ISSN 2250-3153

Evaluation of status of ecosystem of Sawanga (Vithoba) Lake (Malkhed Talav), District Amravati, Maharashtra by assessment of Some Physicochemical Characteristics of water

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Abstract- Lakes are sometimes subjected to wastewater discharges originating from different sources. Chemicals such as nitrogen, phosphorus and carbon in certain concentrations might distort and disrupt aquatic ecosystems. The purpose of this study is to assess water quality of Sawanga (Vithoba) lake. Sawanga Lake is located in district Amravati Maharashtra. This study began in Feb 2011 and was carried out for 12 months by taking monthly water samples from five different stations of the lake. Water quality parameters like pH, Temperature, Total dissolved solids, Total Alkalinity, Total hardness, Phosphorus, Nitrate, Turbidity, Fluoride, chloride, Dissolved Oxygen, Ammonia, Iron, Turbidity and Conductivity analysis were done. This study indicates that Sawanga Lake has not reached the polluted stage yet.

Index Terms- Water Quality, Sawanga (Vithoba) lake, status of ecosystem

I. INTRODUCTION

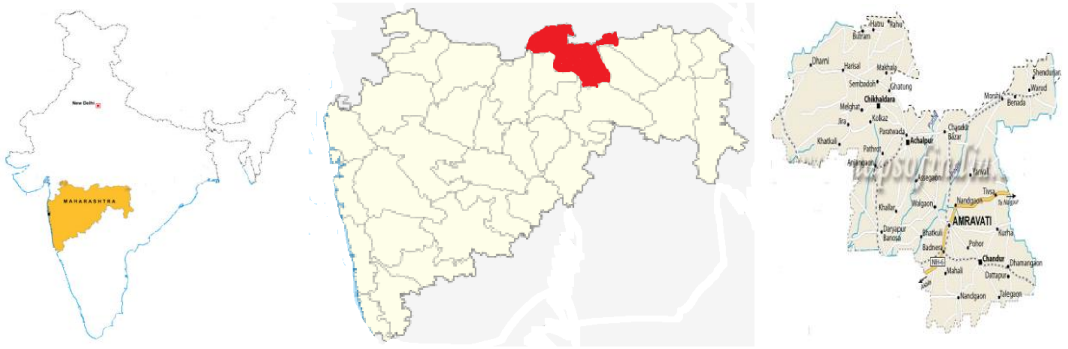
Water quality degradation by various sources becomes an important issue around the world. Lakes and surface water reservoirs are the planet's most important freshwater resources and provide innumerable benefits. They are used for domestic and irrigation purposes, and provide ecosystems for aquatic life especially fish, thereby functioning as a source of essential protein, and for significant elements of the world's biological diversity. They have important social and economic benefits as a result of tourism and recreation, and are culturally and aesthetically important for people throughout the world (Arain *e tal*, 2008). They also play an equally important role in flood control. Hydrological condition of lake water affects the aquaculture activities, decrease in fish productivity, and change in species composition of avifauna, eutrophication and overall loss of biodiversity that resulted in the degradation of Lake Ecosystem (Patra *et al*., 2010). So the present study was undertaken to assess the health of the ecosystem of Sawanga (Vithoba) Lake with special reference to physicochemical properties of lake water . Pollution of water is measured by assessing the physiochemical parameters of water.

Sawanga Lake is situated at 20° 49' 0" N, 77° 53' 0" E, 23 km east to Amravati, Maharashtra; set in hilly region with good forest cover. It is near Chandur-Rly town in Pohara-Malkhed Reserve Forest in Amravati district of Maharashtra state in India. The main water source of the Lake is Kholad River. At mean water level, the surface area is 6,717 km^2, the height from riverbed is 19 m, the largest length of the Lake is 1,422 m and the volume is 481 m^3. The Lake is constructed for irrigation purpose and was started to use in 1972.

The objective of the present study was to assess the ecosystem of Sawanga (Vithoba) Lake by estimating the various physicochemical parameters like *pH, Temperature, Total dissolved solids, Total Alkalinity, Total hardness, Phosphorus, Nitrate, Turbidity, Fluoride, chloride, Dissolved Oxygen, Ammonia, Iron, Turbidity and Conductivity* . This is the first record of such type of study from Sawanga Lake (Malkhed Talav).

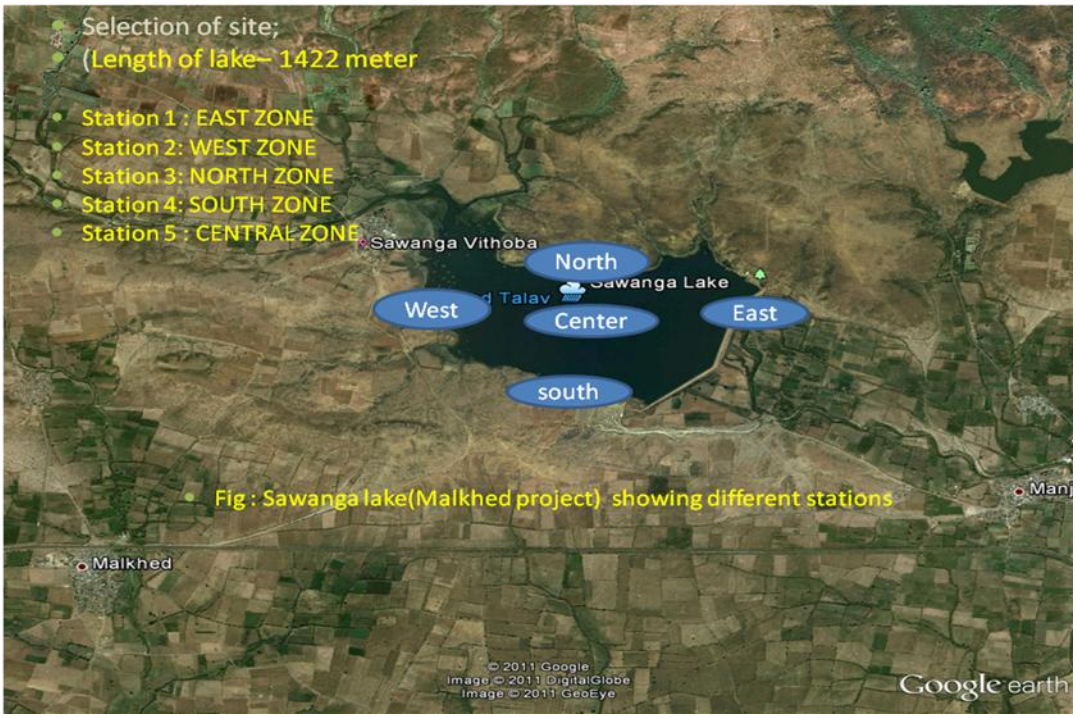
II. MATERIAL AND METHODS

2.1. Study Area: The total study area is comprised of 5 sampling station covering five sectors of Sawanga Lake i.e. Eastern, Western, Northern, Southern and Central stations. Study was conducted from Feb 2011 to Jan 2012. Water sample from each station was collected in a week from various sites of five different stations from the lake.



a) INDIA **b) MAHARASHTRA** **c) AMRAVATI**

Map 1. a - Map of India showing Maharashtra.
b - Map of Maharashtra showing District Amravati.
c - Map of Amravati showing tahsil Chandur Railway.



Map 2: Sawang-Vithoba lake of tahsil Chandur-Railway . Five different stations are shown in the Map (Map is taken from Google earth).

2.2. Analysis of Water sample of lake: Samplings were done in the morning hours between 7 am – 10 am. During sample collection in the lake, necessary precautions were taken to collect water samples undisturbed. Sampling bottles were washed with 1 - 2% HCl a day before sampling day, were rinsed through distilled water and were dried in the drying oven (Boyd and Tucker, 1992). Water samples were taken from 10 cm depth from the surface of water by holding the bottles upward and immediately transferred to the laboratories for analyses. Oxygen, temperature and pH were measured directly at the field by means of digital instruments. Oxygen and temperature were measured by Deluxe Digital analysis kit, pH by pH meter. Other water quality parameters such as Total dissolved solids, Total Alkalinity, Total hardness, Phosphorus, Nitrate, Turbidity, Fluoride, chloride, Ammonia, Iron, Turbidity and Conductivity analyses were done on the same day in the laboratory by using Standard Methods as Prescribed By APHA (1985), Trivedy and Goel (1986), Kodarkar (1992).

III. Result and Discussion

We assayed the water quality of Sawanga (Vithoba) Lake throughout the year from Feb. 2011- Jan 2012. We found following results.

3.1 Temperature:

Water temperature ranged from a lowest of 16ºC in December to a highest of 28ºC in May over the year. It showed that Higher Temperature in summer and relatively lowers in

winter. Jayabhaye et al (2006), Salve and Hiware (2008), observed that during summer, water temperature was high due to low water level, high atmospheric temperature and clear atmosphere. Water temperature plays an important factor which influences the chemical and biochemical characteristics of the water body. Variation in the temperature of lake water throughout the year is illustrated in Figure no.1

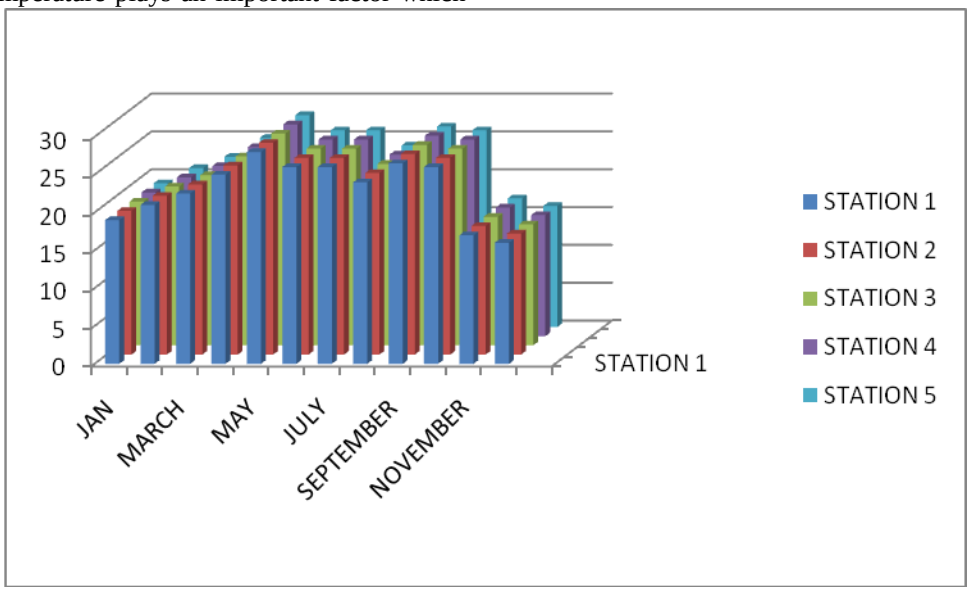


Fig 1. *Variation in the temperature of water at five different stations of Sawanga(Vithoba) lake throughout the year. Y axis represents temperature in degree Celsius*

3.2. Conductivity:

Several factors influence the conductivity of water including temperature, ionic mobility and ionic valences. Conductivity measurement is an excellent indicator of TDS, which is a measure of salinity that affects the taste of potable water (Pradeep, 1998). Conductivity of water of Sawanga (VIthoba) lake was found to be increased from 0.38 mS/cm to 0.47 mS/cm. It is highest in the month of July and then it decreased gradually but there is no significant difference in the values. Station 4 shows little high conductivity. Variation in the Conductivity of lake water throughout the year is illustrated in Figure no.2.

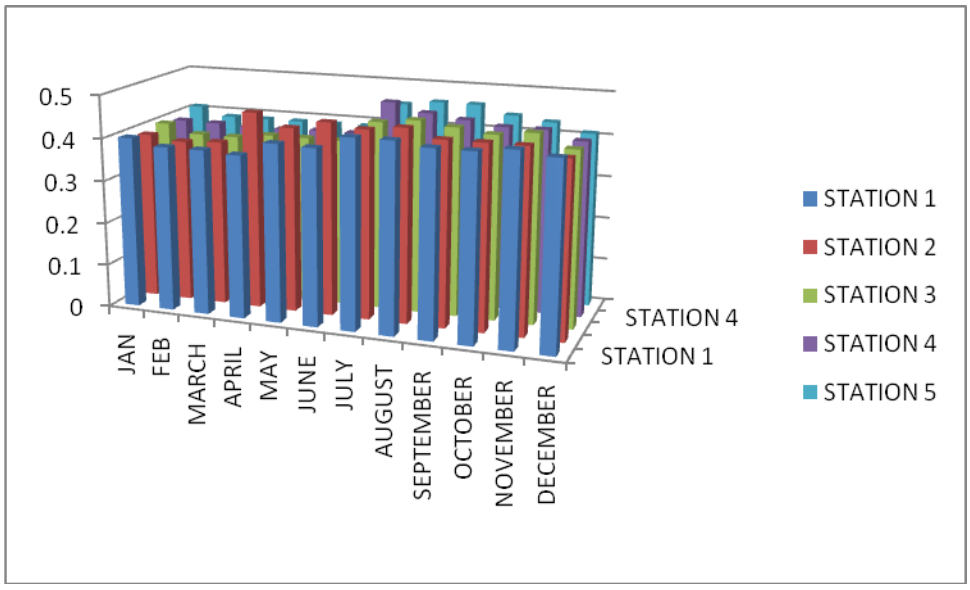


Fig 2: *Variation in the* conductivity of water *at five different stations of Sawaga(Vithoba) lake throughout the year. Y axis represents* Conductivity *in* mS/cm

3.3. Turbidity:

Turbidity of water is caused by the presence of suspended matter such as clay, silts, finely divided organic and inorganic matter, plankton and other microscopic organisms. Silt gives the advantage that it checks light penetration in certain area of the Lake, including the inlets. All the five stations show different values for turbidity in all seasons. It has been seen that the highest turbidity is in station 2 all over the year. It may be associated with the cattle and human activities at this station. Turbidity is found to be highest in the month of July and August and this may be is due to sewage influx, flood etc. The sewage influx and setlable solids have a tremendous effect on the aquatic environment by increasing the turbidity which in turn decreases productivity and photosynthesis (Bartsch, 1960).Variation in the Turbidity of lake water throughout the year is illustrated in Figure no.3

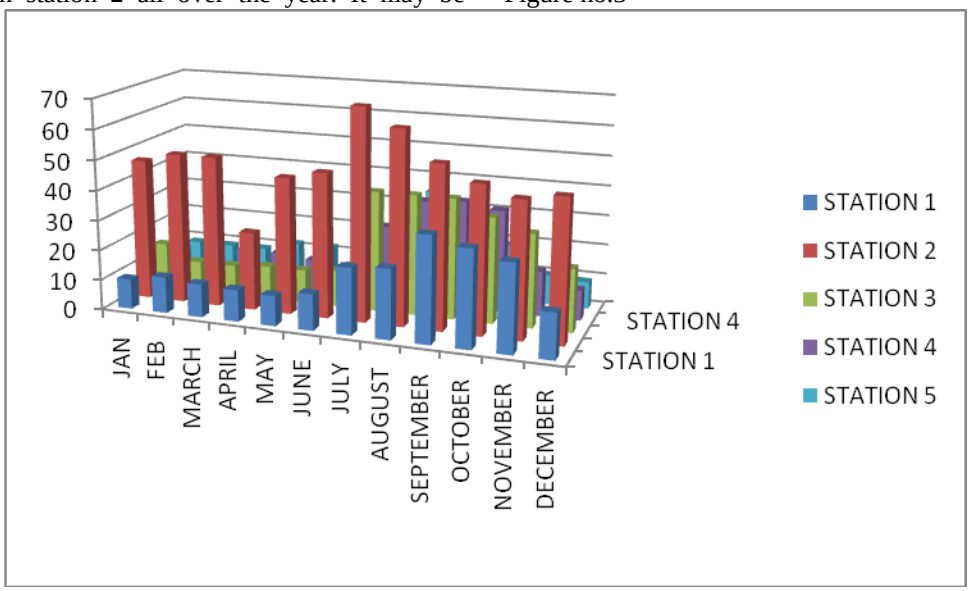


Fig 3: *Variation in the* Turbidity of water *at five different stations of Sawanga(Vithoba) lake throughout the year. Y axis represents* Turbidity *in* NTU.

3.4. pH:

pH value is low in winter and high in summer months(Welch, 1935) pH values ranged between 7.77 and 8.3 during the study. Throughout the study period, no large difference was found in pH values between the stations. Annual mean pH values were 7.97, 7.97, 7.96, 7.99 and 7.98 for the Station 1,2,3,4 and Station 5, respectively. Variation in the pH of lake water throughout the year is illustrated in Figure no.4

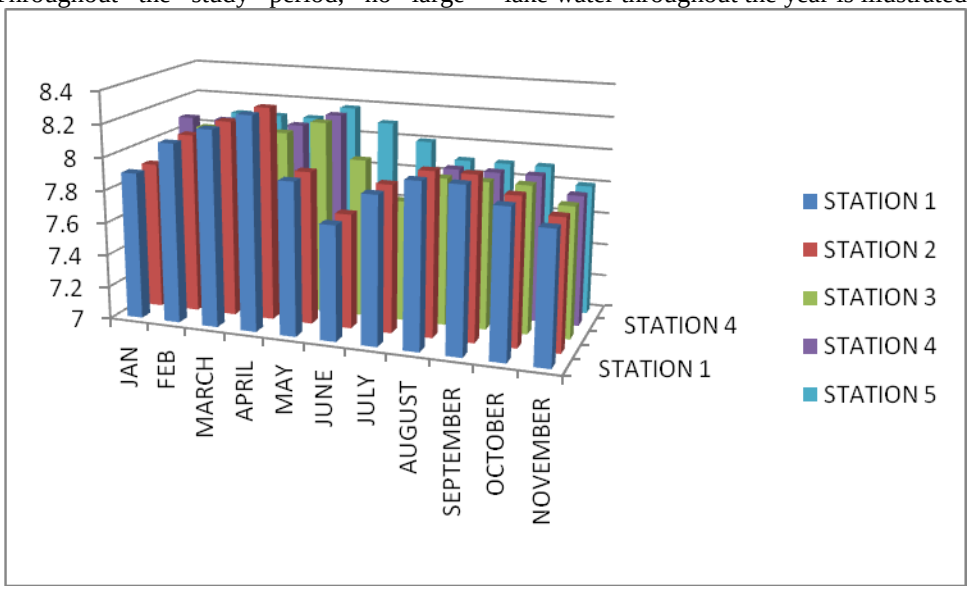


Fig 4: *Variation in the* pH *of water at five different stations of Sawanga(Vithoba) lake throughout the year. Y axis represents* pH.

3.5 Chloride (mg/L):

Chloride occurs in most free water as a salt of Na^{+}, Ca^{++}, K^{+}. Chloride show high concentration during summer and low during winter (Munawar, 1970), We also obtain the same findings. Chloride level was found to be highest in the month of April, May and June while it was less in the month of February and January. Chloride concentrations were also differing from stations and seasons throughout the year. Station 2 exhibits high chloride content than other four stations. This may be due to high human activity at this station. Variation in the Chloride of lake water throughout the year is illustrated in Figure no.5

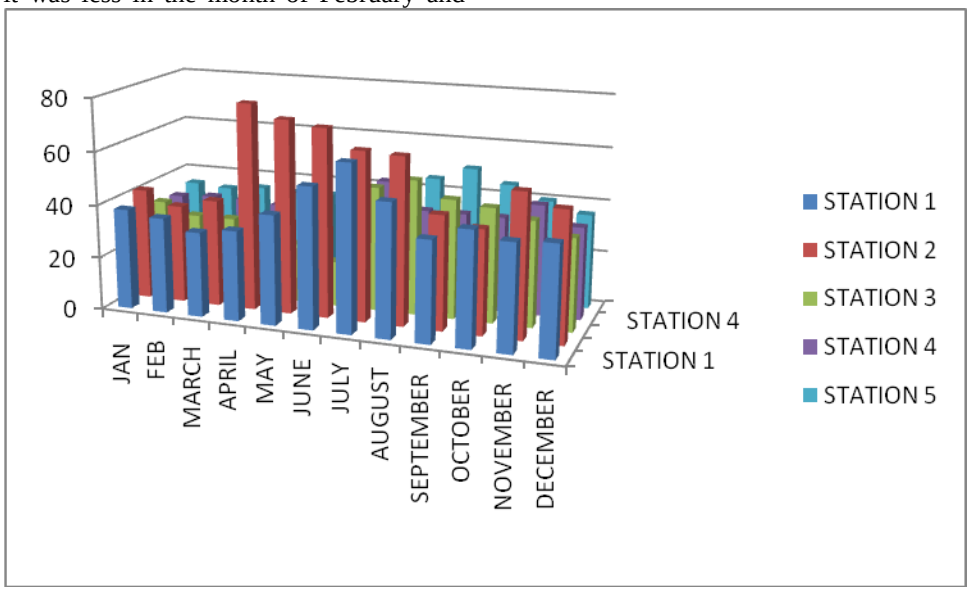


Fig 5: *Variation in the Chloride of water at five different stations of Sawanga(Vithoba) lake throughout the year. Y axis represents Chloride in mg/L*

3.6. Dissolved O2 (mg/L):

During winter low temp and high aeration rate and high photosynthetic activity might have been increased the amount of oxygen (Ganpath, 1964), (Shardendu and Ambast 1988). The report of this study is similar. Dissolved oxygen level in Sawanga (Vithoba) lake was highest in the month of February and March at all stations and then it is decreased. The highest DO was 7.1 mg/L and lowest was 4.4 mg/L. This may be due to less turbidity present in the water. Variation in the Dissolved oxygen of lake water throughout the year is illustrated in Figure no.6

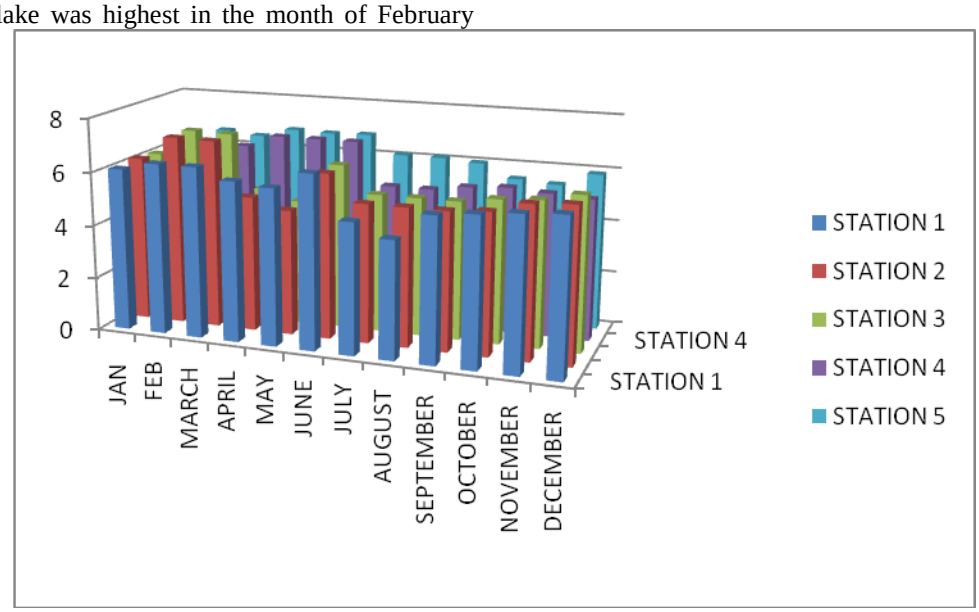


Fig 6: *Variation in the Dissolved oxygen of water at five different stations of Sawanga (Vithoba) lake throughout the year. Y axis represents* Dissolved O2 in mg/L

3.7. Iron:

High iron concentration in the lake waters could be harmful for animals because iron often forms a complex compound with other trace minerals (e.g. copper) that becomes unavailable, and can cause copper deficiency (Thornton 2002). Some what fluctuation was seen in iron content in different stations through

out the year. Iron content was high at station 3 throughout the year. Iron content was found to high in the month of Jan to August. Variation in the Iron of lake water throughout the year is illustrated in Figure no.7

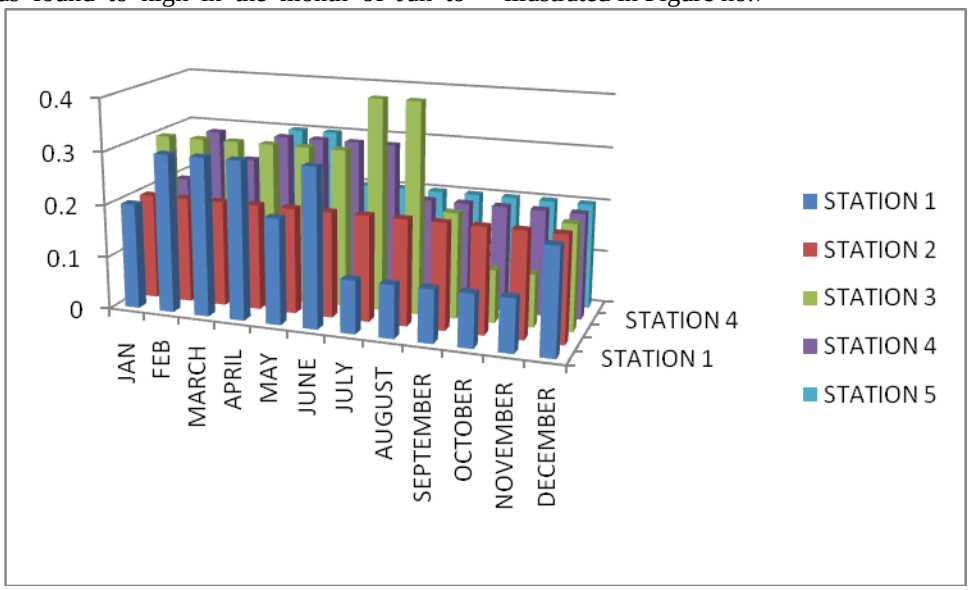


Fig 7: *Variation in the* Iron *of water at five different stations of Sawanga (Vithoba) lake throughout the year. Y axis represents* Iron in mg/L

3.8. Phosphorus:

Phosphorous is an important element which controls the reproduction and growth of aquatic organisms. Many organisms utilize both organic and inorganic forms of phosphorus; however inorganic phosphorus seems to be more appreciated by plants than organic phosphorus. It is interesting to note that increasing values were noted in rainy and summer seasons. Phosphorus content is same in all seasons in all stations except in the month of April to September in station 5. At station 5 phosphorous level increase in the month of May and continued high till October. Variation in the Phosphorus of lake water throughout the year is illustrated in Figure no.8

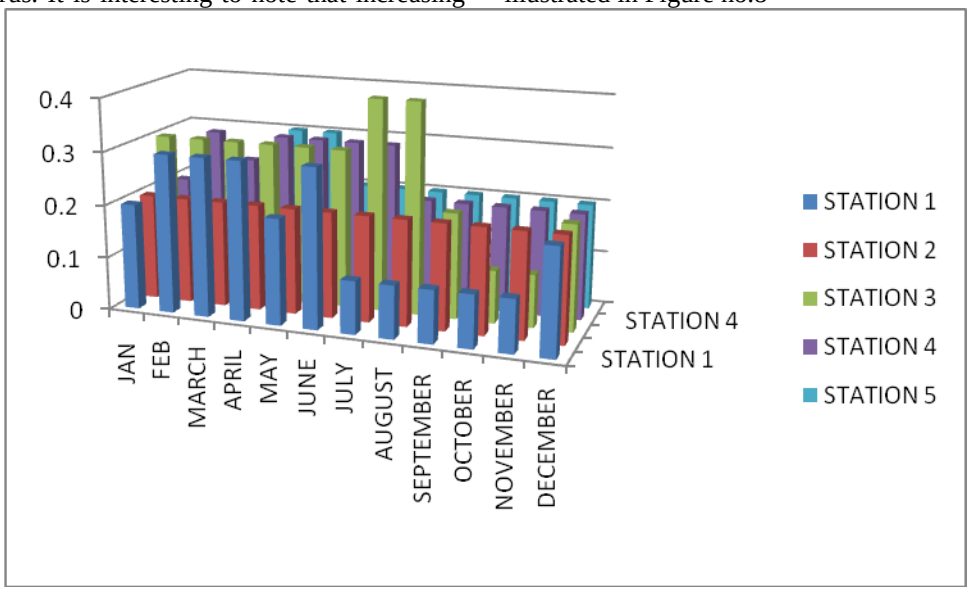


Fig 8: *Variation in the* Phosphorus *of water at five different stations of Sawanga (Vithoba) lake throughout the year. Y axis represents* Phosphorus in mg/L

3.9. Fluoride:

Fluoride is beneficial for human health, if it taken in controlled quantity. According to WHO (1997), permissible limit for fluoride in drinking water is 1.0 mg/l. In the present study, the values of fluoride varied between 0.5 mg/l to 1 mg/l, with maximum value during summer. Fluoride content is some what same in all stations and it is gradually decreased in rainy and winter season. Variation in the Fluoride level of lake water throughout the year is illustrated in Figure no.9

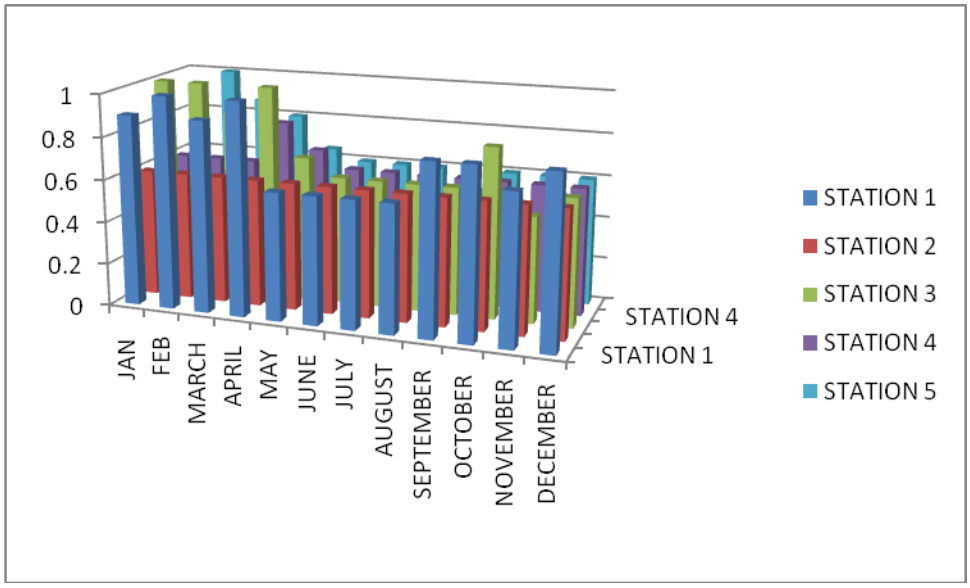


Fig 9: *Variation in the* Fluoride *of water at five different stations of Sawanga(Vithoba) lake throughout the year. Y axis represents* Fluoride in mg/L

3.10. Ammonia:

Ammonia level is found to be low at station 1. Its concentration was 1 mg/L all over the year and was decreased up to 0.8 mg/L from the month of August to December at station 4. Station 5 in the month of November and station 3 in October show decreased level of ammonia. Variation in the Ammonia of lake water throughout the year is illustrated in Figure no.10

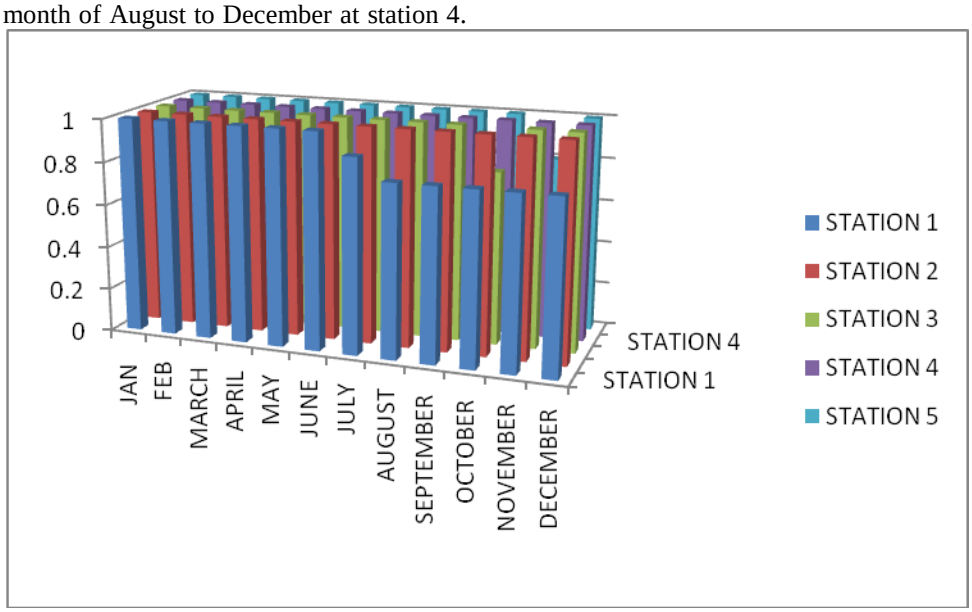


Fig 10: *Variation in the* Ammonia *of water at five different stations of Sawanga (Vithoba) lake throughout the year. Y axis represents* Ammonia in mg/L

3.11. T.D.S.:

Solids refer to suspended and dissolved matter in water. It is an useful parameter describing the chemical constituents of the water and can be considered as general of edaphic relations that contribute to productivity within the water body (Abdo, 2005). Total dissolved solid was ranged between 0.22 gm/L to 0.28 gm/L. It is Lowest in the month of September. Variation in the T.D.S**.** of lake water throughout the year is illustrated in Figure no.11

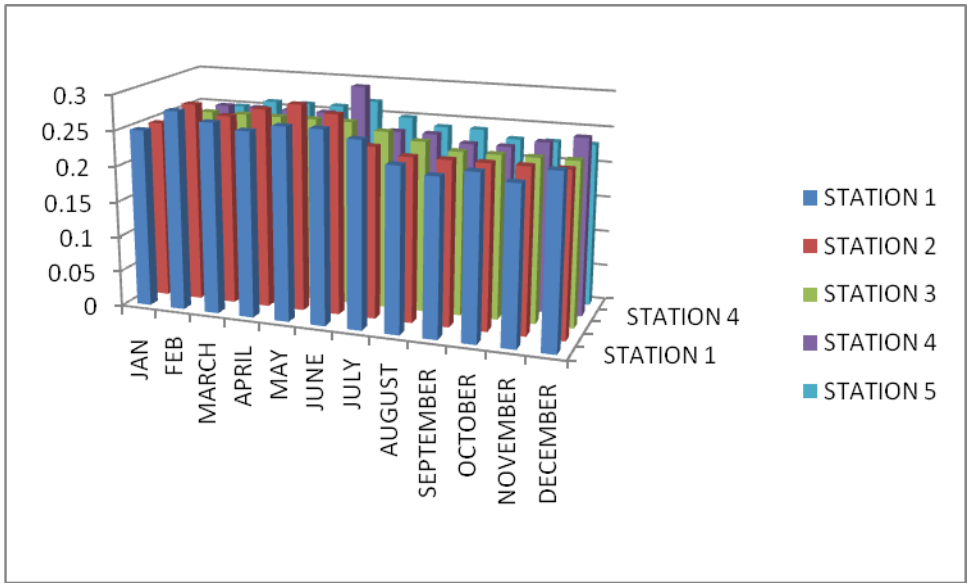


Fig 11: *Variation in the* T.D.S. *of water at five different stations of Sawanga(Vithoba) lake throughout the year. Y axis represents* T.D.S. in gm/L

3.12. Nitrate:

Nitrogen does not occur naturally in soil minerals, but is a major component of all organic matter (both plant and animal). Decomposing organic matter releases ammonia, which is converted to nitrate if oxygen is present (Boyd and Tucker, 1998). This conversion occurs more rapidly at higher water temperatures (Emersson *et al*., 1975). All inorganic forms of nitrogen (NO3 -, NO2 - and $NH4^{+}$) Nitrate concentration were same from month of February to June in all stations and then it is gradually decreased from July to January. Variation in the Nitrate of lake water throughout the year is illustrated in Figure no.12

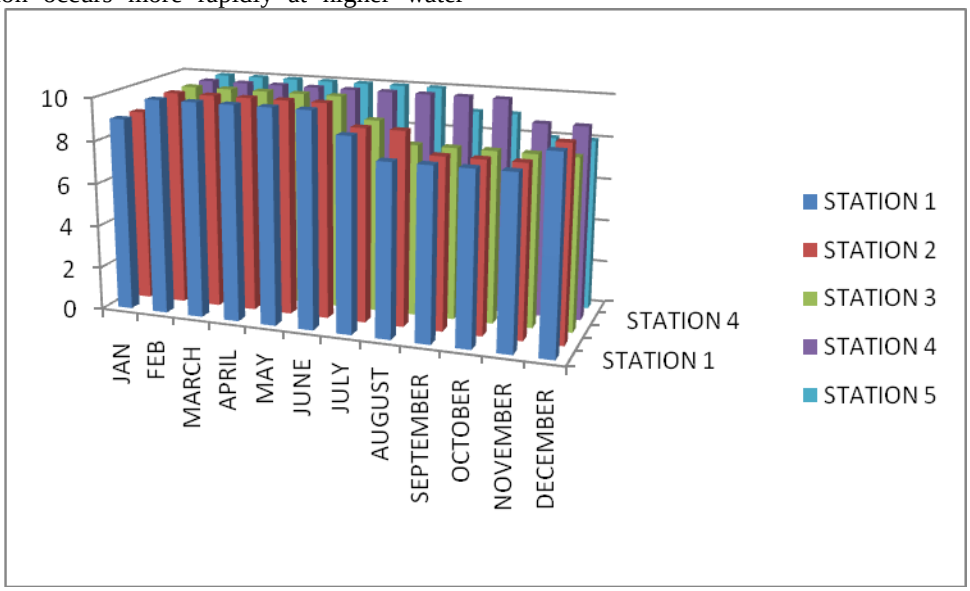


Fig 12: *Variation in the* Nitrate *of water at five different stations of Sawanga (Vithoba) lake throughout the year. Y axis represents* Nitrate in mg/L

3.13. Total alkality:

Alkalinity of the water is the capacity to neutralize strong acids that gives primarily a function of carbonate, bicarbonate and hydroxide content and formed due to the dissolution of carbon dioxide in water. Alkalinity is important for fish and aquatic life because it protects or buffers against pH changes. Fluctuations in total alkalinity and total hardness were similar but the amount of the total hardness was significantly greater than that of the total alkalinity Variation in the Total alkality of lake water throughout the year is illustrated in Figure no.13

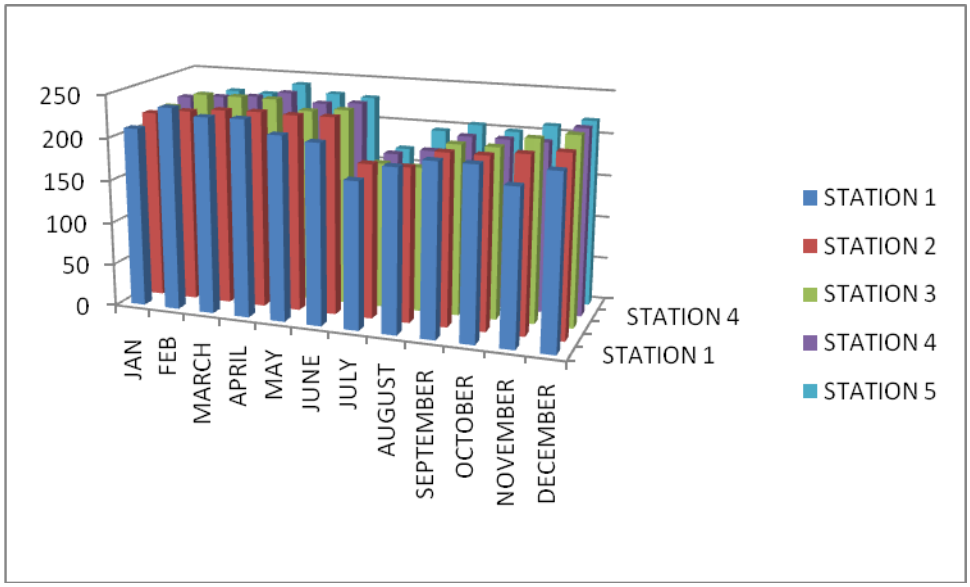


Fig 13: *Variation in the Total alkality of water at five different stations of Sawanga (Vithoba) lake throughout the year. Y axis represents Total alkality in mg/L*

3.14: Total hardness:

According to Spence (1964), waters with more than 60.0 ppm hardness are classified as 'nutrient rich' waters. According to this the present water quality of Sawanga Lake can be categorized as 'nutrient rich'. The high photosynthetic activity causes the release of carboxyl (OH^-) group which helps binding Ca with the carbonate group (Co_3) to form $CaCo_3$ (Saeed 2000 and Ali 2003. Variation in the Total hardness of lake water throughout the year is illustrated in Figure no.14

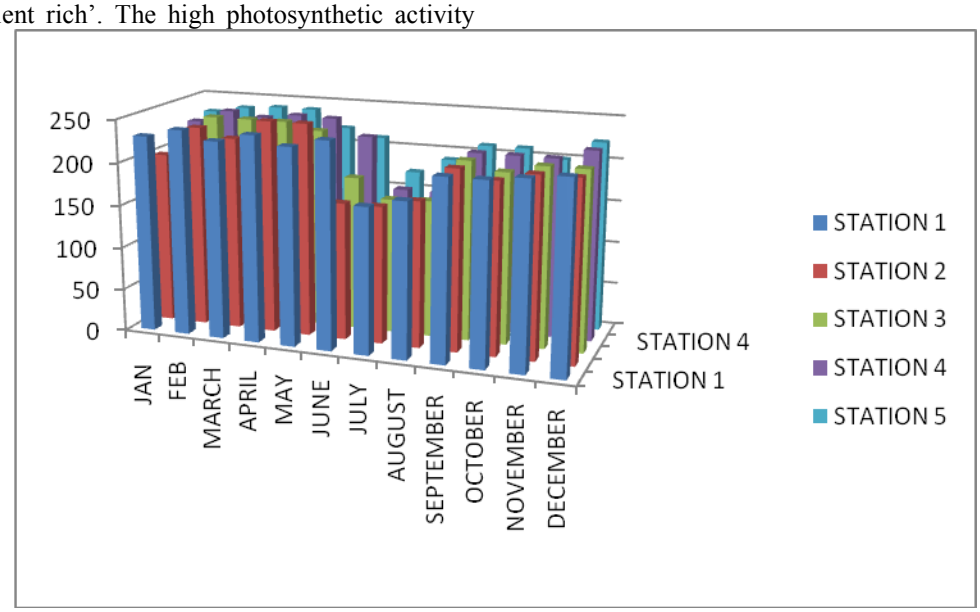


Fig 14: *Variation in the Total hardness of water at five different stations of Sawanga (Vithoba) lake throughout the year. Y axis represents Total hardness in mg/L.*

IV. Conclusion

Most of the parameters of the *Sawanga (Vithoba)* lake are in normal range. Station two shows somewhat different values than other four stations. Station two is near village Sawanga and there is more human and activity and cattle activity at this station. Otherwise *Sawanga (Vithoba) lake is a good, nutrient rich ecosystem and has ability to sustain tremendous diversity of flora and fauna.*

Acknowledgement

The authors would like to thank The Principal Chief Conservator of Forest (PCCF), Government of Maharashtra for giving permission to conduct this study. Our special thank to The Director of ISRO-UoP for providing us necessary funding for the study.

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