

## Study on effects of physical parameters on planktonic population of lonar crater India

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### Abstract

Lake water study is on the basis of both Physical and Chemical parameters, Physical Parameters are also play important role for the micro and macroscopic organism which are live in that water bodies. In this research article Physical parameters and their relation towards the planktonic communities is discus. Thus, the Lonar have very localized temperature systems as well as it has alkaline water which remain stable throughout the study periods, hence Lake water containing microorganism are well adapted such extreme environment. The blue green algae constitute the major among phytoplankton community particularly *Spirulina* is the dominant and Zooplankton, Rotifera is in general *Brachionus* species in particular are dominant over all other types of zooplanktons. Some other Zooplanktonic communities also adapting such extreme environment that those species of Rotifers was quantitatively less they may enhance their number for example *Hexarthra intermedia*, *Polyarthra vulgaris*, *Philodina flaviceps* and *Lecane lunaris*. From these species *Polyarthra sp.* is pollution indicator due to that lake water get polluted from the dominance of such species and hence it may responsible for the Eutrophication.

**Keywords:** Physical parameter, Planktonic population, Lonar crater

### Introduction

In India different eutrophic lakes observed due to enrichment of nutrients one of them is Lonar crater, which was due to the increasing primary nutrients as phosphates and nitrates. Tandale and Dabhade<sup>[1]</sup> also studied the chemical parameters of Lonar Lake, now such Crater Lake has attracted the attention of world different scientists for the investigation of its origin and source of salinity, alkalinity of lake water<sup>[2, 3]</sup>. Such saline lake has marshy areas around it, freshwater streams, natural and manmade plantations, crop fields and the remnants of the original forest and scrub, all provide special niches for plants, animals and it brine, the microbial flora and fauna of the lake basin is still more important hence it has great important about biodiversity. The Lonar crater was formed by the impact of a meteorite which was complex process and depending on the material properties of the target and projectile, parameters of impact, atmospheric effects and on gravity. For the same energy of impact, the greater the height of the ejecta, smaller is the depth of the crater. Plankton is part of aquatic life, which is composed of tiny organisms living and drifting in the direction of water current. It acts as the main source of food for most fauna, both in lotic and lentic water ecosystems<sup>[4]</sup>.

### Material and Methods

Lonar crater is a unique basaltic rock meteorite crater (19°58'N and 76°31'E), ranking third in the world. Monthly

water as well as planktonic sample were collected from the lake during the study periods four different sampling sites which will be named SI, SII, SIII and SIV, located at East, South, West and North sides of the lake respectively. Zooplankton sample were collected by using the plankton net having the suitable for all planktonic communities. Sample were preserved in 4% of formalin and brings to laboratory. Sample was observed by using Sedgwick- Rafter cell and takes their photograph by using COSLAB INVERTED MICROSCOPE and their TAB. Their identification was done by using the standard literature<sup>[5-7]</sup>.



Fig 1: Satellite View of Lonar Crater India

### Results and Discussion

To measure the dominancy, to measure the status of water quality we must know the species diversity indices such as Shannon-Weaver diversity index, Simpson index, species evenness and richness in any water body<sup>[4]</sup>.

### Colour

Coloration is a unique properties of lake water on which we can determine the status and quality as well as roughly predicted the phytoplankton and zooplankton density of that lake. Lonar water appears variable colour in different seasons in month of January to May it was Olive green colour it might be due to monsoon during which some organic materials, sand particles are drained with flow of water, in month of Jun to September it was Yellowish Green and in month of October to December it was Pale green might be due to plankton population increases in that months specially Blue green algae. On sampling site S4 was observed Dark olive Green in 2000 to 2003 studied by Dabhade<sup>[2]</sup>. Dabhade<sup>[8]</sup> and Siddiqi<sup>[9]</sup> observed the colour of crater water resemblances dark green pea or called it 'algal soup'.

The lake water observed to be blue green in colour due to dominance of algal bloom in lake water was studied by Verma *et al.*<sup>[10]</sup>. According to Borul<sup>[11]</sup> colour of the lake water is also light green to dark green because of the dense

algae population with predominating spirulina<sup>[12]</sup>. Satyanarayan *et al.*<sup>[13]</sup> observed the colour of the lake which was strong murky to murky. Yannawar *et al.*<sup>[14]</sup> observed Greenish colour during its study periods. We know color of water is due to phytoplankton, zooplankton, sand particles, organic particles and metallic ions etc. If water colour is clear or colorless or light green or blue in color when phytoplankton is more, If Zooplanktons are their then it develops a brown color<sup>[2]</sup>. Sladeczek<sup>[15]</sup> also studied the rotifers are indicators of water quality. Water with black, blackish green, dark brown, red, yellow color is not good for culture. The red colour of water is due the presence of high levels of iron and death of phytoplankton. According to Clesceri *et al.*<sup>[6]</sup> color is determined by visual comparison of sample with known concentration of colored solution. Comparison is also made with special property calibrated with that of glass disks held the end of metallic tubes containing glass comparator tubes filled with sample and colorless distilled water. Sample color is matched with the color of tube of clear water and calibrated colored glass viewed by looking towards a white surface. Each disk is calibrated to correspond with the colors of the platinum-cobalt scale.

**Temperature:** Temperature of water was recorded monthly, during the study periods mean of temperature was  $26.38 \pm 2.2556$  °C observed on sampling site four sampling sites.

Lonar Lake is subterranean hollow closed just only screening of sunlight at different places and at different times<sup>[2]</sup>. On the basis of water temperature dissolved form of oxygen may fluctuated<sup>[16]</sup>. The highest water Temperature in 2013 was observed in month of May which was 31 °C from sampling site S4 and Lowest was 21 °C in month of August from sampling site S1. In 2014 highest water Temperature was observed in month of July which was 32 °C from sampling site S4 and Lowest was 21 °C in month of November from sampling site S1. During 2014 on sampling site S1 it was  $25.25 \pm 2.4$ , S2  $25.67 \pm 2.34$ , S3  $26.67 \pm 2.15$  and S4  $26.29 \pm 2.4$  degree Celsius. According to it, all such values are accepted due to slight change and such change in water temperature was observed due to seasonal variation, site to site probably due to variable times of observations. The different groups of algae may have different temperature optima for the growth, the maximum temperature for chrysophytes growth tend to be about 24 to 27 °C and this in part explain their presence in arctic lakes and rare occurrence in warm water lakes. The optimum temperatures for the growth of most diatoms are found to be around 20 °C.

The diatoms *Nitzschia*, *Amphiprora* and *Cylindrotheca* are common under ice flora during winter stratification in temperate lakes. Meena *et al.*,<sup>[17]</sup> also studied the phytoplankton diversity with related to physic chemical parameters. Most of the green algae favor the temperature of 20 to 30 °C for their growth and when the temperature raised then green algae replaced by the blue green algae. Therefore the temperature of water may decide that which groups of algae is more favored in that water. The water temperature can influence the growth of algae both by direct and indirect,

the direct effects is on algal metabolism due to increases in biological activity of algal cells like rate of diffusion, carrier mediated uptake, cell division and overall growth by a factors of about 2 for each 10 °C rise in temperature and thereafter their decline with further increases in temperature has been observed. Another one direct effects observed on change in light compensation point as the respiration rate decreases with decreasing temperature. This trend supported by the observation of Dabhade<sup>[2]</sup>. Water Temperature shows positive correlation with pH, turbidity, T.D.S. Conductivity, Carbonate, Total hardness and magnesium hardness but it shows negative correlation with dissolved oxygen, CO<sub>2</sub>, bicarbonate, calcium hardness. The ambient atmospheric and sub-surface water temperature show marked seasonal changes by Siddiqui (2008) the maximum water temperature was observed 35 °C in summer while minimum was observed 23 °C in winter season. Yannawar *et al.*<sup>[14]</sup> average temperature detected 24.6 °C. Quantitative analysis of Zooplankton of Lonar also studied by Dabhade and Tandale<sup>[16]</sup>. Baloch *et al.*<sup>[18]</sup> studied the water temperature range between 13.5 °C to 32 °C is reported to be suitable for the development of the planktonic organisms.

**pH:** Lonar Lake is famous for its alkalinity but now a day it was observed that its pH value goes on changing. The pH value of all four sampling sites was 10 though out the study periods. The pH value was 10.5 in 2000 to 2003 according to Dabhade<sup>[2]</sup>. Tambekar *et al.*<sup>[19]</sup> studied the soda lake are a specific type of salt lake with high to extremely high carbonate alkalinity, a pH from 9 to 11. Average pH was 8.13 recorded by Yannawar *et al.*<sup>[14]</sup> the controversial results obtained by Pawar<sup>[20]</sup> observed the pH 10.2 to 10.5.

Lonar Lake water pH was decreases due to that number of world's different researcher and scientist take attention on the Lake, whether this alkaline lake can loss their alkaline nature such question mark on them?. Behind this several microbiological activity may responsible for lowering the pH of Lake these are, it may due to the production of carbon dioxide by respiring bacterial cells, Oxidation of hydrogen sulphide or sulphur to sulphuric acid or other acid sulphates, due to decomposition of organic matters, assimilation of ammonia as a source of nitrogen, formation of nitrites or nitrates and liberation of phosphates from organic compounds.

**Electrical Conductivity:** Electrical Conductivity measured monthly the observed mean was  $12.553 \pm 3.1887$  mS. Sampling site S1 was observed  $12.713 \pm 3.44$  mS, on S2  $12.43 \pm 3.373$  mS on S3 site it was  $12.57 \pm 3.375$  mS and on sampling site S4 it was  $12.5 \pm 2.961$  mS. On sampling site S1 have highest value in the month of Jun due to the flow of clay soils in rainy seasons which tend to have higher conductivity because of the presence of such material that ionizes when they added in to the water hence conductivity was observed more as compared to other. For comparative study related to overall it was observed that  $12.553 \pm 3.1887$  mS. All such values are accepted and no more change was observed during the study periods. Electrical conductivity of Lonar Lake was 19273 to 19493 mg/L was observed<sup>[21]</sup>.

**Total Dissolved Solids (TDS):** Total dissolved solids (TDS) is used to measure amount of particles that dissolved in water, that is nitrates, calcium, magnesium, sodium, potassium, iron, carbonates and bicarbonate. During the study periods mean of TDS was observed  $7.319 \pm 0.9185$  ppt. Total dissolved solids were found to be maximum in the month of February on S2 which was 8.5 ppt and lowest was 5.5 ppt in the month of January on S1. Sampling site S1 was  $7.271 \pm 1.076$  ppt, on sampling site S2 it was observed  $7.242 \pm 1.007$  ppt, on sampling site S3 it was  $7.315 \pm 0.908$  ppt and on sampling site S4 it was  $7.447 \pm 0.762$  ppt. The highest TDS value was recorded on sampling site S4 near the Dargaha and S2 near the Kamaljadevi Temple because of the erosion of rocks and soils of the escarpment that may be contain calcium bicarbonates, nitrogen, iron phosphates, sulphates and some other minerals can entered in to the lake water and they dissolved in it due to that the value of TDS goes on increases during the study periods. The total dissolved solid is in the range of 6.4 mg/L to 15.2 mg/l observed [20]. Average TDS was 770 was observed [14]. According to Gaikwad and Sasane [22], Lonar lake water has very high TDS about 5696 mg/L, showing unsuitability of water for domestic use and possibility of pollution by the various human activities. Dabhade [8] and Pedge [21] observed strong relationship between the physicochemical parameters according to it TDS values possessed a strong positive relationship with pH, chlorides, salinity and EC.

**Transparency:** Transparency was estimated with the help of Sacchi disc. During the study periods transparency was nil observed. On sampling sites S3 and S4 throughout the periods there was marshy area due to that it was not observed and on sampling sites S1 and S2 during rainy season slightly transparency was observed and was decreases in the winter season. Similar results were observed by Siddiqi [9]. In Monsoon season turbidity is increases due to rain water flow in the reservoir from all sides, similar result obtained by Agarwal and Rajwar [23], according to them increased turbidity in monsoon month attributed to soil erosion in nearby catchment also suspended solids. Turbidity was found different i.e. maximum turbidity found in month of February, due to human activity and decrease in water level [24].

**Other Aquatic Fauna:** Lonar Lake did not show occurrence of fish species in its water body due to low dissolved oxygen and high salinity. The hydrological study reveals deteriorating changes leading towards Eutrophication led to reduction of flora fauna and macrophytes and increase in pathogenic organisms [8, 26, 27].

### Conclusion

Lonar have very localized temperature systems as well as it has alkaline water which remain stable throughout the study periods, hence Lake water containing microorganism are well adapted such extreme environment. The blue green algae constitute the major among phytoplankton community particularly *Spirulina* is the dominant and Zooplankton, Rotifera is in general *Brachionus* species in particular are dominant over all other types of zooplanktons. All these

dominant species may enhance the biological oxygen demand due to that eutrophication was observed on near about all sampling sites for that immediate action is necessary for the conservation of such Ecological wonder [24].

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