

Diversity and Seasonal Variations of Copepods from Lake Venna, Mahabaleshwar, Maharashtra, India

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Abstract

*Copepods used as biological indicators of trophic status of water body. The present study was conducted to determine the diversity and seasonal population abundance of copepods in Venna Lake, Mahabaleshwar during June 2018 to May 2019. The surface water samples of water were collected, analyzed and identified using standard methods and keys. A total four species of copepods were found during the study period. The seasonal percentage composition of copepods revealed 34.91% of *Mesocyclop leucarti*, 28.66% of *Mesocyclop hyalinus*, 22.62% of *Eucyclop spp* and 13.80% of *Heliodiaptomus viddus*. Throughout the year *Mesocyclop leucarti* is dominant over other species.*

Keywords: *Copepods, Diversity, Density, Physico-Chemical Parameters, Venna Lake, etc*

Introduction

Copepods are free living minute crustaceans of phylum Arthropoda. Copepods are represented by over 2500 species, mostly free living, but some are also parasitic. They serve as food of several fishes and play major role in ecological pyramids, trophic levels, food chain and energy transformation in the freshwater ecosystem [1]. Also, they are highly susceptible to wide range of factors like environmental factors such as rainfall, temperature, and nutrient concentration, temporal abundance and seasonal variation. The aim of the present study is to find out diversity and seasonal population abundance of copepods.

Materials And Methods

Study Area

A Venna lake is one of the most popular Lake from Western Maharashtra situated in famous hill station Mahabaleshwar. The lake was constructed by Shri Appa Saheb Maharaj who was the ruler of Satara in 1842. It lies between Latitude 17° 55' 0

N" to 73° 40' 0 E". The area of lake is about 113311.98 Sq.m. the maximum length is 4km, width 1.5 km, average depth is 80 ft. The lake is surrounded by trees. Due to hill region water comes from all high places and gathered in lake. The water of this lake is used for domestic purposes and boating; it is supplied to hill station Mahabaleshwar and for recreation.

During the study period copepod samples collected in Venna Lake at 2 two sites from June 2018 to May 2019. Water parameters like PH, Dissolved Oxygen, Total Alkalinity, Total Hardness, Chloride, Sulphate, Phosphate And Nitrate were estimated by standard methods of [2] and [3]. Samples collected at monthly intervals from surface water by zooplankton net of mesh size 64µ. Collected sample is then concentrated in 25 ml of plastic bottle. Then samples were preserved in 4% formalin with some amount glycerin to avoid the decalcification of organisms. The copepod species were identified using systematic keys of [4]and [5]. The quantitative analyses were

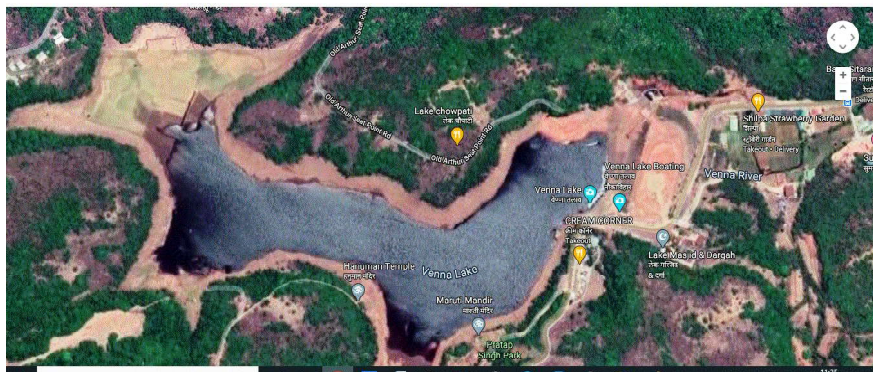


Fig-1: Image showing Venna Lake of Mahabaleshwar, Maharashtra

carried out by drop count method [6].

Result And Discussion

The Physicochemical properties of Venna lake [Fig 1] were studied and given in table No.1. Temperature is basically important for the effect on certain chemical and biological reaction, which take place in organisms inhabiting aquatic media. Temperature is considered to be the most important factor in aquatic system [7]. The value of surface temperature was observed minimum in winter [18.25 ± 1.25 °C] and maximum [21.25 ± 2.21 °C] in summer season. The pH values were minimum in winter [7.25 ± 0.45] and maximum in monsoon season [8.07 ± 0.29]. Range of pH indicates alkaline nature of Lake. Aquatic organisms are affected by pH because most of their metabolic activities are pH dependent [8].

The high value of Dissolved oxygen was recorded in winter season [7.17 ± 0.54 mg/L] and low in summer [4.47 ± 0.27 mg/L]. This may be due to high degradation of organic substances and low solubility at high temperature. Minimum dissolved oxygen in summer season due to higher metabolic rate of organisms and maximum in winter season due to low atmospheric temperature and intensive photosynthetic activity. Similar findings were observed by [9] and [10].

Average seasonal values of total hardness showed higher [26.75 ± 2.21 mg/L] in summer whereas lower values [18.25 ± 1.70 mg/L] in winter season. Hardness of water is mainly due to the concentrations of

calcium and magnesium ions. The higher concentration of total hardness during summer may be due to higher temperature, resulting in the increased concentration of salts by excessive evaporation. The lower hardness recorded during winter may be due to restricted inflow of rain water. The similar observations have also been observed by [11], [12], [13] respectively.

Alkalinity protects or neutralizes or buffers against rapid pH changes because it is important for aquatic life and fishes. Higher values of total alkalinity were observed in summer [20.75 ± 2.75 mg/L] and lower in monsoon season [9 ± 2.94 mg/L]. High values of alkalinity in summer may be attributed to increased rate of decomposition, during which carbon dioxide is liberated which reacts with water to form bicarbonate increasing total alkalinity in summer. The alkalinity values are generally high due to outfall of sewage effluents and washing of cloths. Similar findings were observed by [14] and [15]. The presence of chloride in natural waters can be attributed to dissolution of salt deposits, irrigation drainage and contamination from leechates. Each of the sources may result in local contamination of surface water. Average seasonal record of chloride showed that, minimum [4 ± 0.81 mg/L] in monsoon and maximum [14.75 ± 2.06 mg/L] in summer season. Chlorides are higher in summer season due to evaporation of water because of high temperature and maximum human activities the concentration of chlorides increases. Similar findings

were reported by [16].

Average seasonal record of sulphate is minimum $[46.25 \pm 2.75 \text{ mg/L}]$ in winter season whereas maximum $[66.50 \pm 5.0 \text{ mg/L}]$ in monsoon season. Sulphate comes from runoff water, which contains relatively large quantities of organic and mineral sulphur compounds. Maximum sulphate was recorded in monsoon season because of anthropogenic activities and low values of sulphate in winter season due to dilution effect, biodegradation and low water level. They also come from runoff water, which contains relatively large quantities of organic and mineral sulphur compounds. Similar results are also observed by [17]. The main source of sulphur is the rocks present near the water bodies and biochemical action of bacteria [18]. Phosphorus is an essential element of all living organisms as well as metabolic reactions. The phosphate value was maximum $[1.83 \pm 0.09 \text{ mg/L}]$ in winter season and minimum $[1.10 \pm 0.10 \text{ mg/L}]$ in monsoon season. Surface runoff from washings of agricultural fields and mixing with the incoming water to the lake made higher values of phosphorous and minimum during winter season may be due to abundance of phytoplankton in the lake. Similar findings have been projected by [19] and [20]. Nitrate is normally the most common form of combined inorganic and organic nitrogen in lakes; it moves freely through soils along with subsurface waters. Average seasonal record of nitrate is minimum $[0.64 \pm 0.11 \text{ mg/L}]$ in summer

season whereas maximum $[1.06 \pm 0.18 \text{ mg/L}]$ in monsoon season. Similar findings were reported by [21] and [22]. All the values of Physico-chemical water parameters which are under prescribed limit as per WHO and BIS, indicating oligotrophic condition of the lake.

The diversity and seasonal percentage of copepods were presented in Table No.2 and Table No.3. During the study period a total four species of copepods were identified namely *Mesocyclop leucarti*, *Mesocyclop hyalinus*, *Eucyclop spp* and *Heliodiaptomus viddus*. The annual percent composition of *Mesocyclop leucarti* was dominant [34.91 % Ind/Lit] followed by *Mesocyclop hyalinus* [28.66 % Ind/Lit], *Eucyclop spp* [22.62 % Ind/Lit] and *Heliodiaptomus viddus* [13.80 % Ind/Lit]. Average seasonal record of showed that *Mesocyclop leucarti* is maximum in monsoon season [60 Ind/Lit] and minimum in winter season [40 Ind/Lit]. *Mesocyclop hyalinus* is maximum in monsoon season [64 Ind/Lit] and minimum in winter season [28 Ind/Lit]. *Eucyclopspp* was maximum in summer season [22 Ind/Lit] and minimum in winter season [22 Ind/Lit]. *Heliodiaptomus viddus* is maximum in summer season [54 Ind/Lit] and minimum in winter season [19 Ind/Lit]. Copepods representing one of the biggest sources of animal protein in the world and play a central role in the transfer of carbon from producers to higher trophic levels in aquatic ecosystem [23]. *Mesocyclop* genera were cosmopolitan

in distribution. In monsoon season rich organic matter support higher number of copepods thus suggesting their preponderance in higher trophic state of water [24]. *Mesocyclop* dominance in freshwater lake was also observed by [25,26]. They was highest during monsoon and summer whereas lower in winter season because of favorable Physico chemical parameters. Many studies reported that

diversity, population density, composition affected by nutritional requirements and Physico-chemical parameters [27, 28].

Conclusion And Future Scope

Rich population density of copepods in the lake might be due to increasing the values of pH, Phosphate and sulphate during monsoon season. All the values of Physico-chemical water parameters which are under prescribed limit as per WHO and BIS,

Table 1: Average Seasonal Physico-Chemical Parameters from Venna Lake of Mahabaleshwar during June 2018 to May 2019

Parameters/Seasons	Monsoon	Winter	Summer
Water Temp [°C]	19.25 ± 2.06	18.25 ± 1.25	21.25 ± 2.21
pH	8.07 ± 0.29	7.25 ± 0.45	7.65 ± 0.26
Dissolved Oxygen [mg/L]	5.52 ± 0.52	7.17 ± 0.54	4.47 ± 0.27
Total Hardness [mg/L]	22.73 ± 3.30	18.25 ± 1.70	26.75 ± 2.21
Total Alkalinity [mg/L]	9 ± 2.94	13.50 ± 1.29	20.75 ± 2.75
Chloride [mg/L]	4 ± 0.81	6.75 ± 1.70	14.75 ± 2.06
Sulphate [mg/L]	66.50 ± 5.0	46.25 ± 2.75	54.25 ± 4.11
Phosphate [mg/L]	1.10 ± 0.10	1.83 ± 0.09	1.26 ± 0.11
Nitrate [mg/L]	1.06 ± 0.18	1.05 ± 0.05	0.64 ± 0.11

Table 2: Diversity of Freshwater Copepods from Venna Lake, Mahabaleshwar during June 2018 to May 2019.

S. No	Order	Family	Genus	Copepods
1.	Cyclopoida	Cyclopidae	<i>Mesocyclop</i> [Sars,1914]	<i>Mesocyclop leucarti</i> [Claus, 1857]
2.	Cyclopoida	Cyclopidae	<i>Mesocyclop</i> [Sars,1914]	<i>Mesocyclop hyalinus</i> [Rehberg, 1880]
3.	Calanoida	Diptomidae	<i>Heliodiaptomus</i> [Kiefer,1932]	<i>Heliodiaptomus viduus</i> [Gurney, 1916]
4.	Cyclopoida	Cyclopidae	Eucyclop	<i>Eucyclop spp</i>

Table 3: Average Seasonal Population Density [Ind/Lit] Of Freshwater Copepods from Venna Lake, Mahabaleshwar during June 2018 to May 2019

Copepods/Season	Mansoon	Winter	Summer	Total	Percentage %
<i>Mesocyclop leucarti</i>	60	62	40	162	34.91
<i>Mesocyclop hyalinus</i>	64	28	41	133	28.66
<i>Heliodiaptomus viduus</i>	32	19	54	105	22.62
<i>Eucyclop spp.</i>	23	12	29	64	13.80
Total	179	121	164	464	100

indicating oligotrophic condition of the lake. zooplanktons and from the point of
The present study on copepods will helpful conservation and maintenance.
for further studies on other groups of

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