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# CONSERVATION ON LAKE- A CASE STUDY ON KATRAJ LAKE PUNE, MAHARASHTRA

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**Abstract –** *Katraj Lake is one of the important lakes in Pune Maharashtra which has a historical significance and it is situated in south Pune. It is a manmade lake built at the time of peshwa in the south Pune covering 82 hectares of land. The lake consists of two different proportion system that id dam and canals. The first lake act as a clarifier or trickling filter tank and the water from the first lake seeps into Katraj Lake. Katraj Lake is severely degraded due to present effluent coming local resident from the drainage lines linked to the Katraj lake. At present case the historic Katraj lake is under a thick cover of water hyacinth in the lower Katraj lake and there is a huge patch going towards the upper Katraj lake. Water analysis was done for parameters like temperature, pH, Dissolved oxygen, Biochemical oxygen demand, chemical oxygen demand, Nitrate, Phosphate, Electrical Conductivity and Coliform Bacteria, APHA standard laboratory procedure has been adopted to check the water quality. The study of Katraj Lake is done to find out how a bay or beach covered by a water hyacinth affected the life of a lake community and ecosystem. The aim is to focus on the present scenario and immediate threats on characterization and restoration aspects of a six months covering monsoon and post monsoon season.*

***Key Words***: Physio-chemical characteristic, water hyacinth, restoration, conservation, monsoon season, post monsoon season and management measures.

## 1. INTRODUCTION

Katraj Lake is one of the important lakes of Pune Maharashtra which has a historical significance, and it is situated in the south Pune. It is a manmade lake built at the time of peshwas in south Pune covering 82 hectares of land. In 1749 the water supplies system which was commissioned from "Ambil Odha" that flows down towards Katraj ghat. The Lake consists of two proportion system that is dams and canals. The first lake acts as clarifier or trickling filter tank and the water from the first lake seeps into the Katraj lake. In 19th century the Katraj lake water used to supply water through an underground canal to the old city of Pune. Several fountains, tanks, baths, wells, pipelines were constructed to supply of water from the Katraj Lake to the local resident for domestic use and drinking purpose. In 1879, the Pune municipality corporations have to look over the city's water supply system and from began a gradual decline in the use of Katraj system. Katraj Lake is severely degraded due to present effluent coming from local resident and rapid development of many societies surrounding of Rajiv Gandhi zoological park seem to have got their drainage pipelines linked to the Katraj lake. This may cause the extinction of some species or ecosystem types and cause permanent ecological damage as well as scarcity of water to nearby areas.

The purpose was to assess the major source that degraded the quality of water by doing the physico chemical analysis of lake water in the month from July 2018 to January 2019.

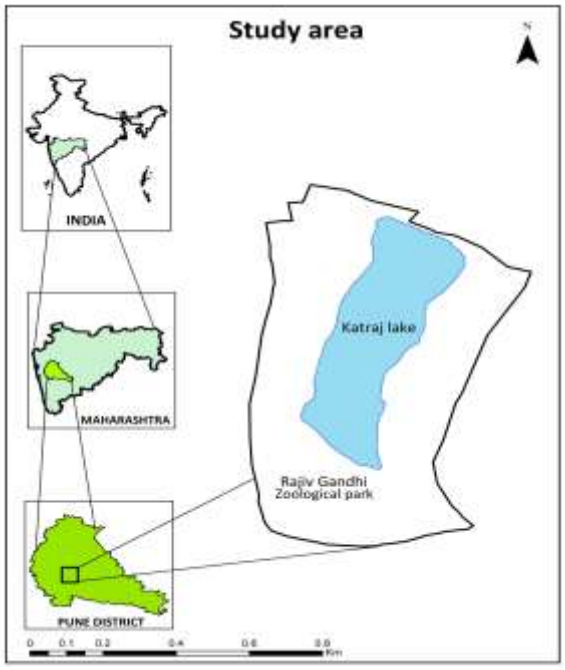
Water analysis will be done for parameters like pH, temperature, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, nitrate, phosphate, electrical conductivity and coliform bacteria. APHA standard laboratory procedure has been adopted to check the water quality, as well as to identify the stage of eutrophication level of lake. The study of Katraj lake is done because to find out how a beach or bay covered by a water hyacinth affected the life of a lake community and ecosystem. Some information from zoo authorities and members that indicated that the weeds carpet impacted in negative form that is disrupted fishing activities, transport, irrigation, water treatment, enhanced breeding grounds for vectors of human diseases. The aim is to focus on the present scenario and immediate threats on characterization and restoration aspects for a period of six months covering post monsoon season.

### 1.1 Study Area

The area of Katraj is in the southern part of Pune Metropolitan Area. The lake is having very less human interference. Katraj Lake is situated in the southern part of the Pune city. The lower Katraj Lake is situated in the Rajiv Gandhi Zoological Park. The total surface area of Katraj Lake is around 165000 square meters. The lower Katraj Lake and the upper lake lies one below the other. The area of Katraj Lake is beautiful surrounded by trees and it has a natural slope and mountain barriers, which seems the beauty of lake. The lower Katraj lake is covered with zoological park having different stations in Zoo Park itself. In 1749 the water supply system which was commissioned from "Ambil Odha" that flows down towards Katraj ghat. In ancient times, the lake

water is use for drinking purpose for nearby areas. The Katraj snake park, agricultural fields, and the forest area are situated and covered by its four sides. The Pune Municipal Corporation have a plantation activity for the area in around 40 hectares of land.

The lake having total area of land is 82 hectares out of these 66 hectares belongs to the Pune municipal corporation. The remaining 65 acres are under the lake water. Presently the lake water is just used for gardening purpose or sprinkling the water to the plants of the campus of Bharati Vidyapeeth Institute. The Katraj Lake covers the area about 8000 to 10000 square meters and having the depth of lake is around 5 to 6 meters. It is located at the southern region of Pune city at altitudes of 18°- 26'N and 72°. 64' longitude. The lower Katraj Lake is 6000meter away from the upper Katraj Lake. Here the map no 1, shows the study area of Katraj lake-:




Map No.1 Study area of Katraj Lake

## 2. METHODOLOGY

### 2.1 The morphometric data of Katraj Lake

The present study deals with the Katraj Lake to study the lake, morphometric data is required to know the latitude longitude and some detailed information for the collection of samples as given in the Table no. 1

Table no. 1: Morphometric data of Katraj Lake

| | |
|---|---|
| The trophic status of Katraj Lake | Eutrophic in nature |
| The presence outlet of the Katraj Lake | Open lake |
| The flow of Katraj Lake based on its nature | Seepage lake |
| The morphometry or shape of the Katraj Lake | Sub rectangular shape of the lake. |

Table no. 2: Classification of Katraj Lake

| | |
|---|---|
| Area covering the Katraj Lake | 300,200 $m^2$ |
| Volume of the katraj Lake | 3002000 $m^3$ |
| Maximum Length of Katraj Lake | 780 meters |
| Depth of the Katraj Lake | 9- 10 meter |
| Shape of the Katraj Lake | Sub rectangular shape |

### 2.2 Site Selection

The present study deals with a Katraj Lake which is situated in Pune in Western Maharashtra (India). The lower Katraj Lake is under the Rajiv Gandhi Zoological park. For the collection of the water sample the selection of the site is necessary. There is a need to study the morphometric data also to understand the area, volume, depth as well as latitude, longitude and gratitude of the Lake. The MTDC area was selected for the collection of water sample the area was selected because it is the center part of Rajiv Gandhi Zoological Park, there are also some legal laws of zoological park while collection of the water sample. Some parts are not allowed to collect the water sample. Therefore, the selection of site was done under the permission of the Director of Rajiv Gandhi zoological park Dr**. Rajkumar Jadhav.**

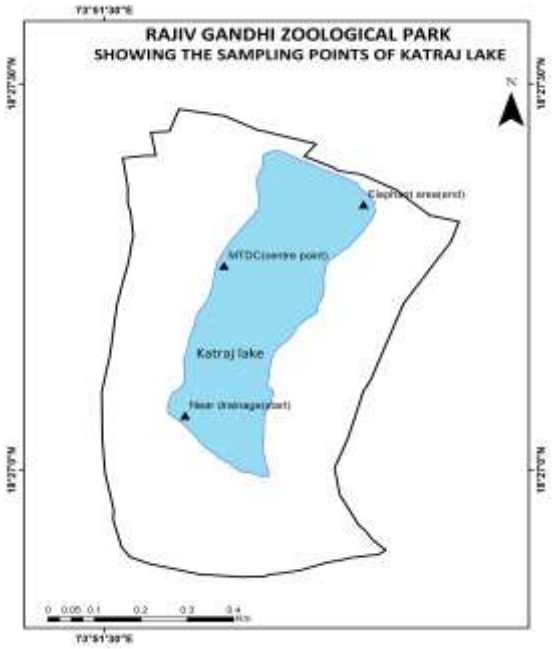
### 2.3 Lake water sampling

The choice of sampling was been influenced by various uses of water and their locations. The stations are identified from a combination of land marks of the shore and depth profiles with echo sounding. Water sample is also taken by the zoological park to evaluate by testing physio-chemical parameters. Numbers of sample should be taken at vertical intervals. The water samples of the lake were been collected from two points of lake. The first point is the middle centre of the of the lake that MTDC area of Rajiv Gandhi zoological park. The second point is the end of the lower Katraj Lake it is near to the elephant point of zoological park. The water analysis was done in monsoon and post monsoon season. The analysis must be taken in the year from 2018 to 2019.

The samples were collected in sterilized bottles using standard procedure in accordance with standard method of (APHA's) American Public Health Association (1995).

The water samples were collected in the month of July, August of Monsoon Season and November, January in Post monsoon Season. The water sample were collected on 10th day of the following months between 10 to 11 am from July 2018 to January 2019. The quality of water way to evaluate by testing various physio-chemical parameters such as Dissolve oxygen (DO), Biological oxygen demand (BOD), Chemical oxygen demand (COD), PH, Nitrate (NO3), Phosphate (PO4), Temperature, Electrical Conductivity and Coliform Ba*cteria***.**

Here the following map shows the sampling point of Rajiv Gandhi Zoological Park for water analysis.




Map no. 2: Sampling Points of Katraj Lake

## 2.4 Parameters and their methods

Different physical and chemical parameters were been analyzed of lake water sample. For such parameters, some technique was used method and procedure. This technique was basically done by standard technique with proper equipments; the detailed information for every procedure is given below.

- The pH of water sample was estimated by potentiometric method (IS :3025(part 11)1983 clause 2).(1)
- The DO of lake water sample was estimated by Azide modification method (IS:3025(part 38)1989 clause 402).(2)
- The B.O.D of lake water sample was estimated by Titration that is Titrimetric Method(IS:3025(part 44)1993 Reaffirmed).(3)
- The COD of lake water sample was estimated by Titrimetric Method (APHA-Ed.22,5220-C).(4)
- The Phosphate of lake water sample was estimated by Spectrometric Method(APHA-Ed.22,4500-P).(5)
- The Nitrate of lake water sample was estimated by Spectrometric Method (IS:3025(part 38)1989 clause 4.2).
- The Electrical Conductivity of lake water sample was estimated by EC meter.

## 2.5 Physiochemical analysis of Katraj Lake

Table no. 3:Data of Monsoon season

| Sr. No | Parameters | Unit | Values observed in July | | Values observed in Aug | |
|---|---|---|---|---|---|---|
| | | | $S_1$ | $S_2$ | S | S |
| 1 | Temp. | **°C** | 28 | 28 | 27 | 27 |
| 2 | pH | ------ | 6.79 | 6.77 | 7.59 | 7.52 |
| 3 | DO | Mg/ L | 4.4 | 4.2 | 3.6 | 4.0 |
| 4 | BOD | Mg/L | 70 | 68 | 48 | 49 |
| 5 | COD | Mg/ L | 160 | 150 | 210 | 260 |
| 6 | Phosphate | Mg/L | 0.019 | 0.020 | 0.026 | 0.027 |
| 7 | Nitrate | Mg/L | 1.04 | 1.0 | 0.48 | 0.49 |
| 8 | Coliform Bacteria | MPN | 1600 | 1600 | 1600 | 1600 |
| 9 | Electrical Conductivity | mil/cm2 | 652 | 650 | 671 | 670 |

Table no. 4: Data of Post monsoon season

| Sr. No. | Parameters | unit | Values observed in November | | Values observed in January | |
|---|---|---|---|---|---|---|
| | | | $S_1$ | $S_2$ | $S_1$ | $S_2$ |
| 1 | Temp. | **°C** | 26.5 | 26 | 27 | 28 |
| 2 | pH | -------- | 7.52 | 7.50 | 7.77 | 7.32 |
| 3 | DO | Mg/L | 3.5 | 3.9 | 4.0 | 4.1 |
| 4 | BOD | Mg/L | 170 | 140 | 130 | 110 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 5 | COD | Mg/L | 280 | 240 | 151 | 189 |
| 6 | Phosphate | Mg/L | 0.026 | 0.024 | 0.020 | 0.024 |
| 7 | Nitrate | Mg/L | 0.48 | 0.40 | 0.39 | 0.36 |
| 8 | Coli form Bacteria | MPN | >1600 | >1600 | >1600 | >1600 |
| 9 | Electrical Conductivity | Ms/ cm | 726.0 | 724.0 | 722.0 | 690.0 |

Table no. 5:Average data of monsoon and post monsoon season

| Sr. No. | Parameters | Unit | Average values | | | |
|---|---|---|---|---|---|---|
| | | | July | Aug. | Nov. | Jan. |
| 1 | Temp. | °C | 28 | 27 | 26.25 | 27.5 |
| 2 | pH | -------- | 6.78 | 7.555 | 7.51 | 7.545 |
| 3 | DO | Mg/L | 4.3 | 3.8 | 3.7 | 4.05 |
| 4 | BOD | Mg/L | 69 | 48.5 | 155 | 120 |
| 5 | COD | Mg/L | 155 | 235 | 260 | 170 |
| 6 | Phosphate | Mg/L | 0.0195 | 0.0265 | 0.025 | 0.022 |
| 7 | Nitrate | Mg/L | 1.02 | 0.485 | 0.44 | 0.375 |
| 8 | Coli form Bacteria | MPN | 1600 | 1600 | 1600 | 1600 |
| 9 | Electrical Conductivity | Ms/ cm | 651.0 | 670.5 | 725 | 706 |

## 3. CONCLUSION

Water quality standard having a significant variation due to its different environmental conditions sometimes either it is positive or negative with an unbalance ecosystem. It is concluded from the present study that the pH of the Katraj Lake exceeds the desirable range of BIS and MPCB standards which means the present water in Katraj Lake is in alkaline condition. But there is a difference found in both of the season that is in monsoon and post monsoon, in monsoon season the value of pH is slightly below as per the desirable standards of BIS and MPCB, but in post monsoon season it exceeds the limit as per BIS and MPCB. All the parameters which are studied in the present study acts as the same, therefore it was right to said that the monsoon water of the Katraj Lake gets naturally filtered by the rain, in the lake water body, so this process we can say that it acts as sedimentation basin, because the dilution from rain to the lake body has been observed. Dissolve Oxygen was found very less as it was analyzed by the standard procedure of APHA (American Public Health Association) standards and the Biochemical Oxygen Demand (BOD) concentration are found very high in Lake Water samples and it is vice-versa process if DO decreases then the concentration BOD increases. But the same difference was seen in the both seasons. COD values are also not I the limit as per BIS and MPCB standards. The coli form Bacteria present in the lake water sample, from the month of July to January from the year o2018 to 2019; there is a higher presence of coli form bacteria are seen in the water sample. According to BIS and MPCB standards the maximum limit of coli form bacteria is 50 MPN is accepted, but in the present study greater than 1600 MPN are estimated in Katraj Lake. The E-coli is also present in the lake body. Hence it is evidence that the lake water is not use for drinking water and as well domestic purposes. All the locations of the Lake need a proper management and treatment process. Removal of weeds by natural process is important, the diversion of drainage line is important because of from the drainage line the sewage is coming from the local resident and thus it's degraded the quality of the lake water. There is a need to place aerators in the lake that may help to control the fish's death rates, because they are at extinct level. If some precautions were taken, then the lake water is use for some recreational purposes and the aquatic life of the lake will survive.

## RECOMMENDATIONS

The present study having the adverse effect in the quality of water, hence it is proved by doing physical and chemical analysis.

For the conservation and restoration of the Katraj Lake some suggestions are given below-

The lower Katraj Lake is totally covered with water hyacinth for that some restoration measures should be necessary, that are as follows:

**1) Pollution source**-: Waste water, sewage, slit etc are entering to the lake from their external source must be stop before any restoration work is implemented.

**2) Diversion of drainage pipeline**-The main cause for the degradation of the lake is due to the drainage pipeline the sewage is coming from the surrounding local residential area that degraded the water quality of lake which promotes to grow water hyacinth in Katraj Lake.

**3) In- lake treatment of Katraj lake**-: The sewage that is present in the lake near the drainage pipeline should be removed and treatment is necessary to control, and precautions should be taken by sustainable measures.

**4) Removal of water hyacinth-** There should be a removal of water hyacinth is necessary to maintain the water bodies; it must be removed by manually or mechanically, there

should be a need that every six month the removal of water hyacinth is necessary because it grows rapidly now a day and the removal weeds can be used as for an composting. Weed infestation can also be controlled by using different chemicals methods or chemicals such as methyl-chlora-phenoxy-acetic acid and by biological methods to control like Chinese grass carp it is a fast-growing fish that feed on many aquatic plants.

**5) Regular testing of Lake Water body-** There should be a need to test the quality of water of the Katraj Lake every month to monitor the difference, as well as the season wise data is necessary to solve the problems of the lake.

**6) Need to place aerators in Katraj Lake-:** The phenomenon of fish death is common but in the recent years the fish death are increasing day by day the present situation is lead towards the extinct conditions of fish this was the main reason behind the decrease in dissolved oxygen (DO) of lake water an increase in BOD level. There is a need to place aerators in Katraj Lake so that the lake community will health otherwise the whole community gets disturbed.

**7) Plantation of trees around the Katraj Lake**- The plantation of trees around the lake may help to control the soil erosion this can be done by the zoo authorities' members. Lake was degraded day by day due to the lack of oxygen caused by the pollution in water. The Pune Municipal Corporation has requested to allot the plantation of trees around the Katraj Lake and the data of every six months plantation must be recorded

**8) Best Management plan**-: The restoration programmes with an ecosystem approaches through the managements planning helps in correcting the point source and non-point source of pollution. The management planning includes-:

- Public participation
- Environmental Awareness
- Environmental Planners
- Research students' opportunities
- Shore line treatment of the Katraj Lake.
- Promoting public Education Programmers
- Awareness for zoo authorities' workers and members
- Removal of weeds from the Lake must be used for composting instead of

  These are solutions which can help for the recovery of the Katraj Lake.

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