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# Sediment Analysis of Shelar Lake, Maharashtra

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## I. Introduction

The loose unconsolidated top layer of earth crust is called soil. It is a site of decomposition of organic matters and mineral materials. Lake soil has several roles to play, especially in the production of fish in the lake. The bottom sediment according to Matida(1968), is important as it supplies essential nutrients to the inflowing water as also in the mineralization of organic sediments and in the storage and release of nutrients in the water. The soil is the chief sources of nutrients for primary producers. The aquatic organic matter and potential energy are stored in the soil at the bottom of a lake in the form of organic residue and humus which regulate the biota of the lake. As pointed out by Jackson (1972), different minerals and organic substances impart a complex structure to the soil. Physically, the lake soil is composed of stones, plant roots, leaves, sand, silt, shells of molluscs and humus.

The presence and proportion of sand, clay, and silt give a relative texture to the soil. Depending upon the predominance of it the soil is said to be sandy, clayed or salty. The water retention capacity of soil is the ability of it to hold water after infiltration. Different textures and composition of the soil impart differences occurring in physical and chemical properties of the sediment. The fertility of soil is influenced by basic nutrients like, Nitrogen and Phosphorus present in the sediment. The soil is composed of abiotic components like minerals, organic matter and biotic components. The organic matter comprises residues of plants and animals at different stages of decomposition and biotic components such as sand, silt and clay. The organic matter is mostly found in the upper layer of the soil which influences the physico-chemical properties of the sediments. According to V.K. Anand et al (2000) the physico-chemical characteristics of bottom sediment in a lake are greatly influenced by geological, regional, climatic factors and also being modified by human activity. Shelar Lake is a fresh water body situated in the rural area of Thane district. It lies between $18^0$42'and $20^0$20' North latitude and $72^0$45'and $73^0$45' East longitude. Earlier this water body was used for drinking and for irrigation. Now a day it is used for fish cultivation. Enhanced population explosion, rapid rate of encroachments and increase in utilization of lake water for disposal and dilution of sewage etc have not only deteriorated the water quality of lake but has also affected the biotic flora. In order to study the bottom sediment of lake the present work has been carried out seasonally for the period of two years by selecting three sampling station for soil analysis.

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## II. Material and Methods

Seasonal samplings were done twice in every season for sediment analysis i.e. pre monsoon, monsoon and post monsoon. The soil samples collected in glass jars were brought to the laboratory and dried under shade. The dry soils were grinded, mixed and then sieved through 0.02mm sieve. The soil samples are then analyzed in the laboratory to study its physical features such as colour, texture and chemical composition that are pH, conductivity, Organic carbon, phosphorus and nitrate, as prescribed by Trivedy and Goel (1984).

## III. Result and Discussion

On the basis of standard methods Physico-chemical parameters of three seasons (pre-monsoon, monsoon and post monsoon) from February 2009 to January 2011 were studied. Arithmetic mean of all values are given in Table-1

The quality of bottom soil plays a vital role in influencing the biological productivity of any water as the overlying water remains in a state of dynamic equilibrium with the bottom soil.

The particle size knowledge is very important for proper management of soil and water quality. The bottom sediment of a lake should be consisting of organic layer followed by thick loam of layer, which help in economic utilization of the nutrients. During the textural analysis of soil of the lake under study it was found that it contains 35% sand followed by 25% silt and 40% clay. Thus the bottom soil is clayed loam in texture.

Soil texture of the lake varied from sandy – clay to clayed loam. Minor variations observed at different seasons may be related to varying composition of suspended materials brought in from surrounding catchments. Kakavipure (2005) observed similar type of clayed loam soil at Khativli lake. The colour of the soil reflects the physical and chemical nature of the soil. During the period of investigation the colour of the soil is observed to be mostly black. The black soil generally consists of high organic matter. In the present investigation the water retention capacity of soil is observed as 47% indicating favorable condition for fish culture practices.

Usually, the quality of sediment of lakes differ from that of other soil, since it is a mixture of different soil profiles and remains submerged for most of the year. In addition, the lakes receive considerable amount of suspended and dissolved materials from their catchments through surface run off most of which eventually settle down at the bottom and gradually alter the soil quality.

The pH of soil determines the chemical nature of soil. Bottom soil of the lake was found to be neutral to alkaline in nature with pH in the range of 7.8 to 8.91.Maximum pH was recorded during pre monsoon while minimum was noted during monsoon. The soil pH plays important role in soil reaction controlling many chemical reactions responsible for availability of nutrients in optimum quantities to the fish food organism in providing congenital healthy environment, A.K. Das (2000). The neutral pH of bottom sediment was observed by Gupta (1988) in Khandia reservoir. While Usha et al (2006) recorded pH in the range of 8.0 to 8.4.at Perumal Lake Tamilnadu.

*Table 1 :* Showing seasonal variation

| Season | Conductivity | | pH | | Org Carbon | | Inorganic Phosphorus | | Inorganic Nitrate | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | 1st | 2nd | 1st | 2nd | 1st | 2nd | 1st | 2nd | 1st | 2nd |
| Pre Monsoon | 0.17 | 0.17 | 8.23 | 8.13 | 0.59 | 0.74 | 0.85 | 0.93 | 0.36 | 0.39 |
| Post Monsoon | 0.17 | 0.17 | 8.91 | 8.2 | 0.84 | 1.02 | 0.96 | 1.09 | 0.15 | 0.29 |
| Monsoon | 0.16 | 0.17 | 7.82 | 7.83 | 1.02 | 0.96 | 0.62 | 0.61 | 0.06 | 0.07 |

The conductivity is a parameter, which indicates the presence of total soluble salts in the bottom sediments. The changes in conductivity are associated with release of soluble ions in the soil water system which might have indirect effect in the lake productivity. The sediment conductivity was observed in the range of 0.16$\mu$mho/cm to 0.17$\mu$mho/cm. The conductivity value of soil increases with stagnant condition of any water body due to restricted outflow. It is observed that the stagnation might have resulted in the concentration of dissolved salts, which increases conductivity. Decrease in conductivity values during pre monsoon might be due to the utilization of ionic minerals by the producers.

As pointed out by Sharma (1994), the organic carbon with other nutrients makes the sediments nutrient rich, which influence the productivity of the lake. Organic carbon content of the lake under investigation fluctuated between0.59% to 1.02%. It has been observed that soil with organic carbon content of 1.5 to 2.5 % or above is considered productive in nature (Banerjea, 1967). Lendhe (2004) observed lesser value of organic carbon as compared to present study. Lendhe observed that high yield fish production is more in lake containing less organic carbon. Increase in carbon content in soil during pre-monsoon and monsoon may be due to decomposition of humus.

Phosphorus and nitrogen are the important constituents of plankton; the present study shows phosphate content of soil in the range of 0.61 mg/100gm to 1.09mg/100gm and nitrogen in the range of 0.06 mg/100gm to 0.39mg/100gm. It is observed that the phosphorus content is very low which is responsible for low productivity of the lake. The minimum level of nitrogen-nitrate was observed during monsoon season may be due to mixing of bottom sediments with the lake water. The nitrogen concentration in the lake under study corroborates the findings of Pandey et al (1995) in Kawar Lake. Baig et al (1990) observed that high alkalinity promotes gross productivity where as high nitrates inhibits. Lower nitrates and optimal phosphates influence the productivity.

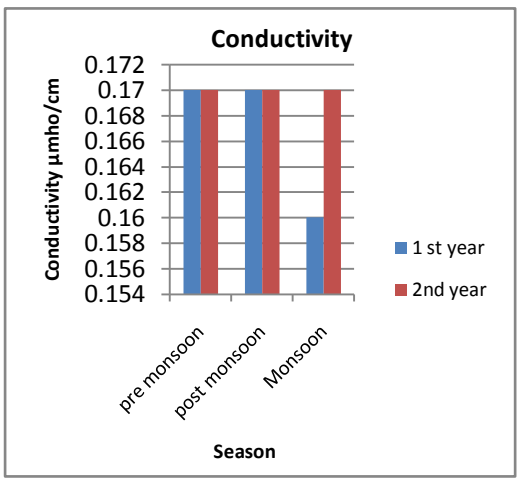


*Figure 1 :* showing seasonal variation in conductivity of soil

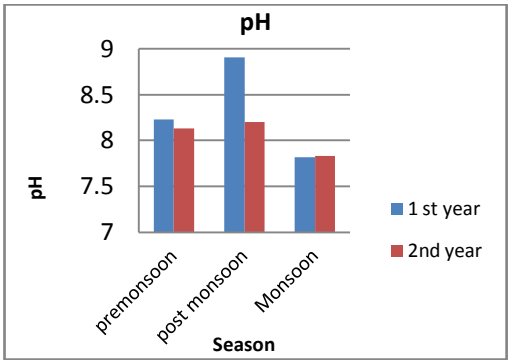


*Figure 2 :* showing seasonal variation in pH of soil

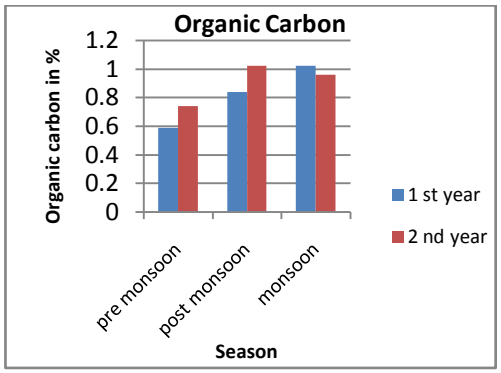


*Figure 3:* showing seasonal variation in organic C of soil

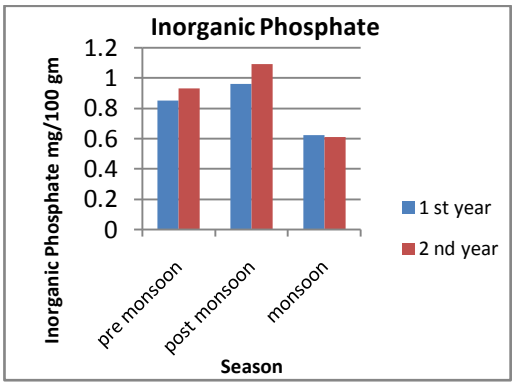


*Figure 4 :* showing seasonal variation in inorganic P of soil

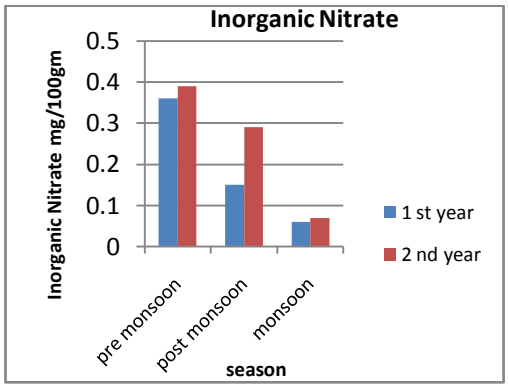


*Figure 5 :* showing seasonal variation in inorganic N of soil

## IV. Conclusion

- Bottom soil was black colour clay loamed with 47 % water holding capacity.
- Sediment of the lake was found to be neutral to alkaline in nature with pH in the range of 7.8 to 8.91. In the present study neutral to alkaline pH is recorded which has been considered favorable for fish production.
- The sediment conductivity was observed in the range of 0.16$\mu$mho/cm to 0.17$\mu$mho/cm. The narrow range of fluctuation of conductivity in the lake can be attributed to the detention of water for long term due to restricted out flow and also due to reduction in water level which led to stagnation and hence increase in the concentration of dissolved salts. The conductivity of the lake under study is found to be moderate.
- Organic carbon content of the lake under investigation fluctuated between0.59 % to 1.02 %. The organic carbon content in the Shelar Lake shows that the lake is productive.
- Phosphorus and nitrogen are the important constituents of plankton, the present study shows phosphate content of soil in the range of 0.61 mg/100gm to 1.09mg/100gm and nitrogen in the range of 0.06 mg/100gm to 0.39mg/100gm.The lake shows marginally higher soil pH as well as considerably low available nitrogen and available phosphorus which suggest gradual accumulation of organic matter and nutrients in the lake over the years.
- For both the years, P and N accumulation rates were higher in summer than in other seasons.
- Our study provides a useful baseline against which to identify future changes in ecosystem structure and function which could result from a variety of factors.

## V. Acknowledgements

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