

# LIMNOLOGICAL STUDIES OF GOVINDGARH LAKE, REWA (M.P.)

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**ABSTRACT:** The present study includes the estimation of twelve various physico-chemical parameters and seasonal abundance of zooplankton of Govindgarh lake during the year 2017-2018. The estimated physico-chemical parameters were Temperature, pH, Transparency, Total dissolved solids, Dissolved oxygen, Carbon dioxide, Total alkalinity, Chloride, Phosphate, Total hardness and Biological oxygen demand. This lake water is used for domestic and irrigation purpose in this area. All the estimated parameters are within the permissible limits of BIS, WHO standards. The four major groups of zooplankton were observed throughout the study period. The identified groups are Rotifera, Copepoda, Cladocera and Ostracoda respectively. Among the four groups Rotifera group of zooplanktons were most dominated species.

**KEYWORDS:-** Physico-chemical parameters, Zooplankton, Rotifera and aquatic ecosystem..

## INTRODUCTION:-

The lentic environment has been including all inland water, in which the water has been not continually flowing in a definite direction. Lakes and rivers are most important water resources in India. Lakes are precious to all life on the earth, we must make renewed efforts to conserve and restore Lake Environment. The amount of freshwater on earth is very small compared to seawater (oceans), of which 69.6% is locked up in continental ice, 30.1% in underground aquifers, and 0.26% in rivers and lakes. Lakes in particular occupy less than 0.007% of the world's freshwater. As a result of water pollution the less amount of freshwater to be polluted and harmful to human being and aquatic fauna. Hence we have to assess the quality of water with the using of physical, biological parameters. The physico-chemical parameters are very important in study of any environmental especially aquatic ecosystem environmental form the coast of India. Much more research work has been done in regard of the hydrobiological aspects and limnology of the lake providence (Moore, 1950). Biological methods of

assessing water quality had been used in Europe early in 20th century (Kolkwitz and Marson, 1908, 1909). Physico-chemical and biological parameters play very important role in assessment of water quality. The study of different water bodies is very important in understanding of the metabolic events in aquatic ecosystem. The parameters influence each other and also the sediment parameter, as well as they governs the abundance and distribution of flora and fauna. The important physico-chemical factors which influence the pond productivity but individually are depth, temperature, transparency, pH, DO, free CO<sub>2</sub>, total alkalinity and dissolved nutrients (Banerjee, 1967). Zooplankton also plays a very important role in increasing photosynthesis, in some algae which pass through their nutrient rich alimentary canal in viable condition (Porter et al., 1976). The occurrence and abundance of zooplankton depends on its productivity which in turn is influenced by biotic factors and the level of nutrients in the water.

## MATERIALS AND METHODS:-

Water samples were collected on monthly basis on specific dates of every month with using a clean plastic container for the study of various physico-chemical and biological parameters. All the sample collection and observation were made in the morning time and some of the parameters are calculated at the collection point and other parameters were estimated between 08:00 am to 10.00 am in the lab throughout the study period. Standard methods for estimation of water and waste water were referred for estimation of parameters (APHA, 1998). Zooplankton collections were made employing a modified Haron-Trantor net with a square metallic frame of area 0.0625 m<sup>2</sup> area. The filtering cone was made up of nylon bolting silk plankton net (No. 25 mesh size 50 $\mu$ ) was used for collection of zooplankton. The net was hauled for a distance of ten meters. Collected samples were transferred to labeled vial bottles containing 4% formalin. The qualitative estimation of

zooplankton communities was carried out in the laboratory. Samples were kept for setting for a period of 48 hours. The samples were transferred on to Sedgwick-Rafter cell and planktonic organisms numerically counted and identified. The identification of zooplankton species was done by the Zoological Survey of India, Kolkata and the same was confirmed by Needham and Needham (1962), Michael (1973), Pennak (1978), Tonopi (1980), Patil and Gouder (1982) and Battish (1992).

### **RESULT AND DISCUSSION:-**

During the present study the total twelve number of physico-chemical parameters and zooplankton abundance and was estimated during the period of 2017-18. In the present study the atmospheric temperature values varied between 24.0 to 31.1°C and the water temperature values varied between 20.8 to 28.6°C the highest values were recorded in summer season and lowest values recorded in north east monsoon season in both parameters. The pH values ranged 7.36 to 7.41, the highest values recorded in south west monsoon season and the lowest values recorded in north east monsoon season. During the present study transparency values varied between 68.2 to 114.6 cm, the highest values recorded in summer season and lowest values recorded in south west monsoon season throughout the study period. In this study Total Dissolved Solids ranged 296 mg/lit to 426 mg/lit, the highest valued noticed in south west monsoon season season and lowest values were noticed in summer season. The atmospheric temperature depends upon radiation from the sun as well as on evaporation, relative humidity, wind, length of the day and cloud cover. Temperature fluctuations in water are influenced considerably by meteorological factors such as wind and atmospheric temperature. The pH indicates acidic and alkaline nature of water. It is affected by environmental factors such as temperature, salinity and pressure. Transparency is nothing but clarity of water and it is primarily affected by algae and suspended sediments. Dissolved solids are impotent in drinking water and other water quality standards. The present results conforming with Surrender Reddy et al. (2015). During the present investigation Dissolved Oxygen values ranged 5.8 mg/lit to 9.4 mg/ lit. The highest values recorded in south west monsoon season and lowest values were noticed in summer season. The free Carbon Dioxide values varied between 0 mg/ lit to 8.4 mg/lit. The highest values recorded in south west monsoon season and zero values were noticed in north east monsoon season. Dissolved Oxygen is necessary to many forms of life including fish, invertebrates, bacteria and plants. In limnology, Dissolved Oxygen is an essential parameter second only to water itself (Wetzel

and Likens, 2001). The total alkalinity values ranged 92 mg/lit to 136 mg/lit. The highest values recorded in summer season and lowest values recorded in south west monsoon season. The chloride values varied between 90 mg/lit to 122 mg/lit. The highest values recorded in summer and lowest recorded in south west monsoon season. Alkalinity measures the ability of water bodies to neutralize acids and bases thereby maintaining a fairly stable pH. Raju and Rao (2001) found that alkalinity values varied between 90 to 265 mg/l in sewage fed fish culture pond at Nambur. The Chloride concentration is higher in organic wastes and its higher level in natural water is definite indication of pollution from domestic sewage. Similar results were observed by Srinivas Reddy (2015). In the present study Phosphate values varied between 1.61 mg/lit to 2.04 mg/lit. The highest values recorded in north east monsoon season and lowest values recorded in south west monsoon season. In the present study total hardness values varied between 108 mg/lit to 152 mg/lit. The highest values recorded in summer season and lowest values recorded in north east monsoon season. In the present study biological oxygen demand values varied between 2.9 mg/lit to 5.6 mg/lit. The highest values recorded in north east monsoon season and lowest values recorded in summer season. Phosphate is a key nutrient for plants. Algal growth in the lake is depending on phosphate. The presence of phosphate in huge quantity in the lake indicates pollution through sewage and industrial water Vasumathi Reddy et al. (2009). Hardness of water is not a specific constituent but is variable and complex mixture of cations and anions. It is caused by dissolved polyvalent metallic ions dissolved in water Balakrishna (2012). Biological oxygen demand test assay procedure involving measurement of oxygen consumed by bacteria while stabilizing organic matter under aerobic conditions, it is necessary to provide standard conditions of nutrient supply, pH, absence of microbial growth inhibiting substance and temperature because of low solubility of oxygen in water. Similar results were observed by Balakrishna et al. (2013b). The zooplankton of three lakes mainly consists of rotifers, cladocera, copepoda and ostracoda. The total numbers of nineteen species were observed from the all three lakes during the present study. The total zooplankton population was dominated by rotifera, cladocera, copepoda and ostracoda respectively. The total ten numbers of rotifera group of zooplankton were observed in the present study. The observed species are *Brachionus diversiconis*, *Brachionus caudatus*, *Cephalodella gibba*, *Lecane luna*, *Brachionus falcatus*, *Keratella cochlearis*, *Brachionus angularis*, *Keratella tropica*, *Cephalodella sps* and *Filinia longiseta*. Among all the rotifer species *Brachionus falcatus*, *Keratella tropica* were dominated. The observed copepoda species are *Mesocyclops hyalinus*,

Mesocyclops leukarti, Paracyclops fimbriatus and Tropicocyclops prasinus. The Mesocyclops leukarti species were dominated throughout the study period. The observed cladoceran species were Moina micrura, Moina brachiata, Ceriodaphnia cornuta, Bosmina longirostris and Moina macrocopa. The dominated species in cladocerans were Moina micrura and Moina brachiata. The two species were observed from Ostracoda order and those are Hymicypris fossilata and Cypris sps. Among the two species, Hymicypris fossilata is dominated. Sharma (2001) dealt with the biomonitoring relations to different indices and highlights the role of rotifera as biomonitor in assessment of water quality of freshwater bodies. In addition to rotifers, a low density and diversity of copepods in the lake provides additional evidence of the eutrophication of lake. Similar results were observed by Balakrishna et al. (2013c). In the present investigation the total 15833 individuals/liter of zooplanktons were counted. Out of which 5823 individuals/liter of rotifera, 5823 individuals/liter of copepoda 3290 individuals/liter of cladocera and 1750 individuals/liter of ostracoda zooplankton were counted. During the south west monsoon season, 2142 individuals/liter of rotifers, 1780 individuals/liter of copepods, 1140 individuals/liter of cladocers and 640 individuals/liter of ostracods were observed. During the north east monsoon season 1869 individuals/liter of rotifers, 1640 individuals/liter of copepods, 1100 individuals/liter of cladocers and 600 individuals/liter of ostracods were observed. In the present study summer season 1812 individuals/liter of rotifers, 1550 individuals/liter of copepods, 1050 individuals/liter of cladocers and 510 individuals/liter of ostracods were observed. In the present study, highest zooplankton diversity observed in south west monsoon season followed by north east monsoon season and summer season. Similar results were observed by Balakrishna et al. (2013c).

#### **CONCLUSION:**

On the basis of the above results the selected lake water is little bit polluted and all the water parameter are within the permissible limits of standard methods like BIS and APHA. This lake water is suitable for drinking with slight purification methods.

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#### **REFERENCES:**

1. APHA, 1998. Standard method for the examination of water and waste water (20th Edn.). American Public Health Association, Washington.
2. Balakrishna, D., 2012. Ecological studies and zooplankton diversity in three different lentic water bodies of Warangal District, A.P. Kakatiya University, Ph.D. Thesis, Warangal.
3. Balakrishna, D., Reddy, T.R., Reddy, K.V. and Samatha, D., 2013a. Physico-chemical parameters and plankton diversity of Ghanpur Lake, Warangal, A.P., India. Int. J. Zool. Res., 3(1), 44-48.
4. Balakrishna, D., Mahesh, T., and Ravinder Reddy, T., 2013b. Physico-chemical properties of Nagaram Lake Warangal, Andhra Pradesh, India. Asian J. Anim. Sci., 8(1), 48-51.
5. Balakrishna, D., Mahesh, T., Samatha, D and Ravinder Reddy, T., 2013c. lake, Warangal District (A.P.). Int. J. Res. Biol. Sci., 3(3) pp-109-111.
6. Banerjee, S.M., 1967. Water quality and soil condition of fish ponds in some states of India in relation to fish production. Indian J. Fish., 14(12), 115-144.
7. Battish, S.K., 1992. Freshwater zooplankton of India. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi. pp. 130.
8. Michael, R.G., 1973. Cladocera: In a guide to the freshwater organisms. J. Madhurai Univ. Suppl., 1-2.
9. Moore, W.G., 1950. Limnological studies of Lovisiona. Lates lake providence. Ecology, 31, 113-118.
10. Needham, J.G. and Needham, P.R., 1962. A guide to the Study of Fresh Water Biology Holden day Ins. SanFrancisco, U.S.A., p.108.
11. Patil, C.S. and Gouder, B.Y.M., 1982. Freshwater fauna of Dharwad (Karnataka State, India): Cladocera. J. Karnataka Univ. Sci., 27, 115-126.
12. Pennak, P.W., 1978. Freshwater invertebrates of United States 2nd Ed. John Wiley and Sons, New York, 303.
13. Porter, K.G., Pace, and J.F. Battery, 1976. Ciliate protozoans as links in fresh water planktonic food chains. Nature, 277, 563-565.
14. Raju, P.B.J. and Rao, N.P., 2001. Limnological investigations and diversity of plankton in sewage fed fish culture pond at Nambur near Guntur, A.P., India. J. Aqua. Biol., 16: 11-14.
15. Sharma, B. K. 2001. Zooplankton diversity, freshwater planktonic cladocera (Crustacea: Brachiopoda) water quality assessment, biomonitoring and zooplankton diversity. (B. K. Sharma Ed.). Department of Zoology, North-Eastern Hill University, Shillong, 190-215.

16. Srinivas Reddy, G., Balakrishna, D. and Ravinder Reddy, T., 2015. A Study of physico-chemical parameters and fish diversity of Nizam Sagar Dam, Nizamabad, Telangana. *Int. J. Fish. Aqu. Stud.*, 3(2), 248-254.
17. Surender Reddy, K., Balakrishna, D., Swarna Latha, U. and Ravinder Reddy, T., 2015. Ecological studies of Renuka Yellamma Lake, Peddapally, Karimnagar District, Telangana. *Ind. J. Biol.*, 2(1), 13-17.
18. Tonopi, G.T., 1980. *Freshwater animals of India (An Ecological Approach)*. Oxford and IBH Publishing Co. New Delhi. 187.
19. Vasumathi Reddy, K., Laxmi Prasad, K., Swamy, M., and Ravinder Reddy, T., 2009. Physico-chemical parameters of Pakhal lake of Warngal District, Andhra Pradesh, India. *J. Aqua. Biol.*, 24(1), 77-80.