ANALYSIS OF WATER QUALITY PARAMETERS ON SHAMIRPET LAKE, RANGAREDDY DISTRICT, TELANGANA STATE, INDIA.

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ABSTRACT: Water quality management forms an integral part of aquaculture most of the problems that arise in aquaculture are the result of the degradation of water quality. Thus the knowledge of chemistry of water quality is vital for predictable and successful aquaculture. The present research paper enables us to understand the Physico-chemical nature of Shamirpet Lake. An attempt was made to access the trophic nature of the present Lake for two years (2011- 2012) and (2012 to 2013). The samples of water were collected by using standard methods and analysis was carried out on each sample using known standard methods. The results for Temperature (27.8 ^{0} C- 31.3 ^{0} C) pH(7.5- 8.0) Turbidity(120.9-140.9 NTU), TDS (540-662.3 mg/lit), D.O(3.2-4.6 mg/lit), BOD (2.3-5.0 mg/lit), Cl⁻(121.7-160.2 mg/lit), NO3- (2.7-4.4 mg/lit) and PO4- (1.0-1.5 mg/lit) during two years of study period.
Key words: Shamirpet Lake, Physico-chemical parameters, Aquaculture, Predictable.

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INTRODUCTION

Water, the precious gift of nature to human being, it is going to be polluted day-by-day with increasing urbanization. Although three-fourth part of earth is being surrounded by water but a little portion of it can be used for drinking purpose. The world is fast growing with its technologies and the population on earth is increasing tremendously. So the dependence as well as exploitation of freshwater resources is also increasing rapidly. It is not just the population increase alone but also the technology-aided excessive uses, abuses and misuses of water resources that break the natural water cycle. Modern humans cannot advance without determining the right levels of uses for various purposes. We have also to learn the secret of all the methods and all the agents involved in the process of natural water cycle. Water quality management forms an integral part of aquaculture, at times a challenging one. Most of the problems that arise in aquaculture are the result of the degradation of water quality. Thus the knowledge of chemistry of water quality is vital for successful aquaculture. The aquaculture environment is a dynamic one in which various Physico-chemical factors vary with seasons and time, and the variations are caused invariably as the result of interactions between them.

Temperature, inflow and outflow, and standing water level are the important environmental factors of marked seasonal variations that affect all the other environmental characteristics of freshwater ecosystems. These are the factors which usually fluctuate according to seasons within a year. Since monthly changes are quite gradual and slight fluctuations in monthly characteristics exist between successive years, calculation of seasonal trends from the regular monthly observations is much more useful to explain ecological status of Shamirpet lake. Hence Various physico-chemical parameters were analyzed in Shamirpet lake, Rangareddy district, Telangana state during 2011- 2012 and 2012 to 2013.

MATERIALS AND METHODS

Shamirpet lake is a minor lake located in Rangareddy District of Telangana State. It is an artificial lake nearer to Hyderabad and located about 24 kilometres north of Secunderabad. It was built during the Nizam period. The salient features of lake was given in the following.

Table-1: Morphometric and Hydrological characteristics of Shamirpet Lake

Location	Rangareddy Dist
Latitude	17.5917° N,
Longitude	78.5822° E
Constration	1892
Surface area [ha]	276.7ha
Catchment area [km2]	40
Water temparature	25-32 c
Annual mean pricipation[mm]	varies 188 mm
Annual mean evaporation [mm]	150 to 250 cm
Wind [m.s.1]	8km/h
Area of distribution	256.7 hectors (NGRI)

The water samples were collected from Shamirpet Lake monthly basis from June to May for two years (2011-2012 and 2012-2013) from four different sites depending on convenience. Physico-chemical parameters as water Temperature, pH and Dissolved oxygen were determined on the site. Other parameters like Turbidity, TDS, D.O, BOD, Chlorides, Hardness, Calcium, Magnesium, Chlorides, Nitrates and Phosphates were analyzed by using standard methods of APHA 2009.

Shamirpet lake is totally surrounded with beautiful rock formation all around, which were declared as Heritage Rock by the Hyderabad Urban Development Authority (HUDA) due to its natural location. The lake and its surroundings have beautiful ambience and picturesque scene. The lake is said to have used to cater drinking water to the inmates of surrounding villagers during Nizam period. After the Rajakar's movement (1950) in Hyderabad residency, the drains near the shamirpet were broken and the water used for drinking and agriculture purpose by the local public.

Image: 1. Picture view of Shamirpet Lake

RESULTS

Temperature (^{o}C)

Temperature is a universal factor and slight change in it may affect the hydrobiology of the water body. The fluctuation in monthly ambient temperature largely depends on the changes in the solar radiation. Water has several unique properties that combine to control temperature changes like high specific heat, high latent heat of fusion and highest known latent heat of evaporation. Temperature ranged from 27.8 to 31.3 ^{0}C. The mean and SD values of temperature were 28.8±0.4 during 2011-2012 (Table:1) and 29.1±1.6 during 2012-2013 (Table:2). The present study it was observed that the water temperature showed relatively similar in different seasons. The observation revealed that there was a decreasing trend from May to December and an increasing trend from January to May during study period with slight variation. Similar trends were observed in all the four stations of the lake.

pH

The functional stability of aquatic ecosystem depends up on the buffering capacity of water. This is reflected in the range of fluctuation of the hydrogen ion concentration brought about by the operational dynamics of CO_2, bicarbonates and carbonates. pH of water has significant role on survival of aquatic biota. The pH ranged from 7.5 to 8.0 to 8.3. the mean and SD values were found 7.6±0.2 during 2011-2012 (Table:1) and 7.7 ± 0.2 during 2012-2013 (Table:2).

Turbidity(N T U)

Maximum turbidity values were found during the pre-monsoon period in all the cases during the present study period. The Turbidity values were ranged from 120.9 to 140.9. The mean and S.D values recorded were 126.1± 0.02 N TU and 126.0 ± 1.4 N TU respectively. A remarkable change in the turbidity value was noticed in April month during two years of study period.

Total Dissolved Solids (mg/L)

The trophic nature of water body reflects in the concentration and composition of its total dissolved solids in water. The underwater climate of a water body is also dependent upon the nature, size, shape, colour, density and dispersion of the suspended particles. The TDS values were ranged from 540 to 662.3. The mean and SD values were found 568.6 ± 8.4 and 587.2 ± 58.1 during first and second year respectively.

Dissolved Oxygen (ppm)

Dissolved oxygen is one of the most important chemical parameters, which has a great influence on the survival and growth of fish. The lake water gets oxygen mainly through interaction of atmospheric air on the surface water of the lake and by photosynthesis. In the present investigation The D.O values were ranged from 32 to 4.6. The mean and SD values were 2.2±0.6 and 2.1±1.0 respectively during first and second year study periods.

Biological Oxygen Demand (mg/L)

BOD is important parameter that indicates the magnitude of water pollution by the oxidizable organic mater. The main source of responsible for organic enrichment of an aquatic ecosystem are domestic savage, agricultural runoff and industrial effluents and the main components of oxidizeble matter include carbonaceous matter, nitrogen compounds and chemically reducing compounds. The BOD values were ranged from 2.3 to 5.0. The mean and SD values were 3.6±0.9 and 4.5± 0.5 respectively during study period.

Chlorides (mg/L)

In aquatic environment calcium serves as one of the micronutrients for most of the organisms. The chloride values were ranged between 121.7 to 160.2. The mean and SD values were 132.4±13.4 and 142.8±15.7 respectively during study period.

Hardness (mg/L)

The relative composition and concentration of the cat ions in the aquatic ecosystem determines the water quality for different uses. The hardness is due to calcium and magnesium, which are bivalent salts. Calcium and magnesium cycle through biotic and abiotic components of the ecosystem. The Hardness values were ranged from 276 to 388.7. The mean and SD values were 297.4±27.9 for the first year and 334.3±53.8 for the second year recorded respectively.

Calcium (mg/L)

Calcium is the major cat ion present in the natural waters, its main source being leaching of rocks in the catchment. Its concentration restricts water use, while it is an important component in the exoskeleton of arthropods and shell in molluscans. The calcium values were ranged from 40.9 to 61.1. The mean and SD values were 54.4±8.6 for 2011-2012 and 54.0±8.8 for 2012-2013 recorded respectively.

Magnesium (mg/L)

Magnesium is another dominant cat ion in natural eaters and lakes to calcium, magnesium is added to the lakes, by leaching of rocks in the catchment. It is vital component of chlorophyll, very high concentration of magnesium imports an unpleasant taste to the potable water. During present study the Mg values ranged between 52.3 - 80.6. The mean and SD values 59.3±8.5 and 66.8±12.7 in the lake during 2011-2012 and 2012-2013 respectively.
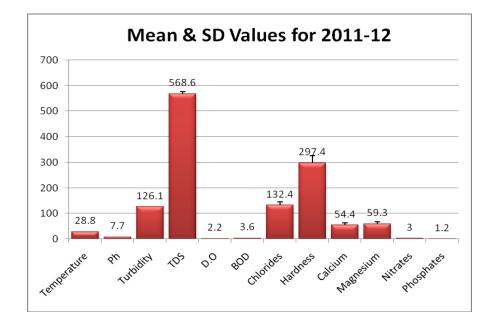
Nitrates (mg/L)

The most important nutrients in water in aquatic systems are nitrogen (N) and phosphorus (P). These nutrients are critical to the growth of plants and animals in aquatic systems. Nitrate is the most highly oxidized from of nitrogen compounds commonly present in natural water, because it is the product of aerobic decomposition of organic nitrogenous matter. The Nitrate values were ranged from 2.7 to 4.4. The mean and SD values in the lake were 3.0±0.4 and 3.4±0.7 first and second years respectively during the study period.
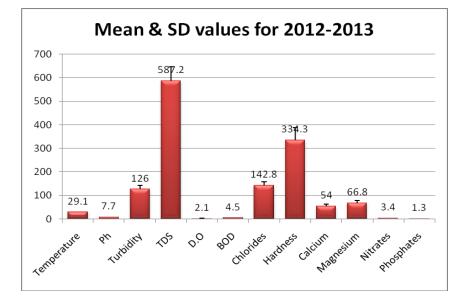
Phosphates (mg/L)

High values of Phosphates during pre monsoon are due to reduced water level Shamirpet Lake. Phosphorus has been identified as the limiting factor for algal growth in most lakes. It is largest contribution to aquatic plant growth. The phosphates were ranged from 1.0 to 1.5. The mean and SD values were recorded as1.2±.02 and 1.3 ±0.1 for first and second years respectively.

Table: 2. Mean and SD Values of Physico-chemical parameters during 2011-2012

Parameters	Site- I	site -II	Site- III	Site- IV	Mean± SD
Temperature	**29.1**	**28.3**	**28.8**	**30.0**	**28.8±0.4**
pH	**7.8**	**7.6**	**7.5**	**7.9**	**7.6±0.2**
Turbidity	**122.5**	**138.6**	**120.9**	**123.0**	**126.1±0.02**
TDS	**550.0**	**540.0**	**634.2**	**550.0**	**568.6±8.4**
D.O	**3.6**	**3.4**	**4.1**	**4.6**	**4.2±0.6**
BOD	**3.7**	**2.3**	**4.5**	**3.8**	**3.6±0.9**
Chlorides	**121.7**	**149.3**	**137.0**	**121.9**	**132.4±13.4**
Hardness	**276.0**	**334.8**	**302.7**	**278.0**	**297.4±27.9**
Calcium	**61.6**	**49.7**	**44.6**	**62.0**	**54.4±8.6**
Magnesium	**52.3**	**69.6**	**63.0**	**52.8**	**59.3±8.5**
Nitrates	**2.9**	**2.7**	**3.6**	**3.0**	**3.0±0.4**
Phosphates	**1.1**	**1.0**	**1.4**	**1.2**	**1.2±0.2**

Table: 3. Mean and SD values of Physico-chemical parameters during 2012-2013

Parameters	Site- I	Site- II	Site- III	Site- IV	Mean+ SD
Temperature	28.8	28.3	31.3	27.8	29.1±1.6
pH	7.7	8.0	7.6	7.6	7.7±0.2
Turbidity	132.5	140.9	104.8	125.8	126.0±1.4
TDS	568.3	595.0	662.3	523.3	587.2±58.1
D.O	2.4	1.1	3.4	1.4	2.1±1.0
BOD	4.8	5.0	4.0	4.2	4.5±0.5
Chlorides	123.0	160.2	139.5	148.5	142.8±15.7
Hardness	279.0	371.2	388.7	298.3	334.3±53.8
Calcium	59.3	40.9	58.1	57.8	54.0±8.8
Magnesium	53.6	80.6	74.3	58.8	66.8±12.7
Nitrates	3.0	3.3	4.4	3.0	3.4±0.7
Phosphates	1.2	1.2	1.5	1.3	1.3±0.1

DISCUSSION

Assessing the level of nutrients is a main feature in determining the lake productivity. Lake water quality is extremely influenced by the relative abundance of nutrients. A moderate amount of nutrients enhances the lake ecosystem by providing a food source for aquatic organisms. Nutrients can transfer into the lake from surface runoff as well as ground water inflows. The temperature ranged between 27.8 ^{o}C to 31.3 ^{o}C, the temperature variation in the lake were normal for metabolic activities of organisms. The range of pH was 7.5 to 8.0 recorded in all stations during study period. The pH below 4.8 and above 9.2 are deleterious for aquatic organisms especially for fish (Buttner et al 1993). Turbidity is correlated with the nature of bottom, wave action and anthropogenic activities in the water body. Turbidity values ranged between 120.9-140.9 NTU and Total dissolved solids ranged from 540-662.3 mg/lit.TDS elevates the density of water, influence osmoregulation of fresh water organisms. The values of D.O was 3.2-4.6.The temperature strongly influences Dissolved Oxygen as oxygen solubility decreases with increasing water temperature.

Inputs into the lake from sewage and manure can reduce dissolved oxygen levels due to the decomposition process (Parikh Ankita N et al 2012). Biological Oxygen Demand values were 2.3-5.0, BOD is the amount of dissolved oxygen needed by aerobic biological organisms in body of water to break down organic material present in a given water sample at certain temperature over a specific time period and considered as an important water quality indicator (J.Mahender et al, 2016). The chloride status in water is indicative of pollution, especially of animal origin the values ranging between 121.7-160.2 mg/lit. These values are attributed due to large amount of organic matter, mass bathing activities, urination and waste of animals (D.D.Mishra, S.S.Dara 2011). The Hardness of the lake is indication of its carbonates and bicarbonates. The values of total hardness were found 276-388.7 mg/lit during the study period (WHO 1993). The sources of hardness are mainly due to the addition of calcium and magnesium through surface run-off from agricultural and other catchment areas. Calcium is directly related to hardness. Calcium concentration ranged between 40.9-61.1 mg/lit. Magnesium is often associated with calcium in all kinds of water, but its concentration remains generally lower than the calcium. Magnesium content in the investigated water samples were 52.3-80.6 mg/lit. The salts of sodium, potassium, and calcium contribute chloride in water. Nitrogen is limiting nutrient especially at higher N/P and considered as an essential factor for water quality assessments. Nitrate contents of the lake were 2.7-4.4 mg/L during study period (Ganai et al 2010). The phosphate concentration were 1.0-1.5 mg/L respectively (Kiran B.K et al 2015).

CONCLUSION

In the present study the concentration of all parameters in all samples were found within the tolerable limits. But the BOD values were shown slightly elevated. It concludes that this lake is suitable for Fish culture, drinking and Irrigation purpose.

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