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ZOOPLANKTON DIVERSITY AND ITS RELATIONSHIP WITH PHYSICO-CHEMICAL PARAMETERS IN MANI RESERVOIR OF WESTERN GHATS, REGION, HOSANAGAR TALUK, SHIVAMOGA DISTRICT KARNATAKA, INDIA

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Abstract: Studies on relationship between zooplankton abundance and water quality parameter in Mani reservoir were made between January 2008 and December 2008. In the current investigation, impact of different physico-chemical parameters on zooplankton population was found. Ten genera of zooplankton were identified. The relationship between zooplankton and water quality parameters was varied from place to place depending upon the condition of the reservoir water

Keywords: Mani reservoir; Zooplankton; physico-chemical parameter.

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INTRODUCTION

Zooplankton and Phytoplankton constitute the very basic nutritional cycles of an aquatic ecosystem. They form a bulk of food for zooplankton and phytoplankton for, fishes and other aquatic organisms. The maintenance of a healthy aquatic ecosystem is dependent on the abiotic properties of water and the biological diversity of the ecosystem. A direct method for the evaluation of the potentiality of an aquatic biotope is the estimation of the rate of its primary production, where it begins the primary fixation of energy and its subsequent transfer to higher trophic levels (Wetzel, 1983). But no information is available on the variation of zooplankton and their relationship with the physico-chemical parameters of water in mani reservoir. The physico-chemical parameters are water temperature, pH, DO, total alkanity, salinity and free Co_2. Although the reservoir is one of the most frequently studied reservoir in Shivamoga district, western ghat region of Karnataka, India.

Study area

Shivamoga district lies in the Western part of Karnataka state on the Western Ghat. It is spread over the geographical area of 8478 km^2 and lies between Latitude of 13° 34′ to 13° 45′ N and Longitude of 74° 52′ to 75° 11′ E. River Varahi which is present in Karnataka state, India and it takes birth in Hebbagilu, Western Ghats of Karnataka and finally reaches the Arabian Sea. Mani reservoir was constructed during 1973 across the river Varahi the place it Mani, near Masthikatte, of Hosanagar taluk, Shivamoga district.

The annual rainfall in the catchment area varies from 2000 to 12 850 mm. Water storage capacity of the reservoir is 32.80 million cubic feet and the height of the water body is about 594.36 m from the ground level. The catchment area is 163 km^2 and the gross storage is 960 m. cum. The reservoir water is mainly used for irrigation, major power generation and fisheries. A total of 25 villages were submerged during the construction of reservoir.

MATERIALS AND METHODS

Zooplankton samples were collected between January and December 2008 from three stations of the Mani reservoir, Karnataka, India by using simple conical tow-net of mesh size 80 µm and samples were kept in the plastic container.

Borax buffered formaldehyde was used at 1.5 to 250 ml samples and samples were taken 250 ml each and every occasion. For zooplankton counting, the sedgewick-Rafter cell (S-R) was used which is 50 mm long, 20 mm wide and 1 mm deep. Number of zooplankton in the S-R cell was derived from the following formula:

$$No.ml\text{-}1 = \frac{C \times 100}{L \times D \times W \times S} \qquad (1)$$

where C = number of organisms counted, L = length of each strip (S-R cell length) in mm, D = depth of strip (Whipple grid image width) in mm, S = number of strips counted, and W = width of S-R cell. Number of cells per mm was multiplied by a correction factor to adjust the number of organisms per liter.

RESULT AND DISCUSSION

Five genera of cladocerans, three genera of copepods and two genera Rotifer, were identified in Mani reservoir. Among *Cladocerans Genera copepods* include *Cyclops*, *Mesocyclops* and *Diaptomus* species, rotifers *Brachinous* species and *Keratella tropica* were recorded while, *Daphnia sp.*, *Moina daphnia*, *Diaphanosoma sp.*, *Ceriodaphnia sp.*, and *Bosmina* species were noticed in the genus respectively. Relationship between zooplankton abundance and different water quality parameter in this reservoir are depicted in **Tables 1−6**.

Water body is an ecosystem with a network of various physico-chemical parameters and its biota. The physico-chemical parameters and zooplankton communities together form comprehensive ecosystem and as in any ecosystem, there are interaction between the zooplankton and also between the phytoplankton and the water quality parameters. These interactions are directly or indirectly subjected to the complex influences, some of which results in quantitative changes e.g. increase or decrease of size of the population (Welch, 1952).

Zooplankton abundance showed inverse relationship with water temperature in site II (r = -0.17) which is poorly negatively correlated. Similar findings resemble the work of Chowdhury & Mazumder (1981) and Islam *et al*. (2000). However, zooplankton showed direct positive relationship with water temperature at site I and III (**Tables 2−4**). Zooplankton abundance also showed inverse relationship with pH in site III (r = -0.29) which is poorly correlated (Alam *et al*., 1987; Patra & Azadi, 1987) (**Table 4**). But site I and II showed direct positive relationship with pH (r = 0.72 and r = 0.15) which are moderately to poorly correlated (**Table 2−4**).

It is found in the present study that free Co2 is highly positively correlated at site I and II (r = 0.906; r = 0.72). The direct relationship of zooplankton with free Co_2 is poorly correlated with zooplankton abundance (r = 0.13). In the current study salinity may be inversely related in site I (r = -0.482) and in site III (r = -0.063) of the present water body zooplankton may be directly correlated with the salinity (**Table 4**).

Table 1. Net zooplankton abundance and different water quality parameters in Mani Reservoir at site-I

Net zooplankton abundance	Water temperature (°C)	pH	Salinity (ppt)	Dissolved oxygen (mg/l)	Total alkanity (mg caco3)	FreeCo$_2$ (mg O 2 L^{-1})
336	30.40	7.00	8.00	5.33	106.39	2.86
385	31.20	7.60	11.10	5.20	99.20	2.62
534	30.30	7.53	14.00	5.10	106.39	3.32
389	28.30	7.50	14.39	5.61	116.60	2.32
353	28.68	7.39	14.39	5.98	116.50	1.80

Table 2. Correlation (r) regression equation (*Y*), net zooplankton abundance and different water quality parameters in Mani reservoir during study at site-I (*significant level at 5%)

Relationship	Regression equation (*Y*)	Correlation 'r'	df
Zooplankton abundance Vs free Co2	$Y = 34.4 + 133.3x$	0.906	4
Zooplankton abundance Vs total alkalinity	$Y = 914.0 + 5.02x$	-0.500	4
Zooplankton abundance Vs DO	$Y = 763.7 + 62.8x$	-0.760	4
Zooplankton abundance Vs Salinity	$Y = 550.8 + 13.5x$	-0.482	4
Zooplankton abundance Vs pH	$Y = -4695.2 + 676x$	0.72	4
Zooplankton abundance Vs Water temp.	$Y = -4670 +168.0x$	0.835	4

Table 3. Net zooplankton abundance and different water quality at site II of Mani Reservoir

Net zooplankton abundance	Water temperature (°C)	pH	Salinity (ppt)	Dissolved oxygen (mg/l)	Total alkanity (mg caco3)	FreeCo$_2$ (mg O 2 L^{-1})
408	28.40	7.30	12.40	9.68	322	0.25
867	29.60	7.58	11.00	9.28	317	0.30
710	28.60	7.30	11.45	9.15	146	0.52
1212	29.50	8.00	12.00	10.00	155.8	0.50
510	29.50	7.74	10.48	9.20	184	0.26

Table 4. Correlation (r) regression equation (*Y*), net zooplankton abundance and different water quality parameters in Mani Reservoir during study at site-II (*significant level at 5%)

Relationship	Regression equation (*Y*)	Correlation 'r'	df
Zooplankton abundance Vs free Co2	$Y = 209.0 + 1338.0x$	0.72	4
Zooplankton abundance Vs total alkalinity	$Y = 951.4 + 0.90x$	-0.33	4
Zooplankton abundance Vs DO	$Y = 4026.1 + 481.7x$	0.68	4
Zooplankton abundance Vs Salinity	$Y = 678.3 + 4.0x$	0.02	4
Zooplankton abundance Vs pH	$Y = 416.2 + 140.3x$	0.15	4
Zooplankton abundance Vs Water temp.	$Y = 3241 + 136.18x$	-0.17	4

Table 5. Net zooplankton abundance and different water quality parameters in Mani reservoir at site-III

Net zooplankton abundance	Water temperature (°C)	pH	Salinity (ppt)	Dissolved oxygen (mg/l)	Total alkanity (mg caco3)	FreeCo$_2$ (mg O 2 L^{-1})
1638	29.04	8.3	2.0	6.2	106.6	1.40
2602	29.66	8.4	0.5	4.8	168.0	1.72
1351	29.6	8.3	0.1	6.04	122.0	1.42
2455	29.7	8.4	0.48	4.90	168.0	1.70

Table 6. Correlation (r) regression equation(Y), net zooplankton abundance and different water quality parameters in Mani reservoir during study at site-III (*significant level at 5%)

Relationship	Regression equation (*Y*)	Correlation 'r'	df
Zooplankton abundance Vs free Co$_2$	$Y = 1354.92 + 424.06x$	0.13	3
Zooplankton abundance Vs total alkalinity	$Y = 248.0 + 13.41x$	0.568	3
Zooplankton abundance Vs DO	$Y = 6208.9 – 731.85x$	-0.66	3
Zooplankton abundance Vs Salinity	$Y = 2533.8 – 554.78x$	-0.063	3
Zooplankton abundance Vs pH	$Y = 37008.12 – 4169x$	-0.29	3
Zooplankton abundance Vs Water temp.	$Y = -42072.05 + 1500.01x$	0.77	3

Zooplankton abundance showed inverse relationship with dissolved oxygen (DO) in site I (r = -0.760) and in site III (r = -0.66) which all are moderately correlated (**Tables 5–6**). On the other hand, zooplankton showed positive relationship with DO at site II (r = 0.680) which is moderately correlated (**Table 4**). Such findings resemble the works of Miah *et al.* (1981) and Alam *et al*. (1987).

Total alkalinity showed direct relationship with zooplankton abundance in site III (r = 0.568). These results have similarity with the findings of Miah *et al.* (1981) and Alam *et al*. (1987). But in the site I (r = -0.500) and in site II (r = -0.33) zooplankton showed inverse relationship (**Table 2** and **4**). This relationship is found in the present investigation.

CONCLUSION

The number of zooplankton species present today and their distribution pattern is the result of both their evolutionary history and present day environmental circumstances. Information on environmental conditions and on the structure and functioning of plankton communities is used in preparing management plan and minimizing adverse effects of unsustainable development and pollution. Conservation on aquatic ecosystem is fundamentally more difficult than on land because of the much greater degree of inter connectedness and lack of clear boundaries. So this type of work will help us to formalize the management plans.

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