



Investigation of physico-chemical properties and zooplankton diversity of a freshwater in bembla dam Yavatmal district, (MS). India

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Abstract

Present study on physico-chemical parameters and zooplankton density. In this study Water sample were collected in sterilized sampling bottle from Bembla dam in Yavatmal District of Maharashtra, analysed by method APHA, 2012, and zooplankton collected with help of net of mesh size 25 micron as well as net numbers 25 bolting silk cloth. This zooplankton identified by APHA (1985); Tonapi (1980) described key.

In present results revealed that Zooplankton communities are highly sensitive to physico-chemical parameters variation and it plays an active role in the modification and remineralisation of the particulate organic matter in the water. Highest zooplankton density recorded in summer month, the zooplankton density and abundance vary with month, which may be due to fluctuation of physico-chemical parameters and reduction in abundance of Phytoplankton.

Keywords: physico-chemical properties, dissolved oxygen, BOD, hardness, bembla dam, water and zooplankton etc

Introduction

Zooplankton is one of the most important biotic elements that impact all functional aspects of aqueous ecosystems including food chains and trophic networks, energy flow, and the circulation of matter. And they inhabit all freshwater habitats of the world and its diversity and density refer to variety within the community and also, study of Zooplankton is important as it could be providing ways to predict the productivity of fresh water aquatic system (Morgan *et al.*, 1978; Borgmann *et al.*, 1984). The biodiversity and distribution of Zooplankton in aquatic ecosystem depend mainly on the physicochemical properties of water.

The occurrence and distribution of plankton fauna depend on a number of factors such as climate change, habitat physicochemical properties, and biotic factors [1, 2, 3, 4, 5]. Environmental factors are also important elements; for instance, water temperature impacts the growth and development of organisms and can influence their mortality [6]. Different species show varied tolerances to increases or reductions in temperature ranges, and particularly sensitive individuals are eliminated by them (Andrulewicz *et al.*, 2008, Tunowski, 2009).

The relationship between growth and distribution of plankton is mainly affected by physico-chemical factors. The present work is in relation to physico-chemical properties of Bembla dam water. Studies on the freshwater reservoirs, lakes and rivers in India started in 1933. The important works in this line are those of [7, 8, 9, 10]. So, present work is carried out physico-chemical properties of Bembla dam water it helps for investigation of diversity of zooplankton and relationship between physico-chemical properties of water and also, occurrence accordingly to season as well as ecological factor of water in Bembla dam.

Materials and Methods

Water sample were collected in sterilized sampling bottle from Bembla dam.in Yavatmal District of Maharashtra. The

Dam is constructed on river Godavari. Bembla dam 7203 m long earthen dam with a maximum height of 19.06 m and 447 m long masonry/concrete dam having the maximum height of 29.15 m with 297 m long central spillway having 20 radial gates, each of size 12 X 8 m across river Bembla near Khadak - Sawanga in Bahulgaon taluka of Yavatmal District. The project also includes 115 km long Right Bank Canal with distribution network and Dehani Lift Irrigation Scheme (LIS). The annual irrigation potential of the project is 52543 Ha. (47,000 Ha. By flow and 5543 Ha. By lift) in Yavatmal District. The CCA of the project is 60528 hectare. Water sample were analysed different physico-chemicals parameter as per previously and modified methods used are as following.

The temperature of water measured immediately on site of water body by using glass thermometer. pH of water sample also measured on site with help of Digital PH meter and then in laboratory with help of deluxe pH meter-101 Model, Conductivity were measured by conductivity meter EQ 660B μp Based model. Turbidity of the water samples were measured using a turbidity meter, Alkalinity of determined by Titration Method, TDS (mg/L) measured by TDS meter and hardness and chloride were determined by titration method and also remaining parameter measured and determined according to APHA, 2012, NEERI, Govt. of India. In present investigation water sample were collected from Bembla dam water body in July 2021 to June 2022. The water was collected directly from each selected sampling station of Dam. The samples were transferred to the bottle and brought to the laboratory without disturbances. The water samples were collected by monthly intervals from the sampling stations for a period of one year. The samples were collected during morning hours with help of net of mesh size 25 micron as well as net numbers 25 bolting silk cloth. Plankton net acts as a filter, it is the most common method for collection of zooplanktons. The concentrated zooplankton samples are carefully transferred to another container. 5 ml of 4% formalin, 2 to 3 drops of

glycerines were added to it. A pinch of detergent powder was also added to avoid the aggregation of zooplankton. Samples were collected in separate glass phials with label containing name of site, date of sampling, time of sampling, etc. Identification of zooplankton with help of a compound microscope. A dissecting microscope is also handy for sorting and counting. Specimens are mounted on glass slides and examined at 25-100X magnification. With its standard identification and its monographs as well as keys which were suggested by APHA (1985); Tonapi (1980); Dodson and Frey (1991) and Williamson (1991) and following the systematic key by Battish (1992) and Altaff (2004). Main characters are considered for identification are lorica, corona and type of trophi for rotifers; antennules, post abdomen, number and arrangement of spines, location of lateral setae and rostrum for cladocera; antennules, antenna, caudal setae, and endopodite for copepoda and antenna, valve shape and setae for ostracods used by Gajanan Sontakke and Satish Mokalsh (2014). Population density was quantified by Drop count method of Lackey (1938), and was calculated using the following formula of Lackey (1938):

$$N = n \times v / V$$

Where,

N = Total no. of organisms/ lit of water filtered,

n = Number of zooplankton counted in 1 ml plankton sample,

v = Volume of concentrate plankton sample (ml),

V = Volume of total water filtered through (L)

Results and Discussion

Present water sample of bembra dam collected from three different site of dam were P^H observed in sample site 1 was 07.80 followed by 07.90. And 08.03 respectively but PH of all three-sample showed difference within same dam water sample. Also, Electrical conductivity (dS/m) was measured 182.91, 183.83 and 183.33 respectively.

The TDS of all water sample are 109.08, 111.91 (mg/l) and 116.75 and also total hardness of all three-water sample are 77.75, 62.18 and 94.08 (mg/l). In the present three sample of water Alkalinity were highest recorded in sample site (3) are 92.41 followed by 92.16 and 90.00 mg/l and also Calcium as Ca⁺⁺ (mg/L) were recorded from three sample of water 18.14, 22.19 and 21.83 in which highest recorded in sample site 3.

Table 1: Physico-chemical parameter of Bembra dam water

Sr. No.	Physico-chemical Parameter	Average value in Years 2021-22		
		Sample 1	Sample 2	Sample 3
1	pH at 25°C	07.80	07.90	08.03
2	Electrical conductivity(dS/m)	182.91	183.83	183.33
3	Total dissolved solid(mg/L)	109.08	111.91	116.75
4	Total hardness(mg/L)	77.75	62.18	94.08
5	Alkalinity(mg/L)	90.00	92.16	92.41
6	Calcium as Ca ⁺⁺ (mg/L)	18.14	22.19	21.83
7	Magnesium as Mg ⁺⁺ (mg/L)	10.15	06.21	05.24
8	Chloride(mg/L)	10.37	09.77	13.63
9	Free CO ₂	05.30	04.76	04.61
10	Dissolved oxygen (DO) (mg/L)	04.09	04.83	04.15
11	Biochemical oxygen demand (BOD) at 5 th day (mg/L)	09.62	04.46	06.03
12	Chemical oxygen demand (COD) (mg/L)	54.35	25.77	56.22
13	Free ammonia(mg/L)	00.22	00.55	00.48
14	Nitrite(mg/L)	00.02	00.01	00.02
15	Phosphate(mg/L)	00.36	00.38	00.39

Note: All results in three replicates

Table 2: Month wise variation in physico-chemical parameter of water 2021-2022

Parameter (Sam.1)	Month wise variation in physico-chemical parameter of water 2021-22					
	Apr	May	June	July	Aug	Sept.
Total hardness	80	92	100	101	88	78
E.C. (dS/m)	194	214	217	219	261	271
TDS (mg/L)	116	124	130	133	114	112
Dissolved oxygen (mg/L)	5	5.2	5.5	3.16	3.6	2.1
BOD at 5 th day(mg/L)	12.2	10.8	13.1	12.9	7.6	6.2
Nitrite(mg/L)	0.032	0.021	0.022	0.023	0.011	0.025
Phosphate(mg/L)	0.91	0.76	0.88	0.81	0.021	0.012
Chloride	19.9	20.8	22.4	20.1	4.89	3.79
Species Name 1) <i>Rotifera</i>	Zooplankton density org./10 lit. in during 2021-2022					
<i>Keratella tropica</i> (Apstein, 1907)	16	21	17	14	10	11
<i>Brachionus angularis</i> (Gosse, 1851)	13	16	11	10	08	04
<i>Trichocerca cylindrica</i> (Imhof, 1891)	09	13	06	04	02	.....
<i>Monostyla bulla</i> (Gosse, 1851)	12	15	05	05	01	02
<i>Brachionus forficula</i> (Wierzejski, 1891)	14	17	04	08	04	01
2) <i>COPEPODA</i>						
<i>Cyclops viridis</i> (Jurine, 1820)	06	08	04	01	.....	....
<i>Mesocyclops leuckarti</i> . (Claus, 1857)	04	06	03	01	.....	01
Ostracoda						
<i>Hemicyprisanomala</i> (Klie, 1938)	.....	01	02	.....	.....	.....

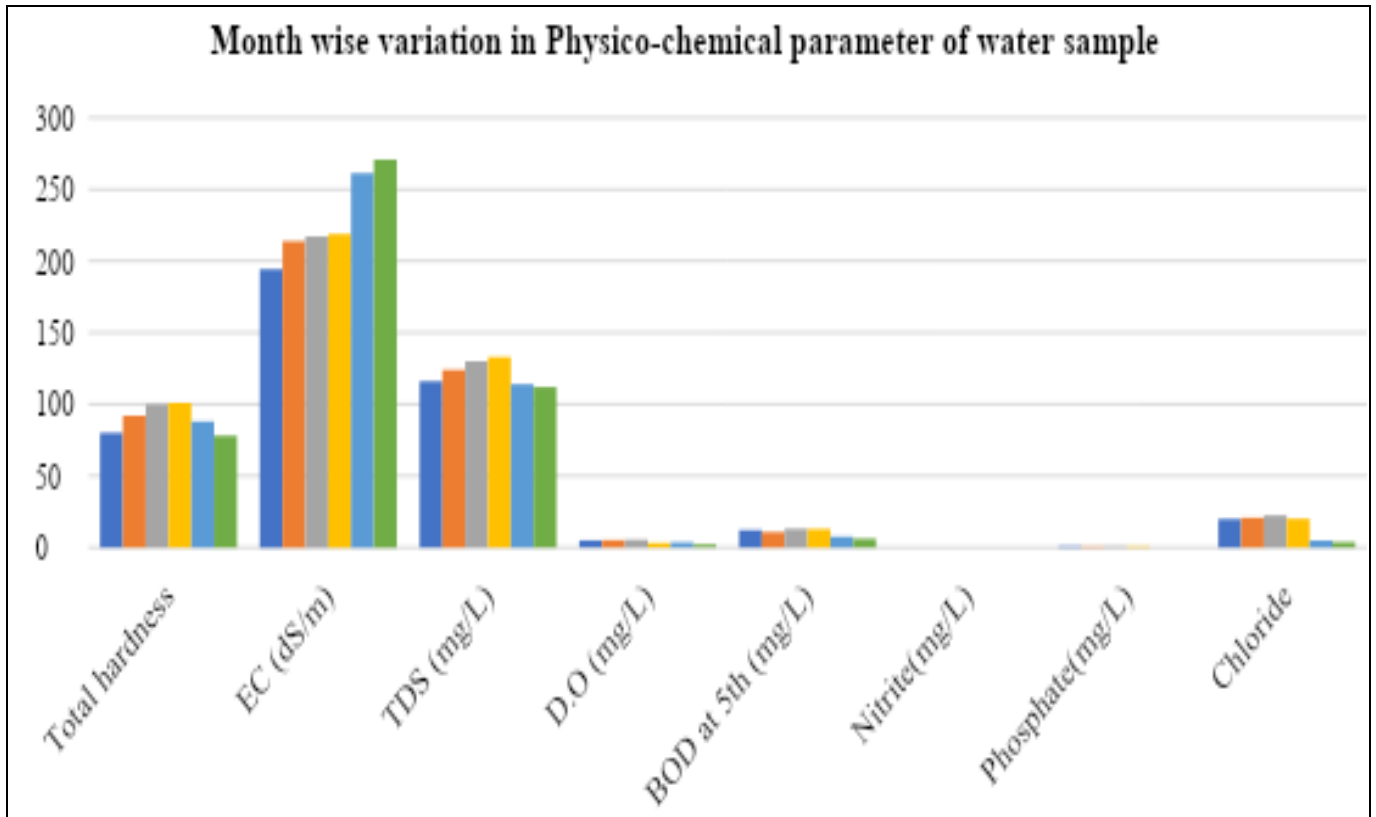
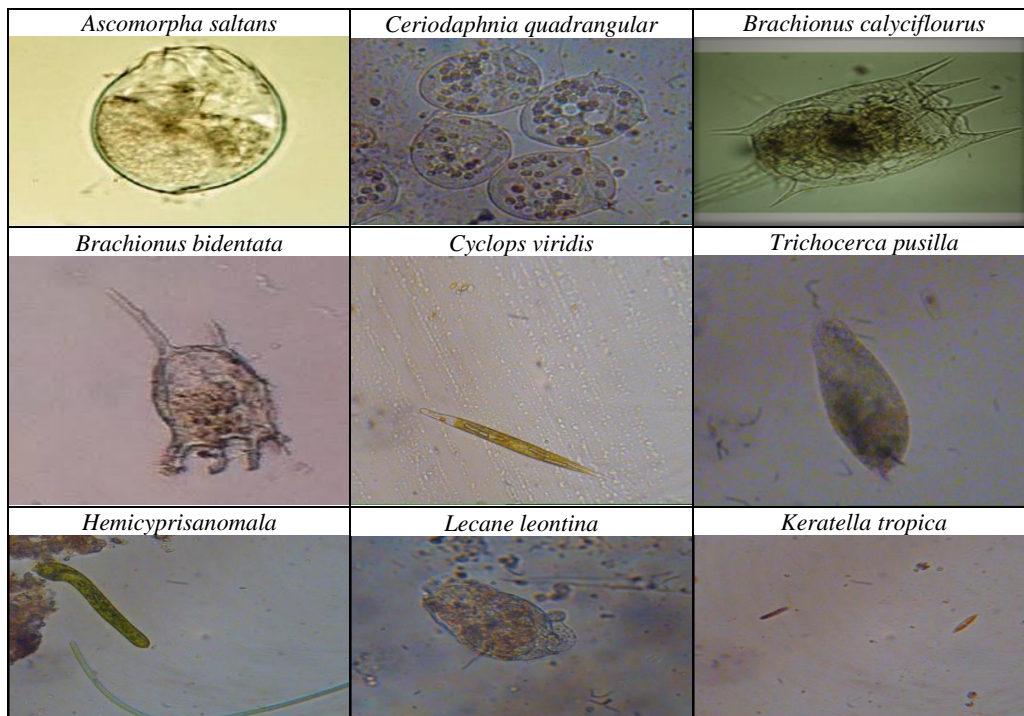


Fig 1

Table 3: Photograph showing some diversified zooplanktons in Bembla Dam fresh water



Dissolved oxygen (DO) (mg/L) also recorded from all three sample of water are 04.09, 04.83 and 04.15 respectively. The highest DO record in sample site 2 mentioned in Table 1. And Biochemical oxygen demand (BOD) at 5th (mg/L) highest recorded in sample site 1.

Abba A. *et al.*,^[11] reported sources of high BOD values at Katsina metropolis, Katsina Nigeria as a result of high rate of decaying of organic matter in the water. Nitrate-Nitrogen and Phosphate-phosphorous concentrations were also higher in May with 0.36 ± 0.05 and 0.24 ± 0.02 mg/l each. Present

results showed that the total hardness of water sample highest found in July that was 101 mg/l followed by June, may, Aug., Apr and least in sept.2021-22 respectively. E.C. of water sample highest found in Sept. that was 211 mg/l and followed by Aug., July, June, May and least in April respectively. Also, TDS highest found in July that was 133 mg/l. (Table 2.). Dissolved oxygen (mg/L) and BOD at 5th (mg/L) of water sample were highest recorded in the month of June that was 5.5 mg/l and biological oxygen demand (BOD) 13.1 mg/l. followed by May. Nitrite(mg/L),

Phosphate(mg/L) and Chloride were highest recorded in April that was 0.032, 0.91 and 22.4 in June respectively. Zooplankton density were recorded highest in summer month and followed by winter and rainy month. According to Rajagopal *et al.*,^[12] zooplankton plays an integral role and serves as bio-indicator and it is a well-suited tool for understanding water pollution status. Mahar^[13] reported factors such as light intensity; food availability, dissolved oxygen, and predation affect the population composition of zooplankton. There were high zooplanktons composition and abundance during the month of June. According to Abba *et al.*,^[11] studies that physico-chemical properties of water positive impact on the Percentage compositions of Zooplankton indicate that *Copepods* has the highest percentage with 30.54% also the highest number of zooplanktons were recorded in the month of May while the least percentage were recorded in the month of April. *Rotiferans* are the second in abundance 20.3% followed by *Cladocerans* with 19.6% in which their highest percentage were recorded in the month May and lowest in April and protozoans identified was 79 which account for 13.78% of the total Zooplankton identified; the highest number was recorded in the month of May while the lowest was in April.

Conclusion

Zooplankton communities are highly sensitive to physico-chemical parameters variation and it plays an active role in the modification and remineralization of the particulate organic matter in the water. Highest zooplankton density recorded in summer month, the zooplankton density and abundance vary with month, which may be due to fluctuation of physico-chemical parameters and reduction in abundance of phytoplankton, which are the primary producers. Hence this study is carried at bembra Damb and also, physico-chemical parameters are effective tools in the studies of zooplankton (Job T.J. 1943).

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