

Physico-Chemical, Biological Properties and Biodiversity of Aquatic Plant Species In Macferson Lake Allahabad, U.P. India

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Abstract

Present study is directed towards the analysis of the water quality of the Macferson Lake, Allahabad which is heavily polluted by human activity. The required water samples collected randomly from different locations of the study area and analyzed in the department of Environmental Sciences and NRM, SHUATS, Allahabad. The Temperature, EC, pH, TDS, Turbidity, Total hardness, Mg Hardness, Ca Hardness, BOD, DO, Alkalinity, Chloride, and Total coliform of the water samples have been analyzed. To assess the quality of the water each parameter was compared with the standard prescribed by Central pollution control board (CPCB, 2012). It is found that the *Water hyacinth* and *Typha latifolia* aquatic plant species were showing higher dominancy over the MacfersonLake. Above both are covering the maximum surface water area of the lake. It is also found that receives species like *Lemna minor*, *Sagittarialatifolia* and *Hydro-cotyleranunculoids* are found in a very less quantity and restricted to limited areas of the Lake. The findings of the present study help in multi-dimensional aspects and uses of water of afore said lake including domestic purpose.



Article History

Received: 07 July 2017
Accepted: 28 September 2017

Keywords

Macferson lake,
Physico-chemical,
Hardness,
Alkalinity,
BOD,
Floral diversity etc.

Introduction


Water bodies serves as habitat for a varying number of aquatic organisms ranging from microscopic plankton to large aquatic animals and macrophytes³. According to NWP (2002), supply of fresh drinking water to most of the living beings should be the first priority on any available water reservoir. The

safe and reliable sources of water availability are an essential pre-requisite for the establishment of a stable community⁵.

There is a definite permissible limit of different organic and inorganic substance in water which can tolerated for drinking water. The characteristic

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To link to this article: <http://dx.doi.org/10.12944/CWE.12.3.14>

of water quality of aquatic environments is a results of interactions of physical, chemical and biological properties⁶.

Deep sense of knowledge and the importance of water for sustenance of life pertaining to the need for conservation of water bodies especially the fresh water bodies is now realized every where in many parts of the country. There is less than 5% of fresh water available to uses and confined in the ice caps, glaciers and groundwater. Most of the remainder is in lakes, streams and soil moisture. The global water scenario is very much alarming¹⁰.

The plan on Indian lake management provides detail and integrated approach to lake management including their safeguard and conservation but not limited to exotic weed control, water quality monitoring and aquatic vegetation surveying⁴.

Wetlands are considered as one of the most diverse biological ecosystems on the planet earth. They inhabits a diverse fauna and flora, including so many threatened species of plant and animals. Wetlands also provides important ecological services, including storage of water, sequestration of carbon sediments trapping and mitigating the harmful effects of dangerous pesticides and other types of household pollution through biodegradation and bio magnification. Although wetlands accounts only 6% of the total available land area, their value

is estimated to cost between 49 billion to 3.4 trillion Euros per year, measured as the budget needed if these services were to be replaced⁹.

The aim of this study is to assess the quality of water which affects the floral and faunal diversity of the lake.

Material and Method

Sampling Area

Study Area

The present investigation was carried out to examine the status of the highly pollution affected Lake water of Allahabad district. Allahabad district is situated between 25.4358° N, 81.8463° E Longitude and 98 meter asl. (Fig. 1). The water of the present lake is being used for industries, agriculture, fisheries and partially for domestic uses.

Sample Collection

Samples from the Macferson Lake of were collected from four selected sites during Jan 2017 to June 2017. All the precautions were taken with great care during the sampling. The collected water samples were lab analyzed for different physico chemical parameters viz. pH, electrical conductivity, total dissolved solid, temperature, alkalinity and biological oxygen demand by following the standard protocols. All the above analyses were performed in triplicate.

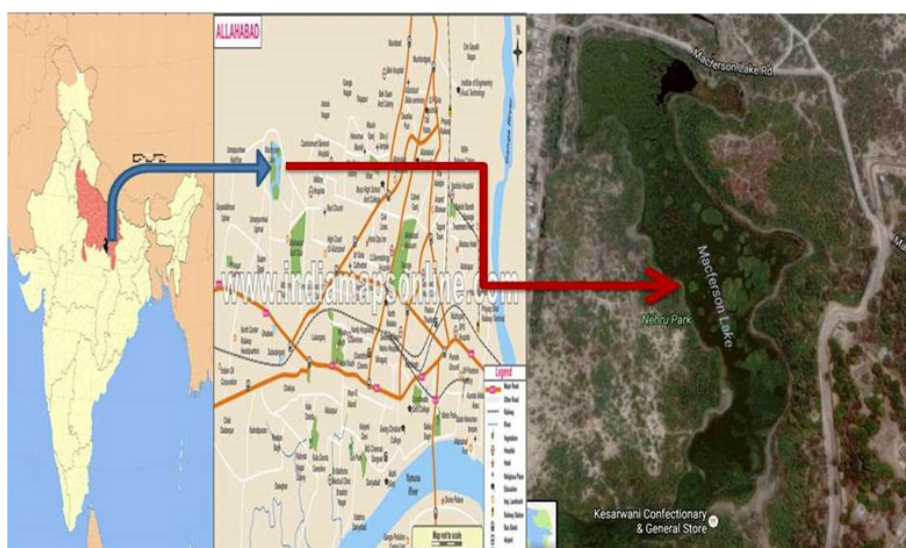


Fig.1: Map of Macferson Lake, Allahabad, U.P. India

Result And Discussion

During this study temperature ranged from 27.75 to 28.50 °C. Many scientist reported similar findings with regard to temperature of lake, India⁶.

pH ranged from 7.87– 8.04, Maximum pH value was recorded at site B whereas minimum was observed at Site- A⁶.

Electrical Conductivity ranged from 1.16 – 1.27 µmhos/mm. Maximum electrical conductivity was recorded at site A whereas minimum was at site C and site D⁶. Total Hardness is ranged from 1396 to 1456. Maximum Total Hardness was observed at site D, whereas minimum was recorded at site A¹¹.

Calcium Hardness is ranged from 123– 140 mg/l. Maximum calcium Hardness was observed at site D, whereas minimum was recorded at site B⁹.

Magnesium hardness is ranged from 1246- 1316. Maximum calcium Hardness was observed at site D, whereas minimum was recorded at site B. Generally it has been seen that Magnesium is associated with calcium in varying range of water, but its concentration remain generally lower than the calcium. Decrease in level of Mg reduces the phytoplankton population¹.

Chloride is ranged from 159.52 - 177.2475 Maximum chloride was observed at site B, whereas minimum was recorded at site A. Chlorides in excess impart the salty taste to water and people not accustomed to high chloride are subjected to laxative effect⁶.

Alkalinity is ranged from 73 - 76.75. Maximum Alkalinity was observed at site B, whereas minimum was recorded at site A⁶.

TDS ranged from 679.75 – 709.25 ppm. Maximum TDS was observed at site A, whereas minimum was recorded at site C¹¹.

Turbidity is generally associated with presence of solid contents and causes light scattering by suspended particles. Clay, slit, organic matter, phytoplankton and other microscopic organisms play vital role turbidity in pond water. The maximum turbidity in water was recorded in June (55) at site D and minimum turbidity was recorded in April (39) at site C in Macfersonlake. High turbidity in pond

water was due to addition of sand, clay, slit, dung and various other pollutants along with rain water from the surrounding area into the pond⁸.

The maximum BOD in water was recorded in July, (4) at site C and minimum BOD was recorded in May, (29) at same site C in Macferson Lake. Increasing the rate of BOD in the lake can be due to the maximum microbial activity which was utilizing more DO for decomposition of organic matter. As it was already mentioned the MPN in lake was very high. The aquatic animal in lake was also responsible for higher BOD which is also consuming DO for respiration¹⁰. In Macferson Lake the MPN was very high from the range maximum bacterial activity shows the maximum utilization of dissolve oxygen. Examination reports on various physico-chemical properties shows that the lake water was highly contaminated and it does not suitable for irrigation purpose, drinking water supply, recreation aspects as well as fish raring purposes and can be easily assessed with poor diversity of lora and fainas. The maximum MPN in water was recorded at 7 different sites 1700 and minimum MPN was recorded at 3 different sites 1100 at the period of sampling in Macferson lake. Maximum MPN in the lake was due to direct mixing of huge amount of contaminated sewage water containing with organic material in the lake².

Biodiversity of Aquatic Plants in Macferson Lake Ecosystem, Dhoomanganj Allahabad U.P.

Plant diversity was studied with the help of quadrates. The analysis shows that the distribution and abundance of 2 species was higher in Macferson Lake. They are *Typha latifolia* and *Water hyacinth* which frequency, relative frequency and number is also high. They are covering more than 70 % of whole lake area while remaining 3 species are showing very low dominancy and hardly they cover 10 % area of the lake while other 20% area is open area where was no dominancy of any aquatic species. Due to maximum covering area by aquatic plant species and very less mixing of diffused oxygen (DO) in lake causes the aquatic life is so rare to survive. Diversity in lake is degraded and not higher much higher. The poor quality of water is one of the driving forces of depletion of aquatic richness of the lake.

The lake was distributed lake In 3 zones, namely shoreline, 10 m from the shoreline and throughout

the lake and it was found that the area covered by 2 species is nearly similar in all 3 zones and other 3 species are showing different dominancy in different zones. *Hydrocotyle ranunculoides* not present in shoreline zone but in other two zones they are

showing their presence in very less numbers. *Lemna minor* species was at very less amount in all zones but *Sagittarialatifolia* was more dominant in all zones in comparison to *Hydrocotyle ranunculoides* and *Lemna minor* species.

Table 1: Means of various physical and Chemical and biological analysis of Macferson lake water

Sites Parameter	Site A	Site B	Site C	Site D
Temperature (°C)	28.00	27.75	28.25	28.50
pH	7.87	8.04	7.82	7.83
Electrical Conductivity	1.27	1.17	1.16	1.16
Total Hardness (mg/l)	1396	1413	1427	1456
Calcium Hardness (mg/l)	127.5	123.75	130	140
Magnesium Hardness (mg/l)	1267.5	1246.25	1285	1316
Chloride (mg/l)	159	177	162	172
Alkalinity (mg/l)	73	73.25	76.75	74
Total Dissolve Solids (ppm)	709	688	680	681
Turbidity (mg/l)	45	47	43	47
Biological Oxygen Demand (mg/l)	34.75	35.25	35.5	37
MPN (mg/l)	1550	1475	1400	1475

Table 2: Analysis of aquatic plant species in Macfersonlake

S. No.	Plant species in lake	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Total no. of species	Frequency	RF
1	<i>Sagittarialatifolia</i>	10	7	20	12	7	0	20	30	0	0	106	70	20.11
2	<i>Lemna minor</i>	10	20	0	0	0	300	3	0	13	5	351	60	17.14
3	<i>Water hyacinth</i>	20	5	20	35	10	6	0	0	35	3	134	80	22.85
4	<i>Hydrocotylera nunculoids</i>	0	3	1	0	0	5	3	0	0	2	14	50	14.28
5	<i>Typhalatifolia</i>	20	35	45	55	20	0	40	70	6	15	306	90	25.71
6	TOTAL											911	350	100

Table 3: Dominant species in different ranges inside the lake

Species	Species recorded at shoreline	Species recorded at 10 m from shore line	Species recorded throughout the lake
<i>Sagittarialatifolia</i>	++	++	++
<i>Hydrocotyleranunculoides</i>	-	+	+
<i>Typhalatifolia</i>	+++++	+++++	+++++
<i>Lemna minor</i>	+	++	+
<i>Water hyacinth</i>	+++++	+++++	+++++

Present study concludes that the physico-chemical findings of the lake water shows very high value for different parameter beside the MPN compare to CPCB. Plant diversity of the lake is also less abundant and mostly the *Hydrocotyle ranunculoids* covering a maximum area of the lake. It is suggested that the wetland water bodies are kidney of the environment and it need to take care it properly. It is also suggested that the sewage water must be restricted in the lake to improve the quality as well

sustainability of faunal and floral life of Macferson Lake.

Acknowledgment

The authors are grateful to the College of Forestry, SHUATS, Allahabad, India for providing all necessary helps and facilities during the course of experiment and valuable comments of anonymous reviewers helped us a lot to improve the manuscript.

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