

## Variations in Hydrobiological Properties of Saroli Pond in Ajara Tahsil (Kolhapur) of Maharashtra

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### Abstract

Studies on the physico-chemical properties of the Saroli pond (Tahsil-Ajara, Dist-Kolhapur) of Maharashtra were carried out for a period of one year from December 2007 to November 2008. The study was performed to determine the pollution status of the pond and to implement the measures for pollution control. Variables analyzed from surface water of the tank were temperature, transparency, pH, electrical conductivity, dissolved oxygen, alkalinity, hardness, chlorides, biological oxygen demand and primary productivity. It was observed that the water of Saroli pond is rich in nutrients showing that this pond has become eutrophic.

**Key words :** Water quality, Physico-chemical properties, Freshwater, Saroli pond (Kolhapur).

Water is a unique liquid which is regarded to be the most important substance for the sustenance of life for all the living organisms of the biosphere. Water quality is affected by various factors like its uses in agriculture, industry, recreation and flow through dams (1, 2). It is known that water quality is closely related to the surrounding environment and the prevalent land used (3). Water used for drinking should be potable which means that it could be consumed in any desired amount without adverse effect on health, and that this vital fluid should be free from turbidity, color and objectionable taste (4). The quality of water becomes deteriorated due to waste disposal, improper water management and carelessness towards environment. This has led to scarcity of potable water affecting the human health (5). Saroli pond was selected for the present study which is located in Kolhapur district (16°09' 53.10'' N to 74°18' 12.41'' E) of South Western part of Maharashtra. The climate of the district is tropical monsoon. The area of Saroli pond is 0.40 hector and depth is 4.57 m (Fig. 1). Saroli pond is 13 km from Ajara. This pond is semi natural and is surrounded by sugar cane fields and constructed mainly domestic purpose. The rain water is main source of pond. In rainy season water collects from the adjoining area. As the pond is surrounded by crop fields, the fertilizers used in the field leached

through the fields into the ponds, due to which there is a threat of degradation of water quality of this water reservoir due to the fertilizers and pesticides. There is no sufficient base line data about physico-chemical parameters of Saroli pond. Hence the present work was undertaken to study the water reservoir. This pond is mostly used for the washing cloths and also for drinking purposes of animals.

### Methods

#### *Collection of Samples*

The samples of surface water were collected monthly from different sites in December 2007 to November 2008. The samples were collected in plastic container in the morning hours and brought to the laboratory for further analysis.

#### *Analysis of Physico-Chemical Properties*

For the analysis, the standard methods were used. Some parameters like temperature, pH, transparency were analyzed at the investigated sites. The sample for DO, BOD and primary productivity was fixed in the BOD bottles at the sites and then brought to the laboratory for analysis. Winkler's method was



Figure 1. Satellite image of Saroli pond.

followed for this analysis, while remaining analysis was made by the standard methods of APHA (3).

### Results and Discussion

The average minimum and maximum values of each parameter were monthly recorded and described

as below. The surface temperature is ranged between 21 to 32 C through out the year (Fig. 2). It was recorded minimum during July and maximum in March. The monthly variation showed that the water temperature followed the seasonal pattern and fluctuated. The range of air temperature was 24 to 35 C (Fig. 3). According to the prevailing atmospheric tempera-

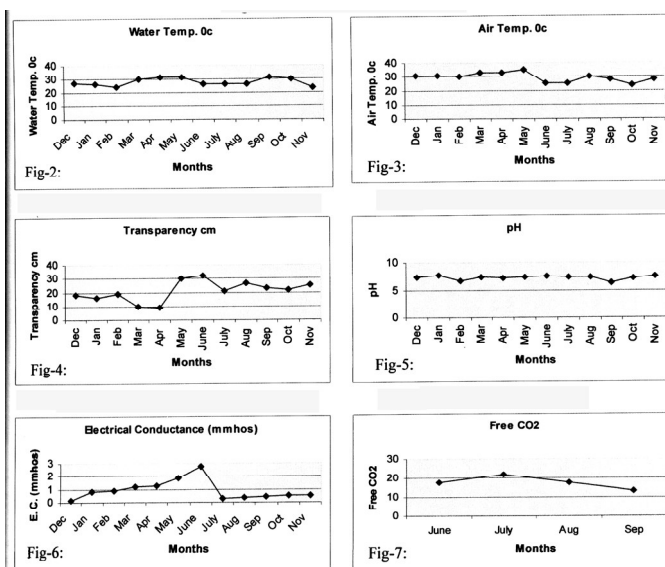
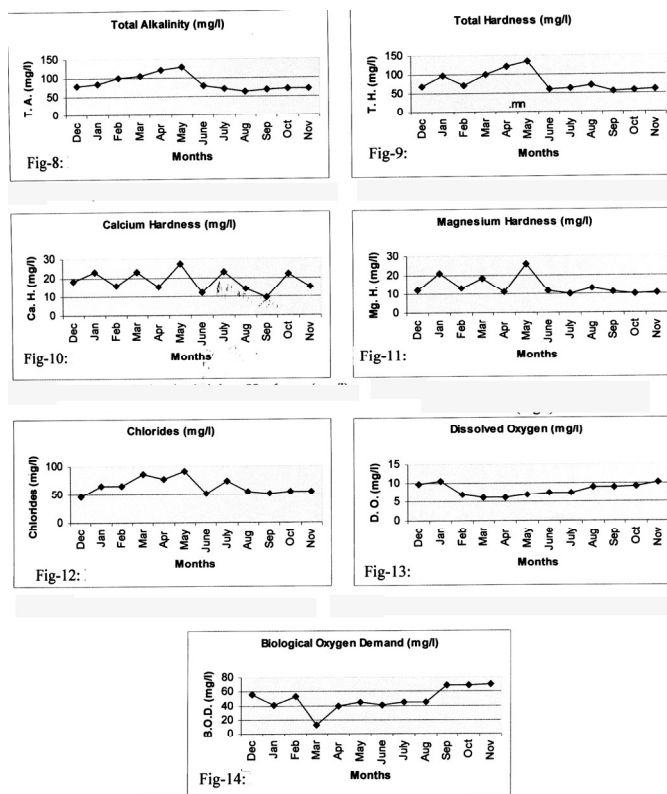


Figure 2. Monthly variation in water temperature. Figure 3. Monthly variation in air temperature. Figure 4. Monthly variation in transparency (cm). Figure 5. Monthly variation in pH. Figure 6. Monthly variation in EC (mmhos). Figure 7. Monthly variation in free CO<sub>2</sub>.



**Figure 8.** Monthly variation in total alkalinity (mg/l). **Figure 9.** Monthly variation in total hardness (mg/l). **Figure 10.** Monthly variation in calcium hardness (mg/l). **Figure 11.** Monthly variation in magnesium hardness (mg/l). **Figure 12.** Monthly variation in chlorides (mg/l). **Figure 13.** Monthly variation in dissolved oxygen (mg/l). **Figure 14.** Monthly variation in biological oxygen demand (mg/l).

ture, the average air temperature was minimum in October and maximum in May. Temperature is vital parameter for growth of organisms. Air and water temperature, both play important role in the physico-chemical and physiological behavior of biotic components of aquatic eco-system. It also reflects on the dynamics of biotic components and other climatic factors.

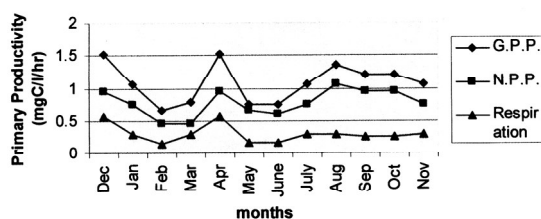
The transparency ranges between 9 to 32 cm. The minimum transparency is recorded in April and maximum in June (Fig.4). The rain water brought in a lot of dissolved and undissolved inorganic and organic material that made water turbid and caused lowest transparency. These observations are in agreement with the findings of Timms and Midgley (6).

The range of pH was 6.3 to 7.8. The minimum pH was recorded in September and maximum pH is re-

corded in January (Fig. 5). The pH is considered as an important environmental factor. These observations are in agreement with the findings of Mathivanan et al. (7).

The electrical conductivity values ranges from 0.32 to 1.90 mmhos, being minimum in July and maximum in May (Fig. 6). The relation of electrical conductivity with temperature is explained on the basis that solubility of minerals and other inorganic matter increases with increase in water temperature (8).

The range of free  $\text{CO}_2$  concentration was 13.2 to 17.22 mg/liter. The free  $\text{CO}_2$  concentration is minimum during the month of September and maximum during July (Fig. 7). The free  $\text{CO}_2$  concentration in water indicates the presence of decomposable organic matter, bacterial action on organic matter and physiological activities of biotic components. Lower level of free



**Figure 15.** Monthly variation in primary productivity (mg C/l per hour).

CO<sub>2</sub> during summer months might be due to high photosynthetic activity utilizing free CO<sub>2</sub> which is in agreement with the work of Yousuf et al. (9).

The alkaline nature of the fresh water ponds is reported by Sampath Kumar and Ramkrishnan (10) in Tiruvannamalia. The total alkalinity of water is due to Ca<sup>++</sup> and Mg<sup>++</sup> ions and high levels of calcium ions have considered to be the signs of eutrophic state of water bodies. The alkalinity range for studied water bodies is higher showing its eutrophic nature. The high values of alkalinity in present study imply large reserve of total CO<sub>2</sub> which provide supply of inorganic carbon for the support of algal population as observed by Sinada and Abdel Karim (11).

The range of total alkalinity was 62 to 130 mg/liter. The alkalinity was minimum in August and maximum in May (Fig. 8). The total hardness of water ranged between 56 to 134 mg/liter. It was minimum in September and maximum in May (Fig. 9). The values are similar with Hujare (12). The total hardness of water is characterized by contents of calcium and magnesium salts. The calcium ion concentration varied from 9.62 to 23.26 mg/liter (Fig. 10), and the magnesium ion concentration varied from 9.9 to 25.93 mg/liter (Fig. 11). The chloride values ranged from 50.60 to 90.88 mg/liter. It was minimum in September and maximum in May (Fig. 12). High chloride concentration is also an indicator of large amount of organic matter (13).

Goel et al. (14) reported higher values of chlorides ranging from 10.65 to 455 mg/liter in some fresh water bodies from Southern Maharashtra. In the present study chloride concentration increased due to the additions of the pesticides and fertilizers from the agricultural field. In the investigated pond the chlorides range is also higher due to the constant

washing of cloths and animals by the local people.

Dissolved oxygen varied from 6.08 to 10.54 mg/liter being minimum in March and April while maximum in January (Fig. 13). DO showed significant inverse relationship with water temperature. This might be attributed to two reasons, i.e. in summer at high temperature the rate of oxidation of organic matter increases and oxygen is consumed and secondly at high temperature oxygen holding capacity of water decreases (15).

Biological oxygen demand value varied from 12.16 to 70 mg/liter. BOD value recorded lower in March and higher in November (Fig. 14). Biological oxygen demand is directly proportional to the amount of organic waste (16).

Productivity of lakes depends on the presence of planktonic biomass. Enrichment of nutrients and dissolved matter in the water bodies affects diversity of water. Diversity in the distribution, abundance and variations in the biotic factors provide information of energy turnover in aquatic ecosystem. Most of workers have studied the influence of nutrients and physico-chemical factors on algal density (17).

The values of gross primary productivity, net primary productivity and respiration rate ranged between 0.60 to 1.52, 0.45 to 1.06 and 0.15 to 0.56 mgC/liter per hour respectively in all months (Fig. 15). The maximum values were recorded in the December and April and minimum in February. Sharma and Sharma (18) noted that phytoplankton encountered in the water body may be used as indicators of the water quality.

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