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Original Research Paper

Limnological Studies on Walayar Reservoir, Palghat, Kerala

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ABSTRACT

Water quality plays an important role in the survival and distribution of aquatic organisms. It is dependent on physicochemical and nutrient parameters. Studies on the physicochemical characteristics of the Walayar reservoir were carried out for a period of one year from December 2006 to November 2006. The study was performed to determine the pollution status of the reservoir and to implement the measures of pollution control. The parameters analysed include the physical parameters such as temperature, suspended solids, dissolved solids and total solids. The chemical parameters were evaluated such as pH, DO, free CO_2, total alkalinity and nutrients such as calcium, magnesium, nitrate, phosphate, silicate, Iron, fluoride and chloride. The water quality of the Walayar reservoir was within the safe limits throughout the study period, which shows that this water is fit for utilization for irrigation, domestic purposes and also to support biodiversity.

INTRODUCTION

Pollution of environment is inevitable with the growth of industries in developing countries like India. These industries lead to alteration of physical, chemical and biological characteristics of the environment. Water is one of the essential natural resources for existence and development of life on the earth. The discharge of sewage and industrialization in India have created problems of disposal of waste products**.** Most often the domestic wastes and industrial effluents are indiscriminately discharged in the nearby rivers, reservoirs and lakes with almost no pretreatment. This impairs the water quality rendering the water unsuitable for domestic, agricultural, industrial and other uses. With the contamination of water, the aquatic life is also disturbed, thus, disrupting the whole aquatic system. Enormous anthropogenic activities make all these water resources unfit for any human purpose. Eutrophication of water bodies is rapidly increasing due to growing increase in quantity of sewage discharge, which in turn enhance algal proliferation.

The physicochemical and biological properties give each lake its own characters. However, substantial research of lake ecosystem is still needed. Hence, the present study was undertaken to assess the physicochemical characters of the Walayar dam water for a period of one year from January 2006 to December 2006.

MATERIALS AND METHODS

Walayar dam is located in the Palghat district of Kerala, 25 km away from Coimbatore. The water from Walayar river and Navakarani river coming from Parapatti is being stored in this dam and released to Nellicheri dam for irrigation and drinking purposes. The water samples were collected from 12 noon to 2 p.m. during the first week of every month. The physicochemical parameters such as temperature, colour, suspended solids, (SS), dissolved solids (DS), total solids (TS), pH,

alkalinity, dissolved oxygen (DO), dissolved carbon dioxide (DCO_2) and COD were analysed following standard method (APHA 1998). Colour and temperature were recorded at the site of collection.

RESULTS AND DISCUSSION

In the present study, variations in the physicochemical characteristics and nutrients were analysed and shown in Table 1 and 2. The maximum and minimum temperatures were 36°C and 24°C. Temperature is a vital parameter for growth of organisms and plays an important role in the physicochemical and physiological behaviour of aquatic ecosystems. The pH value ranged from 6.9 to 7.9, which reveals that the pH of the water samples is associated in the desirable range and the samples are slightly alkaline nature. The level of dissolved oxygen was high throughout the period and ranged from 5.90 mg/L to 8.64 mg/L. Amount of oxygen in the reservoir is its purity indicator, which also acts as an indicator of trophic status and magnitude of eutrophication in freshwater ecosystem.

Free carbon dioxide ranged from 21.75 mg/L to 32.00 mg/L. Carbon dioxide was maximum during summer due to its release by microbial decomposition of organic matter. Total alkalinity ranged from 49.0 mg/L to 134.30 mg/L. Alkalinity of natural freshwaters is generally caused by carbonates and bicarbonates. The value of total dissolved solids (TDS) ranged from 160.30 mg/L to 448.50 mg/L. The seasonal fluctuations show that total dissolved solids are higher in summers.

The maximum calcium content (124.75 mg/L) was recorded in the month August, and the minimum (42.08 mg/L) in the month of January. Any value above 25mg/L indicates calcium rich water. Calcium shows positive correlation with magnesium. The magnesium values were found to be ranging from 4.43 mg/L to 11.2 mg/L. Magnesium is often associated with calcium primarily due to its similar chemistry. The element is usually present in aquatic system in large amounts relative to plant needs (Goldman 1972). Increased levels of calcium and magnesium enhance the water hardness.

Minimum nitrate level of 4.43 mg/L was observed in the month of April, and maximum of 8.4 mg/L in the month of August. Presence of nutrients in water is essential for the sustained proliferation of algae but at higher levels they become toxic to aquatic organisms. The high concentration of nitrate was observed during rainy season, which might be due input of fertilizers from the adjacent agricultural fields (Jaya Kumar 1994).

The level of phosphate was maximum (9.15 mg/L) in the month of August, and minimum (6.2 mg/L) in the month of April. Jain et al. (1996) have stated that any amount in excess of 0.50 mg/L of PO_4 is an indicator of pollution. Rao et al. (1993) have observed the high level of phosphate due to anthropogenic activities. Phosphate is least abundant and yet most commonly limits biological productivity.

Silicate level ranged from 0.91 mg/L to 2.00 mg/L. Silicate fluctuates because of the relative abundance of diatoms, which utilizes it for the synthesis of expostulation and also for preparing their own capsule (Hutchinson 1967). The higher level of chloride was 43mg/L observed in the month of June, and minimum level of 21.24 mg/L was observed in the month of April. The high chloride concentration in water indicates the presence of large amounts of organic matter (Jayakumar 1994, Dhanapakiam et al. 1999).

From the study it is concluded that the overall water quality of the Walayar reservoir remained within the safe limits throughout the study period, which shows that this water is fit for utilization for irrigation, domestic purposes and also to support biodiversity.

Table 1: Variations in physico-chemical characters of Walayar reservoir in 2007.

Months	Temperature (°C)	Suspended solids	Dissolved solids	Total solids	pH	Dissolved O_2	Dissolved CO_2	Total alkalinity
Jan	30	46.25 ± 3.403	383.8 ± 11.09	427.0 ± 4.6904	7.6	6.22 ± 0.062	23.25 ± 0.956	96.25 ± 2.872
Feb	31	42.25 ± 3.406	410.5 ± 7.141	459.0 ± 2.708	7.4	6.31 ± 0.207	26.75 ± 1.500	113.8 ± 2.630
Mar	33	37.75 ± 2.062	448.5 ± 2.380	482.5 ± 4.1231	7.1	6.50 ± 0.250	28.25 ± 0.957	127.8 ± 2.062
Apr	35	34.25 ± 0.957	420.5 ± 6.137	457.0 ± 4.761	7.5	6.70 ± 0.123	30.00 ± 1.915	130.5 ± 1.915
Ma	36	29.50 ± 1.00	321.5 ± 2.380	353.25 ± 2.3629	7.9	7.37 ± 0.089	29.75 ± 1.258	134.3 ± 2.872
Jun	28	64.50 ± 2.38	253.8 ± 4.787	320.25 ± 0.9574	7.3	8.64 ± 0.106	21.75 ± 2.217	57.75 ± 2.062
Jul	29	71.25 ± 1.258	248.5 ± 2.380	319.75 ± 1.893	7.5	8.45 ± 0.166	32.00 ± 1.414	49.00 ± 0.816
Aug	28	80.75 ± 1.893	200.5 ± 2.517	284.0 ± 2.4495	7.4	8.17 ± 0.111	31.25 ± 0.957	72.25 ± 1.258
Sep	30	73.35 ± 1.893	182.3 ± 3.403	279.0 ± 2.708	6.9	7.42 ± 0.088	28.00 ± 0.816	66.75 ± 1.893
Oct	24	78.25 ± 1.258	169.8 ± 1.258	247.5 ± 1.7327	7.6	6.63 ± 0.153	29.75 ± 0.957	60.75 ± 0.957
Nov	28	65.50 ± 1.732	164.0 ± 1.414	229.75 ± 1.2583	7.4	6.20 ± 0.117	26.75 ± 1.500	62.75 ± 2.062
Dec	28	55.50 ± 1.732	160.3 ± 1.258	215.5 ± 1.7321	7.3	5.90 ± 0.087	22.75 ± 0.957	75.00 ± 1.414

Table 2: Variations in nutrients of Walayar reservoir in 2007.

Months	Calcium	Magnesium	Nitrate	Phosphate	Silicate	Iron	Fluoride	Chloride
Jan	42.08 ± 0.1354	11.2 ± 0.1354	6.2 ± 0.133	6.9 ± 0.0535	1.1 ± 0.0574	1.3 ± 0.0408	0.53 ± 0.0189	49.6 ± 0.4173
Feb	91.25 ± 0.9574	8.5 ± 0.0957	4.2 ± 0.0535	7.5 ± 0.1258	1.3 ± 0.010	1.2 ± 0.0816	0.58 ± 0.050	38.0 ± 0.8165
Mar	51.25 ± 0.9574	7.8 ± 0.1063	6.2 ± 0.075	6.7 ± 0.1414	1.4 ± 0.0672	0.93 ± 0.0189	0.61 ± 0.0144	21.24 ± 0.3373
Apr	47.41 ± 0.3296	6.8 ± 0.0479	4.2 ± 0.0287	6.2 ± 0.0661	1.2 ± 0.025	0.91 ± 0.0103	0.51 ± 0.0062	15.05 ± 0.100
May	63.36 ± 0.2509	6.7 ± 0.0585	5.2 ± 0.0535	6.5 ± 0.0819	0.92 ± 0.0206	0.6 ± 0.0082	0.45 ± 0.0354	16.0 ± 0.1414
Jun	93.0 ± 2.4495	6.25 ± .1225	8.2 ± 0.0816	7.6 ± 0.0854	0.91 ± 0.0096	4.8 ± 0.1063	0.39 ± 0.0283	19.12 ± 0.0957
Jul	93.0 ± 1.4142	6.4 ± 0.1258	8.3 ± 0.050	8.4 ± 0.0957	2.0 ± 0.030	3.2 ± 0.1198	0.30 ± 0.0038	36.3 ± 1.2583
Aug	124.75 ± 1.2583	4.43 ± 0.101	8.4 ± 1.1414	9.15 ± 0.100	1.7 ± 0.034	2.8 ± 0.0661	0.41 ± 0.0193	42.0 ± 1.4142
Sep	119.25 ± 0.9574	7.9 ± 0.0854	5.2 ± 0.1811	8.7 ± 0.1633	1.5 ± 0.2062	2.5 ± 0.1258	0.43 ± 0.0242	50.4 ± 0.4330
Oct	113.75 ± 2.2174	10.4 ± 0.2828	6.1 ± 0.1414	7.9 ± 0.0957	1.5 ± 0.0957	2.2 ± 0.0707	8.4 ± 0.1500	36.9 ± 0.5951
Nov	111.95 ± 0.6338	8.7 ± 0.0957	5.7 ± 0.1414	6.4 ± 0.1633	1.4 ± 0.0618	1.94 ± 0.0938	8.0 ± 0.0957	39.2 ± 01915
Dec	94.55 ± 1.732	8.8 ± 0.1658	6.4 ± 0.0957	6.7 ± 0.1414	1.2 ± 0.0479	1.8 ± 0.032	7.45 ± 0.0577	43.0 ± 0.8165

Each value is the mean of four replications. All values expressed in mg/L, except temperature and pH.

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