

Eutrophication in the Lakes of Udaipur city: A case study of Fateh Sagar Lake

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Abstract. Udaipur has faced water scarcity from its inception, due to its geographical location. The Hindu monarchs who ruled the city built an array of artificial lakes to ensure regular water supply for their subjects. They were taken care of not only by the administration but also the local people. In the British regime, Udaipur came to be known as the city of lakes, and the four large water bodies, Pichhola, Swaroop Sagar, Fateh Sagar and Badi, remained its lifelines. But the condition of the lakes deteriorated sharply in the post independence era. While, unregulated and rapid commercialisation escalated the inflow of pollutants, indifferent government machinery that paid scant attention to proper cleaning up operations, only intensified the problem. As many as twelve government agencies were assigned the task of working as *caretakers* of these water bodies. But they merely passed on the responsibility to one another. The health of the lakes grew shakier very year. The paradox is that tourism in Udaipur can grow immeasurably, especially with improved communication and infrastructure, but Udaipur tourism can dry up completely if lakes are not saved. The present paper is an attempt to outline the chief causes of degradation of Fateh Sagar Lake and aims to suggest methods for the regeneration of this world famous artificial lake.

Keywords: Eutrophication, Lakes, Sewage, Udaipur

1. Introduction

Udaipur is famous all over the world for its enchanting lakes. Udaipur is dependent on its lake system, which is directly, or indirectly the life source of the city in terms of surface water resources, tourism, and the ecosystem at large. Most of the tourists (domestic as well as foreign) come to the city primarily because of placid beauty of the lakes. Lakes thus form the backbone of the city's economy which is however under imminent danger of irreparable degeneration, possible destruction.

Before independence the water of the lake was hardly used for any purpose and it remained full of water almost throughout the year. The water in this lake was so clean the British officers even used to drink this water. All the three islands found in the lake were full of vegetation and hundreds of aquatic birds and waders inhabited the island.

While superficially, the beauty of Udaipur is un-smearred, the heavy siltation after deforestation has reduced the depth of the lakes to a quarter of which it used to be 40 yrs ago. With the uncontrolled increase of the density of habitation around the lakes, they have become a substitute for a sewage system. Over the last 25-30 years, massive deforestation and faulty land-use practices have severely degraded the catchments of the lake of Udaipur, resulting in increased inflow of sediments into these water bodies.

The increased commercial activities have also contributed considerably to the water pollution. The total outcome of the above activities is the heavy loading of lake waters with phosphate and nitrates. These two elements basically increase the botanical fertility of lake water and lead to intermittent, but luxurious growth of Water Hyacinth. The lake bottom is also covered with a thick mat of submerged vegetation. In some portions of the lake, there is presence of floating micro algae which are detrimental to the public health, and harbor varieties of harmful organisms

Hydrobiological work on various inland water bodies of India including lakes of Udaipur have been conducted by several workers. No systematic work however has been done on the causes of eutrophication in any of the lakes of Udaipur. Paliwal (1984) made an Ecological Study of Fateh Sagar Lake (Udaipur) with Special Reference to Macrophytic Vegetation. A great deal of work however has been done on the eutrophication of several lakes of other states of India (Fruh 1966, Shreenivasan 1969, Pant et al 1980, Prat and Daroca).

2. Study Area

Fateh Sagar Lake in Udaipur was built during monarchy. Its area is 20 Sq. km. The lake has four islands. One is converted into a small island called Nehru Park, for one solar observatory is created. The third rocky output has developed into a fountain and the fourth one is just near the north western shore.

The runoff emerging from surrounding hills drains into this lake. The lake is pear-shaped and is encircled by the Aravalli hills on three sides with a straight gravity stone masonry dam on the eastern side which has a spillway to discharge flood flows during the monsoon season.

Three causeways, one from Pichola Lake, the other from Madar Lake and the third one from Badi Lake lead to the Fateh Sagar Lake. There are three inlet channels, which feed the lake and an overflow section on the eastern side in the Masonry dam of 800 m length. Monsoon rains are the main source of all water to the lake. Initially constructed as an irrigation scheme, it is now the second major source of drinking water to the city of Udaipur and the irrigation supplies have been discontinued. A canal from the Rang Sagar Lake connects to the Fateh Sagar Lake. A gate controlled canal further connects Fateh Sagar Lake with Lake Pichhola. The Northeastern embankment is known by three names viz., the Pal, the Drive, or Connaught Bund (bund means embankment).

Table 1 Physical Dimensions of Fateh Sagar Lake

Parameter	Value
Surface area(km ²)	4
Volume(km ³)	.0121
Maximum depth(m)	13.4
Mean depth	5.4
Water level	regulated
Length of shoreline (m)	8.5
Normal range of annual water level fluctuation (m)	3-4
Catchment area (km ²)	54

3. History of the lake

After independence trees looming over the water edge and near to it were chopped off which reduced the heroneries. Government allowed contract for killing of crocodiles in early fifties. These harmless reptiles were killed for skin and within two years almost all of them were killed. Fish contractors were also allowed which considerably reduced fish population in the lake. Though the fisheries department periodically stocks the lake with fingerlings of exotic, commercially viable fishes of 3 or 4 types only the other fishes viz. cat fish are on the verge of extinction. In the lake the demand for water also increased. The water works department started pumping water from the lake which resulted into constant fluctuation of the water table. Several permanently marshes and reed swamps are no more in the lake.

The bigger island was an ideal place for pythons as these reptiles are mostly found in semi aquatic habitats. There was no scarcity of food as there were several nesting birds and roosting places for birds. There was strict restriction on fishing so that the lake was full of fishes. Apart from fish eating birds the population of crocodiles was in good number. As the lake remained full of water, there was abundance of reeds and other aquatic vegetation. The lake was also ideal for migratory birds and every year in winter lot of migratory birds visited the place.

4. Ecological Degradation of Fateh Sagar Lake:

4.1. Habitat Destruction

- A lot of residential areas have come up around the lake and even some people have acclaimed the submerged areas for residential purposes. The discharge from these colonies is directly polluting the lake.
- One of the islands which was ideal for basking and egg laying place for crocodiles is now no more an island. During rainy season it remains an island just for two months only .Mot of the trees have been chopped off.
- The bigger island is converted into Nehru Park and the pythons have disappeared. Now it is recreational place for tourists.

4.2. Pollution

The city & downstream lakes are heavily polluted and are facing an imminent danger of irreparable degeneration.

- The physical setting of the Udaipur city enhances the flow of pollutants into the Fateh Sagar Lake. Most of the hotels along with 6000 residential houses accommodating 33000 populations are located on the lake slopes.
- 73 Ghats (used for bathing and washing), 42 garbage spots, 45 drain spots and 118 open defecations spots, all of which release a shocking quantity of pollutants into the lakes.
- The people living in the walled city look towards the lakes for bathing and sanitary facilities. Apart from bathing, vehicles are also washed in Lake Fateh Sagar.
- The people perform their religious rituals and ablutions at the lakeside. Muslims and Hindus submerge their religious creations (Tajias & idols) into the lake
- In the catchment area of Fateh Sagar Lake, effluents from synthetic fiber mills and soft drink plant etc are discharged. . The lake is subjected to heavy organic contamination
- From the shores people go to Nehru Park by mechanized boats. The oil spillage from this boat is disturbing the aquatic flora and fauna and is polluting the air.

4.3. Waste Disposal

- Several road side restaurants have come up which dispose the wastes in the lake It mainly comprised of metallic cups, of cold drink bottles, ice cream cups, paper or leaf plates, etc.
- Around 100 thousand populations, residing in the vicinity of lakes release all sorts of dirt and drain waste water into the lakes.
- The garbage collected from the roads, dirt thrown from the houses, debris of the dilapidated houses, and dead animals are thrown on the banks of the lakes.

5. Results and Discussions

The lakes are continuously facing the threat of illegal construction despite the Government's notification of "No Construction Zone "(17-01-1997) and High Courts interventions. The solid waste disposal around the periphery is further worsening the situation. Further, the rate of organic matter production by water hyacinth leads to silting @ 0.7 cm per year. The continuous sedimentation has not only reduced the water holding capacity but the quality of water is also being deteriorated severely.

The deposition of the sediments & continuous organic loading have not only affected the quality of water originally retained by the lakes but has drastically deteriorated the quality also. It is relevant to mention here that the Fateh Sagar Lake is in an advanced stage of eutrophication.

Over the last 10 years, because of less rainfall & degradation of the catchment, the maximum & minimum water levels are continuously receding. Lakes of Udaipur were totally empty from 1998 to July 2005. Considering the social, economic (revenue generation out of tourism is of the order of Rs. 15000 million), historical, cultural & ecological importance of Udaipur lakes General public, administrative departments and political leaders were educated that by doing such inter-basin transfer of surplus waters, the lakes will at least have water above silt level throughout the year & ground water level of the city would be maintained at fairly high level minimizing the consumption on electricity in fetching the water from less depth and maintaining the ecological balance.

- Silt removal programs should be organized on regular basis.
- Developing reservoir operation policy so as to keep and maintain the minimum conservation pool level of at least 10% of the total storage capacity the lakes at all times.
- The public of Udaipur is greatly aware of the problem and of water hyacinth and has, several times, participated in the campaign of removal of water hyacinth in the last 25 years.
- Removal of the surface and submerged aquatic weeds like hydrilla, vallisneria and lemna, the protection of native fish species & rejuvenation of certain conservatory type fishery plays an important role in the water quality control, conservation & upkeep of the entire lake system.

6. Conclusion

Udaipur city is growing in population and business activities and with the rise in the standard of living the waste water flow is rising. The present research work concludes that Fateh Sagar Lake is highly eutrophic and polluted lentic water body. It is now left to the citizens of Udaipur to fight for the life of these dying water bodies. And they have been doing so with singular zeal. The people of Udaipur have tried to draw the attention of the authorities to the lakes through rallies, public meetings, lecture sessions and distributing relevant literature. In 1980, the citizens removed water hyacinths that had totally covered Fateh Sagar Lake. Again in 1995 the people undertook another cleaning programme. Some of the damage done to this lake is irreversible but still we can rectify some of our mistakes and for this we would have to take some drastic steps to save this wetland otherwise in due course of time this lake will be converted into semi sewerage pond and may effect the recreational value..

7. References

- [1] Sharma, L. L. & Sharma, S. K. First Annual Report of the Department of Science and Technology Project. 24pp 1988.
- [2] Kumar, S. Certain Aspects of Water Quality of Lakes Pichhola and Fateh Sagar, Udaipur, Rajasthan - A Limnological Study. M. Sc. Thesis, Rajasthan Agricultural University, Bikaner 1987.
- [3] Paliwal, P. P. An Ecological Study of Fateh Sagar Lake (Udaipur) with Special Reference to Macrophytic Vegetation. Ph. D. Thesis, Sukhadia University 1984.
- [4] Sharma, M. S. Studies on Plankton and Productivity of Udaipur Waters in Comparison to the Selected Waters of Rajasthan. Ph. D. Thesis, Sukhadia University, Udaipur 1980.
- [5] Sharma, L. L. Some Limnological Aspects of Udaipur Waters in Comparison to the Selected Waters of Rajasthan. Ph. D. Thesis, Sukhadia University, Udaipur 1980.
- [6] Dhawan, S. Fish fauna of Udaipur lakes. Jour. Bombay Nat. Hist. Soc., 66: 190-194 1969.
- [7] Upadhyaya, P. Observations on the Planktonic Population of Lake Fateh Sagar, Udaipur, Rajasthan, Ph. D. Thesis, Sukhadia University, Udaipur 1987.