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ASSESSMENT OF PHYSICO-CHEMICAL PARAMETERS OF MADDUR AND KERETHONNUR LAKES IN MANDYA WITH RELATION TO ZOOPLANKTON DIVERSITY

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Abstract

Mandya district in Karnataka is in Cauvery river basin. It is famous as sugar bowl of Karnataka and known for fishing also. Maddur and Kerethonnur are two important lakes present in Cauvery river basin and are the source of irrigation for many villages of the area. In Maddur and Kerethonnur lakes the physico-chemical parameters were analyzed from January 2021 to December 2021 on monthly basis for totally 12 months. Estimation of different physico-chemical parameters with relation to zooplankton diversity was done during the investigation period. Most of the parameters values were found within the WHO permissible limits. These values were found supporting the growth of zooplankton. Totally 14 protozoan species, 06 cladoceran species, 04 ostracod species, 04 copepod species and 10 species of rotifers were recorded during the study period.

Keywords : Mandya, Maddur lake, Physico-chemical, Cauvery, Kerethonnur lake, zooplankton.

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Introduction

Water is one of the most important physical or abiotic factors that acts as a substratum for many of the organisms. Water forms the hydrosphere which occupies roughly 3/4th of the biosphere. The movement of water on earth is closely related to the energy changes that take place when water changes its form between solid, liquid and vapor. The speed at which hydrogen bonds produced and broken determine the physical status of water such as gas, liquid or solid.

Water resources are certainly inexhaustible gift of nature, but it is essential to make its availability for all the time to come. It becomes necessary to maintain, conserve and use this resource carefully. It is a practical experience all over the world that appropriate maintenance, protection and judicious use of water will halt the water scarcity for future generations. Water demand is increasing day by day because of population explosion, urbanization and industrialization. Water bodies normally flowing through populated areas are often subjected for industrialization and urbanization pressures. Change in precipitation quality is one of the documented evidence for industrialization and urbanization pressures on water bodies (Ramalingaiah, 1985). The information available on the lentic water bodies condition of Indian subcontinent shows the deterioration of water quality in general (Chandrashekhar and Jafer, 1998).

Zooplanktons have a significant role in ecological balance maintenance and its basic study is needed. Zooplankton seasonal variations shows a bimodal oscillation with spring and autumn in the temperate lakes and reservoirs (Wetzel, 1983). This kind of fluctuation is influenced by various factors (Singh, 2000).

The objective of the present work was to establish the interrelationship of various physico-chemical factors and their influence on the growth of different zooplankton species. Hence the seasonal dynamics of these zooplanktons was thoroughly studied and correlation between biological and physico-chemical factors has been analysed.

Description of study area

Mandya district is in the south part of Deccan peninsula and a district of south Karnataka. It is popularly called “sugar bowl” of Karnataka. Sugar cane and paddy cultivation is famous here. Geographically Mandya district is present between 12^0 25′ and 13^0 35′ North latitude and 74^0 04′ and 77^0 84′ East longitude. Altitude of Mandya district varies between 609. 60 to 807. 72 meters MSL.

Maddur lake is situated at a distance of 3.0 kms from the Maddur town in Northwest direction. Lake is found at a height of 649.83 meters above MSL. Longitude and latitude range of the lake is 77 ^{0}10′ E and 12 ^{0} 40′ N respectively. Watershed area of the Maddur lake is 4220 hectares. Lake possess maximum depth of 7.0 meters and a mean depth of 4.90 meters (Devaraju, 2011).

Kerethonnur lake is situated on the way to famous pilgrimage center Melukote from Pandavapura. Kerethonnur lake is at a height of 647.15 meters above MSL. It lies across

77^0 12′ E longitude. It is a famous pilgrimage and tourist centre. Both these lakes fall under Cauvery river basin. Inflow of lake water is mainly the river water. Due to this, these lakes are almost perennial in nature.

Materials and Methods

Field investigation was conducted for a period of one year from January 2021 to December 2021. Samples were collected during morning hours from 9.00 AM to 10.30 AM. Samples were collected in 1000 ml plastic bottles for physico-chemical analysis. Water temperature measured at the sampling site. BOD bottles were used to fix the dissolved oxygen at the spot. To determine other parameters standard methods of APHA (1995) were employed.

Zooplankton were collected using modified Haron-Trantor net with a square metallic frame of 0.0625-m^2 area. Filtering cone of nylon bolting silk plankton net (No.25 mesh size 50 µ), was used. Samples collected were transferred to clean 500 ml polythene bottles. Then, 5 ml of lugos iodine solution and 10-15 ml 4% formaldehyde was added to fix and preserve. After sedimentation 100 ml sample was subjected to centrifugation at 1500 rpm for 20 minutes and used for analysis. Sedgewick Rafter cell (Welch, 1948) was used to count zooplankton and identification was done by following the procedure of Edmondson (1966), Needham and Needham (1978) and APHA (1995).

Results

In Maddur and Kerethonnur lakes the physico-chemical parameters were analyzed from January 2021 to December 2021 on monthly basis for totally 12 months. Monthly differences in the values of physico-chemical parameters are presented in Table-1.

Water temperature positively influenced the growth of euglenoids, chlorococcales, desmids, protozoa, cladocerans, ostracods, copepods and rotifers. When the water temperature was high the population of copepods was increased. Decrease in water temperature during winter season affected the growth of copepods. Usually during summer due to low storage of water, fishing activities and high decomposition of organic matter SDT decreased. Among the planktons euglenoids and protozoa had significant relationship with SDT. When water was clear with less turbidity, total dissolved solids and phosphate these planktons were found in less number. pH influenced the growth of euglenoids and all the zooplanktons such as protozoans, cladocerans, ostracods, copepods and rotifers. When ammonia-N content was increased or decreased, accordingly protozoan population also increased or decreased. These results were in conformity with the findings of Tharavathi and Hosetti (2003).

Zooplankton diversity of Maddur and Kerethonnur lakes during the investigation period were shown in Table-2. Protozoan growth was much influenced by the variations in physico-chemical parameters like turbidity, pH, conductivity and ammonia-N (Adibisi, 1980). When protozoans number was increased or decreased accordingly euglenoids, cladocerans, ostracods and copepods number also increased or decreased. pH, conductivity, nitrate, carbonates and bicarbonates were the important physico-chemical parameters influenced the growth of cladocerans. Growth of ostracods was influenced by variation in pH and conductivity.

In Maddur and Kerethonnur lakes totally 14 protozoans were recorded during the investigation period. Cladocerans are commonly known as water fleas belongs to the order Cladocera of the subclass Branchiopoda of the subphylum Crustacea. Totally six species of five genera of Cladocerans were found during the study period. Ostracods are commonly called seed shrimps. They are tiny crustaceans commonly found in aquatic habitats like lakes, pools and streams. Totally four species of ostracods were reported from both the lakes. Copepods form a dominant groups of zooplanktons and it is the largest class of Entomostracan crustacea. They play a significant role as primary consumers in the aquatic ecosystems. Distribution of copepods in Maddur and Kerethonnur lakes have shown that they were more abundant during summers. Four species of copepods were recorded during the investigation period. Rotifers are known as wheel animalcules. They are microscopic, pseudocoelomate animals and forms important group of freshwater zooplanktons. Totally 10 rotifer species were recorded in both the lakes.

Discussion

Protozoans include a variety of microorganisms range from approximately spherical forms to bizarre shapes not readily explained on a functional basis. In recent period many zoologists worked on seasonal dynamics and ecology of protozoans. Esteban *et al*. (1991) reported the influence of physico-chemical variables on the development of ciliate population and pointed out that environmental conditions play a very important role for the development of each ciliate species and for the whole ciliate population. Pathak and Mudgal (2002) recorded different protozoan species in Khargone reservoir. Prakash *et al*. (2002) recorded various zooplanktons in a freshwater pond and observed maximum density during April and minimum during January. They observed significant correlations between zooplankton density and physico-chemical parameters. Tharavathi and Hosetti (2003) noticed that when high dissolved oxygen is present, protozoans like *Paramecium caudatum*, *Acanthamoeba* sp. are found dominant. In our investigation also the average DO record at 8.15 mg / L and highest number of protozoans are recorded during April, May and June. This may be attributed to the favorable factors like water temperature, DO, total solids, calcium, BOD, pH and other factors. Khare (2002) and Manzer *et al*. (2005) also observed that different physico-chemical factors influence the growth of zooplanktons. Prakash *et al*. (2002) and Manzer *et al*. (2005) observed maximum number of protozoans during summer and minimum number of protozoans during winter. Observations in Maddur and Kerethonnur lakes were in correlation with these findings.

Table 1 : Average values of monthly variations in physico-chemical parameters of Maddur and Kerethonnur lakes from January 2021 to December 2021 (All parameters from Sl. No. 5 to 15 are in mg./L).

Parameters	January	February	March	April	May	June	July	August	September	October	November	December
Water temp, ^{0}C	28.20	29.45	27.50	26.20	26.40	26.60	23.50	22.50	21.90	25.10	28.00	28.90
SDT, m	1.54	1.65	2.00	2.20	2.40	2.40	2.40	2.35	2.45	2.40	2.35	1.6
Turbidity, NTU	14.50	10.50	9.60	8.10	8.00	7.95	6.65	7.00	7.25	7.00	7.15	11.00
pH	8.00	8.00	7.95	7.90	7.75	7.60	7.70	7.95	7.90	8.00	8.10	8.20
DO	8.10	8.50	8.05	7.90	8.10	7.30	8.20	8.35	8.40	8.25	8.30	8.20
Total alkalinity	117.5	122.5	121.5	157.0	148.0	153.0	128.5	122.0	127.0	132.5	131.5	128.0
Total acidity	9.95	14.30	14.20	12.95	13.20	11.85	11.50	13.10	12.30	10.60	12.00	10.85
Calcium	38.0	38.5	37.5	36.5	35.0	36.5	33.4	33.4	32.5	33.5	36.5	38.0
Magnesium	8.15	8.3	7.75	7.4	7.1	7.3	7.75	8.1	8.2	7.9	7.9	8.35
T.D.S.	335.0	311.0	309.5	282.5	256.0	222.0	304.0	293.5	293.0	288.5	284.0	308.5
Phosphates	0.031	0.026	0.025	0.029	0.023	0.021	0.018	0.019	0.018	0.019	0.021	0.026
Nitrates	0.093	0.091	0.082	0.081	0.084	0.080	0.075	0.072	0.076	0.064	0.093	0.107
Nitrites	0.071	0.074	0.077	0.076	0.074	0.076	0.076	0.065	0.071	0.080	0.079	0.081
BOD	25.0	23.0	27.0	25.0	23.0	25.0	24.0	21.0	19.4	20.5	20.3	22.5
Ammonia - N	0.32	0.28	0.26	0.23	0.19	0.18	0.18	0.19	0.16	0.18	0.26	0.29

Table 2 : Diversity of Protozoa, Cladocera, Ostracods, Copepods and Rotifers in Maddur and Kerethonnur Lakes.

Protozoans	Cladocerans	Ostracods	Copepods	Rotifers
Actinophrys sp.	*Alona quadrangularis*	*Candonocypris dentatus*	*Cyclops scutifer*	*Asplancha brightwelli*
Cochliopodium granulatum	*Daphnia carinata*	*Cypris protubera*	*Cyclops sp.*	*Brachionus calyciflorus*
Centropyxis aculeata	*Kurzia longirostris*	*Halocypris brevirostris*	*Nauplius larva*	*B. quadridentatus*
Cucurbitella mesipiliformis	*Macrothrix spinosa*	*Parastenocypris canaliculata*	*Sinodiaptomus indicus*	*Cephalodella catellina*
Difflugia pyriformis	*Pleuroxux aduncus*			*Lecane (Monostyla) bulla*
Naegleria tachypodia	*P. procurvus*			*L. leontina*
Pelomyxa sp.				*Lindia intermedia*
Didinium nasutum				*Monostyla quadridentata*
Epalxis mirabilis				*Philodina flaviceps*
Euplotes patella				*Trichocerca kostei*
Oxytricha fallax				
Paramecium caudatum				
Stentor sp.				
Vorticella sp.				

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