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Assessment of Some Macro Nutrients to Determine the Nutritional Status of Anchar Lake of Kashmir Himalaya

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ABSTRACT: Anchar lake water receives substantial concentration of nutrients (nitrogen, phosphorus and Potassium) due to growing anthropogenic pressure in the form of agricultural, domestic and commercial sources. Current status and trend of nutrients in Anchar lake were investigated in this study. The minimum nitrogen level of 212.8 ppm was recorded at site S_5 and maximum value of 342.4 ppm was recorded at site S_1 during spring season. In summer, the minimum value of 191.2 ppm and maximum value of 385.3 ppm nitrogen was recorded at sites S_5 and S_3 respectively. During autumn season, the maximum value of nitrogen was 423.6 ppm and minimum value was 261.4 ppm at sites S_1 and S_5 respectively. Available Phosphorus During spring season, minimum value of 13.1 ppm of phosphorus was recorded at site S_5 and maximum value of 33.8 ppm was recorded site S_3. The minimum value of 11.6 ppm and maximum value of 28.8 ppm of phosphorus was recorded at sites S_5 and S_1 respectively in summer season. During autumn season, the maximum value of phosphorus (37.7 ppm) was recorded at site S_3 and minimum value (15.0 ppm) was recorded at site S_5. The minimum of 21.2 ppm of potassium was recorded at site S_5 and maximum of 72.51 ppm was recorded at site S_3 during spring. In summer, the minimum of 16.01 ppm of potassium was found at site S_5 and maximum of 90.01 ppm was recorded at site S_1. During autumn, the maximum potassium of 67.62 ppm and minimum of 28.75 ppm was recorded at sites S_3 and S_5, respectively. Currently lake is in dystrophic condition; Both mechanical and soft management may be employed to conserve this wetland.

Keywords: Nitrate-nitrogen, Phosphates, Potassium, eutrophic, Anchar lake

I. INTRODUCTION

Wetland is the collective term for marshes, swamps, bogs, and similar areas. Interfacing between land and water systems, they are highly productive and biologically rich ecosystems. Wetlands filter sediments and nutrients from surface water and support all life forms through extensive food webs and biodiversity. Wetlands sustain all lifeforms and perform useful functions in the maintenance of ecological balance. Wetlands directly and indirectly support millions of people, providing goods and services to them. They contribute to important processes, which include the movement of water through the wetland into streams or the ocean, decay of organic matter, release of nitrogen, sulfur and carbon into the atmosphere and the growth and development of all organisms that require wetlands for living. The direct benefits of wetlands are the components/products such as fish, timber, recreation, and water supply, and the indirect benefits arise from the functions occurring within the ecosystem such as flood control, ground water recharge, and storm protection. Wetlands may be of great significance to indigenous people as part of their cultural heritage. Wetlands have the capacity to retain excess floodwater during heavy rainfall that would otherwise cause flooding. Wetland vegetation plays a major role in erosion control, which in turn contributes to shoreline stabilization and storm protection. Apart from this, the socio-economic values, through water supply, fisheries, fuel wood, medicinal plants, livestock grazing, agriculture, energy resource, wildlife resource, transport, recreation and tourism, and so forth, are significant. The functional properties of a wetland ecosystem clearly demonstrate its role in maintaining the ecological balance.

II. MATERIALS AND METHODS

The famous Anchar Lake, situated 14 km to the north west of Srinagar city is situated at an altitude of 1583 m. s. l within the geographical coordinates of 34° 20´ to 34° 26´ N latitude and 74° 82´ to 74° 85´ E longitudes. It is fed by the cold water river, Sindh which enters the lake on its northern end, while the southern end receives water from Khushalsar lake. The lake has a number of small outlet channels that drain the lake water into the nearby Shalabough wetland. Due to various anthropogenic activities the lake has shrunken from 19.54 Km^2 to 5.8 Km^2 in just 10-20 years (ESRO-2007). Lake is barely visible, with weeds growing dense and deep. Lake encroachment is taking place at a rate of 0.142 Km^2 $year^{-1}$ (ESRO-2007). Effluent brought in by the Sindh Nalla, agriculture wastes and entry of raw sewage from the entire catchment (spreading approximately upto 66 Km^2) has deteriorated the lake to an alarming extent. Besides, the lake is receiving lot of effluents containing lot of biomedical & radioactive substances form Sher-e-Kashmir Institute of Medical Sciences, Soura (Largest Hospital in Northern India). Such activities have deteriorated the water quality of the lake to an alarming extent. The sampling sites for the present study were selected depending on the type of land use around the lake and are discussed below (Fig. 1).

i) **Site-1** (Near Agricultural fields): This site of the lake is near to agricultural fields. Most of the runoff from the agriculture (paddy) fields directly enters into the lake body.

ii) **Site-2** (Near Plantation): This site of the lake is surrounded by dense plantation of willow and poplar trees.

iii) **Site-3** (Near Settlements): This site of the lake is near to the human habitation. The washout from the toilets and kitchen wastes from the households are directly discharged into the lake body.

iv) **Site-4** (Near SKIMS Soura): This site is located towards the north east region of the lake. At this site, the lake receives the toxic effluents and sewage wastes from the drainage system of SKIMS.

v) **Site-5** (Lake Centre): This site is located near the centre of the lake. At this site lake has a maximum depth. This site of the lake was taken as a control.

The nutrient characteristics of water was carried out on seasonal basis from March to November and the samples were taken in quadruples. Standard APHA methodology was adopted to analyse the macro nutrients in water.

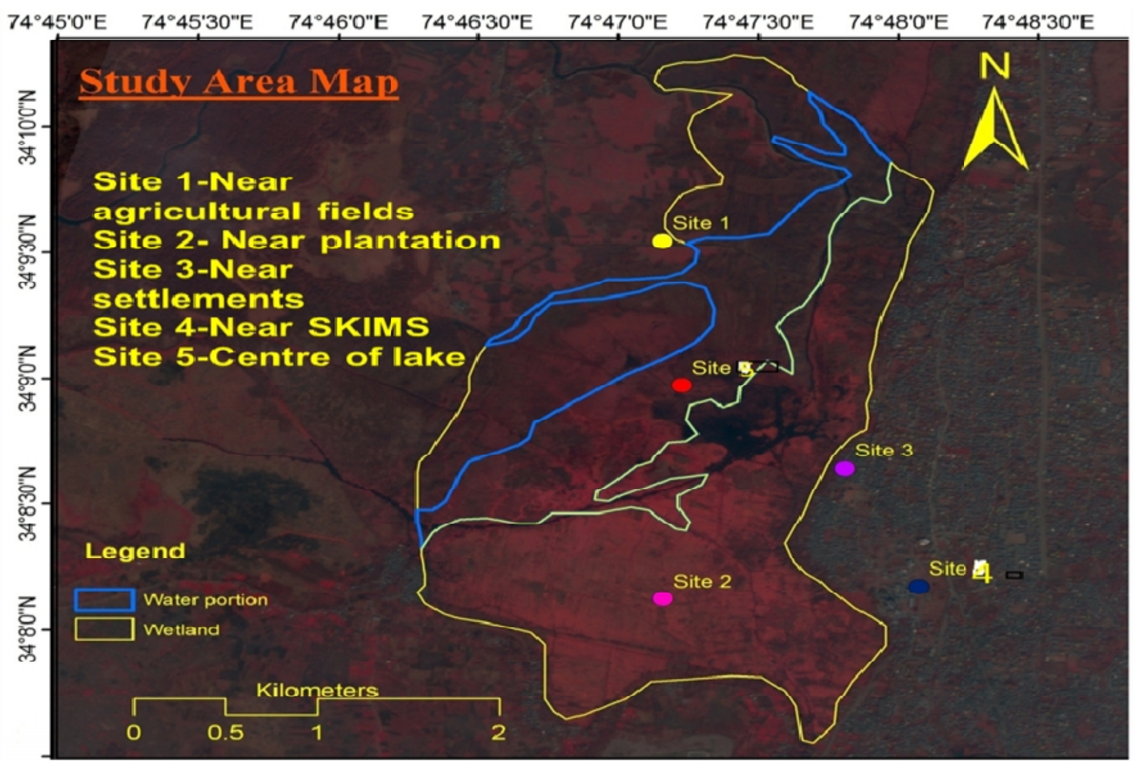

Fig. 1. Study area with sampling sites.

III. RESULTS

The level of different macro, micro elements and heavy metal constituents in Anchar lake sediment in three different seasons and at five selected sites is shown in Fig. 2.

A. Nitrate Nitrogen

During spring, minimum nitrate nitrogen of 13.4 ppm and maximum of 33.10 ppm was recorded at sites S_5 and S_1 respectively. In summer, the minimum and maximum recorded concentration of 10.5 ppm and 21.8 ppm were found at sites S_5 and S_3 respectively. During autumn, the maximum levels (34.5 ppm) at site S_1 and minimum (17.1 ppm) were recorded at site S_5.

B. Phosphate Phosphorus

The minimum level of 1.28 ppm of phosphate phosphorus was recorded at site S_5 and maximum of 2.14 ppm at site S_1. During summer, the minimum concentration (1.23 ppm) at site S_5 and maximum (2.03 ppm) was recorded at site S_1. The maximum of 2.19 ppm at site S_1 and minimum of 1.34 ppm was recorded at site S_5.

C. Potassium

During spring, the minimum level of 2.0 ppm potassium was observed at site S_5 and maximum of 11.75 ppm each was found at sites S_3 and S_4.

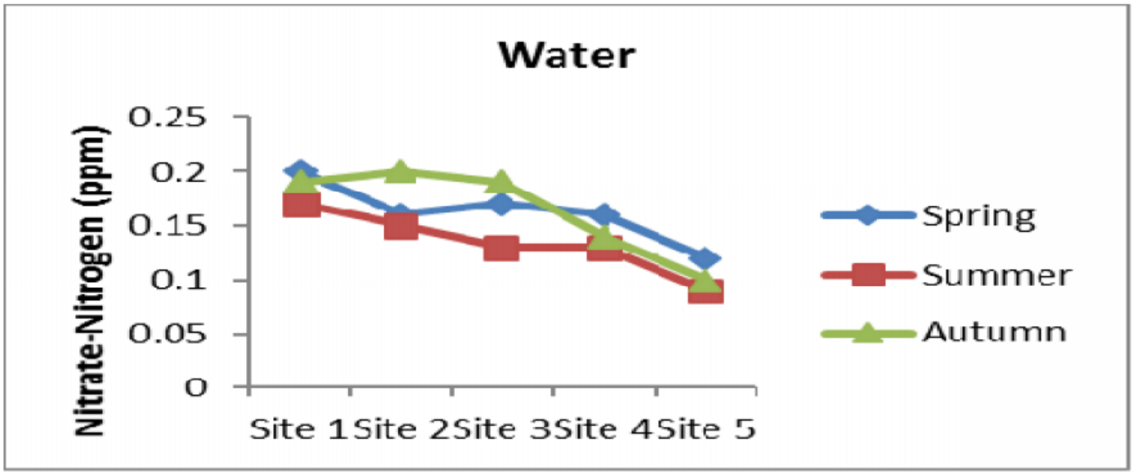

Fig. 2. Nitrogen Assessment of Anchar lake water.

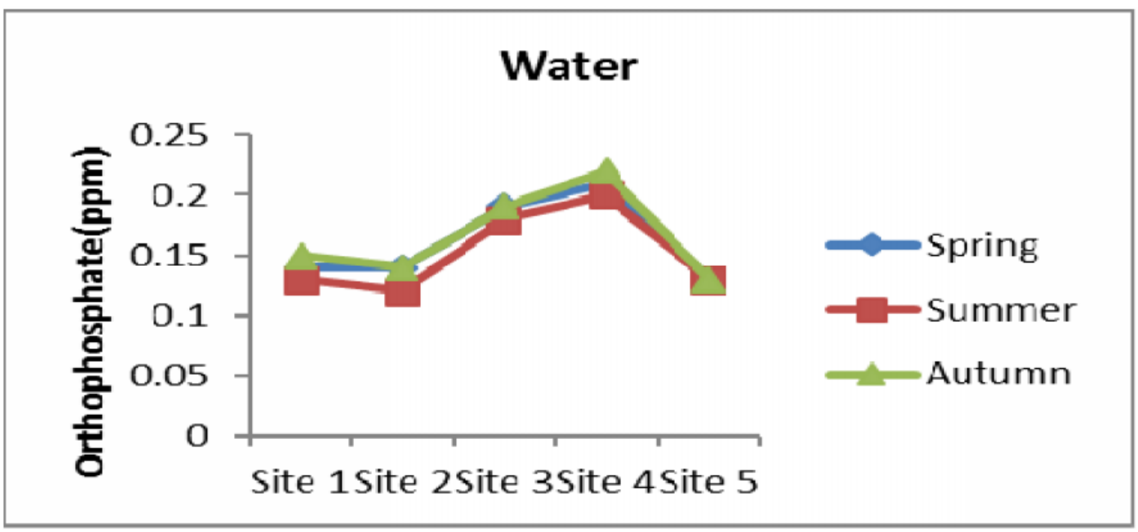

Fig. 3. Phosphate Assessment of Anchar lake water.

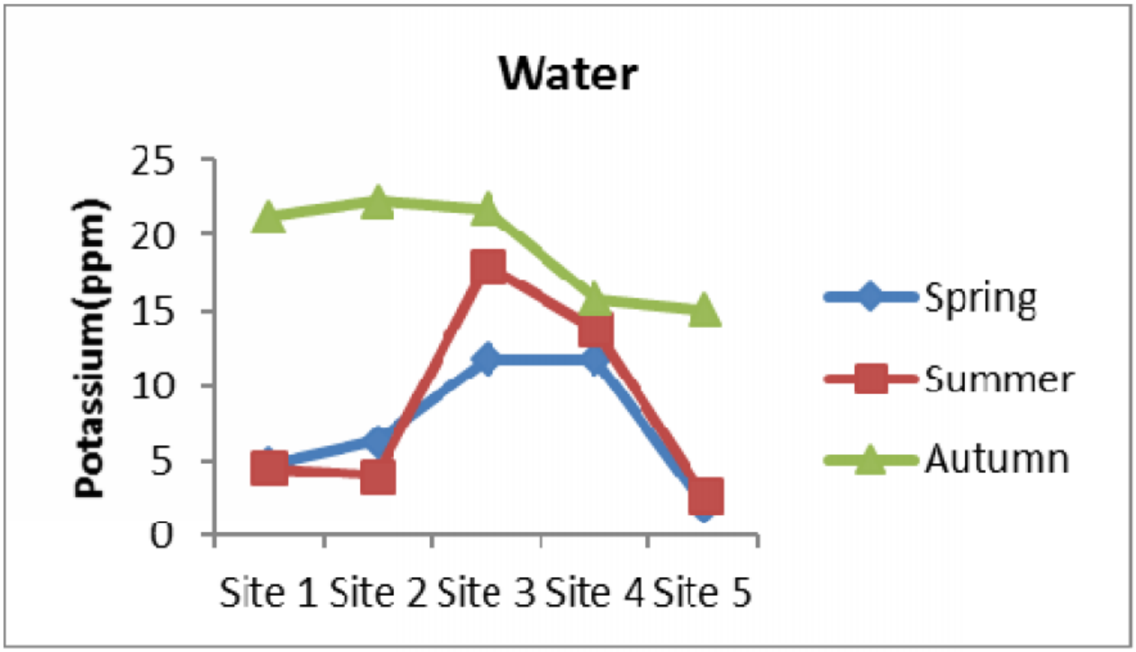

Fig. 4. Potassium Assessment of Anchar lake water.

The minimum of 2.73 ppm and maximum of 18.00 ppm were observed at sites S_5 and S_3, respectively during summer. During autumn, the maximum of 22.25 ppm and minimum of 15.01 ppm potassium was noted at sites S_2 and S_5 respectively.

IV. DISCUSSION

Nitrate nitrogen is the most oxidized form of nitrogen and is an important plant nutrient. Due to its higher mobility as compared to other plant nutrients its concentration in freshwater systems apart from autochthonous production is largely regulated by waste water loading, agricultural runoff and ground water sources. The presence of nitrate in fresh water bodies depends mostly upon the activity of nitrifying bacteria on nitrogen source of domestic and agricultural origin [1, 2]. Nitrate nitrogen during the present study fluctuated from the minimum value of 10.5 ppm at site S_5 during summer season to a maximum of 34.5 ppm at site S_1 during autumn season. The higher values during the autumn season may be due to the increased decomposition of organic matter and due to the decay of a large amount of phytoplankton which settles from the water column [3]. The lower values in the summer season may be due to the photosynthetic assimilation by autotrophs during their growth period in the late spring and early summer [1,4].

Among different sites higher nitrate nitrogen values at site S_1 *i.e.* near agricultural fields could be due to surface runoff of nitrophosphate fertilizers from the nearby agricultural fields and also due to domestic sewage coming from the nearby settlements. Sajad and Mir, 2013 [5] also reported that domestic wastes and municipal sewage are being indiscriminately discharged into the water bodies which detiorated the quality of water. Lower values at site S_5 *i.e.* Lake Centre site could be related to site being far away from any direct source of pollution [6]. This could be also the reason for site variation of total nitrogen content in macrophytes.

Higher values of nitrate nitrogen at different sites in the lake are an indication of organic pollution and thus the water is favourable for prolific growth of obnoxious weeds [7]. Further higher values may be attributed due to domestic sewage that contributes nutrients to the lake [8] and use of fertilizer in nearby agricultural fields [2].

The phosphate phosphorous concentration in water was highest (2.19 ppm) at Site S_1 *i.e.*, near agricultural fields. The higher concentration of phosphate phosphorus at other sites may be due to the use of nitro-phosphate fertilizers in the agricultural fields located near this site [6]. Hutchinson (1957) [9] also pointed out that water contaminated with sewage had more phosphate. The high concentration of phosphate in water may be due to same reason as that of sediments. The values for phosphate phosphorous concentration were lower in summer than in autumn which can be attributed to its use and uptake by the macrophytes [10-12].

Potassium is a naturally occurring constituent in sediment. Although K is a relatively abundant element, its concentration in natural fresh waters is usually less than 20 mg/l. The main sources of K are the rocks containing K, contributions from ground water, atmospheric precipitation, sediments and decomposed plants within the lake [13-14].

The major source of potassium in fresh water is due to weathering of rocks. But the quantity increases in the polluted water due to the mixing of domestic wastes [15]. In the present study highest concentration of potassium of 90.01 ppm in sediments was observed during summer season at site S_1, where there is inflow of agricultural runoff from the agricultural fields and lower concentration of 16.01 ppm at site S_5 during the same season, attributed to the location of the site that is not under the direct influence of the pollution sources, similar results have also been found by Aabid *et al.*, 2013 [16].

Water in Anchar Lake exhibited both seasonal as well as site variations in potassium levels. Average potassium values at different seasons fluctuated from 2.00 ppm to 22.25 ppm. The highest concentration of potassium was reported by the water samples during the autumn season at the site S_2 *i.e*., near plantation field and lowest value of potassium was observed during spring season at site S_5 *i.e* lake centre.

V. CONCLUSION

Anthropogenic coupled with natural sources are responsible for growing substantial concentration of nutrients (N, P and K) in Anchar Lake. Currently lake is in dystrophic condition but at the rate nutrients are discharged into the lake could be the potential factor to change thefresh water dynamics of the lake into eutrophic condition.

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