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RESEARCH ARTICLE

Seasonal water quality status in Udhayamarthandapuram Bird Sanctuaries (Tamil Nadu)

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SUMMARY: A study was conducted in seasonal water quality variation in Udhayamarthandapuram bird sanctuary. This sanctuary was visited twice in a month during August 2010 to March 2011. During the study periods, analysis of 17 water quality parameters was made at three distinct seasons namely, pre-monsoon (August and September), monsoon (October, November and December) and post- monsoon (January, February and March). The temperature, dissolved oxygen and nitrate were recorded highest in pre- monsoon of the study periods. The turbidity, salinity, nitrate, sodium and potassium were recorded highest in monsoon and the nitrate, pH, phosphate, hardness, chloride, calcium, sulphate, zinc and iron were recorded in post-monsoon of the study periods.

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Key Words :
Wetland, Water quality, Seasonal variation, Electrical conductivity

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Wetlands are at great value to mankind in a variety of ways such as agriculture, fishing, sewage disposal, cultivation of edible water plants, reed gathering, fuel wood collection, domestic use, wildlife production, flood control, storm production, ground water recharge, pollution control, sediment control and maintaining high atmospheric humidity. (Cladridge and Davies, 1993 and Buckton, 2007). Among the inland wetlands the freshwater wetland includes river system, streams, irrigation canals as well as reservoirs, lake, ponds and marshes including rice fields. Tanks, reservoirs and other water bodies' marshes, freshwater lakes and the stagnant as lentic ecosystem and the running water bodies fall into the lentic ecosystem category. There are 32 river system 11 major reservoirs 2679 canals and 38863 tanks in Tamil Nadu. The rivers of Tamil Nadu flow eastwards from the Western Ghats and are entirely reined. The perennial rivers are Cauvery, Palar, Cheyyar, Moyar, Bhavani, Amaravathi, Vaigai, Noyal, Suruli, Guhar, vaipar, Valparai and Varshali. The 760 km long Cauvery is the longest river of the state. The total length of the rivers of Tamil Nadu is 7420 km, the area of reservoirs is 0.52 lacks ha the area of tanks and ponds 6.92 lacks ha and 63,000 ha back waters and swamps (Venkatraman, 2005). Tamil Nadu has 31 natural wetlands covering an area of 58,068 ha and 20,030 manmade wetlands with an area of 201132 ha. According to Sathe *et al.* (2001), a larges number of ecological processes in the fresh water bodies is influenced by temperature. Graham *et al*. (1982) had shown the water temperature to regulate photosynthesis in the aquatic ecosystems. pH of wetland as an important factor in water bird distribution had also been reported earlier. Water electrical conductivity influenced the density of water birds. Dissolved oxygen level influenced the density of all water bird groups. According to Wetzel and Linkers (1997), among all the biotic factors, dissolved oxygen is the most important factor in the fresh water life as it provided valuable information about the biological and biochemical reactions going on in waters, Sathe *et al.* (2001) stated that dissolved oxygen is of great limnological significance as it regulates metabolic

process of aquatic organisms and indicates the status of a water body.

According to Murphy *et al.* (1984), the inclusions of hydrological considerations in water bird habitat evaluation had considerable merits because levels of primary productivity in the aquatic system and their tropic structure and total biomass throughout the aquatic food web are mediated via a host of interacting physical and chemical factors. Mittal *et al.* (1990) had stated that functioning of an ecosystem and its ability to support life forms depend to a greater extent on the physic-chemical character stirs of water. Hydrology and physic-chemical factors were reported to influence water densities. Wide variations in the water bird populations associated with the levels of dissolved oxygen, carbon dioxides, alkalinity, salinity, calcium and magnesium had been reported by Sampath and Krishnamoorthy (1990) at Kaliveli tank, Tamil Nadu, India. Murphy *et al.* (1984) found that the water bird density was most influenced by hydrologic features of the habitat such as phosphate, water pH, alkalinity, hardness and temperature in the taiga ponds, Alaska, U.S.A. The authors also found that water depth- and area and silica content also accounted significantly for the same. The author had further reported that nitrate, nitrate and ammonia in the water to influence heavily the variations in the water bird density. Role of hydrological characteristics on water bird population dynamics had been documented by Swanson *et al.* (1984) also. Silicates play a very important role in fresh water ecosystems (Maitland, 1990). The concentration of silicate together with salinity could influence the composition, succession and dominance of various aquatic organisms. The major cations, calcium, magnesium, sodium and potassium are usually required in very low quantities but their concentrations in the fresh water can influence the osmo-regulation of organisms, nitrates were reported to be very low during periods of high primary productivity (Ramamoorthy, 1965).

Study area :

Udhayamarthandapuram lake:

Udhayamarthandapuram Lake is located in Thiruvarur district of Tamil Nadu. It is an important migratory water bird habitat of Tamil Nadu (Southern India). This lake was declared as bird sanctuary in 1991 and has a total area of 45.30 ha. The area coordination as $10^0$26''50'' N, $79^0$27''58'. A large number of resident and migratory water birds visit the sanctuary from October to March every year, they come from places such as North India, Central Asia, Tibet, Ladakh and Northern Russia. This lake basically irrigation tank and receives water from Koraiyar River which is connected to river Cauvery, every year during north east monsoon from August to December. It remains dry from April to August. Irrigational exploitation of fishery resources of the lake and poaching birds by people. It is the major conservatory issues of the lake. So. based on the rainfall, seasons can be distinguished at the study area, namely, pre-monsoon, monsoon and post-monsoon since the lake got dried during March to July. Data were collected from August 2010 to March 2011 for the present study.

EXPERIMENTAL METHODOLOGY

Study period:

Data were collected from August 2010 to March 2011 *i.e.* during three seasons *viz.,* pre-monsoon (August to September), monsoon (October to December) and post-monsoon (January to March)

Physical and chemical analysis :

Temperature, pH and DO were measured on-site, using mercury in glass thermometer, portable hand pH meter and the aside modification of the Winkler's method, respectively. The collected samples were immediately transferred and analyzed in the laboratory. All samples analyzed for various water quality parameters and were determined according to standard procedure (APHA, 2005).The metals were analyzed using Elmer Perkin Model 8100c Atomic Absorption Spectrophotometer.

EXPERIMENTAL FINDINGS AND DISCUSSION

The findings of the present study well as relevant discussions have been presented under following heads:

Month wise and season wise comparisons of fluctuations in water quality parameters :

With regard to surface water temperature, the highest temperature was recorded during August (29.3±0.24) of the study periods and the least temperature during December (27.6±0.19) of the study periods. There was another peak in surface water temperature during August. Overall surface water temperature (28.4±0.28) was higher during the pre-monsoon (28.3±0.35) season than the other seasons. The electrical conductivity was higher during February (654.4±5.6) and lowest during August (458.7±10) in the study periods. Overall electrical conductivity was higher during the post-monsoon (651.2±8.7) season than the other seasons. The turbidity level was higher during November (2.6±0.1) and lowest value recorded during December (2.3±0.07) in second year of study. The pH level increased during February to March (8.3±0.03) and decreased during October (7.9±0.09). The highest dissolved oxygen level was recorded during February (6.7±0.1) and lowest value recorded during September 5.5±0.1). Overall dissolved oxygen was higher during the pre-monsoon (6.7±0.1) season than the other season of the study period. The salinity level was recorded highest during September

Table 1 : Seasonal water quality variables in Udhayamarthandapuram bird sanctuary

Sr. No.	Water parameters	August	September	Pre Monsoon	October	November	December	Monsoon	January	February	March	Post Monsoon
1.	Temperature (°c)	29.3 0.24	28.4 0.13	28.3 0.18	27.6 0.1	28.4 0.28	27.6 0.19	28.3 0.22	28.6 0.18	28.3 0.17	27.6 0.19	28.3 0.16
2.	Water depth (cm)	72.3 3.0	39.8 3.91	56.3 3.46	39.8 3.88	48.2 1.72	61.8 3.91	49.9 3.17	64.7 4.96	83.2 2.63	75.1 4.75	74.3 4.11
3.	Turbidity (NTU)	2.5 0.09	2.3 0.16	2.4 0.12	2.3 0.39	2.6 0.1	2.3 0.07	2.4 0.08	2.3 0.14	2.4 0.11	2.4 0.14	2.35 0.13
4.	EC(mho/cm)	458.7 10	557.5 8.5	508.1 9.3	564.6 15.3	573.3 12.6	636.2 10.8	598 12.6	649.3 10	654.4 5.6	650 10.32	651.2 8.7
5.	pH	7.6 0.15	7.6 0.12	7.6 0.13	7.9 0.09	7.6 0.15	8.2 0.16	7.9 0.13	7.6 0.1	8.3 0.09	8.3 0.09	8.1 0.1
6.	DO(mg/l)	6.4 0.14	5.5 0.11	6.7 0.131	5.9 0.17	6.0 0.1	6.3 0.16	6.0 0.14	6.0 0.14	6.7 0.13	6.0 0.14	6.2 0.1
7.	Salinity(ppm)	43.4 2.7	47.5 2.53	45.7 2.6	44.6 3.62	45.5 2.5	42.3 1.5	44.4 2.74	43.6 2.64	42.5 2.1	44.9 3.5	43.5 2.7
8.	Nitrite(ppm)	0.02 0.06	0.04 0.08	0.03 0.07	0.02 0.06	0.02 0.06	0.02 0.07	0.02 0.06	0.02 0.05	0.02 0.05	0.02 0.06	0.02 0.05
9.	Nitrate (ppm)	0.4 0.09	0.9 0.08	0.6 0.08	0.5 0.12	0.4 0.9	1.1 0.16	0.6 0.12	0.6 0.1	0.7 0.1	0.5 0.12	0.5 0.1
10.	Phosphate (ppm)	0.03 0.04	0.03 0.04	0.03 0.06	0.02 0.07	0.03 0.08	0.04 0.15	0.03 0.06	0.03 0.1	0.03 0.08	0.02 0.07	0.16 0.09
11.	Silicate (ppm)	0.5 0.2	0.3 0.23	0.5 0.21	0.2 0.2	0.2 0.2	0.1 0.13	0.1 0.17	0.1 0.11	0.2 0.27	0.1 0.11	0.1 0.19
12.	Hardness (mg/l)	124 2.83	131.3 1.92	127.6 2.3	123.2 2.4	179.1 4.24	175.2 8.0	159.1 3.57	159.8 3.37	183.7 2.75	179.9 1.97	174.4 2.7
13.	Calcium (mg/l)	19.9 0.1	32.9 0.08	26.4 0.11	20.3 0.1	23.7 0.5	29.8 0.07	24.6 0.11	29.8 0.07	32.8 0.07	34.2 0.12	32.3 0.09
14.	Sodium (mg/l)	46.3 1.4	40.5 0.9	43.6 1.1	35.1 1.1	42 1.4	45.2 1.5	40.4 1.0	46.8 1.3	46.1 1.1	38.6 1.0	43.8 1.3
15.	Potassium (mg/l)	1.0 0.3	1.2 0.16	1.1 0.25	1.0 0.3	1.5 0.35	2.5 0.35	1.6 0.33	2.2 0.35	1.1 0.25	1.1 0.25	1.4 0.28
16.	Chloride (mg/l)	63.3 1.85	56.6 1.0	59.9 1.47	60.7 2.16	63 2.16	56.3 2.3	60 2.22	58.5 1.75	56.3 1.94	63 2.47	59.4 2.5
17.	Sulphate (mg/l)	8.1 1.12	7.3 0.88	7.7 1.0	7.3 0.88	8.5 1.68	8.0 1.0	7.9 1.0	8.1 1.12	7.3 0.88	8.8 1.26	8.0 1.12
18.	Zinc (mg/l)	0.8 0.47	1.0 0.35	0.9 0.41	2.2 0.35	2.5 0.35	2.0 0.35	2.2 0.35	2.5 0.35	1.0 0.35	2.2 0.35	1.9 0.35
19.	Iron (mg/l)						0.3 0.06					

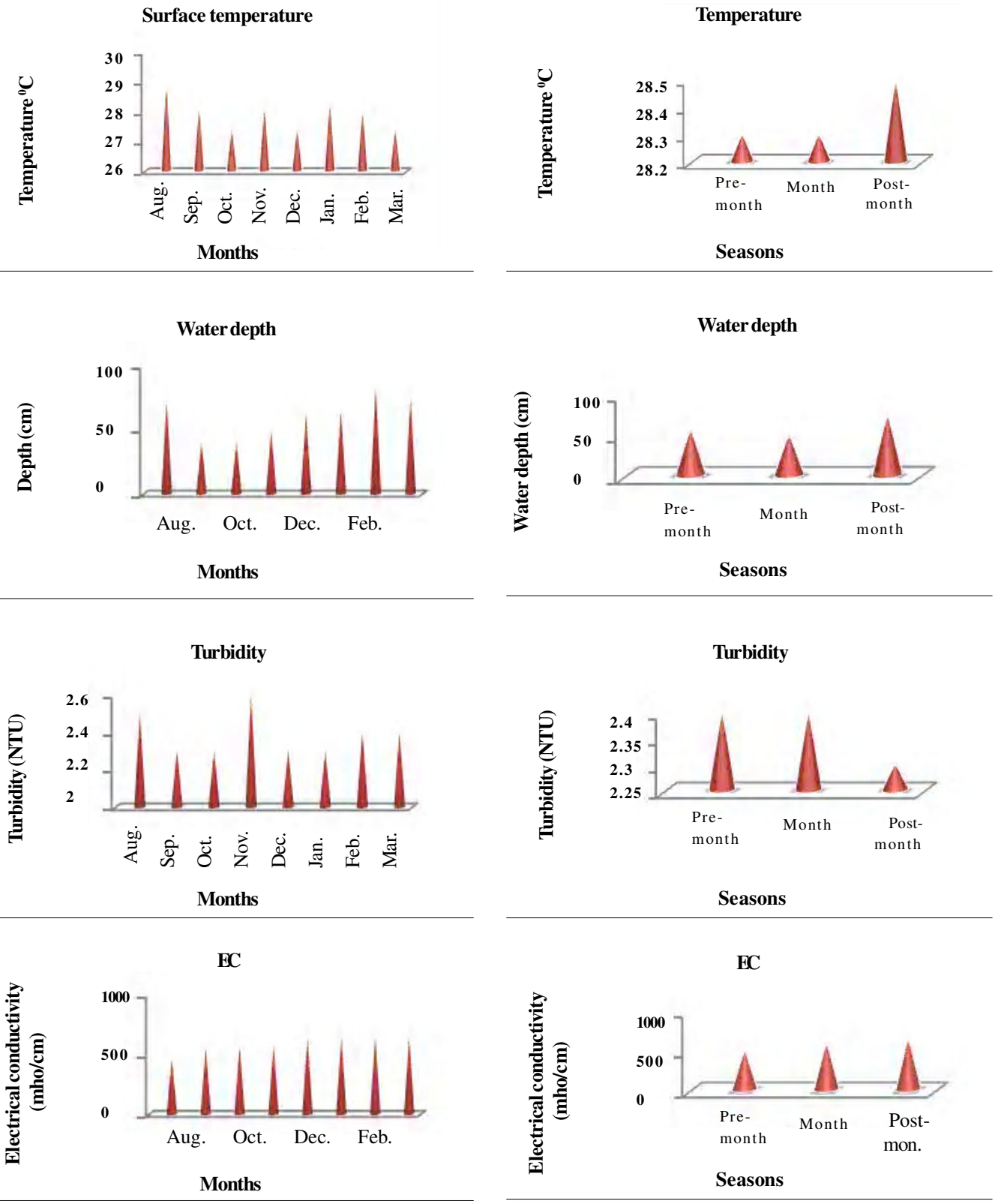

Fig. 1 : A comparison of month wise and season wise variations in the water quality parameter during the study periods

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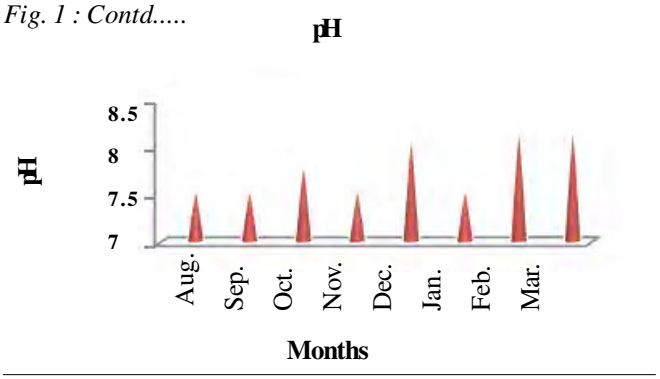

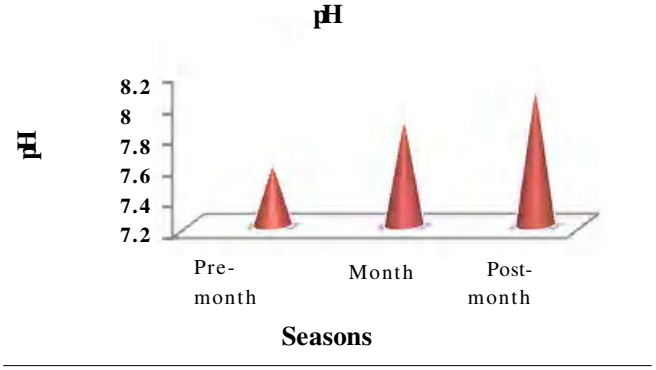

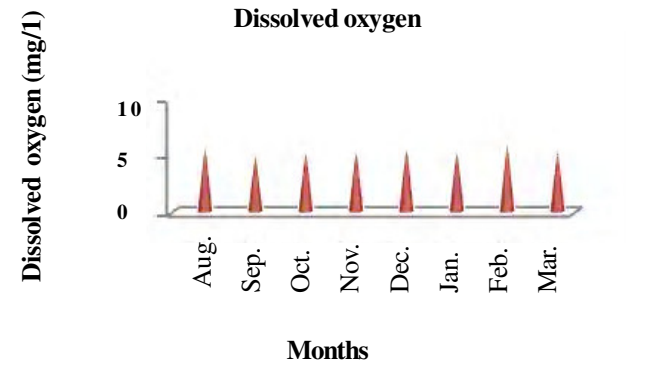

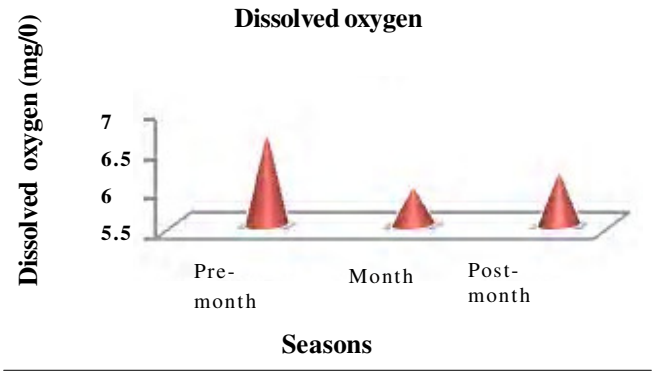

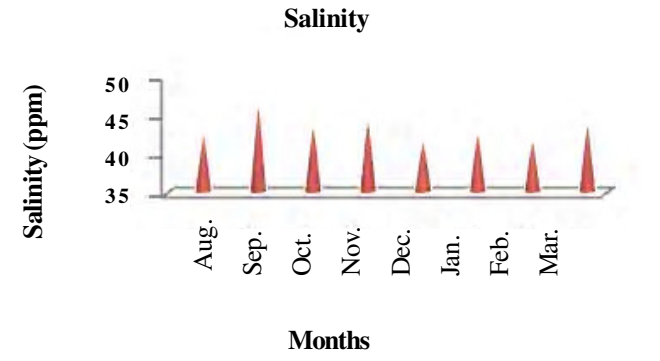

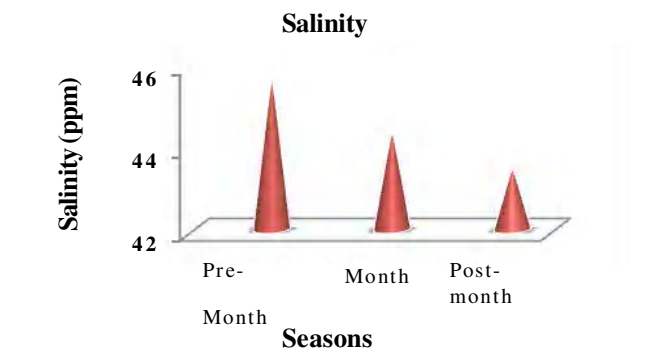

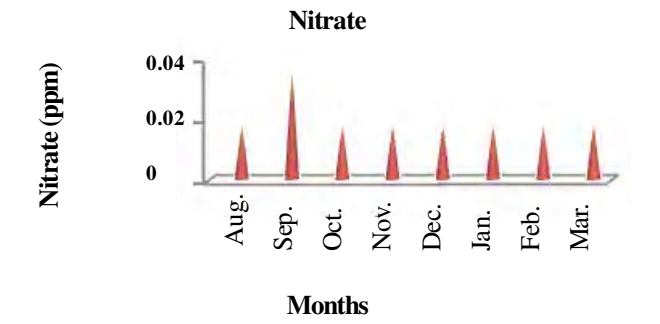

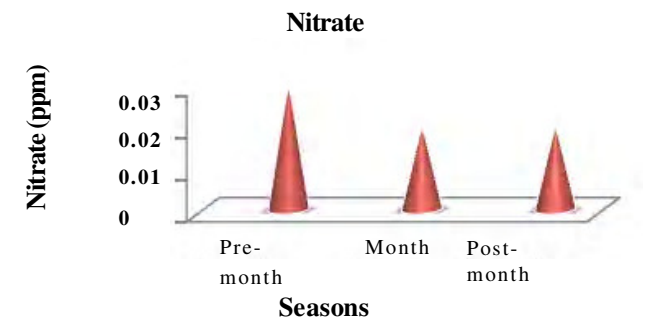

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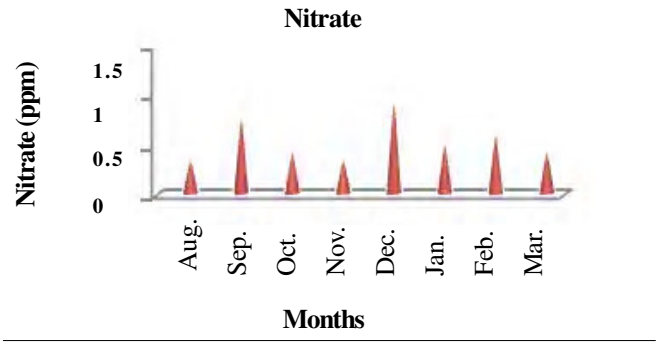

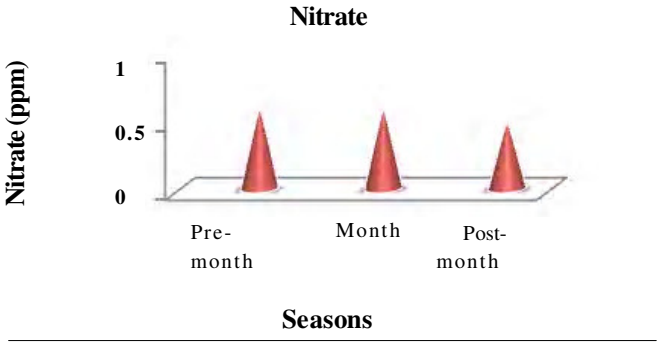

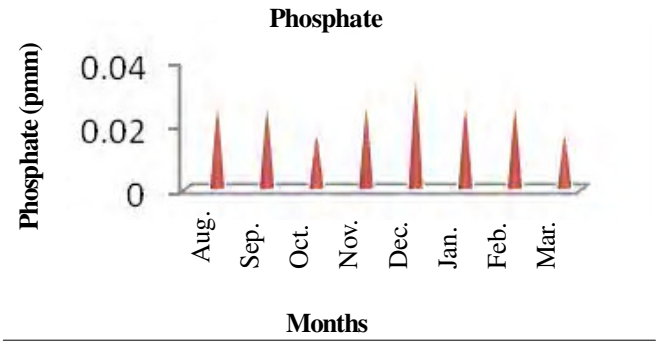

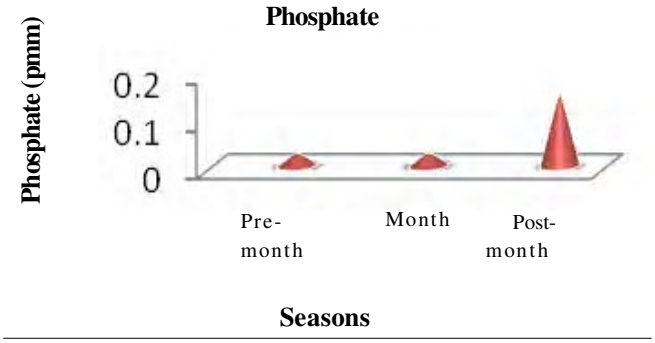

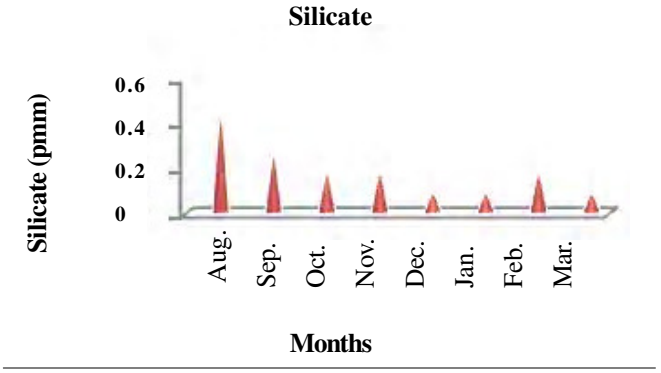

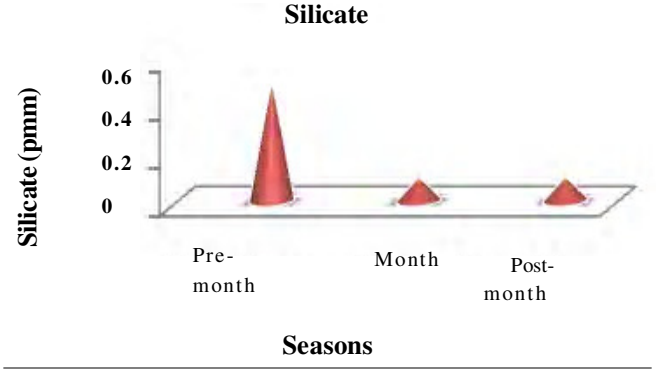

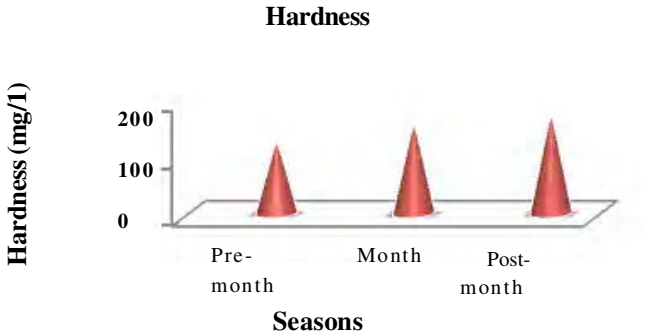

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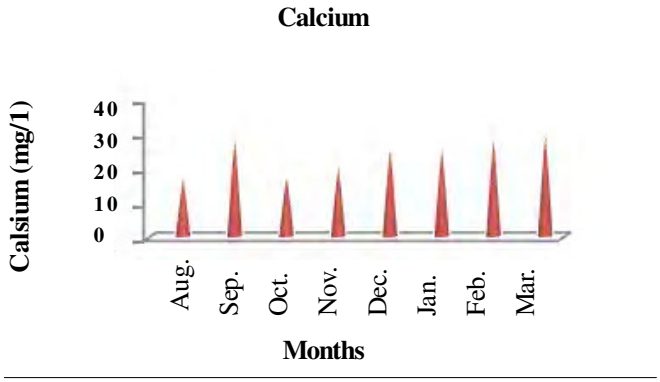

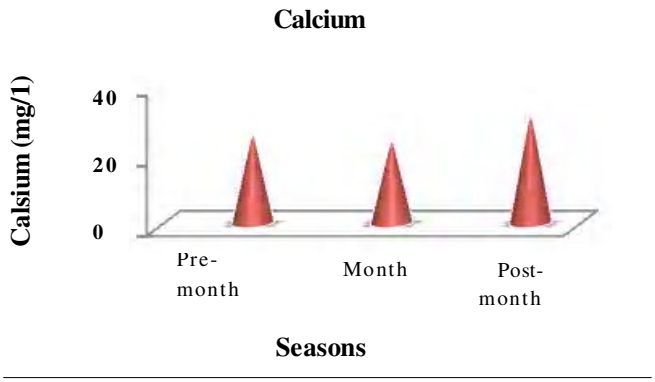

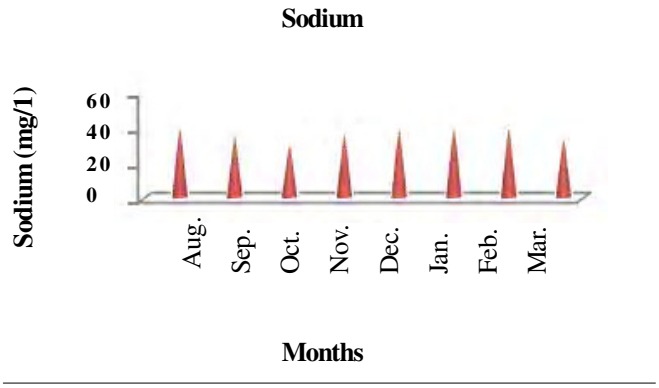

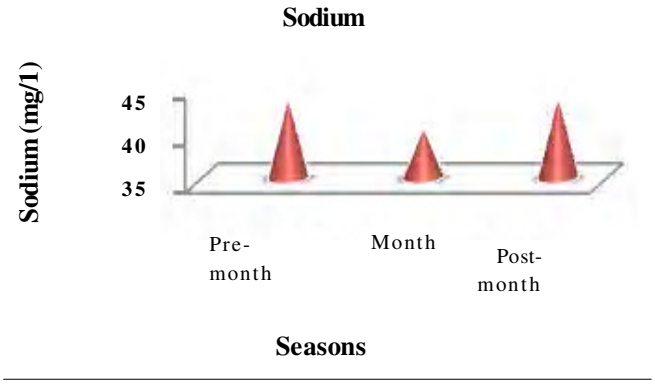

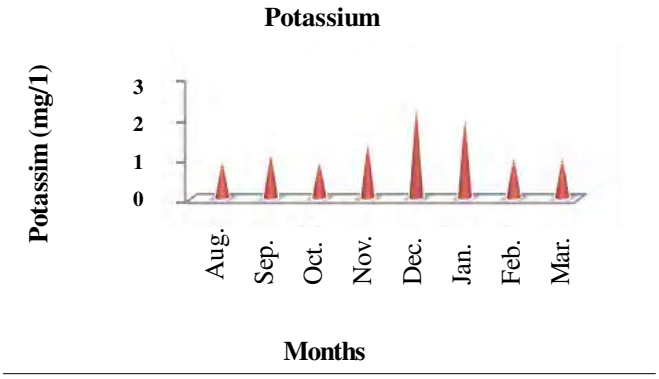

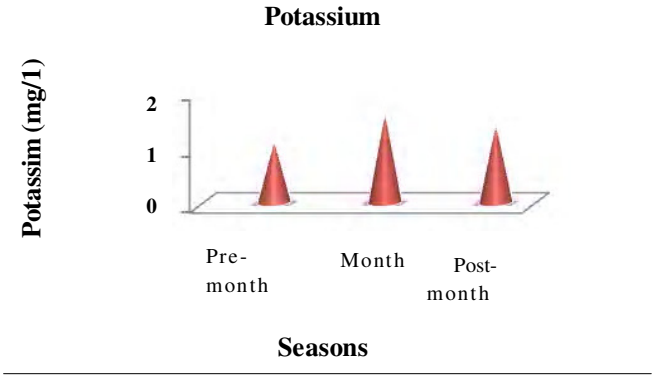

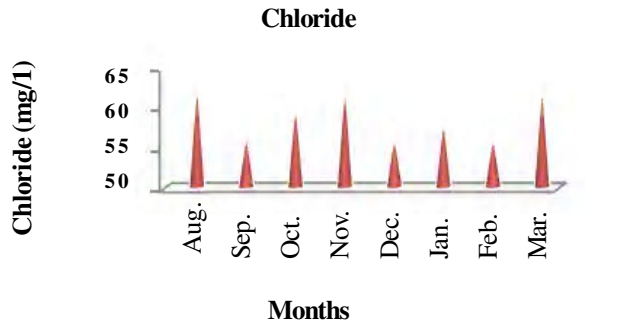

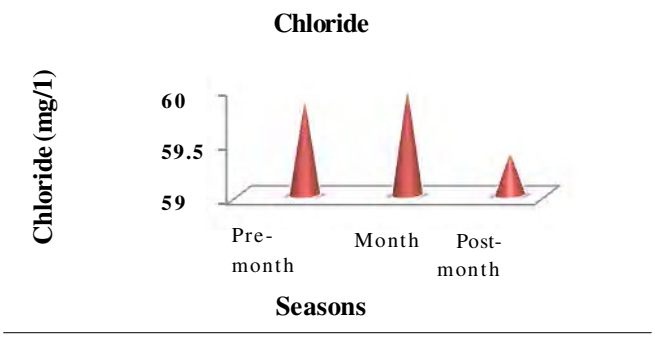

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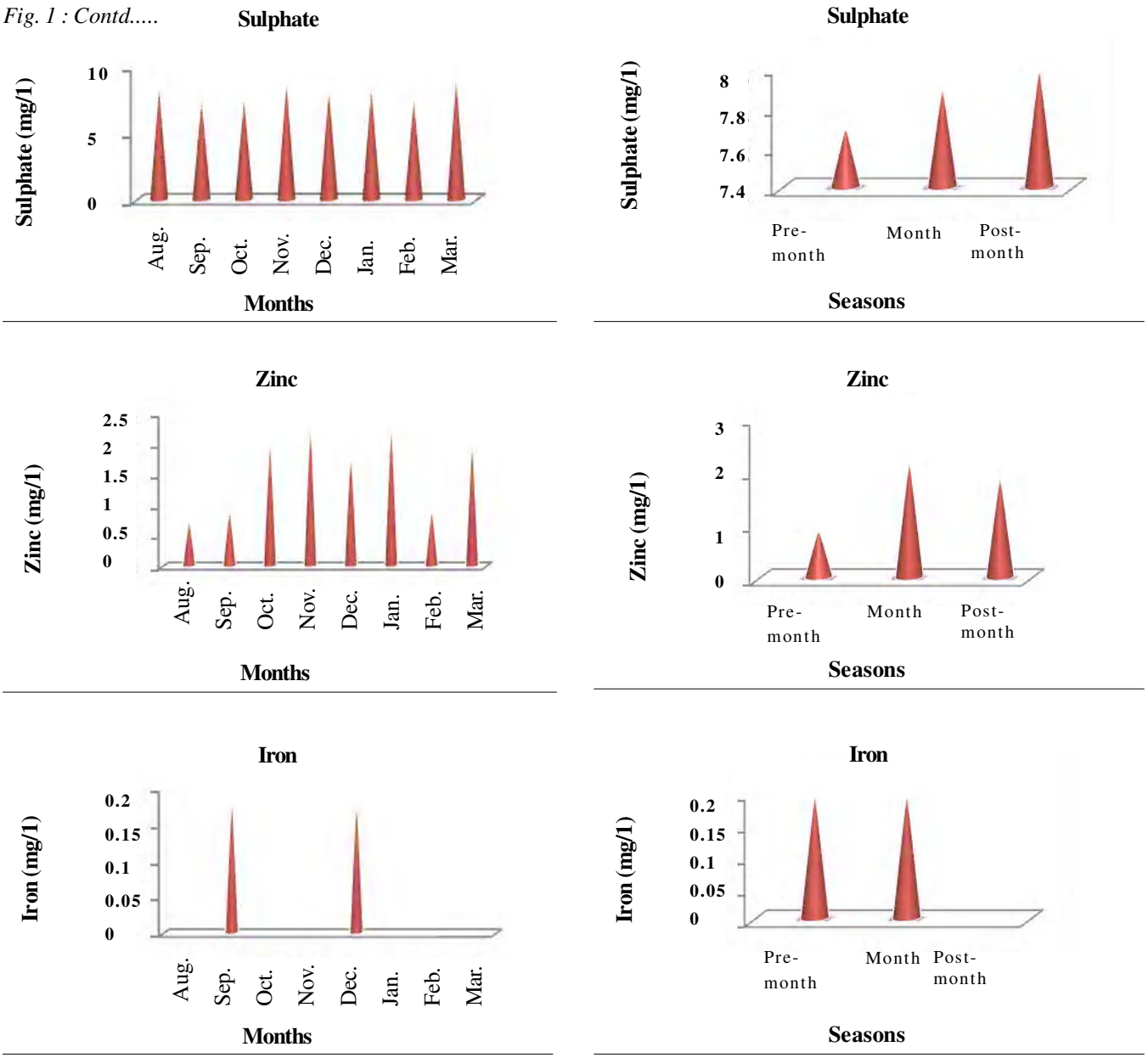

(47.5±2.5) and lowest value recorded during December (42.3±1.5). The nitrate level was recorded highest during September (0.04±0.08) and lowest level recorded during January (0.02±0.05) in study the study period. The nitrate level was recorded highest during December (1.1±0.1) and lowest level during August and November (0.4±0.09). The overall nitrate level was highest during the monsoon season (0.6±0.1). The phosphate level was highest during December (0.04±0.1) and lowest during March (0.02±0.07). The overall phosphate level was highest during the post monsoon season (0.16±0.8) in study period. The highest value of hardness recorded during February (183.7±2.7) and lowest value of October (123.2±2.4) in study period. The calcium level was highest during March (34.2±0.1) and lowest during August (19.9±0.1). The sodium level was recorded highest during January (46.8±1.3) then the lowest during October (35.1±1.1) in the study period. The potassium level increased in December (2.5±0.3) and decreased in August and October (1.0±0.3). The chloride level was highest in August (63.5±1.8) and lowest in February (56.3±1.9). During study period the sulphate level was recorded highest in March (8.8±1.2) and lowest in September, October and February (7.3±0.8). The zinc level was recorded highest during November (2.5±0.3) and lowest during August (0.8±0.4). The Iron level was recorded only December

(0.3±0.06) in the study period (Table 1 and Fig. 1).

Conclusion :

Thus, it can be concluded that there was variation in water quality in different seasons of the study period at Udhayamarthandapuram lake. The temperature, dissolved oxygen and nitrate were recorded highest in pre-monsoon of the study periods. The turbidity, salinity, nitrate, sodium and potassium were recorded highest in monsoon and the EC, pH, phosphate, hardness, chloride, calcium, sulphate, zinc and iron were recorded in post-monsoon season of the study periods. (Fig.1)

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