*Environment & Ecology* 29 (3A) : 1451—1455, 2011
 *ISSN 0970-0420*

# Assessment of Water Quality Status in Muduganukunte Lake Gouribidanur Taluk, Karnataka

A. RAJESH GAVAL, V. R. RAMAKRISHNA PARAMA, M. D. RAJANNA, BALAKRISHNA GOWDA AND K. T. PRASANNA

*Department of Forestry & Environmental Science, University of Agricultural Sciences, GKVK Bangalore 560065, India*
*E-mail : gavalraj@gmail.com*

**Abstract**

The water bodies are facing a severe threat of pollution all over the world. To ensure fresh water availability from local water resources has become a big challenge. The main objective of this paper was to assess water quality status of Muduganukunte lake situated in Gauribidanur Taluk, Karnataka. The Muduganukunte lake is a part of historical, cultural, economical and recreational life of Gauribidanur. But now a days facing multifold pressure due to bathing, washing, agricultural practices and wet land encroachment. Different sampling sites ($MW_1$ to $MW_{10}$) were taken to assess the different physico-chemical parameters of the lake. The results revealed that $MW_9$ (1 m beyond the outlet) was recorded high value of pH (7.72), EC (0.05 dS/m), DO (10.14 mg/l), TDS (465.7 mg/l), Hardness (254.8 mg/l), carbonate (13.4 mg/l), bicarbonate (287.1 mg/l), calcium (25.98 mg/l), magnesium (19.4 mg/l), potassium (22.7 mg/l), sodium (75.6 mg/l), nitrate (9.18 mg/l), phosphate (0.99 mg/l), sulfates (59.78 mg/l) and chlorides (136.8 mg/l) as compared to all the sampling sites.

**Key words : Fresh water pond, Nutrients, Eutrophic, Lakes.**

Ponds in rural areas are most easily accessible sources of water for various human needs such as bathing, washing, irrigation aqua culture. Large numbers of ponds in the villages occupy a unique position in limnology and help in maintaining water table. Being open lentic water bodies, ponds are more easily susceptible to pollution due to various factors such as the industrial, municipal domestic waters and surface run off from adjoining areas (1). Ponds form the life lines in Indian villagers. The fresh water systems of the region are characterized by the seasonal fluctuations in water levels. Fresh water resources are deteriorating factor day-by-day and water quality is affected. The fresh water communities like phytoplankton zooplankton, macrophytes and macro invertebrate are sensitive to environmental factors. Different species of planktons vary in different seasons duer to changes in physical and chemical nature of water. The diversity index is also governed by physico-chemical characteristics of water like free carbon, oxygen, temperature and color (2). The study was made to assess the water quality of Muduganukunte lake in different seasons.

## Methods

A study was conducted to investigate the water quality status of Muduganukunte lake. Gouribidanur Taluk, Karnataka. Muduganukunte lake is located eight km from Gouribidanur and is situated between $13^0 36' 39.95''$ N latitude and $77^0 33' 53.60''$ E longitude. It covers an area of 28.77 hectare when full and is 1.5 meters deep at the middle of the tank. The lake is man made rainfed and used by people for anthropogenic and agricultural purpose, the catchments area is 18.30 sq km and the lake receives run off material from surrounding agricultural fields. The procedures were followed from the standard methods APHA et al. (3).

### *Sampling of Water*

Water samples from Muduganukunte lake were collected at regular interval for a period of one year during 2009. These samples were collected from ten sampling sites. All the samples were collected in dilute acid washed polythene bottles. The samples were

**Table 1.** Details of water sampling points at Muduganukunte lake.

| Site index | Sampling sites |
|---|---|
| $GW_1$ | Near Rock |
| $GW_2$ | Near Ficus tree |
| $GW_3$ | Near Bund |
| $GW_4$ | Near Bore well |
| $GW_5$ | Near Agricultural plot |
| $GW_6$ | Center of the lake |
| $GW_7$ | 1 meters before inlet |
| $GW_8$ | 50 meters before inlet |
| $GW_9$ | 1 meters beyond outlet |
| $GW_{10}$ | 50 meters beyond outlet |

brought to the laboratory on the day of collection and were analyzed for pH and electrical conductivity. Thereafter the samples were acidified to pH 2 with analytical grade $HNO_3$ and stored at 4C for further analysis. All the samples were collected in dilute acid washed polythene bottles. The samples were brought to the laboratory on the day of collection and were analyzed for pH and electrical conductivity. Thereafter the samples were acidified to pH 2 with analytical grade $HNO_3$ and stored at 4C for further analysis (Table 1).

## Results and Discussion

### *pH*

The maximum value of pH recorded was 7.72 at site $MW_9$ and minimum value of pH 7.24 was recorded at site $MW_1$(Table 2). The pH is considered as an important environmental factor. The rural lake pollution was due to intensive agriculture practices using heavy doses of NPK fertilizers in and around the lakes. Krishna Ram et al. (4) noted that the pH range of 6.7 to 8.4 is considered to be safe for aquatic life and to maintain productivity. However, pH below 4.0 and above 9.6 was hazardous to most of life forms. Dash et al. (1), reported that the pH gives an idea of the type and intensity of pollution, which influences aquatic production in rural areas.

### *Electrical Conductivity (EC)*

Maximum value of EC recorded was 0.05 dS/m at site $MW_9$ and minimum value of EC 0.028 dS/m was recorded at site $MW_1$ (Table 3). EC is a numerical expression of the ability of an aqueous solution to conduct electric current. This ability depends on the presence of ions, their total concentration, mobility, valence and relative concentrations. Conductivity increases with increase mobility of ions which are released by the breakdown of ionic compounds. They conduct electricity because they are negatively or positively charged (4). Therefore it is an indirect measure of the presence of dissolved solids suh as nutrients and can be used as an indicator and can be used as an indicator of water pollution.

**Table 2.** Methods followed for analysis of Muduganukunte lake water.

| Parameters (mg/l) | Methods | References |
|---|---|---|
| pH | Potentiometric method | 5 |
| EC (dS/m) | Conductometric method | 5 |
| DO | Stannous chloride method | 5 |
| Total dissolved solids (%) | Gravimetric method | 5 |
| Carbonate | Titration method using phenolphthalein indicator | 5 |
| Bicarbonate | Titration method using methyl orange indicator | 5 |
| Calcium | Versenate titration method | 5 |
| Magnesium | Versenate titration method | 5 |
| Potassium | Flame photometry | 5 |
| Nitrate | Phenol-Disulphonic acid method | 5 |
| Phosphates | Stannous chloride method | 5 |
| Sulfate | Turbidimetry method | 5 |
| Chlorides | Winkler's method using potassium chromate as indicator | 5 |

### *Dissolved Oxygen*

The maximum value of DO recorded to be 10.14 mg/liter at site $MW_9$ and minimum value of DO 7.9 mg/liter was recorded at site $MW_2$ (Table 3). Its plays a vital role in the growth of fauna and amount of oxygen in lake than atmospheric air but the amount is small in aqueous solution. It also acts as an indicator of tropic status and magnitude of eutrophication in fresh water ecosystems. The exchange of oxygen across air water interface depends upon temperature, partial pressure of gases in atmosphere, dissolved salt concentration, wave action, relative solubility, photosynthetic activity of plants and respiration by bacteria, plants and animals in the water (4).

**Table 3.** Water quality status of Muduganukunte lake water near Gauribidanur, Chikkaballapur district. M-Muduganukunte lake, W-Water sample.

| | | | Sampling stations | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Parameters | Units | $MW_1$ | $MW_2$ | $MW_3$ | $MW_4$ | $MW_5$ | $MW_6$ | $MW_7$ | $MW_8$ | $MW_9$ | $MW_{10}$ |
| 1 | pH | - | 7.24 | 7.25 | 7.53 | 7.55 | 7.45 | 7.45 | 7.57 | 7.67 | 7.72 | 7.6 |
| 2 | EC | ds/m | 0.028 | 0.03 | 0.031 | 0.031 | 0.03 | 0.03 | 0.04 | 0.04 | 0.05 | 0.04 |
| 3 | DO | mg/l | 7.99 | 7.9 | 8.3 | 8.5 | 8.2 | 9.03 | 9.08 | 9.72 | 10.14 | 9.5 |
| 4 | TDS | mg/l | 441 | 443 | 444 | 453 | 445.3 | 462.6 | 463.1 | 464.2 | 465.7 | 464 |
| 5 | Hardness | mg/l | 234.3 | 230.1 | 243.9 | 250.1 | 239.6 | 251.6 | 251.9 | 253.8 | 254.8 | 253 |
| 6 | Carbonate | mg/l | 6.23 | 6.57 | 7.4 | 7.5 | 7.2 | 9.5 | 10.7 | 11.5 | 13.4 | 11.27 |
| 7 | Bicarbonate | mg/l | 280.1 | 280 | 281.3 | 282.4 | 281 | 282.3 | 284.1 | 286.3 | 287.1 | 285.4 |
| 8 | Calcium | mg/l | 16.64 | 16.83 | 17.51 | 18.43 | 17.4 | 23.68 | 23.72 | 24.51 | 25.98 | 24.5 |
| 9 | Magnesium | mg/l | 10.68 | 10.78 | 11.3 | 12.8 | 11.39 | 16.2 | 18.25 | 18.9 | 19.4 | 18.1 |
| 10 | Potassium | mg/l | 14.27 | 14.38 | 14.4 | 14.9 | 14.5 | 20.4 | 20.9 | 21.5 | 22.7 | 21.3 |
| 11 | Sodium | mg/l | 68.72 | 68.91 | 69.3 | 70.5 | 69.4 | 73.1 | 73.4 | 74.5 | 75.6 | 74.15 |
| 12 | Nitrate | mg/l | 8.95 | 8.95 | 9.01 | 9.03 | 9 | 8.67 | 9.1 | 9.14 | 9.18 | 9.12 |
| 13 | Phosphates | mg/l | 0.76 | 0.78 | 0.81 | 0.82 | 0.79 | 0.77 | 0.81 | 0.95 | 0.99 | 0.88 |
| 14 | Sulfates | mg/l | 26.13 | 26.53 | 27.3 | 28.9 | 27.2 | 57.33 | 57.37 | 58.46 | 59.78 | 58.23 |
| 15 | Chlorides | mg/l | 97.43 | 97.43 | 98.71 | 98.81 | 98.1 | 132 | 133.8 | 135.8 | 136.8 | 134.6 |

*Total Dissolved Solids (TDS)*

In the present investigation maximum value of TDS was recorded to be 465.7 mg/liter site $MW_9$ and minimum value of TDS 441 mg/liter was recorded at site $MW_1$ (Table 3). In fresh water ecosystem dissolved solids originate from natural sources and depend upon location, geological basin of the water body, drainage, rainfall, bottom deposits and inflowing water. The cattle pollution and human interference also contribute to the enrich ment of dissolved soilds (4).

*Hardness*

Maximum value of hardness was recorded to be 254.8 mg/liter at site $MW_9$ and minimum value of hardness 230.1 mg/liter was recorded at site $MW_1$ (Table 3). Hardness is a measure of polyvalent cations (ions with a charge greater than + 1), in water hardness generally represents the concentration of calcium ($Ca^{2+}$) and Magnesium ($Mg^{2+}$) ions. Because these are the most common polyvalent cations generally water with hardness in the range of 0 to 60 mg/liter are termed soft, from 60 to 120 mg/liter moderately hard, from 120—180 mg/liter hard and above 180 mg/liter, very hard. If the water is very hard water softeners must be required to avoid deposits from fixtures.

*Carbonates ($CO_3$)*

Maximum value of carbonate was recorded to be 13.4 mg/liter at site $MW_9$ and minimum value of carbonate 6.23 mg/liter was recorded at site $MW_1$ (Table 3). Carbonate alkalinity is a measure of the buffering capacity of water or the capacity of bases to neutralize acids. Alkalinity is important in determining the lakes ability to neutralize acidic pollution from rainfall (4).

*Bicarbonates ($HCO_3$)*

Maximum value of bicarbonate was recorded to be 287.1 mg/liter at site $MW_9$ and minimum value of bicarbonate 280.1 mg/liter was recorded at site $MW_1$ (Table 3). Bicarbonate is a measure of bases to neutralize acids. Bicarbonates are added to water system if the water passes through soil and rock that contain minerals. In general term above pH 8.3, alkalinity is mostly in the form of carbonate and below 8.3, alkalinity is present mostly as bicarbonate. In this lake the bicarbonate contents were observed to quite high (6).

*Calcium (Ca)*

Maximum value of calcium was recorded to be 25.98 mg/liter at site $MW_9$ and minimum value of calcium 16.64 mg/liter was recorded at site $MW_1$ (Table 3). This is important component of the carbonic buffer system and also cycles through biotic and abiotic components of the ecosystem. Krishna Ram et al. (7)

noted that calcium as a main cation or factor causes water hardness in natural water. It originates from natural process i.e. as dissolvent of minerals containing calcium and other sources such as industrial wastes and agricultural wastes and this is non-toxic.

*Magnesium (Ca)*

Magnesium was maximum of 19.4 mg/liter at site $MW_9$ and minimum of 10.68 mg/liter at site $MW_1$ (Table 3). It is main cation causing water hardness. In natural water magnesium comes from natural process that is on dissolvent of mineral containing Mg and from other sources such as industrial and agricultural wastes. Higher magnesium reduces the utility of water for domestic use as concentration above 500 mg/liter impart unpleasant taste and renders water unfit for drinking and also higher concentrations of magnesium has been proven to be diuretic (6)

*Sodium (Na)*

The maximum value of sodium recorded was 68.72 mg/liter at site $MW_9$ and minimum value of sodium 75.6 mg/liter was recorded at site $MW_1$(Table 3). Sodium is the main cation from natural minerals dissolves in water. The concentration is remarkably high and its limits the biological diversity, because of osmotic stress.

*Potassium (K)*

The maximum value of potassium recorded was 22.7 mg/liter at site $MW_9$ and minimum value of potassium 14.27 mg/liter was recorded at site $MW_1$(Table 3). Potassium is the main cation in natural fresh water. It plays a vital role in metabolism of fish environment and is an important– macro nutrients (4).

*Nitrates ($NO_3$)*

The maximum value of nitrate recorded was 9.18 mg/liter at site $MW_9$ and minimum value of nitrate 8.95 mg/liter was recorded at site $MW_1$ (Table 3). Nitrate concentrations of the water bodies are influenced by the geochemical conditions of organic load. The mineralization of rainfall is found to be responsible for increasing the amount of nitrate in water. The presence of excessive nitrate in water is due to manmade domestic activities and fertilizers from fields (4). Nitrate at high load may cause eutrophication of aquatic body.

*Phosphates ($PO_4$)*

The maximum value of phosphates recorded was 0.99 mg/liter at site $MW_8$ and $MW_{10}$ and minimum value of phosphates 0.76 mg/liter was recorded at site $MW_1$ (Table 3). Phosphorus is a nutrient required by all organisms for the basic processes of life. In lakes, phosphorus is often found to be the growth limiting nutrient, because it occurs in the least amount relative to the needs of plants for phosphates, 0.08 ppm was the critical level for occurrence for eutrophication in lakes. Phosphate at high load may cause eutrophication of aquatic body. There are various sources of phosphate to the lake water, such as rock deposit, runoff surface catchments and interaction between the water and sediment from dead plant and animal remains at the bottom of the lakes. Phosphate is considered to be the most significant among the nutrients responsible for eutrophication of lakes, as it is the primary initiating factor. Phosphate enters the lakes in domestic waste water, accounting for the condition of eutrophication. Atmospheric input may account for a significant proportion of the influx of nutrients to the lakes (4).

*Sulfates ($SO_4$)*

The maximum value of sulfates recorded was 59.78 mg/liter at site $MW_9$ and minimum value of sulfates 26.13 mg/liter was recorded at site $MW_1$ (Table 3). Sulfur exits in a number of oxidation states, from the most oxidized sulfate to sulfur can take place in both aerobic and anaerobic conditions (8). A high concentrations of sulfates stimulates the action of sulfur reducing bacteria which produce hydrogen sulphide, a gas highly toxic to fish life and high concentrations of sulfate associated with the depletion of oxygen led to anoxic and anaerobic conditions in the lake water.

*Chloride*

The maximum value of chloride recorded was 136.8 mg/liter at site $MW_9$ and minimum value of chloride 97.43 mg/liter was recorded at site $MW_1$ (Table 3).

This element in an important component of the carbonic buffer system and also cycles through biotic and abiotic components of ecosystem (8). The chloride values are maximum in bottom layer and this may be due to washing down of organic matter from the surrounding catchment area.

**References**


1. Das J. R., P. C. Dash and H. K. Patra. 2008. Statistical studies on the surface water quality in rural areas around Angul–Talcher industrial zone, Orissa. *J. Ecotox. Envi. Monit.* 18 : 101—114.
2. Himansu B., Mohanauda, M. R. Mahananda and B. P. Mohanty. 2005. Studies on the physico-chemical and biological parameters of Kuchinda pond pollution. *Eco. Env & Cons.* 11 : 537—541.
3. APHA, AWWA and WPCF. 1975. *Standard methods for examination of water and wastewater*, 14th edition. Am. Pub. Hlth. Assoc., Washington, DC, USA. 1—624 pp.
4. Krishna Ram H., M. Mohan, Ramachandra and Y. Vishalakshi. 2007. Limnological studies on Kolaramma Lake Kolar, Karnataka, *Environ. Ecol.* 25: 364—367.
5. Manivasakam N. 1987. *Physico-chemical examination of water, sewage and industrial effluent*. Pragathi prakashan.
6. Krishna Ram H., M. Mohan and Ramachandra. 2008. Nutrient overloading of a few lakes in Bangalore, Karnataka. *Environ. Ecol*. 26 : 300—302.
7. Krishna Ram H., M. Mohan and Ramachandra. 2008. Limnological studies on Thalli lake, Krishnagiri District, Tamilnadu. *Environ. Ecol*. 26 : 1518—1522.
8. Krishna Ram H., M. Mohan, Ramachandra, A. Naidu and Savithri. 2008. Water quality status of Amanikere lake, Kolar, Karnataka. *Environ. Ecol.* 26 : 1462—1470.