

LIMNOLOGICAL STUDY OF PASHAN LAKE, PUNE (MAHARASHTRA, INDIA)

Mrs. M.S. Jadhav¹ * and Dr. Mrs. K.C. Khare²

1 - HOD, Department of Civil Engineering, Sou. Venutai Chavan Polytechnic, Pune 411041, Maharashtra

2 - Professor of Civil Engineering, Sinhgad College of Engineering, Pune 411041, Maharashtra

ABSTRACT

Pashan Lake is a important Lake in Pune city which attracts migratory birds. Deforestation on nearby hills has caused heavy siltation resulting in decrease in the depth of the lake. This has reflected in reduction in the number of deep diving ducks which prefer to occupy the central deep portion of the lake. They are now outcompeted by dabbling ducks which prefer shallow water. The increasing number of these ducks in the central position is a clear indicator of decrease in the depth of the lake. It was found that depth of the lake in 1980 was 30-40 ft. which was reduced to 15-20ft in year 2001-02. The surface water quality of Pashan Lake is severely degraded due to the pollution from surrounding areas directly entering the water. Three surface sampling points were selected to evaluate the water quality. The study presents the. Physico_chemical characteristics of the lake water and suggests the means to improve the water quality through eco remediation measures for restoration.

1. INTRODUCTION

Pashan Lake is situated between 18°32'7"N and 73°46'58"E near Mumbai - Pune by pass highway in Western India. Pashan lake is manmade lake built by bunding Ram river. The catchment area is 40 sq.km. Silting of lake occurs due to deforestation, road construction, and other land disturbances which results erosion. The surface water quality of the Pashan Lake is severely degraded due to the pollution

from surrounding areas directly entering the water. Three sampling points were selected to evaluate the water quality. Surface water samples are collected from established sites .Water analysis was done for the parameters like P^H, Dissolved oxygen (DO), Biochemical oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total dissolved solids (TDS), Chloride, Calcium and Magnesium and Hardness for testing the suitability for drinking, agricultural purposes.



Figure 1 : Location of Pashan Lake

* mrunaljadhav@gmail.com

The lake does not seem to have received care and attention during last few years as a result, the lake as well as its catchment is facing serious threats from encroachment and pollution, in this connection Pune Municipal corporation is going to undertake the lake improvement project which includes desiltation, beautification and removing of aquatic weeds and its disposal with the help of government and NGOs.

2. CHARACTERISTICS OF LAKE

When selecting a lake/reservoir station, there should be a comprehensive collection of information and an appraisal of the information requirements. There is a need for data on the lake characteristics such as volume, surface area, mean depth, water renewal time together with such information as is available on the thermal, bathymetric, hydraulic and ecological characteristics. Pashan lake area is around 144 Acers. Depth is 25-30 ft. after desiltation. The source for the lake is water from Ram river and under ground water from wells which are situated in lake.

3. LAKE WATER SAMPLING

The choice of sampling stations is influenced by the various uses of the water and their location, relative magnitude and importance. It is important to note that any information obtained from the survey of a water intake from a lake for drinking water, industry or agriculture cannot reflect the overall quality of this water body which should be determined from vertical profiles.

Lake sampling is normally carried out from a boat. The station is usually identified from a combination of landmarks on the shore and depth profiles with echo sounding. Precise identification of the station each time is not easy but this is usually immaterial because of the good lateral mixing.

A number of samples will need to be taken at vertical intervals. The following minimum programme is recommended.

- Two depths (surface and bottom) if lake depth does not exceed 10 m;

- Three depths (surface, thermocline and bottom) for lakes not deeper than 30 m;
- Four depths (surface, thermocline upper hypolimnion, bottom) for lakes of at least 30m depth; in lakes deeper than 100 m additional depths may be considered.[3]

4. MATERIALS AND METHODS

For the present study, the water samples were collected in sterilized bottles using the standard procedure in accordance with the standard method of American Public Health Association (1995). The samples were collected for a period of 6 months from December 2006 to June 2007, at three sampling stations. The samples were brought to the laboratory with due care and were stored at 20°C for further analysis. The physico-chemical parameters such as pH, Biochemical Oxygen Demand, (BOD), Dissolved (340 to 960 m/m) was used for analysis and chemical used were of analytical grade.[2]

Table 1: [1] Parameters and methods employed in the chemical examination of water samples:

Sr.No.	Parameter of water analysis	Methods
1	pH	Potentiometric
2.	DO	Azide modification
3.	BOD	Azide modification
4.	COD	Dichromate reflux
5.	Chloride	Gravimetric
6.	Calcium	Titrimetric
7.	Magnesium	Titrimetric
8.	Hardness	Titrimetric

Table 2: Physico – chemical analysis of Pashan Lake During December 2006.

	Station I	Station II	Station III
pH	7.9	8.07	8.2
DO mg/L	6.8	6.9	6.6
BOD mg/L	128	130	133
COD mg/L	134	136	137
Chloride mg/L	51.2	47.50	52.60
Calcium mg/L	80	78	83
Magnesium mg/L	16	18	19
Alkalinity mg/L	172	175	186
Hardness mg/L	203	209	228
Total dissolved solids mg/L	295	300	310

Table 3: Physico – chemical analysis of Pashan Lake During June 2007.

	Station I	Station II	Station III
pH	8.3	8.8	8.5
DO mg/L	6.2	5.8	5.9
BOD mg/L	119	120	124
COD mg/L	124	128	126
Chloride mg/L	50.8	56.2	54.5
Calcium mg/L	84	88	86
Magnesium mg/L	14	21	18
Alkalinity mg/L	186	189	184
Hardness mg/L	198	189	194
Total dissolved solids mg/L	311	312	308

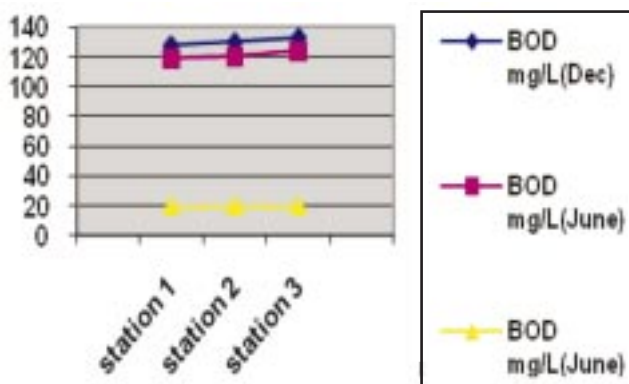


Figure 2.1 : BOD During Different Seasons

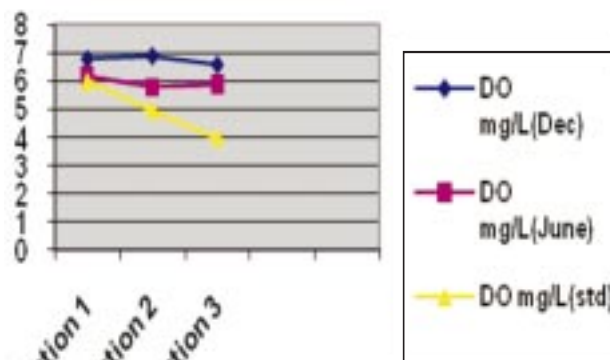


Figure 2.2 : DO During Different Seasons

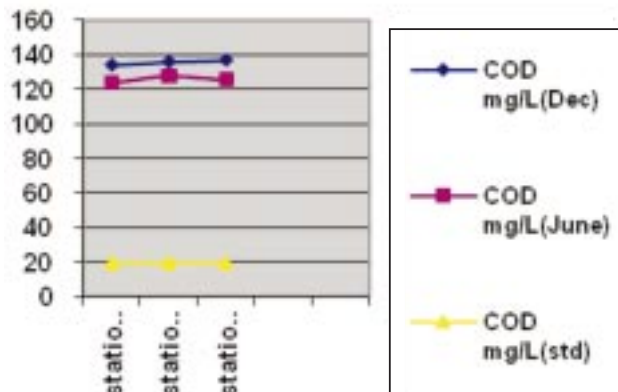


Figure 2.3 : COD During Different Seasons

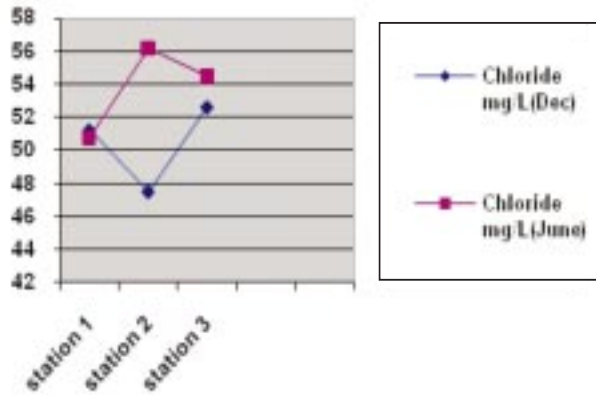


Figure 2.4 : Chloride Concentration During Different Seasons

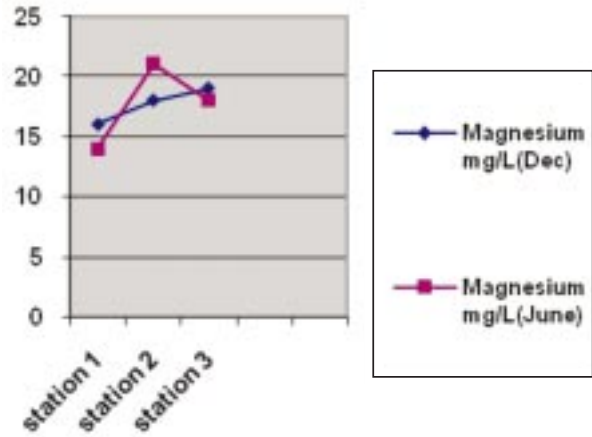


Figure 2.7 : Magnesium Concentration During Different Seasons

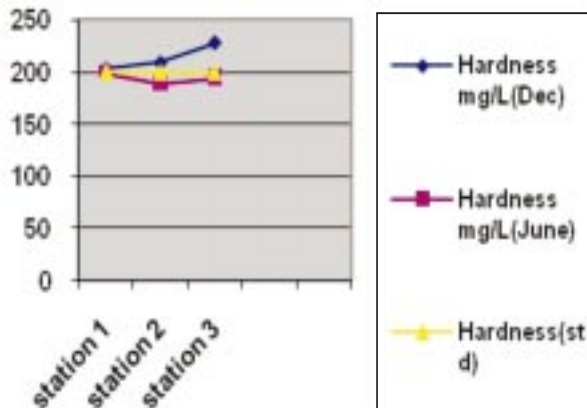


Figure 2.5 : Hardness During Different Seasons

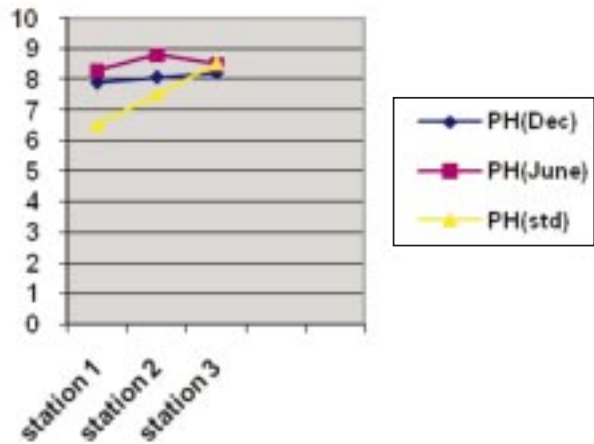


Fig 2.8 P_H During Different Seasons

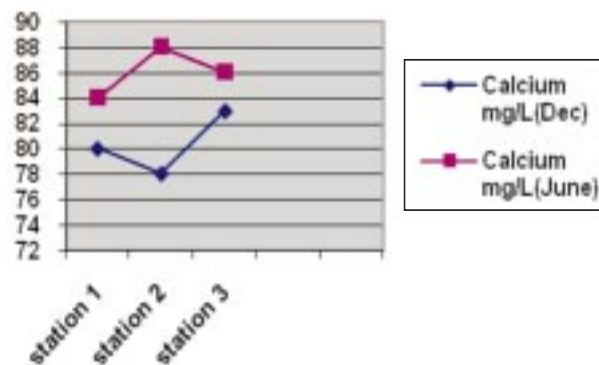


Figure 2.6 : Calcium Concentration During Different Seasons

5. RESULTS AND DISCUSSIONS

The seasonal variation in Physico- chemical parameters are given in table No. 2 and 3 respectively. In the present study P^H range was recorded 7.9 to 8.2 in Dec. 2006 and 8.3 to 8.8 in June 2007. The high P^H range was recorded in summer and low range in winter. P^H of water is important for the biotic compound because most of the plant and animal species can survive a narrow range of P^H. According to literature P^H is considered to be the most important factor particularly in the case of the green algae. The

lower value of P^H during rainy season may be due to the dilution of alkaline substances.

The dissolved oxygen varied from 6.6 to 6.9 mg/l (Dec. 2006) and 5.8 to 6.2 mg/l in June 2007. Dissolved oxygen in water at a given temperature depends on factors like temp. of water. Almost all plants and animals need Dissolved oxygen for respiration. The biochemical oxygen demand was recorded in the range 128 to 133 mg/l (Dec.2006) and 119 to 124 mg/l (June 2007). The values of Dec.2006 are somewhat higher as compared to June 2007. The Chemical oxygen demand was recorded in the range 134 to 137 mg/l (Dec. 2006) and 124 to 128 mg/l (June 2007). COD is a measure of any kind of oxidisable impurities present in the water.

COD is a measure of both the biologically oxidisable and biologically inert organic matter present in the water sample. The chloride was recorded in the range 47.5 to 52.6 mg/l (Dec. 2006) and 50.8 to 56.2 mg/l (June 2007). The total hardness ranged from 203 to 228 mg/l (Dec. 2006) and 189 to 198 mg/l (June 2007). The calcium levels varied from 78 to 83 mg/l (Dec. 2006) and 84 to 88 mg/l (June 2007). The magnesium levels varied from 16 to 19 mg/l (Dec. 2006) and 14 to 21 mg/l (June 2007). The maximum values were during monsoon while minimum values were during winter. The calcium and magnesium along with other salts are responsible for the hardness of the water. The calcium is not known to indicate or produce any hazardous effect on human health. The magnesium has higher solubility than calcium. The calcium and Magnesium hardness are the two elements which form the most abundant ions in fresh water. The average values of calcium and magnesium hardness never exceed the standard limits of [7]. i.e. 200mg/l and 100mg/l. The total dissolved solids ranged from 295 to 310 mg/l (Dec. 2006) and 308 to 312 mg/l (June 2007). The excessive total dissolved solids generally affects potability of water.

6. RESTORATION OF LAKE

The lake restoration actions can be categorized under five broad heads, i) in- lake treatment ii) shore line treatment iii) source control iv) people's participation v) environmental awareness.

For Pashan Lakes following restoration techniques can be used.

- 1) Diversion of sewage line from the lake.
- 2) Dredging of silt and removal of weeds.
- 3) Bio- remediation
- 4) Planting native trees around the lake to control the erosion of soil
- 5) Introduction of composite fish culture to control mosquitoes
- 6) Creation of landscape or artificial land at centre of the lake will provide many benefits, which include increased land value, recreation facilities, water for gardening, jogging track [4].

7. REFERENCES

1. R., Azhagesan, "NWA Water Quality parameters and water quality standards for different uses"
2. K.K.S., Bhatia and O., Singh, "Water quality assessment for management of a typical lake in South India" NCEC, 2006.
3. K.K.S., Bhatia, "Lake water quality monitoring and Modelling Chaturvedi Samiksha; Dineshkumar and R.V.Sing" Res. *j.chem. Environ*, Vol.7 (3), 2003
4. S., Joshi, "Monitoring of Environmental factors and lake water quality Pune Municipal Corporation Report", Renewal and management of sewage and drainage disposal in city of Pune under JNNURM .
5. N., Shaikh, and S.G. Yeragi, " Seasonal Temperature changes and their influence on free

carbondioxide, Dissolved (DO) and pH in Tansa river of Thane District, Maharashtra”, J.Aqua. Biol., Vol.18(1), PP. 73-75, 2003.

6. K., Sahastrabuddhe, and A., Patwardhan, “Changing status of urban water bodies and associated health concern in Pune India”, International Conference on Environment and Health, Chennai, 2003
7. “Standard Methods For Examination Of Water and Waste”, 20th ed; American Public Health Association, Washington; D.C. 1995. (APHA)
8. R. K., Trivedi, “Assessment of water quality of some Indian Rivers based on factor analysis WHO Guidelines for Drinking Water Quality”, Second Edition Vol.1 PP. 52-82, Geneva, 1993.

