PHYSICAL- CHEMICAL RELATIONSHIP IN FRESHWATER ZOOPLANKTON AT LAKE KALINJUR, VELLORE, TAMIL NADU.

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ABSTRACT

The zooplankton found in almost all water bodies is diverse. Because of the pivotal role of zooplankton in most aquatic ecosystems, Usethere is a constant need to explore the effect of stressors (such as physicochemical properties of freshwater) on their abundance Present paper deals with the study of monthly variations in the zooplankton population and their correlations with some physical characteristics of Kalinjur lake in Vellore district, Tamilnadu. From January 2021 to December 2021, Statistical analysis of data involves Pearson's Correlation analysis and various diversity indices viz. Zooplankton diversity and population dynamics are controlled by numerous physicochemical factors. Zooplankton populations fluctuate with physicochemical factors. A total of 27 species of zooplankton from 4 major taxonomic groups were observed: Rotifera (9 species), Cladocera (7 species), Copepoda (6 species), and Ostracoda (5 species). Physico-chemical parameters of Kalinjur Lake revealed well-marked fluctuations with maxima and minima values of each parameter during specific seasons and zooplankton analysis revealed seasonal variations with an increase during winter and a fall during monsoon and summer seasons. Zooplankton populations were highest in December and January. The present investigation showed positive correlations with Rotifer parameters like calcium, nitrite, phosphate, chloride, and the Tidey test. In contrast, Turbidity, Electrical Conductivity, pH, Alkalinity, Total Hardness, Magnesium, Ammonia, Nitrite, Fluoride, Sulfate, BOD, and COD water showed negative correlations with the zooplankton population.

KEYWORDS: Physico-chemical parameters, Monthly variation, Zooplankton, Correlation

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INTRODUCTION

Aquatic systems' performance is heavily influenced by water physicochemical characteristics (Sharmila and Rajeswari, *et al.,* 2015). An ecosystem's water quality provides insight into the resources available for supporting life as well as the health of the water body (Shinde *et al.,* 2011). In the aquatic environment, temperature, rainfall, dissolved oxygen, and free carbon dioxide are among the factors influencing its physical and chemical characteristics. Plankton analysis can also be used to explain color, turbidity, odor, taste, and visible particles in water (Pradhan, *et al.,* 2014). Zooplankton has fascinated scientists for a long time. In the last two decades, much attention has been paid in tropical countries to the study of the biology, ecology, and toxicology of zooplankton. This is because of their importance in various emerging concepts in environmental management like environmental impact assessment (EIA), bioindication of pollution, and biological monitoring. Zooplankton consists of microscopic organisms such as Rotifers, Copepods, cladocerans, and Ostracods. These organisms are indicators and fast lake to environmental stressors (Pawlowski *et al.* 2016) such as nutrients (Xiong *et al.* 2019) and pesticide accumulation (Hanazato 2001). Zooplankton contributes to aquatic ecosystem biodiversity.

Physicochemical parameters determine the species distribution and abundance of zooplankton in any water body (Patra *et al.,* 2011). Zooplankton occupies an intermediate position in the food web. Additionally, they play a significant role as indicators of trophic conditions in both cold temperate and tropical glasses of water (Ahmad *et al*., 2011). Research has shown that zooplankton species have different tolerance limits to physicochemical parameters. Balakrishna *et al.* (2013) reported changes in zooplankton species densities affected by changes in physicochemical parameters across seasons. According to Waikato Environmental Technical Report (2008) in New Zealand, rotifers can be used to grade the eutrophic status of lakes. This study aimed to determine the relationship between physicochemical parameters and zooplankton abundance in Kalinjur Tamil Nadu, India. A zooplankton study and its relationship to physicochemical parameters will provide insight into the current limnological status of Lake Kalijur, which has never been done. That will be valuable baseline information for researchers and government agencies interested in the lake management

MATERIALS AND METHODS

WORK AREA

In the southern district of Vellore, Kalinjur Lake is one of the most prominent lakes in Katpadi. It is used for a wide variety of purposes, including irrigation, laundry, and other uses. Geologically, it is located at 12.962429 latitudes and 79.127706 longitudes. It is located at an altitude of 118 meters, as shown in Figure 1. The lake is shown on this map.

WATER SAMPLING AND ANALYSIS

For the analysis of physical and chemical parameters, a monthly collection of water samples was done for one year (January to December 2021) from the selected study sites of the water body. An accurate understanding of water quality requires physicochemical studies. Various aspects of physicochemical characteristics and their impacts on lake water quality. The following parameters were analyzed in the current study: Color, Odor, Turbidity, Electrical Conductivity, pH, Alkalinity, Total Hardness, Calcium, Magnesium, Ammonia, Nitrite, Nitrate, Chloride, Fluoride, Sulfate, Phosphate, BOD, and COD. Water samples were collected in glass bottles and brought to the laboratory for further analysis. Table show 1. Planktonic invertebrates or zooplankton were collected by filtering a 1-liter surface of water samples passed through a conical plankton net of standard bolted silk cloth no. 45 (mesh size 0.003-0.004 microns). Finally, zooplankton samples were adjusted to 10 ml. The collected samples were preserved in a 10 % formalin solution. The preserved zooplankton samples were then brought to the laboratory and analyzed qualitatively and quantitatively. Dhanpathi (2000) identified this using keys. Sedgwick Rafter Cell counted Zooplanktons by taking one ml of diluted sample.

STATISTICAL ANALYSIS OF DATA

The correlation coefficient (r) is computed with the help of the computer. Correlation analysis between abiotic and biotic parameters was also done by using Excel and Statistical Package for the Social Sciences software(SPSS Software) (Version 2.0)

RESULTS AND DISCUSSION

Water contains dissolved and suspended constituents in varying proportions. They often have different physical and chemical properties along with biological variations. The physical-chemical environment of water bodies was found to limit the diversity and density of zooplankton and other microorganisms. The present study helped to understand the effect of different physicochemical parameters and their interactions

among themselves. This helped to decide the final biotic and abiotic environment of the water body. During the present investigation, 27 Zooplankton taxa were observed from Kalinjur Lake belonging to 4 major taxonomic groups: Rotifera (9 species), Cladocera (7 species), Copepoda (6 species), and Ostracoda (5 species).Population dynamics of zooplankton. Overall, the percent contribution of different groups to the total zooplankton population inhabiting the Kalinjur Lake during the study period of one year revealed the dominance of Rotifera (32.4%) followed by Copepoda (29%), Cladocera (25%), and Ostracoda (14%) (Fig. 3).

Figures2-3 reveal the order of dominance of different taxonomic groups at all stations depicting the dominance of Rotifera over other zooplankton groups and the main species which contributed maximally to the Rotifera population and its abundance may be due to its high growth rate with the attainment of maximum size in a very short period (Moreira *et al.,* 2016). Apart from this, more food availability and optimum temperature also favored Rotifers' growth over other zooplankton groups, while the observational Kadam *et al.* (2014) also recorded a similar dominance order.

SEASONAL VARIATIONS IN WATER QUALITY PARAMETERS

It's common knowledge that water's physicochemical properties are crucial to aquatic life. Several physicochemical parameters, including electrical conductance, pH total alkalinity, total hardness, magnesium, ammonia, nitrite nitrates, chloride fluoride, sulfate, phosphate, tidey test, chemical oxygen demand, and biological oxygen demand, were measured for one year in Kalinjur Lake. While the Mean and SD values for electrical conductance (8.78E), and total alkalinity (7.83E) improved significantly, the water's pH remained fairly alkaline (2.74E). The overall total hardness concentration was (1.29E). The average calcium concentration was (1.29E). The average magnesium concentration was (2.00E). While the most common nitrite concentration was (1.39E) the concentration of chloride concentration was(1.81E) The most common sulfate concentration was (2.11E) the highest phosphate concentration was (1.54E), The symptomatic tide test concentration was (1.39E) the most common BOD concentration was (2.70E) The total COD concentration was (1.96E) With this, we agree with the finding of Monthly variations in the physicochemical parameters of Kalinjur Lake revealed well-marked fluctuations with maxima and minima during specific seasons. Mean standard deviations of each parameter of all the stations of the lake in which air temperature, water temperature, Water Temperature, Turbidity, pH, Alkalinity, EC, Hardness, Phosphate, Calcium, Magnesium, Nitrate, Nitrite Sulfate, Phosphate, Chloride, Ammonia, Fluoride, Bio-Chemical Oxygen Demand (BOD), and Chemical Oxygen Demand (COD) showed a summer hike in their values. Their summer maxima might be attributed to the accelerated decomposition of organic matter with the rise in temperature and release of excessive nutrients (c) and increased respiratory activity of aquatic organisms at high temperatures and magnesium during winter. Another parameter like water depth revealed maximum values during the physicochemical parameters of water plays a significant role in water productivity. It also plays a conspicuous role in zooplankton diversity and biomass in tropical shallow freshwater bodies. (Dhanpathi 2000). Some biological parameters affect zooplankton metabolic activities and proliferation.

CORRELATION COEFFICIENT (R) BETWEEN THE ZOOPLANKTON AND PHYSICOCHEMICAL

The correlation coefficient (r) between zooplankton and physicochemical parameters exhibited significant positive and negative correlations (Table 2). **Rotifera** recorded a positive and significant correlation with air temperature (r= 0.586), water temperature (r=0.555), chloride (r=0.63766), phosphates (r=6.00518), sulfates (r=0.729)Ec(r=0.63875), Calcium (r=0.351649) nitrite (r=6.00518) while the negative and significant correlation with pH(r= -0.1682), Alkalinity (r=-0.53031), TH (r=-77821)and magnesium (r=-0.19649) sulfates (r=-0.5225) BOD (r=-o.480899), COD(r=-5938. Tidame and Shinde (2012), Bera *et al.,* (2014), and Sivalingam et al. (2016) also found a strong positive correlation between the rotifer and temperature and free carbon dioxide. These parameters exhibited significant correlations and negative correlations.

Shinde (2011) also recorded a significant positive correlation between temperature and free carbon dioxide. During the present study, Rotifer occupied the first position of dominance in total zooplankton**. Copepods** are essential contributors to zooplankton population dynamics and are almost universally distributed. They form a primary food source for planktivorous fish and constitute an essential link in the aquatic food chain. The relative contribution of different planktonic groups in lentic habitats was influenced by the tropical level of water. Copepods recorded a positive and significant correlation between EC

(r=0.09618), alkalinity (r=0.2216), calcium (r=0.17219) magnesium (r=6168), and chloride (r=0.458) while invertebrate predators from aquatic environments, Copepods represent a key group in energy transfer along the food chain.

During the present study, Copepods occupied the 2nd position of dominance in total zooplankton The general scarcity of **cladocerans** in lakes has been related to factors like shortage of suitable-sized food particles and fish production (Ahwange *et al.,* 2012). Cladocerans recorded a negative and significant correlation with EC (r=-5306) alkalinity (r=-0.59809113), magnesium (r=-0.764057), calcium(r=-0.518) chloride(r=-0.3311), sulphate (r=-0.6462) BOD(r=-0.4708) COD(r=-0.61148) while positive and significant correlation with pH (r=0.6549)calcium(r=0.2753).During the present study, Cladoceran occupied the 3rd position of dominance in total zooplankton **Ostracods** recorded a positive and significant correlation with EC(r=0.059844) calcium (r=0.19844) BOD (r=0. 173917) COD(r=0.16269) while a negative and significant correlation with pH (r=-0.01259) alkalinity (r=-0.14942) TH (r=-0.04651) and magnesium(r=-0.4159) phosphate (r=-3.97205), Tidey test (r=-3.97205) Significant positive correlation of Ostracods with dissolved oxygen and bicarbonate coincides with the findings of (Sivalingam *et al.,* 2016). During the present study, ostracods occupied the fourth position of dominance in total zooplankton.

CONCLUSION

The present study revealed 27 genera of Zooplankton from the freshwater lake belonging to four groups namely Rotifera, Copepoda, Cladocera, and Ostracoda. Among all four groups, a maximum abundance of Rotifera (34%) was observed (Table 2). The present study indicated that rainy is the most favorable season for the maximum abundance of zooplankton followed by monsoon, winter, and summer, and their distribution was greatly influenced by different environmental factors and physicochemical parameters viz; temperature, pH, calcium, magnesium, chloride, nitrates, phosphates, and sulfates. Moreover, the maximum abundance of Rotifera both qualitatively and quantitatively in the present study indicated the eutrophic status of the studied water body. It was evident from the current investigation that monsoons are the high and most diverse seasons, while the rainy season is the high dense and summer is low dense and diverse. The physicochemical parameters of this lake were almost suitable for domestic use and aquatic life.

Thus, it is clearly understood that the provides a diverse array of freshwater habitats and their ecology. Thus, the presence, diversity, and seasonal abundance of various components of zooplankton- Rotifera, Cladocera, Copepoda, and Ostracoda in Kalinjur Lake is different in diverse habitats.

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Fig. 1 Map showing the locations of the freshwater lake in Kalinjur (Vellore District)

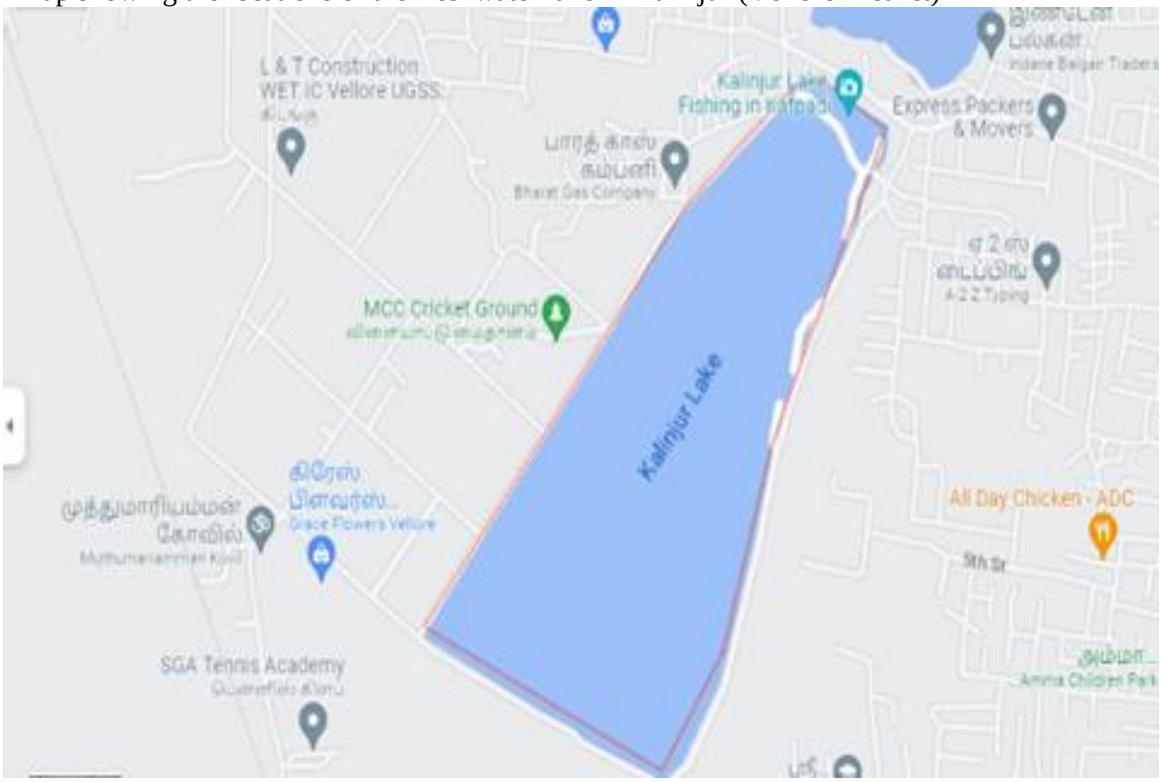

Fig 2. Graphical representation of seasonal variations of different groups of zooplankton in Kalinjur Lake (Jan-Dec 2021)

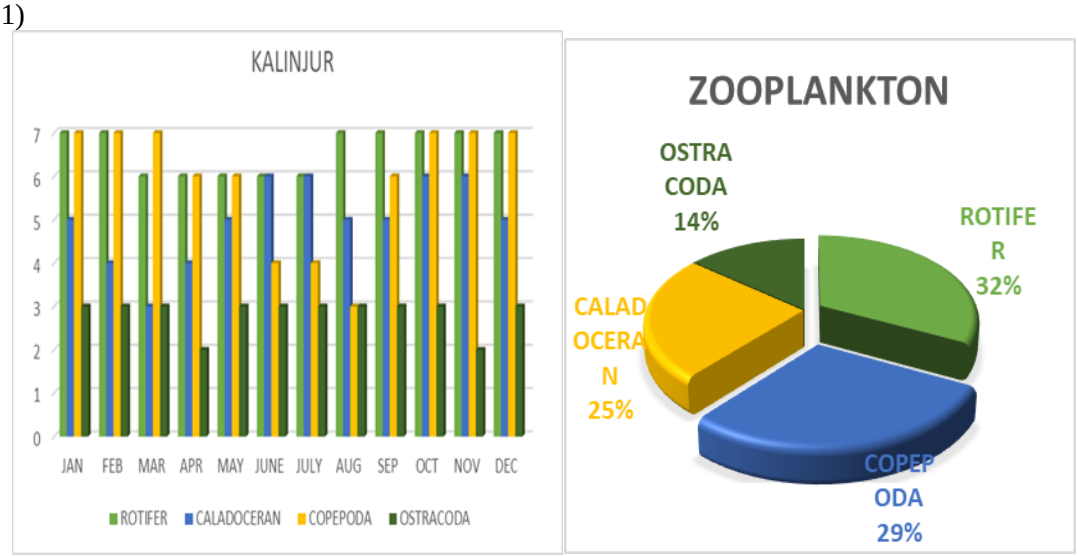

Table:1 Correlation coefficient (r) between the zooplankton fauna and various physicochemical parameters of water in Kalinjur Lake.

PARAMETER	ROTIFERA	CALADOCERAN	COPEPODA	OSTRACODA
EC	-0.63875	-0.53064	0.096186	0.059844
pH	-0.1682	0.654952	-0.56836	-0.01259
Alkalinity	-0.53031	-0.59809	0.221622	-0.14942
TH	-0.77821	-0.40906	-0.12599	-0.04651
Calcium	0.351649	0.275396	0.17219	0.198443
Magnesium	-0.19649	-0.76406	0.61688	-0.4159
Nitrite	6.00518	0	-2.14237	-3.97205
Chloride	0.637665	-0.33113	-0.19461	0.194666
Sulphate	-0.52254	-0.64626	0.085532	-0.07298
Phosphate	6.00518	0	-2.14237	-3.97205
Tidey Test	6.00518	0	-2.14237	-3.97205
BOD	-0.4809	-0.47085	-0.22933	0.173917
COD	-0.59382	-0.61148	-0.10467	0.162699