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Physicochemical Parameters of Pakhal Lake, Wild Life Sanctuary in Warangal District, Telangana, India

B. Lalitha Kumari

Department of Botany, Kakatiya University ,Warangal, Telangana, India

Email: lalitharadhabandaru@gmail.com

Abstract

Pakhal Lake is situated about 70 km from Warangal city. This huge man-made lake is enveloped by forested hills. The lake has great historical importance constructed in 1213 AD of Ganapathy Deva ruler of Kakatiya kingdom. A study was carried out on Pakhal Lake to assess the impact of anthropogenic events sewage, agricultural runoff pollution on the water quality of the lake. Physico chemical parameters such as temperature, electrical conductivity, Dissolved Oxygen, Bio-Chemical Oxygen Demand, Chemical Oxygen Demand, Total Hardness, Total Alkalinity, chlorides, calcium, magnesium and organic matter and eutrophic factors like phosphates and nitrates were observed as per WHO guidelines. The Coliform bacteria were found to be high in the banks of the tank. All these parameters are in permissible limits. Hence, it can be recommended for aquaculture drinking and irrigation purpose.

Keys words: Pakhal Lake, Warangal, Telangana, Wild Life Sanctuary

Introduction

Water is a vital and essential entity of universe and next to air. Water can be used as a multiple resource for all living beings on the earth. Water is a universal solvent and one of the most precious commodity required for survival of any form of life and primary like, natural resource required for various purposes like agriculture, forestry, urbanization and many other activities which satisfy human needs (Manai et. al 2010). Fresh water ecosystems are of great aesthetic, cultural, socio economic and ecological value besides playing an important for the sustainable economy of the state. As much as they provide food, fodder, fish, wild life, green manure, vegetables, medicinal plants, timber and other useful products, besides being potential sources of water and recreation. Various kinds of natural and man-made activities like industrial, domestic and agricultural create water pollution problems particularly fresh water systems. According to WHO (2005) 30-80% human diseases occur due to impurities of water. It is estimated that around 37.7 million Indians are affected by water borne diseases annually.1.5 million Children are estimated to die of diarrhea. The water quality of system depends on the terrain threw which it flows and its quality. It depends on physical, chemical and bacterial constraints (Krishnamurthy and Selva Kumar 2010, Kadse et al 2010, Bhagade et al 2010). Various kinds of natural and man-made activities like industrial, domestic agricultural waste create water pollution problems particularly in fresh water systems.

Materials and Methods

Study Site

It is 75 km away from Warangal city. It was historical city in Telangana. It is huge man-made lake in 1213AD constructed by Ganapati Deva the ruler of Kakatiya Kingdom while Orugallu as capital city. They were constructed by mainly tribes for harvesting rain water for the

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monsoon run off in the valley sills. It is located between Latitudeof17^0 $42^{1/2}$', 18^0 and North between Longitude of 99^0 55' and 80^0 East. The lake covers 960 sq.km inside the forested hills. 200 varieties of trees and strubs, herbs and lians. Including those of exotic type such as Teak, Bamboo, Tuniki (Beedi leaf), etc. Near cultivated 18,000 acres officially, unofficially 18000 acres of land cultivated in rabbi and kharif season with main crop is paddy (Rice). Common crops are chillies, red gram black gram vegetables. Laterite soils are major soil types in this area. The average rainfall is 1150mm. the area receives 770mm South west monsoon and 380mm in North East. Water samples collected in a day time between 8:00 AM to 4:00 PM. The present study has been made on the seasonal variation (Pre and Post Monsoon) of water quality in Pakhal Lake Warangal district, Telangana. Many crocodiles are present in the lake.

Water samples collected from different study sites are as follows:

1. Water sample collected from near the weir.
2. Water sample collected from mid-stream.
3. Water sample collected from canal starting point.
4. Water sample collected from near main road.

Four different sites at Pakhal Lake were in ordered to study the physic chemical and bacteriological characters of water samples. The samples were collected during 2018 following the standard methods prescribed for sampling. Chemicals are of analytical grade. Analytical methods are standard methods suggested by APHA, (1995). Trivedi et al (1986), NEERI (1988). Water quality parameters were estimated. Samples were brought to the laboratory and parameters like temperature,(air and water) dissolved oxygen, p^H, electrical conductivity were immediately estimated.

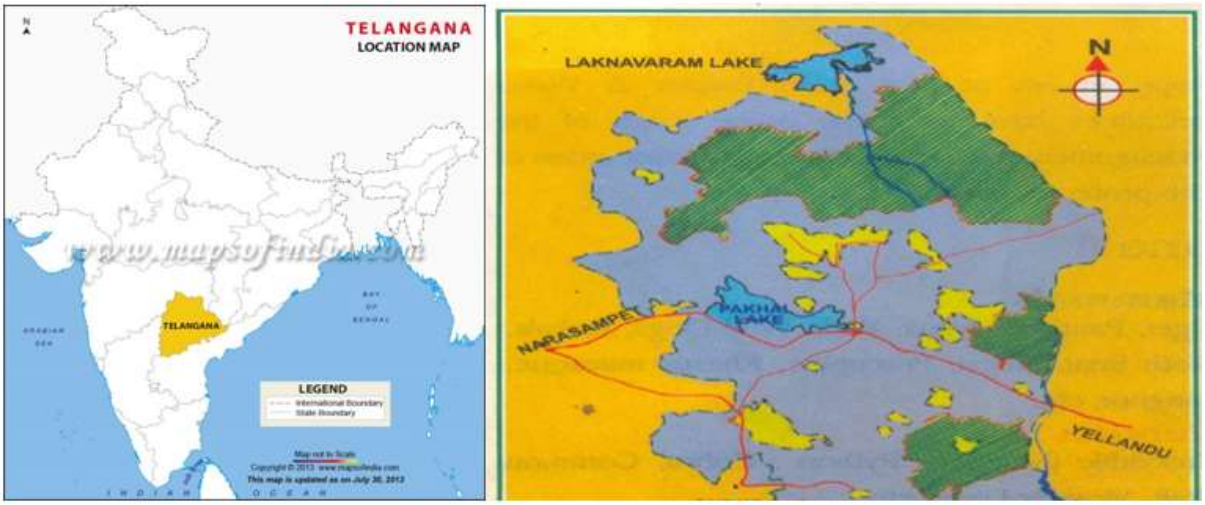

Figure-1. Study site-Pakala Lake

Figure-2. Pakala Lake Starting Point

Results and Discussion:

Water quality plays an important role in the survival and distribution of aquatic organisms. It is dependent on physico chemical and bacteriological parameters. The present investigation has been designed to assess the water quality parameters of Pakhal lake for Pre monsoon and Post monsoon in 2018.The physicochemical characteristics of the water samples are presented in table-1.

Table-1: Physical characteristics of Water samples from Pakhal lake

S.NO.	Parameter	Season	Site-1	Site-2	Site-3	Site-4
1.	Temperature ^{0}C Air	Pre-Monsoon	30.9	32.5	32.4	33.1
		Post-Monsoon	22.2	22.6	22.8	22.8
2.	Temperature ^{0}C water	Pre-Monsoon	29.9	31.5	31.4	32.1
		Post-Monsoon	21.2	21.6	21.8	21.8
3.	Total Dissolved Solids	Pre-Monsoon	320	340	314	335
		Post-Monsoon	424	420	415	430
4.	Transparency in cms	Pre-Monsoon	30	29.5	29.1	29
		Post-Monsoon	21	22	21.2	21
5.	Electrical Conductivity µ mho/cm	Pre-Monsoon	196	200	208	216
		Post-Monsoon	204	185	189	199
6.	Turbidity (NTU) Nephlometric Turbidity Units	Pre-Monsoon	7	6	7	7
		Post-Monsoon	9	8	9	8
7.	p^H Hydrogen and Ion concentration	Pre-Monsoon	7.2	7.1	7.4	7.6
		Post-Monsoon	7.1	7.4	7.2	7.4

All the values are compared with standards given by WHO (1984). The temperature of water is important for biological reactions of organisms into the samples had temperature ranging from 27.1^0C to 35.8^0C. Appearance is neat and clear except in rainy seasons. Taste is agreeable. Color is always color less except in rainy season flooded water discharged into the lake, odor less. The p^H affects the taste of water and the p^H value of natural water changes due to biological activity, temperature. In this study samples in below permissible limit (WHO) p^H range was 7.0 – 8.2.

Overall, the p^H of the samples is not exceeding the excessive limits in both pre monsoon and post monsoon seasons. Electrical conductivity in water is due to ionization of dissolved inorganic solids which is measure of salinity that affects the taste of potable water (WHO 1984). The concentration of dissolved salts increases the conductivity, which also depends on temperature of water. Electrical conductivity of water in the study area various from 80-180 um Mho/cm in both pre and post monsoon seasons content of water samples fluctuated with slight variations.

The Chemical parameters:

The Chemical parameters were presented in Figures 3-15.

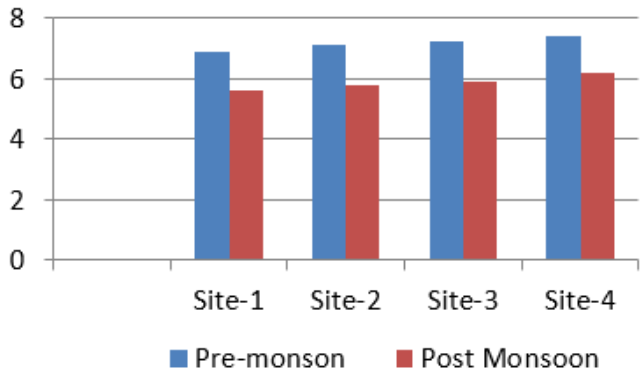

Figure-3: Dissolved Oxygen mg/L Concentration in Water Samples from Pakhal lake

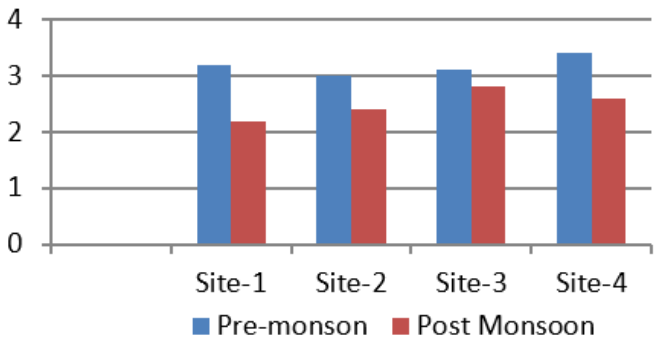

Figure-4: Biochemical Oxygen Demand mg/L Concentration in Water Samples from Pakhal lake

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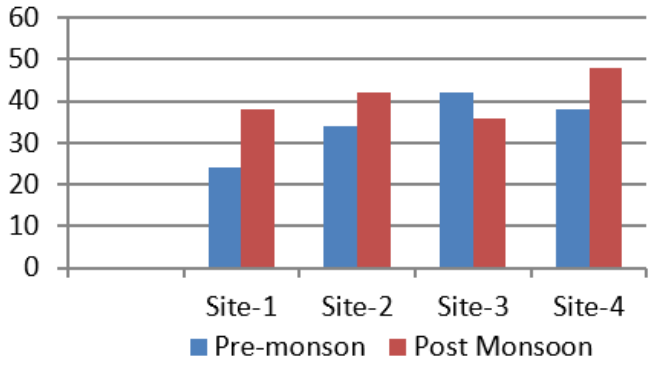

Figure-5: Chemical Oxygen Demand mg/L Concentration in Water Samples from Pakhal lake

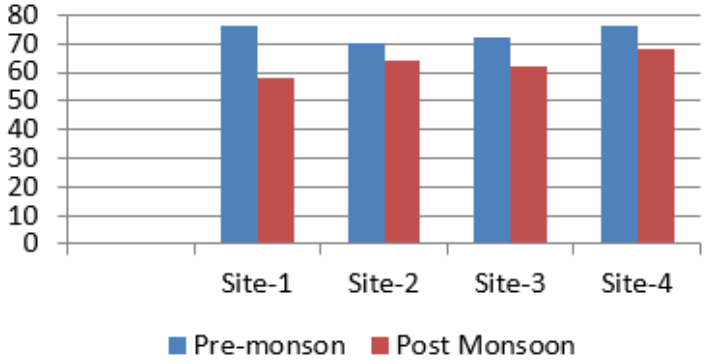

Figure-6: Total Hardness mg/L Concentration in Water Samples from Pakhal lake

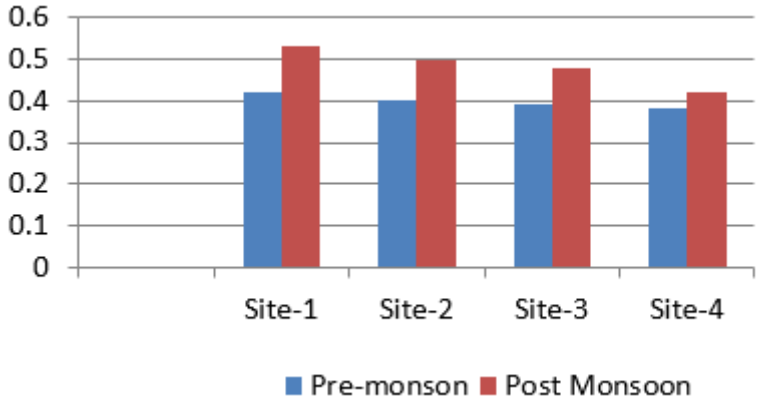

Figure-7: Calcium mg/L Concentration in Water Samples from Pakhal lake

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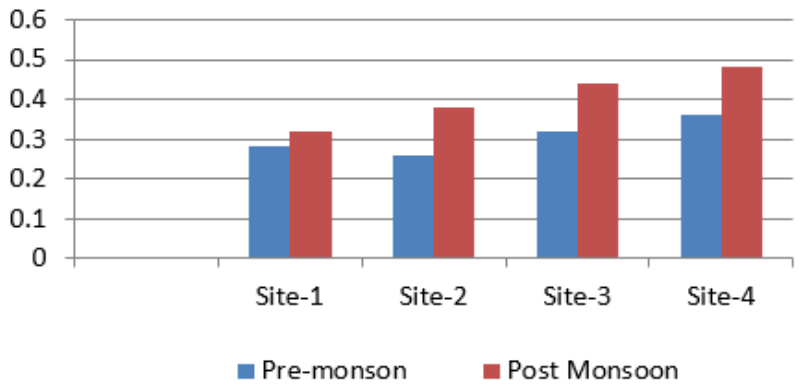

Figure-8: Magnesium mg/L Concentration in Water Samples from Pakhal lake

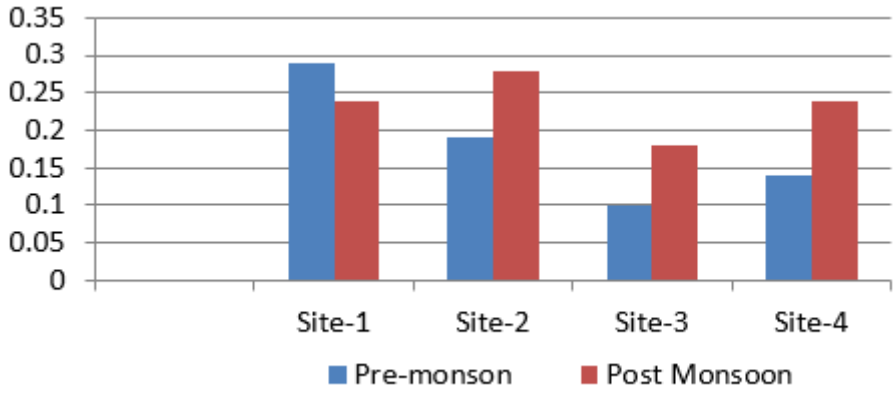

Figure-9: Iron mg/L Concentration in Water Samples from Pakhal lake

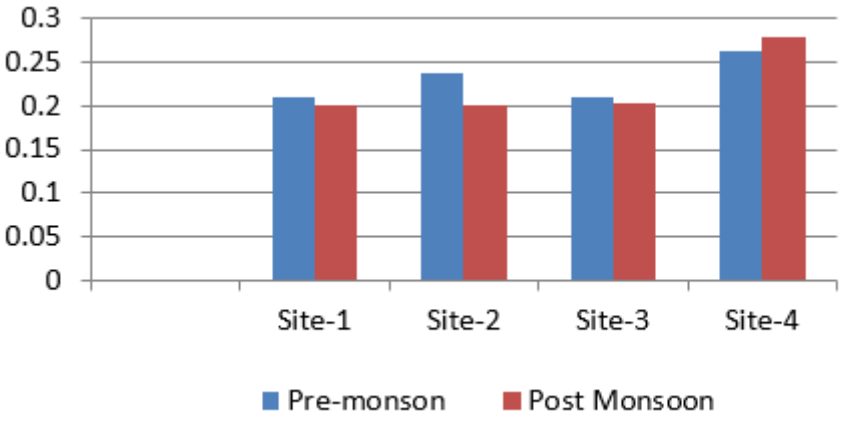

Figure-10: Organic Matter % Concentration in Water Samples from Pakhal lake

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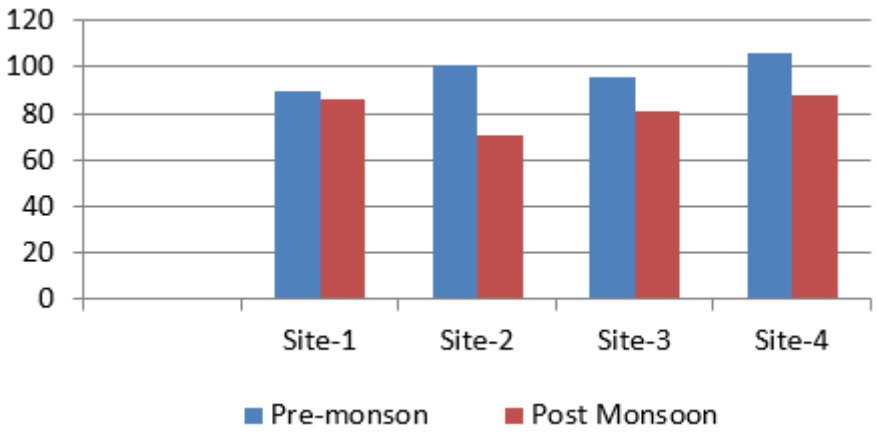

Figure-11: Total Alkalinity Concentration in Water Samples from Pakhal lake

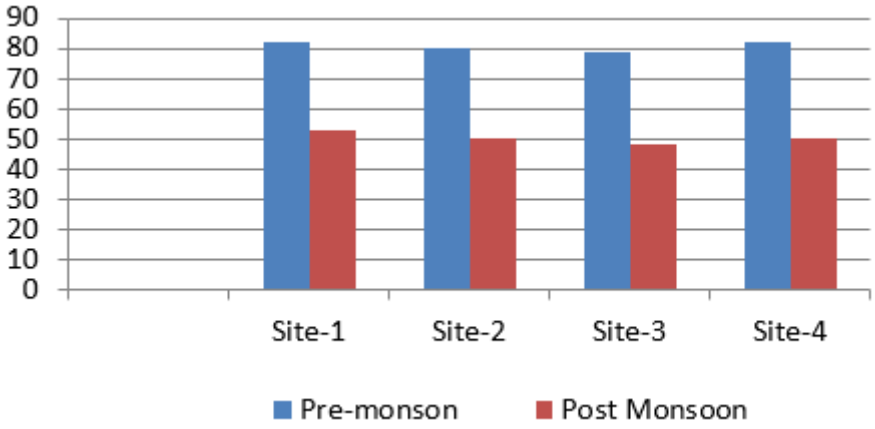

Figure-12: Chloride mg/L Concentration in Water Samples from Pakhal lake

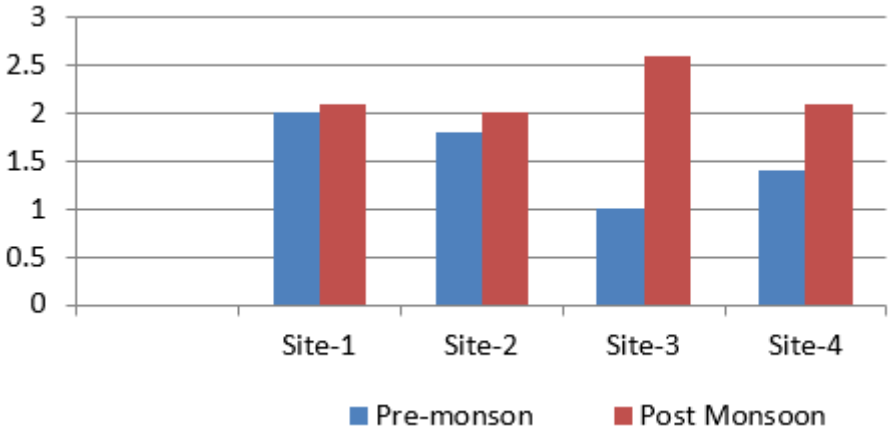

Figure-13: Phosphate mg/L Concentration in Water Samples from Pakhal lake

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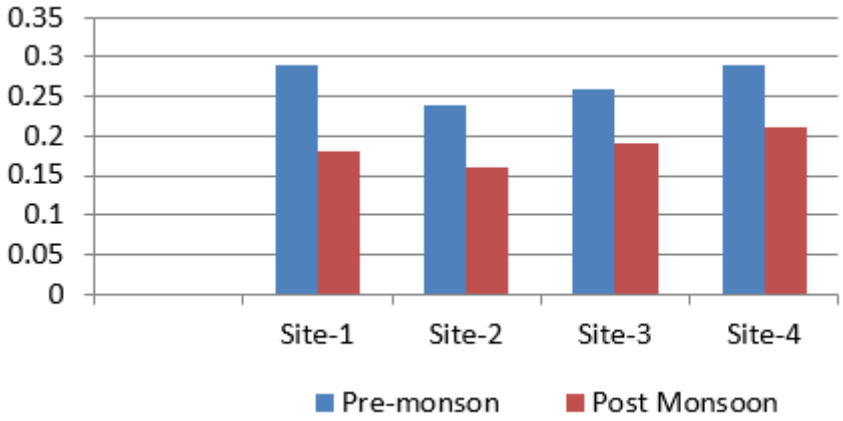

Figure-14: Nitrates mg/L Concentration in Water Samples from Pakhal lake

Dissolved oxygen is an Index of physical chemical and biological process going on in water. It is moderately soluble in water and its solubility decreases with increases in water. The high Dissolved Oxygen, of middle stream is due to lower temperature and less microbial activities. The lower concentrations of dissolved oxygen in other lakes is due to decomposition of organic matter and presence of more microorganisms. The biochemical oxygen demand is highest in 1.6 – 2.4 mg/L and lowest in pre monsoon 1.9 – 3.9 mg/L.

This is due to decomposition of biochemical degradable high organic load as the is lake receive domestic sewage and other anthropogenic activities (Khan et al 2009;). The increase in biochemical oxygen demand at site 4 is due to deposition of carbon particles generated from exhaust of vehicles moving on the near by main road. The chemical oxygen demand values were also found to be maximum in summer season. The values was linked with pollution from anthropogenic events on the bank of the lake and the reduced water flow in summer. The low chemical oxygen demand of 60 mg/L in site-2 is an indication of low quality of organic as well as oxy disable materials in the water bodies which may be attributed to the less sewage contamination and less anthropogenic activities.

Free carbon dioxide value was 2.8 mg/L at site-1 mg/L recorded in pre monsoon. The free carbon dioxide in due to less acidity is less as compared to other sites which may be due to algal blooms and microbial activity. Total hardness of water sample was the lowest value was recorded 60 mg/L in site-2. The highest value recorded 84 mg/L in site-1. The WHO acceptable limits for total hardness is 200-600 mg/L. Samples in two monsoons were within the permissible limit The higher hardness value in summer seasons mainly attributed to rising temperature thereby increasing the solubility of calcium and magnesium salts. The calcium forms the principle cation in most of the natural freshwater samples, as it is an essential constituent in the igneous rocks. The presence of other cations like potassium and sodium also influences the concentration of calcium. The calcium concentration in water recorded in lowest 22 mg/L in site-1, highest value 44 mg/L in site -4 recorded in pre monsoon. The lowest value recorded 23 mg/L in site-3 and highest value 43 mg/L in site-2 recorded in post monsoon season. Magnesium and calcium both are present to plant nutrients. Magnesium is due to the ionic exchange of minerals in rocks and soils by weathering

Water magnesium and calcium together are major contributors to hardness of water. In the present study magnesium lowest value recorded 21 mg/L in site-1, highest value was 24 mg/L in site-3 recorded pre monsoon. The lowest value 22 mg/L recorded in site-3 and

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highest value 30 mg/L in site-4 recorded post monsoon. All the samples of both pre monsoon and post monsoon with in the permissible limits. Total alkalinity ranges from 84 - 102 mg/L in pre monsoon, 72-86 mg/L post monsoon slight variations were recorded. According to the World Health Organization permissible limit of alkalinity is 100mg/L. Chloride occurs in natural water with widely varying concentration.

The concentration of chloride in the study area during pre monsoon varies from 42-56 mg/L in pre monsoon to 42-46 mg/L in post monsoon. The four samples does not exceed the permissible limits. Sulphates the sources of sulphate in rocks are sulphur minerals and sulphate of metals that occur in igneous and metamorphic rocks. Apart from natural sources, sulphates are introduced through the application of sulphatic soil conditions, sulphates do not affect the taste of water (Rohankar et al 2009; Mathur et al 2010). when sewage disposal phosphates is more, it may impart pungent smell to the water. The main source of phosphate in water is domestic sewage detergents and agricultural effluents and excess phosphate may lead to eutrophication. All the samples were found to name phosphate content ranging from 16-28 mg/L recorded in pre monsoon to 22-28mg/L recorded in post monsoon which were recorded below the WHO limit (5.0 mg/L). Nitrates in neutral surface waters, nitrate content is low. Nitrate in water may be due to oxidation of organic nitrogenous substances and sewage disposal. The water samples had nitrate conduct ranging from 1.0-2.2 mg/L recorded in pre monsoon.

The highest values were 1.2 -1.9 mg/L recorded in post monsoon the WHO standard for nitrate is 20-45 mg/L for nitrates is less than the permissible limits. Very small amount of nitrogen is present in rocks but it is concentrated to a greater extent in soils or biological organic matter material nitrogen compound applied to soils decompose to ammonia and nitrate ions (Kulkarni et al 2008; Bihari et al 2010; Rajput et al 2009; Wetzel and Likens 2000). Un affected natural water sources contain only low levels of nitrates ref. it is mainly due to aerobic decomposition of nitrogen from organic matter. Bacteria presumption test performed for drinking water showed the presence of bacteria in all samples and were identified.

The microbial population of lakes was much more extensively studied than those of rivers (Hutchinson 1957, Cole (1983). Ford 1993 Vijay Kumar et al 2000). The mircrobial examinations of water was to determine the sanitary quality and degree of contaminations with waste. Bacteria and fungi are important in understanding thoroughly the various structural and functional concerns of aquatic ecosystems. Godleuke (1976) successfully exploited the bacterials populations as an indicator of degree of eutrophication and degradation of lakes. Similar to the above observations, Sivalingam (2013), Vasumathi et al (2009), Hutchinson (1969), Agarwal et al. (1976), Born (1979), Hanmen (1979), assessed the bacteriological influences on the lentic and lotic systems and related to health effects.

Conclusion:

In view of the safe drinking water supply in rural areas, the assessment and monitoring of water quality for physico-chemical and bacteriological parameters are to be undertaken. People awareness regarding water disinfection, hygienic condition prevention and remedy measures with respect to water quality and cause are of prime importance. In the present investigation on Pakhal lake the parameters range were found to be lower than the tolerance limits prescribed by WHO, with out changing water quality. The water is free from diseases

and can conveniently be used for the drinking and irrigation purposes which shows that water is fit for utilization to irrigation domestic drinking purposes and also support biodiversity.

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