinations of these sources may contribute to the accumulation of carbon dioxide within a water body. This may occur due to the action of calcium and magnesium alone or in combination. The highest value of Free Carbon dioxide was recorded in the monsoon (16.715 mg/L) pre-monsoon months (15.65675 mg/L), post-monsoon (13.96925 mg/L). The monthly average varied between the maximum 20.47mg/L was recorded in July-2020 and the minimum 9.0 mg/L was recorded in January-2021.

Maximum free carbon dioxide is produced during summer due to the decomposition of organic matter and the respiration of aquatic organisms. However, the minimum amount of free carbon dioxide may be attributed to a decrease in photosynthetic activity by aquatic organisms during monsoon [26].

BOD mg/L

Biological oxygen demand (BOD) is the quantity of oxygen required for the metabolic activities of microorganisms for the biological degradation of organic matter present in water. The readings were recorded in the monthly variation between 2.23 mg/L to 5.50 mg/L the maximum recorded in October-2020 and minimum recorded in July-2020. And pre-monsoon-3.45 mg/L, monsoon-3.56 mg/L and post-monsoon-3.95 mg/L. The concentration of chloride, nitrate and sodium ions and biological oxygen demand seems to decrease during the summer monsoon [27]. BOD is a measure of the dissolved oxygen consumed with the aid of microorganisms all during the oxidation of reduced substances in waters and wastes. BOD at once influences the amount of dissolved oxygen in rivers and streams. The extra the BOD, the more rapidly oxygen is depleted in the flow. This indicates less oxygen is to be had to better kinds of aquatic life. The results of the high BOD are the same as those for low dissolved oxygen aquatic organisms which end up stressed, suffocate and die. Sources of BOD encompass leaves and woody particles; dead plants and animals; animal manure; effluents from pulp and paper turbines, wastewater treatment plants, feedlots and food-processing plants; failing septic systems; and concrete stormwater runoff. The release of wastes with high stages of BOD can cause water satisfactory problems such as extreme dissolved oxygen depletion and fish kills within the receiving water bodies [28].

COD mg/L

In aquatic systems, chemical oxygen demand measures pollution. The presence of high COD could deplete oxygen levels in aquatic systems due to the decomposition of microbes. A measure of how much oxygen is present in water that is used in the various chemical reactions occurring in it (mainly oxidation). As a measure of how much oxygen is required for oxidation, chemical oxygen demand (COD) is determined by the amount of oxidant used. The COD values recorded ranges between 179.2 mg/L to 74.6 mg/L in maximum was April-2021and minimum was recorded in the month November-2020as well the values were shown in highest readings were recorded in the pre-monsoon (149.55 mg/L), monsoon (108.9 mg/L), post monsoon (96.45) [29].

Analysis of Seasonal Variation NPP, GPP and CR

The present study primary productivity of Gogi Lake, Yadgir District, Karnataka has been conducted for the period from June - 2020 to May-2021.

Seasonal variation of primary productivity was recorded as gross primary productivity, net primary productivity, and community respiration, and all the values were presented in [Table-2]. Net primary productivity is the rate of storage of organic matter in plant tissues in the excess of the respiratory use by the plants during the measurement period. This is also called apparent photosynthesis or net assimilation. The maximum value was recorded in pre-monsoon may be due to the clear water surface, which permitted lighter to penetrate and water flow perhaps accounted for the higher values of primary productivity during summer. A seasonal record at Gogi Lake showed a minimum in pre-monsoon - 0.094 gC/m^3/hr. and higher in monsoon -0.151gC/m^3/hr.

Gross Primary Productivity

It's for the overall charge of photosynthesis inclusive the organic matter used up in respiration for the duration of the measurement period. This is also known as total photosynthesis or total assimilation. The maximum value was recorded in pre-monsoon may due to the availability and utilization of solar radiation leading to the high biomass of phytoplankton and algal blooms. Minimum in monsoon may be due to the minimum photoperiod of the seasons with low solar radiation, temperature coupled with less abundance of number phytoplankton. GPP (gC/m^3/hr) the average mean values are monsoon - 0.257gC/m^3/hr, post-monsoon-0.212g C/m^3/hr, monsoon-0.22g C/m^3/hr was recorded.

Community respiration is defined as the reduction of NPP from GPP and later converted into releasing of CO_2. The study results indicate that community respiration of the reservoir is low during the monsoon, while high values were obtained during the summer season. The high community respiration of all biotic and abiotic components of organic matter reduces the content of dissolved oxygen. This examination supports the present investigation as dissolved oxygen was found low in concentration during the summer season. Community respiration the season-wise values are monsoon- 0.117gC/m^3/hr., post-monsoon-0.128 gC/m^3/hr., pre-monsoon- 0.109gC/m^3/hr was recorded.

Conclusion

In order to prioritize the factors affecting the water quality of the sampled streams, physico-chemical analysis was performed on data for month-wise (monsoon, pre-monsoon and post-monsoon seasons). Physio-chemical analysis of 15 parameters variables about water samples from 10 different sampling points (during the period of June - 2020 to May-2021) helped in understanding the main decisive factors of stream water quality across seasons. Gogi Lake is highly productive during the study period. High productivity lakes indicate that their food chain and food web are in good condition and the rich productivity of the reservoir also favors better growth of aquatic organisms like zooplankton and higher organisms of the lake.

Application of research: Study of rich productivity of the reservoir.

Research Category: Environmental Science

Abbreviations: GPP-Gross primary productivity
NPP-Net primary productivity, CR-Community respiration

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Study area / Sample Collection: Gogi Lake, Shahapur Taluk, Yadigr District, Karnataka, India

Cultivar / Variety / Breed name: Nil

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References

[1] Bakure B.Z., Fikadu S. and Malu A. (2020) *Appl Water Sci*, 10, 234.
[2] Anuradha K. and Rao N.B. (2021) *Annals of the Romanian Society for Cell Biology*, 5734-5750.
[3] Saturday A., Lyimo T.J., Machiwa J., *et al*., (2021) *Appl. Sci*., 3, 684.
[4] Chauhan R.K., Bansal A.K., *et al*., (2019) *International Journal of Engineering, Applied and Management Sciences Paradigms*, 54, 4.
[5] Ahmad T., Gupta G., Sharma A., Kaur B., Alsahli A.A., Ahmad P. (2020) *Water*, 12(9), 2365.
[6] Lakshmi P., Reddy M.S., Reddy C.P., Rao A.N. (2016) *J Earth Sci Clim Change*, 7, 347.
[7] Sharma R., Kumar R., Satapathy S.C., Al-Ansari N., Singh K.K., Mahapatra R.P., Agarwal AK, Le HV and Pham BT. (2020) *Environ. Sci*., 8, 581591.
[8] Gardner T., Gran H.H. (1927) *Cons Internat Explore Scient MerMediterr*, 42, 1-48.
[9] Amte G.K. Shinde P.P. and Ansari Gulista R. (2021) *International Journal of Engineering Research and Applications*, 11(5), 01-04.
[10] Maansi J.R. and Wats M. (2022) *Appl Water Sci*., 12, 2.
[11] Rathod R.P., Chavan B.R., Pai R.K. (2016) *Curr World Environ*., 11(1).
[12] Ranibai and Ramakrishna Reddy B. (2015) *Golden Research Thoughts*, 4.
[13] Bhaskar K., Nautiyal S., Imran Khan Y.D., Rajanna L. (2015) *IJIRSET*, 4, 2030-2037.
[14] Trivedi R.K. and Goel P.K. (1984) *Env. Pub. Karad, India*, 215.
[15] APHA (2005) (21thed.) *Washington DC, American Public Health Association*
[16] Kumar S., Jain V. and Raghuvanshi S.K. (2021) *Int. J. Adv. Res. Biol. Sci*., 8(3), 30-36.
[17] Wetzel R.D., Linkens G.E. (2000) *Edn 3, Springer Newyork. Xv*, 429.
[18] Parmar S. and Sharma V. (2018) *IJFBS*, 5(3), 105-107.
[19] Shwetanshumala, Sharma B.K. and Sharma L.L. (2019) *JEZS*, 7(3), 1647-1649.
[20] Benton A.H., Werner W.E. (1972) *Edn 5, Burgess Publishing Company, Minniapolis, Minnesota*.
[21] Kumari S., Khan J.A., Thakur M.S., Lal H. (2019) *J Atmos Earth Sci*, 2, 006.
[22] BIS, 1983, IS, 10500, (1983) *Indian standard Institute, New Delhi*.
[23] WHO (1993) *International standards for drinking water, World Health Organization, Geneva*.
[24] Ramachandra T.V., Sincy V., Asulabha K.S. and Vinay S. (2018) *J Biodiversity*, 9(1-2), 69-80.
[25] Sharma R., Kumar A., Singh N. (2021) *SN Appl. Sci.,* 3, 28.
[26] Elayaraj B. and Selvaraju (2015) *Journal of Environmental Treatment Techniques*, 3(2), 126-133.
[27] Umerfaruq M.Q., Solanki H.A. (2015) *J Pollut Eff Cont*., 3, 134.
[28] Bhateria R., Jain D. (2016) *Water Resour. Manag*., 2, 161-173.
[29] Islam M.S., Uddin M.K., Tareq S.M., Shammi M., *et al*., (2015) *Environments*, 2(3), 280-294.