

Evaluation of Water Quality in Bellandur Lake

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ABSTRACT:

Bangalore, a garden city has plenty of fresh water lakes and greenery around it. The lakes of the city are facing extinction due to pollution. One such highly polluted lake is 'Bellandur Lake'. Located at 18 km towards the south of the city with a water spread area of 2.5 sq. km. The lake catchment has been subjected to extreme environmental stress mainly due to lush unplanned developmental activities in the catchment in recent years. The development plans of the region ignore the integrated planning approaches considering all the components of the ecosystem. This lake is scattered throughout the region, therefore different samples were taken and detailed analysis were conducted

Keywords: status of water quality, the physical and chemical characteristics of water

INTRODUCTION:

Water is one of the most significant natural resource available to mankind. Knowing the importance of water for sustenance of life, the need for conservation of water bodies especially the fresh water bodies is being realized worldwide.

Lakes in Bangalore, Karnataka are numerous, and there are no rivers close by. Most lakes in the Bangalore region were constructed in the sixteenth century by damming the natural valley systems by constructing bunds.

In recent years, the Management of Lakes traditionally done by the government agencies witnessed experimentation by the Lake Development Authority with a limited public-private sector participation in respect of three lakes, which has proved controversial and resulted in almost a reversal of the policy.



Figure 1 Fig: water bodies in Bengaluru

LAKES:

Lakes are important feature of the Earth's landscape which are not only the source of precious water, but provide worthy habitats to plants and animals, moderate hydrological cycles, influence microclimate, increase the aesthetic beauty of the landscape and extend many recreational opportunities to humankind.

CAUSES OF LAKE POLLUTION:

- Nutrients (problematic in 50% of impaired waters).
- Nitrogen and phosphorus pollution .
- Metals (42% of impaired waters).
- Sediment (21% of impaired waters).
- Total Dissolved Solids (TDS; 19% of impaired waters).

The success of any lake study depends on development of appropriate objectives, based on careful attention to the overall purpose(s) of the study. A study plan, selection of methods, and a data-collection program for the lake and its watershed then can be developed to acquire the information necessary to achieve these objectives.

Objectives of lake studies generally include one or more of the following:

- Assess current physical, chemical, and biological conditions
- Determine how conditions are changing with time
- Assess watershed characteristics (hydrology, water quality, land uses, nutrient and sediment yields, and sources of nutrients)
- Identify problems and opportunities for lake improvement
- Determine causes of lake problems, and provide information that can be used to design management actions, if any, that are feasible and likely to be successful in treating the lake's problems
- Evaluate the effectiveness of implemented management measures and determine whether they are performing as planned.

STATUS OF THE LAKES:

The lakes of the city have been largely encroached for urban infrastructure, and as result, in the heart of the city only 17 good lakes exist as against 51 healthy lakes in 1985. According to a scientific study carried out by the Centre for Ecological Sciences (CES), Indian Institute of Science, Bangalore, the water bodies of the city have reduced from 3.40 per cent (2,324 ha (5,742.7 acres)) in 1973 to just about 1.47 per cent (1005ha (2,483.4 acres)) in 2005 with built up area during the corresponding period increasing to 45.19 per cent (30,476 ha (75,307.8 acres)) from 27.30 per cent (18,650 ha (46,085.2 acres)). The adverse results of such big change are reported to be:

- Frequent flooding and micro-climatic changes in the city
- Undesirable impact on the diversity of flora and fauna
- Decrease in the number of migratory birds
- Fishing community and washer-men will be robbed of their livelihood

STUDY AREA: BELLANDUR LAKE

Background Data: Bellandur Lake, the largest in Bangalore city spreads across an area of 892 acres. It is located at latitude of 12°58_ N and longitude of 77°35_ E at an altitude of 921 m above mean sea level and has a catchment area of 110.94 sq. Miles or 287.33 sqm. The water storing capacity of Bellandur Lake is 17.66 million cubic feet, being 3km in length and 2.75km in width. It is one of the largest man-made lakes in Southeast Asia, located about 20 km from the city towards the south-east of Bangalore city which is extremely important ecological zone. It represents what was once a beautiful and wholesome source of water for the city of Bangalore.



Figure 2: Fire caused in the lake recently in the month of February 2017

METHODOLOGIES:

Sample Collection: Samples were collected from different points of Bellandur Lake in the months of February, March and April 2017. The samples were taken between 8am to 10am before the temperature increased later during the daytime. The samples were collected in a clean and sterilized bottles and care was taken such that the sample is not exposed to the solar radiation. The depth of the sample collection was 15 cm below the surface of water and it was brought to the Laboratory to test for its Physical, Chemical and Biological characteristics. The Physio-Chemical parameters selected are: Color, Odor, pH value, Turbidity, Total Alkalinity, TDS, Calcium, Magnesium, Chloride, Sulphates, Nitrates, DO, BOD, COD.

Table 1: values of Physio-Chemical parameters for the month of February (Laboratory tested and standard)

<i>Label</i>	<i>February</i>	<i>Standard</i>	<i>Reference</i>
Temperature, °C	28.11	0	
Turbidity, ntu	16	5	IS10500
Electrical Conductivity	1196.6	300	ICMR
TDS, mg/l	776.62	500	IS10500
pH	7.29	8.5	IS10500
Total Hardness, mg/l	269.68	300	IS10500
Calcium, mg/l	76	75	IS10500
Magnesium, mg/l	193.68	30	IS10500
Sulphates, mg/l	47.36	200	IS10500
Nitrates, mg/l	47.767	45	IS10500
Chlorides, mg/l	190.27	250	IS10500
Alkalinity	541.9	200	IS10500
DO	2.4	6	CPCB
BOD	56.4	5	CPCB
COD	153.85	10	CPCB

Table 2: values of Physio-Chemical parameters for the month of March (Laboratory tested and standard)

<i>Label</i>	<i>March</i>	<i>Standard</i>	<i>Reference</i>
Temperature, °C	29.8	0	
Turbidity, ntu	18.43	5	IS10500
Electrical Conductivity	1158	300	ICMR
TDS, mg/l	751.94	500	IS10500
pH	7.63	8.5	IS10500
Total Hardness, mg/l	288.4	300	IS10500
Calcium, mg/l	92	75	IS10500
Magnesium, mg/l	196.4	30	IS10500
Sulphates, mg/l	50.83	200	IS10500
Nitrate, mg/l	49.767	45	IS10500
Chloride, mg/l	188.8	250	IS10500
Alkalinity	562.77	200	IS10500
DO	2.85	6	CPCB
BOD	51.72	5	CPCB
COD	146.16	10	CPCB

Table 3: values of Physio-Chemical parameters for the month of April (Laboratory tested and standard)

<i>Label</i>	<i>April</i>	<i>Standard</i>	<i>Reference</i>
Temperature, °C	26.2	0	
Turbidity, ntu	19.2	5	IS10500
Electrical Conductivity	1062	300	ICMR
TDS, mg/l	689.61	500	IS10500
pH	7.2	8.5	IS10500
Total Hardness, mg/l	336	300	IS10500
Calcium, mg/l	140	75	IS10500
Magnesium, mg/l	196	30	IS10500
Sulphates, mg/l	46.81	200	IS10500
Nitrate, mg/l	47.27	45	IS10500
Chloride, mg/l	178.26	250	IS10500
Alkalinity	577.30	200	IS10500
DO	2.76	6	CPCB
BOD	54.82	5	CPCB
COD	149.26	10	CPCB

RESULTS:

- The results revealed that pH ranged from 7.2 – 7.63, the water samples analyzed results were within the prescribed standard limit. The three main processes affecting Lake PH are photosynthesis, respiration and nitrogen assimilation. The effect of photosynthesis and respiration depends on carbonate, bicarbonate and carbon dioxide equilibrium.
- Electrical conductivity ranged between 1062- 1150 $\mu\text{mhos/cm}$, which was within the prescribed limit.
- Total Dissolved solids ranged between 690-870 mg/L, which was above the prescribed limit.
- Dissolved oxygen (DO) was below the prescribed standard against 4 mg/L. It was in the range of 2.4-2.85 mg/L.
- Biological Oxygen Demand (BOD) ranged from 51-56.4 mg/L.
- Chemical Oxygen Demand (COD) ranged from 146 to 143mg/L which is alarmingly high.
- Total hardness (TH) ranged from 270-340 mg/L which is slightly in the higher side.
- Chlorides ranged between 170-190mg/L which has exceeded the limit.
- Total Alkalinity (TA) ranged between 542 to 580 mg/L.
- Nitrate (Nitrogen) ranged between 47-49 mg/L. Nitrate (nitrogen) slightly exceeds standard limit.
- Sulphates ranged between 46 to 50 mg/L which is within the permissible limits.
- Turbidity is in the range of 16- 19 mg/L which is very high when compared to permissible limits.

CONCLUSION:

- In spite of several efforts being made to find a lasting solution for the status of the Bellandur Lake, Bangalore aquatic map continues to be threatened by encroachment and effluent discharge.
- According to our study, the Salinity of the water is at higher levels with its pH dropping down than the standards.
- Although Nitrates and Chlorides levels have been greatly reduced to lower limits, the lake is still severely colored and highly turbid. This still indicates the presence of disease causing micro-organisms in water which can cause symptoms such as nausea, diarrhea, headaches, etc.
- Sulphates level is still significantly and comparatively higher. It appears that raw sewage running parallel to the lake continues to seep in - causing reduced dissolved oxygen and increase in BOD.
- Solving the problem at end point is a temporary measure with more serious repercussions.
- The solution is to tackle this problem at source points with strict enforcement of our environmental laws and regulations. But until that happens, the “City of Lake” will soon be history.

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