

Analysis of water quality using physico-chemical parameters in lower manair reservoir of Karimnagar district, Andhra Pradesh

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ABSTRACT

This study was aimed to estimate current status of physico-chemical characteristic of Lower Manair Reservoir at Karimnagar District, Andhra Pradesh. Monthly changes in physico-chemical parameters such as water temperature, pH, turbidity, transparency, total dissolved solids, total hardness, chlorides, phosphate, nitrates, dissolved oxygen and biological oxygen demand were analyzed for a period of one year from September 2009 to August 2010. The results indicated that physico-chemical parameters of the water were within the permissible limits and can be used for domestic, irrigation and pisciculture.

Keywords: Lower Manair Reservoir, Physico-chemical parameters, Monthly variation, DO, BOD, irrigation.

1. Introduction

Water resources are of critical importance to both natural ecosystem and human development. It is essential for agriculture, industry and human existence. The healthy aquatic ecosystem is depended on the physico-chemical and biological characteristics (Venkatesharaju et al 2010). 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 and biological characteristics. To asses that monitoring of these parameters is essential to identify magnitude and source of any pollution load. These characteristics can identify certain condition for the ecology of living organisms and suggest appropriate conservation and management strategies. Many researches are being carried out till present (Rajesh et al 2002, Jayaraman et al 2003, Sharma & Gupta 2004; Rajasekar et al., 2005; Sridhar et al., 2006; Anilakurmary et al., 2007; Prabu et al., 2008; Raja et al., 2008; Pradhan et al., 2009; Srivastava et., 2009; Damotharan et al., 2010; Prasanna and Ranjan, 2010). In order to assess water quality index we have carried out the physico-chemical analysis of water in Lower Manair Reservoir. The aim of the study is too reveled out the pollution status of Reservoir in terms of physico-chemical characteristics of water. However, very little information is available in relation to physico-chemical characteristics of water in the Lower Manair Reservoir, at Karimnagar. Hence, the preset study was conducted to study the physico-chemical properties of water in the Lower Manair Reservoir of Karimnagar for a period of one year from September 2009 to August-2010.

2. Materials and method

2.1 Study area

To evaluate the water quality an effort was made to investigate the water in Lower Manair Reservoir, Karimnagar District, and Andhra Pradesh, India. It lies between North latitude 18°38' and East longitude 79°12'. The total area of the reservoir is about 8,103 hectare and maximum depth is 21.9m. The climatic condition of the study area was hot summer and cool winter. In the present study period temperature range a minimum 29°C and a maximum of 38°C. The region gets much rainfall from south west monsoon. The place gets most of its rainfall from June to September during the monsoon. In October and November also increased rainfall from the north east monsoon. The average rainfall of this study area is 100.9 mm. The water of this Reservoir is used for drinking, agriculture and supports fish culture.



Figure 1: Map of the study area showing the different sampling stations.

2.2 Collection of sample

In order to determine the water quality index four stations were chosen for sample collection from the Reservoir during September 2009 to August 2010 in the first week of every month. The sampling locations are shown in a figure-1. Some of the results were recorded at the sampling stations whereas the others were recorded in the laboratory, according APHA, 2005, Kodarkar et al, 2008.

3. Results and discussion

Mean values of physico-chemical parameters are presented in Table-1 and correlation coefficients among physico-chemical parameters are shown in Table-2

3.1 Water temperature

Temperature of Reservoir water ranged from 24.75°C to 28.5°C in different seasons (Figure 2). High seasonal variations were observed at all the sites. Water temperature was high due to

low water level, high air temperature and clean atmosphere. Sharma et al (2000) observed that water temperature fluctuate between 21°C to 29°C during limnological studies of Udaipur lakes.

3.2 pH

During present study water pH values were found (6.99 to 7.0075). It is indicating alkalinity nature throughout the study period (Figure 3). The high values may be due to attributed sewage discharged by surrounding city and agricultural fields. pH value is very important for plankton growth (Chisty, 2002). According to Umavathi et al (2007) pH is ranged 5 to 8.5 is best for plankton growth.

3.3 Turbidity

In the present study water turbidity values ranged from 0.5 to 10.5 NTU (Figure 4). The results supported by Dagaonkar and Saksena (1992) and Garg et al (2006b) have also reported high turbidity during rainy season. During rainy season silt, clay and other suspended particles contribute to the turbidity values, while during winter and summer seasons settlement of silt, clay results low turbidity.

3.4 Transparence

In the present study water transparency values ranged from 18.58 to 32.62 cm (Figure 5) which indicates productive nature of this water on the basis of clarity values as proposed by Sharma and Durve (1991). Khan and Chowdhury (1994) reported that higher transparence occurred, during winter and summer due to absence of rain, runoff and flood water as well as gradual settling of suspended particles. Kadam et al (2007) also reported similar observation from Masoli reservoir of Parbhani district, Maharashtra.

3.5 Total dissolved solids

Total dissolved solids value ranged from 261.25 to 269.05 mg/l in different seasons (Figure 6). Similar findings have been reported by Rao et al 2003, Kirubavathy et al 2005, Garg et al 2006b. TDS analysis has great implications in the control of biological and physical waste water treatment processes.

3.6 Total hardness

In the present study total hardness ranged from 161.5 to 183.75 mg/l in different seasons (Figure 7). These high values may be due to the addition of calcium and magnesium salts. The increase in hardness can be attributed to the decrease in water volume and increase in the rate of evaporation at high temperature. Hujare (2008) reported total hardness was high during summer than rainy season and winter season.

3.7 Chloride

Chloride found high during the study ranged from 36.39 mg/l to 40.44 mg/l (Figure 8). Similar results were reported by Swarnalatha and Nasing rao (1998) and Umavathi et al (2007) showed that higher concentration of chloride is association with increased level of pollution.

3.8 Phosphate

It is one of the most important nutrient and a limiting factor in the maintenance of reservoir fertility. During the study the phosphate concentration ranged from 0.015 to 0.0575 mg/l in different seasons (Figure 9). This finding is agreement with that of Udaipur lakes (Ranu 2001, Chisty 2002).

3.9 Nitrate

During the study Nitrate fluctuated between 0.02 to 0.03mg/l (Figure 10). These values are much lower than the chisty (2002) and Rani et al (2004). High concentration of nitrate in drinking water is toxic (Umavathi et al 2007).

3.10 Dissolved oxygen

Dissolved oxygen is an important aquatic parameter, whose presence is vital to aquatic fauna. It plays crucial role in life processes of animals. In the present study the DO values found from 5.60 to 8.395 mg/l (Figure 11). Dissolved oxygen concentrate was 5mg/l throughout the year the reservoir is productive for fish culture Benerjee (1967) Torzwall (1957). Rani et al., (2004) also reported lower values of Dissolved oxygen in summer season due to higher rate of decomposition of organic matter and limited flow of water in low holding environment due to high temperature.

3.11 Biochemical oxygen demand (BOD)

Biological oxygen Demand (BOD) is an important parameter to the oxygen required to degradation of organic matter. During the study period BOD recorded from 2.62 to 3.975 mg/l which is within the permissible range (Figure 12). Devaraju et al (2005) has made similar observations in Maddur Lake and Garg et al., 2010 has also made similar observations in Ramsagar reservoir. High BOD value is unflavored with zooplankton.

Table 1: Showing Seasonal mean and statistical characteristics of water from Lower Manair Reservoir during September-2009 to August- 2010

| S.No | Parameters | Seasonal mean | | | Statistical parameters | | | | |
|------|------------|---------------|--------|--------|------------------------|-------|---------|---------|--------|
| | | Winter | Summer | Rainy | Mn | Mx | Mean | SD | SE |
| 1 | WT | 24.75 | 28.5 | 25.75 | 24 | 30 | 26.333 | 2.0150 | 0.591 |
| 2 | pH | 7 | 7.0075 | 6.99 | 6.99 | 7.01 | 6.999 | 0.0079 | 0.002 |
| 3 | TUR | 1 | 0.5 | 10.5 | 0 | 12 | 4 | 4.8617 | 1.403 |
| 4 | TR | 32.61 | 29.122 | 18.58 | 17.03 | 40.03 | 26.771 | 7.6641 | 2.212 |
| 5 | TDS | 261.25 | 269.05 | 262.8 | 257.8 | 272.8 | 264.366 | 5.3826 | 1.55 |
| 6 | TH | 161.5 | 183.75 | 168.25 | 159 | 188 | 171.166 | 12.209 | 3.524 |
| 7 | Cl | 38.72 | 40.44 | 36.39 | 35 | 42.01 | 38.5183 | 2.2457 | 0.648 |
| 8 | P | 0.015 | 0.0575 | 0.045 | 0.01 | 0.1 | 0.0391 | 0.03579 | 0.0103 |
| 9 | N | 0.020 | .012 | 0.03 | 0 | 0.04 | 0.0208 | 0.01379 | 0.003 |
| 10 | DO | 8.395 | 5.6025 | 5.83 | 5.18 | 9.72 | 6.6091 | 1.74508 | 0.503 |
| 11 | BOD | 2.88 | 3.975 | 2.62 | 2.2 | 5 | 3.1583 | 0.8167 | 0.253 |

WT= Water temperature, pH, TUR= Turbidity, TR= Transparence, TDS=Total dissolved solids, TH= Total hardness, Cl=Chloride, P= Phosphate, N= Nitrate, DO=Dissolved oxygen, BOD=Biological oxygen demand.

4. Correlation (r) between different parameters

In the present study the correlation coefficient (r) between every parameter pairs in computed by taking the average values as shown in table-2. Correlation coefficient (r) between any two parameters, x & y is calculated for parameter such as water temperature, pH, turbidity, transperance, total dissolved solids, total hardness, chloride, phosphate, nitrate, dissolved oxygen and biological oxygen demand of the Lower Manair Reservoir water. The degree of line association between any two of the water quality parameters as measured by the simple correlation coefficient (r) is presented in table-2 as 11×11 correlation matrix. The water temperature has been found to show positive correlations with pH, total dissolved solids, total hardness, chloride, phosphate and biological oxygen demand. The transparency has been found to show positive correlation with chloride, dissolved oxygen and biological oxygen demand while nitrate negatively correlated with transparency. There is a strong positive correlation (r=0.82794) between pH and chloride. Biological oxygen demand showed significant positive correlation pH and Chloride. pH and turbidity showed a highly significant negative correlation(r=-0.8725).

Table 2: Correlation Coefficient (r) among physic-chemical parameters of the Lower Manair Reservoir

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|----|---------|----------|----------|----------|----------|----------|----------|----------|--------|--------|----|
| 1 | 1 | | | | | | | | | | |
| 2 | 0.64478 | 1 | | | | | | | | | |
| 3 | 0.24127 | -0.8725 | 1 | | | | | | | | |
| 4 | 0.09269 | 0.52447 | -0.78305 | 1 | | | | | | | |
| 5 | 0.70850 | 0.51898 | -0.25359 | -0.08766 | 1 | | | | | | |
| 6 | 0.70700 | 0.49924 | -0.24811 | -0.07983 | 0.91641 | 1 | | | | | |
| 7 | 0.59697 | 0.82794 | -0.71099 | 0.57372 | 0.43835 | 0.40292 | 1 | | | | |
| 8 | 0.63442 | 0.22154 | 0.04701 | -0.28242 | 0.39715 | 0.55580 | 0.20740 | 1 | | | |
| 9 | 0.18218 | -0.49857 | 0.54018 | -0.50965 | -0.064 | -0.16422 | -0.40792 | -0.44183 | 1 | | |
| 10 | 0.32729 | 0.02882 | -0.28926 | 0.12710 | -0.20188 | -0.415 | -0.11947 | -0.29923 | -0.006 | 1 | |
| 11 | 0.56319 | 0.599107 | -0.50571 | 0.489062 | 0.297495 | 0.444357 | 0.705021 | 0.196479 | -0.101 | -0.373 | 1 |

Data is the mean value of monthly collected samples. The values (r) ranged from 0.400 to 0.52 and 0.53 to above are significant at P<0.05 and P<0.01 respectively. 1. Water temperature 2. pH 3.Turbidity 4.Transperance 5. Total dissolved solids 6. Total hardness 7. Chloride 8. Phosphate 9. Nitrate 10. Dissolved oxygen 11.Biological oxygen demand.

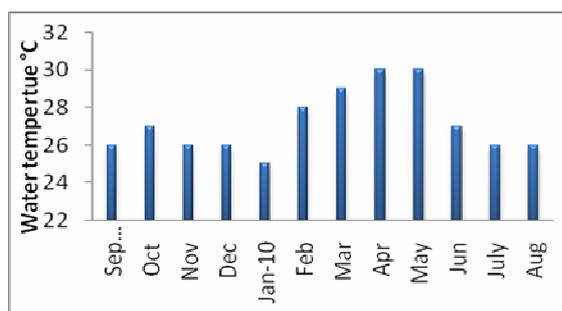


Figure 2: Monthly variations in water temperature



Figure 3: Monthly variation in pH

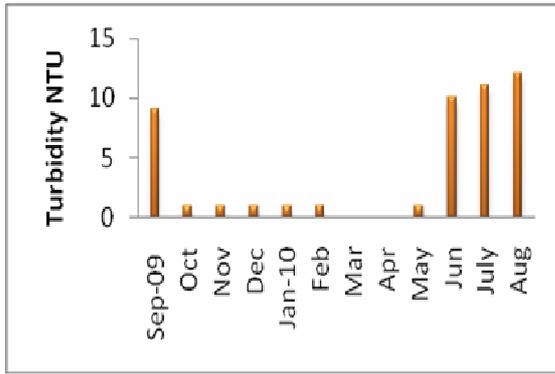


Figure 4: Monthly variations in turbidity.

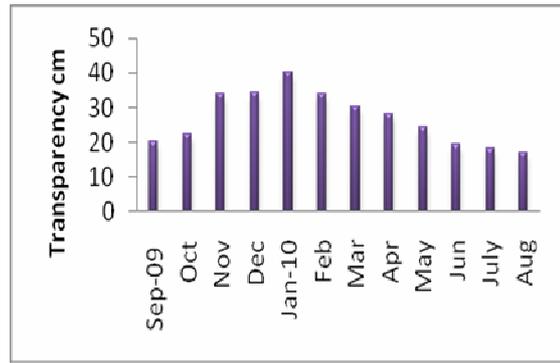


Figure 5: Monthly variations in transparency

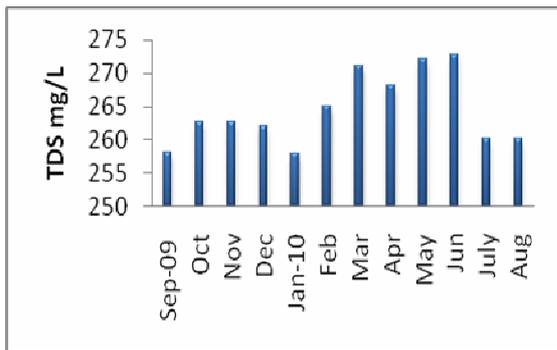


Figure 6: Monthly variation in TDS

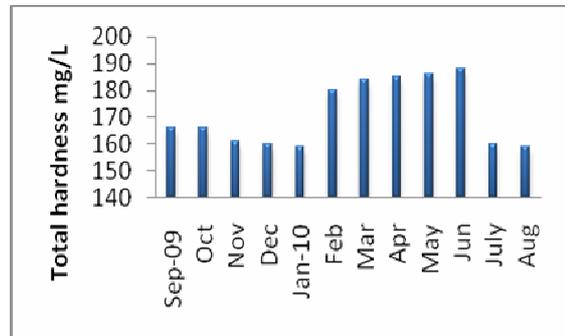


Figure 7: Monthly variation in TH

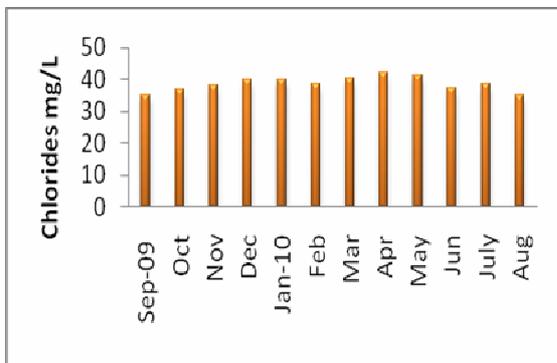


Figure 8: Monthly variation in Chlorides

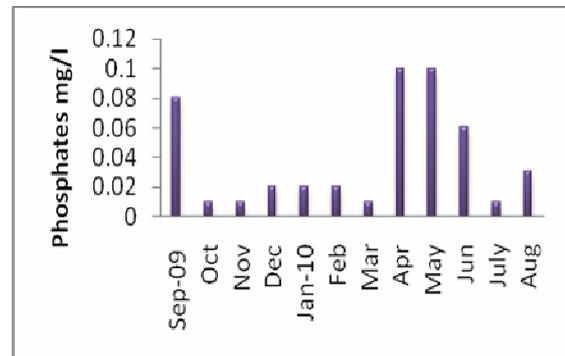


Figure 9: Monthly variation in Phosphates

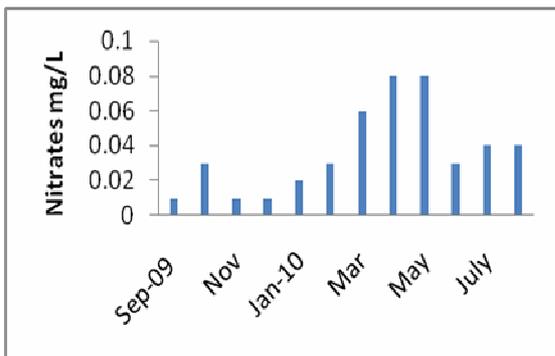


Figure 10: Monthly variation in Nitrates

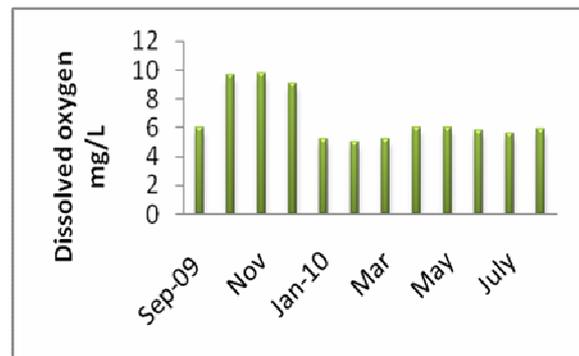


Figure 11: Monthly variation in DO

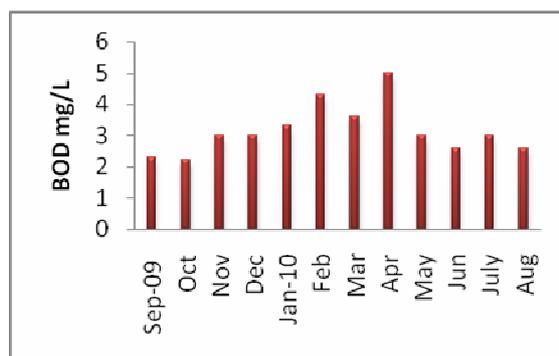


Figure 12: Monthly variation BOD

5. Conclusion

All the physical and chemical properties of Lower Manair Reservoir water were within desirable limits. The results obtained from the present investigation shall be useful in future management of the reservoir. The physico-chemical characteristics of reservoir water suggested that there was no harmful to pisciculture, irrigation and drinking water.

6. References

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