Lake Water Quality Monitoring, A Comparative Review and Future Direction: Kolhapur city

[1] Mr. Ketan T. Gejage, [2] Mr. S. M. Bhosale, [3] Dr. H. P. Salunkhe

[1] PG Scholar M.Tech Environmental Science & Technology , [2] Co Ordinator M.Tech- Environmental Science & Technology Shivaji University Kolhapur., [3] Assistant Professor Department of technology, Shivaji Technology, Kolhapur.
[1]Environmental Science and Technology,
[1]Department of Technology Shivaji University, Kolhapur, India

***Abstract*: Kolhapur Lake water quality monitoring is essential for understanding the health of freshwater ecosystems and safeguarding the availability of clean water resources for both ecological and human needs. For this paper Rankala Lake and Rajaram Lake from Kolhapur were studied. Through our review, we identify key similarities and differences between these studies. Both papers emphasize the significance of water quality monitoring in lakes, but with distinct approaches and scopes. By identifying the gaps and similarities in two papers we can further enhance the future needs and demand of the Lake water quality monitoring. Based on the findings of these two studies, we discuss the implications for lake management and highlight the need for integrated approaches that combine field measurements with remote sensing technologies.**

***Key words*— Remote Sensing Technologies**

I. INTRODUCTION

Kolhapur city is Located in the South-West side of Maharashtra State, on the banks of Panchganga River. It is mostly Famous for ancient temples. Temples like Ambabai (Mahalaxmi) Mandir and Jyotiba Temple. The Famous Panhala Fort is at Just 20 km distance from Kolhapur city. Kolhapur city is blessed with a huge Number of lakes, as the initiative to build the lakes was taken by the king of Kolhapur - Shahu Maharaj. Kolhapur used to have 40 large and small lakes in total but only few of them are left. There are many famous lakes in Kolhapur like Rankala Lake, Rajaram Lake etc. Rankala Lake is present in the Heart of the city and Rajaram Lake resides on the outskirts of the city. Even though most lakes are restricted for public use, people often ignore the restriction and use the water for irrigation purposes and washing the cattle, Ganesh idol emission, etc. Due to human involvement in the lake's biodiversity it is getting heavily polluted. This review paper is a detailed comparison between the two research papers published on the lake water quality analysis of the lake in Kolhapur city. This review paper also states the comparison of methodology and conclusions of the research papers. Also it will provide an overall view of both papers and agreements and disagreements in the research. The purpose of this review paper is to find the advanced solution to the problem mentioned in the review papers, and also to find out if there is a new need for research to be done. The research papers used for this review paper are "Study On Pollution Sources, Water Quality And Conservation Of Rankala Lake, Kolhapur, India" by Abhijeet S. Ghone, Sunil K. Singal & "Physico-Chemical Characteristics Of Water Quality Of Rajaram Lake In Kolhapur" by Akshay Thorvat, Vidula A Swami. These two papers had research done on water quality of lakes in Kolhapur city.

II. LITERATURE REVIEW

The First research paper studied the water sources of pollution in rankala lake of Kolhapur for the Physico-chemical properties of the water. Total 5 stations were selected for water sampling, water sample were then analyzed in the laboratory for water parameters such as BOD, TDS, TS, DO, pH, chlorides, hardness, conductivity, turbidity, and alkalinity. In this research paper the WQI of the water was calculated by using the standards of drinking water quality recommended by the Indian council of Medical Research (ICMR) and Bureau of Indian Standards (BIS). For calculation of WQI Following Formula was used [1]:

$$WQI = \frac{(\Sigma QnWn)}{(\Sigma Wn)}$$

Total 5 stations were selected for water sampling. The water sample showed the result that Water quality at different stations ranged from very poor for drinking to suitable for drinking. This paper concludes that water in Lakes in Kolhapur are unsuitable for drinking unless treated properly & most of the societies in the locality are the main contributors for water pollution of the lakes. In the Second Review Paper in the context of this, the aim of this research is to conduct a physicochemical parameter analysis of this Rajaram Lake with the objective to discover any possible explanations for the lake's declining water quality. The project also wants to develop a Water Quality Index to measure the amount of pollution at specific location. A water quality assessment is conducted for the parameters of pH, total dissolved solids (TDS), total suspended solids (TSS), total solids (TS), electrical conductivity (EC), hardness, acidity, alkalinity, dissolved oxygen (DO), and biochemical oxygen demand (BOD) at four points in Rajaram Lake in order to figure out the environmental impact of such activities on the lake's water quality. No preservatives are used because they interfere with the chemical processes [2]. Four water sampling stations—Station 1, Station 2, Station 3, and Station 4—were chosen for the current study along the Rajaram Lake's stretch, and samples of Water samples are taken on a weekly basis to assess the lake's water

quality and conduct a trend analysis to determine its impact. With all of the site characteristics in thoughts, the manual method of sample collection is used. The DO is fixed on site, and temperature is only recorded on site, while samples have been utilized in DO tests. The drinking water quality standards (desirable limits) as described by IS-10500, (1991) are used for the determination of the Water Quality Index in the current study in order to check the amount of contamination at each station. WQI is determined by adding the product of the rating scale (Vr) and unit weights (Wi). To determine the degree of contamination, the Water Quality Index (WQI) of the collected water samples is calculated [2].

$$WQI = \Sigma Wi \times Vr$$

The range of the rating scale (Vr) and its importance for the physicochemical characteristics of Lake water is in tabulated data to provide the WQI of lake water samples taken at four sites around Rajaram Lake. According to the study, the Water Quality Index for Stations 1 through 4 (WQI = 49.61, 49.61, 46.05, and 46.05 respectively) is found to be extremely polluted and completely unsafe for drinking purposes. This is mostly caused by the continual addition of domestic sewage, runoff from adjacent areas, immersion of Ganesh idols, and dumping of religious garbage, garlands, and other waste materials in the area. Ganesh sculptures are submerged, religious materials, garlands, and other garbage is thrown away from the community in each station, and it may end in excessive pollution [2-5].

Table 1: Status of Water Quality

Range of WQI	**Status of Water Quality**
00-25	Excellent for Drinking
26-50	Good for Drinking
51-75	Poor for Drinking
76-100	Very poor for Drinking
Above 100	Unsuitable for Drinking

Fig. 1: Rankala Lake (station locations)

Fig. 2: Rajaram Lake (satellite view)

III. GAPS

Despite the extensive research conducted on lake water quality analysis, there are several notable gaps that warrant further investigation. Many studies focus on short-term assessments of water quality parameters, providing limited insights into long-term trends and variations. More long-term monitoring programs are needed to understand the temporal dynamics of lake water quality and identify any gradual changes or emerging patterns. With the advancement of technology and changes in human activities, new contaminants are constantly being introduced into aquatic ecosystems. The review reveals a limited understanding of the occurrence, fate, and potential impacts of emerging contaminants, such as pharmaceuticals, micro plastics, and nano materials. Further research is needed to assess their prevalence, behavior, and ecological consequences in lake ecosystems [1-5].

IV. FUTURE SCOPE

Based on the identified gaps, the following future directions can guide research and management efforts in lake water quality analysis establishing long-term monitoring networks at regional or global scales would enable the collection of consistent and standardized data over extended periods. This would enhance our understanding of long-term trends, support the identification of emerging issues, and facilitate effective management strategies. Given the potential ecological risks associated with emerging contaminants, future studies should focus on understanding their sources, fate, transport mechanisms, and ecological impacts. This research can inform the development of targeted mitigation measures and policies to minimize their introduction and potential harm to lake ecosystems. The integration of ecological, hydrological, and socioeconomic models can improve our ability to predict and manage lake water quality. Future research should focus on developing integrated modeling frameworks that incorporate various

stressors, feedback mechanisms, and socio-economic considerations to guide decision-making and develop effective management strategies. By addressing these gaps and pursuing these future directions, we can enhance our knowledge of lake water quality, develop more effective management strategies, and ensure the long-term health and sustainability of these vital freshwater ecosystems. By analyzing both the papers we can see clearly that both lakes in Kolhapur city are not suitable for drinking purposes. Below is the chart showing some water quality parameters [5-7]. This is mostly caused by the continual input of home sewage, runoff from adjacent areas, and Ganesh immersion idols, the disposal of religious debris, garlands, and other trash from the community in each station might result in excessive pollution. As we could see in the chart below, although TDS and The pH are the same for both the lakes, TSS has different readings for both the lakes. The reading taken at both lakes might be taken at different times of the year as in the rainy season the TSS of the lake measure at its highest and in the summer season it shows low readings. Hence we need continuous data for solid conclusion for any need in the future [7-9].

V. DISCUSSION

By analyzing both the papers we can see clearly that both lakes in Kolhapur city are not suitable for drinking purposes. Below is the chart showing some water quality parameters. This is mostly caused by the continual input of home sewage, runoff from adjacent areas, and Ganesh immersion idols, the disposal of religious debris, garlands, and other trash from the community in each station might result in excessive pollution. As we could see in the chart below, although TDS and The pH are the same for both the lakes, TSS has different readings for both the lakes [1-2].The reading taken at both lakes might be taken at different times of the year as in the rainy season the TSS of the lake measure at its highest and in the summer season it shows low readings. Hence we need continuous data for solid conclusion for any need in the future [2].

Table 2: Lake Water Parameters Data

Parameters	Rankala Lake	Rajaram Lake
pH	8.16	8.56
TS	223.56	338.05
TSS	42.8	162.727
TDS	165.6	175.78

VI. CONCLUSION

In conclusion, the analysis of Kolhapur lake water quality has provided valuable insights into the environmental health and potential impacts on human activities. Through the review of various studies, it is evident that water quality parameters such as pH, dissolved oxygen, TSS, TDS and pollutant concentrations play a crucial role in determining the overall health and ecological balance of lakes. The findings highlight the importance of regular monitoring and assessment of water quality to identify potential issues, implement appropriate management strategies, and ensure the sustainability of freshwater ecosystems. Further research is needed to investigate the long-term trends, effects of climate change, and the effectiveness of mitigation measures in improving and preserving lake water quality.

VII. ACKNOWLEDGMENT

The preferred Gratitude to friend, family and teachers whose support shaped my academics. Their guidance and encouragement lit the path, turning this difficult journey into a collaborative and meaningful experience.

REFERENCES

[1] Akshay R.Thorvat et al. Evaluation of Physico-Chemical Characteristics of Water Quality of Rajaram Lake in Kolhapur. International Journal of Engineering Research and Technology. ISSN 0974-3154 volumne10, Number 1 (2017)
[2] Abhijeet S. Ghone, Sunil K. Singal. Study On Pollution Sources, Water Quality And Conservation Of Rankala Lake, Kolhapur, India. ISSN 2348-7550 Volume No-03, issue No-01, January 2015.
[3] A report by the Ministry of Environment and Forests, Conservation and management of lakes – An Indian perspective, Ministry of Environment and Forests, Government of India, New Delhi, 2010.4
[4] Kolhapur Municipal Corporation: Environmental status report (2012–2013).
[5] Shaha, S. S., and Rajemahadik, C. F., Control of Water Hyacinth-A Case Study, In Proceedings of Taal2007: The 12th World Lake Conference (28 Oct–2 Nov, 2007) Jaipur, Rajsthan (India), 1051, 2007, 1051-1057.
[6] B. Banakar, B. R. Kiran, E. T. Puttaiah, R. Purushotham and S. Manjappa; 2005, "Hydrochemical Characteristics of Surface Water in Chandravalli Pond near Chitradurga", Indian Journal of Environmental Protection, IJEP Vol. 25, No. (3): PP 249-253
[7] Bhadra Bhaskar, Chakraborty Ranadhir, Das Susanta and Nanda Ashis Kumar; 2005, "Investigation of Some Basic Water Quality Parameters of the North Bengal Terai River Kaljani–A Tributary of River Torsa, and Comparison thereof with the Mainstream", Journal of Environ Bio, 26 (2): PP 277-286.

[8] C. Barghigiani, T. Ristori, R. Scerbo, C. Cini, R. Nottoli, L. Moschini and V. Giaconi; 2009, "Assessment of Water Pollution and Suitability to Fish Life in Six Italian Rivers", Environmental Monitoring and Assessment, 66: PP 187–205.
[9] C. R. Ramakrishnaiah, C. Sadashivaiah and G. Ranganna; 2009, "Assessment of Water Quality Index for the Groundwater in Tumkur Taluk, Karnataka State, India", E-Journal of Chemistry, ISSN: 973-4945, 6(2): PP 523-530.
[10] Chandra Sekhar M, Umamahesh N. V.; 2004, "Mass Balance Approach for Assessment of Pollution Load in the Krishna River", Journal of Environ Sci and Engg,, 46 (2): PP 159-171.