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Investigation of physico-chemical properties of Arunavati dam water, yavatmal district, India with special reference to the zooplankton relationship

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Abstract
Present study on physic-chemical parameters and zooplankton density. In this study Water sample were collected in sterilized sampling bottle from Arunavati dam situated in Digras tehsil of Yavatmal District of Maharashtra, India. Physiochemical parameters were analysed by method APHA, 2012, and zooplankton collected with help of net of mesh size 20 micron as well as silk cloth. This zooplankton identified by APHA (1985); Tonapi (1980) described key.
In present studies revealed that zooplanktons in water highly sensitive to physico-chemical parameters variation and it play an active role in the simplification 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 continue changes in physico-chemical parameters and reduction in abundance of Phytoplankton.

Keywords: physico-chemical properties, dissolved oxygen, bod, hardness, Arunavati 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 Arunavati 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 Arunavati 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 Arunavati Dam.

Materials and Methods
Water samples were collected in sterilized sampling bottle from Arunavati Dam located near digras Tehsil in Yavatmal District of Maharashtra. The Dam is constructed on river Arunawati. Three water samples were analysed 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. p^H of water sample also measured on site with help of Digital PH meter and then in laboratory with help of Deluxe p^H 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 this we have three water sample collected from Arunavati dam, and three locations are selected to collect water sample and immediately detection of their physiochemical parameters which possible on side of arunavati dam and same water sample are transferred in water bottle and brought to the laboratory without any damage, all sample are collected in between one month duration gap throughout year 2021-2022 and zooplankton sample were collected with help of 20 micron mesh size.

Photo 1: River flow near Dam, Sample collection site 1

Photo 2: Sample site 2 Arunavati Dam

Photo 3: Sample site 3

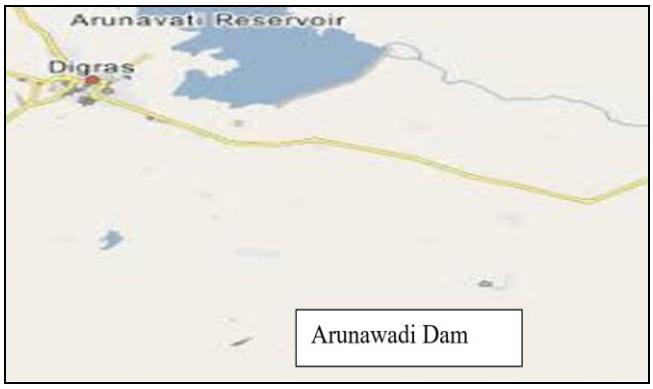

Fig 1: Zooplankton sample collection Dam view

Zooplankton samples were carefully transferred to 500 ml container. Least amount of 4% formalin and 2-3 drops of glycerines were added and also pinch of detergent powder for avoid of aggregation of zooplanktons and container given well labelled with date and time.

Zooplanktons sample were put on glass slides for identification under microscope and zooplanktons identified by standard methods used by APHA (1985); Tonapi (1980); Dodson and Frey (1991) and Williamson (1991) and following the systematic key by Battish (1992) and Altaff (2004).

Population density of zooplanktons 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 Arunavati Dam collected from three different site of dam were P^H observed in sample site 1 was 07.80 followed by 07.90. and 07.03 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 three sample of Arunavati Dam water

Sr. No.	Physico-chemical Parameter	Average value in Years 2021-2022		
		Sample 1	Sample 2	Sample 3
1	pH at 25°C	07.80	07.90	07.03
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 CO2	05.30	04.76	04.61
10	Dissolved oxygen (DO) (mg/L)	04.09	04.83	04.15
11	Biochemical oxygen demand (BOD) at5thday (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 2021-22

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 5th 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) *Rotifera*	Zooplankton density org./10 lit. in during April to Sept 2021-2022					
Keratella tropica (Apstein, 1907)	16	21	17	14	10	11
Brachionus angularis (Gosse, 1851)	13	16	11	10	08	04
Trichocerca cylindrica (Imhof, 1891)	09	13	06	04	02	…..
Monostyla bulla (Gosse, 1851)	12	15	05	05	01	02
Brachionus forficula (Wierzejski, 1891)	14	17	04	08	04	01
2)*COPEPODA*						
Cyclops viridis (Jurine, 1820)	06	08	04	01	…….	….
Mesocyclops leuckarti. (Claus, 1857)	04	06	03	01	……	01
Ostracoda						
Hemicyprisanomala (Klie, 1938)	…..	01	02	……	……..	…….

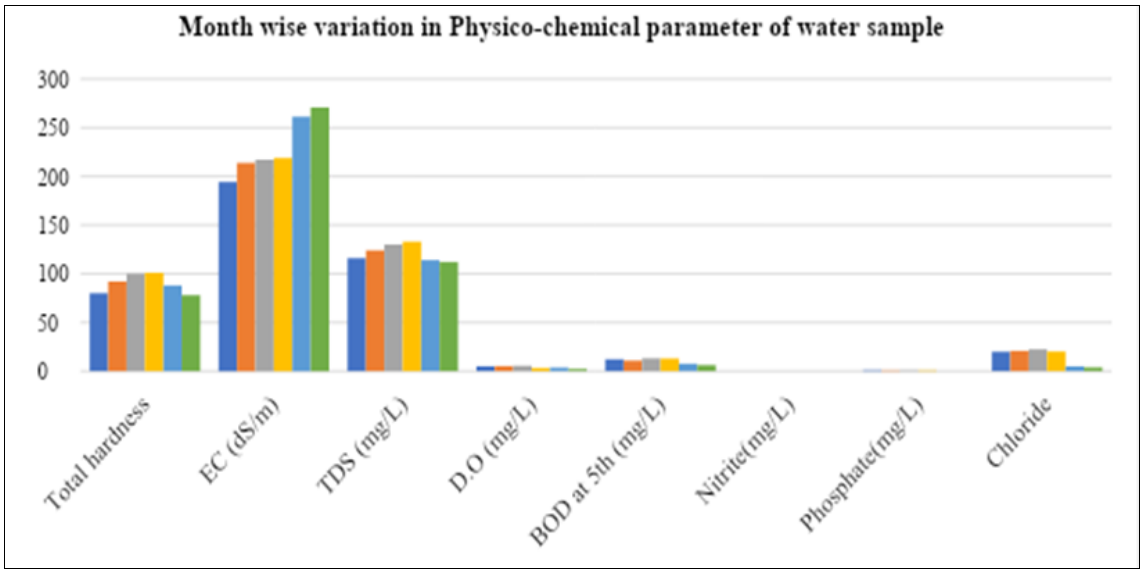

Fig 2: Graphical representations of water parameters

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.

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.2017-18 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 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.

Zooplanktons play an important role degradation of organic matter in to mineral which help to survive of aquatic animal so is called as bio indicators in aquatic system for reduction of pollution (Rajagopal *et al*., 2010). The highest zooplanktons density and abundance found in month of June (Mahar M.A.2003)

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 physic-chemical parameters and reduction in

abundance of phytoplankton, which are the primary producers. Hence this study is carried at Arunavati Dam and also, physico-chemical parameters are effective tools in the studies of zooplankton. (Job TJ, 1943).

Competing Interests

Authors have declared that no competing interests exist.

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