Journal of Advances and Scholarly Researches in Allied Education
Vol. 21, Issue No. 3, April-2024, ISSN 2230-7540

DOI: https://doi.org/10.29070/0bpdza50

Analyzed the Physicochemical Characteristics, Zooplankton Fauna variety of betwa river

Monika Shivhare [1] * , Dr. Pratibha Saxena [2]

1. Research Scholar, Department of Zoology, LNCT University, Bhopal, Madhya Pradesh, India
muskan.lnct@gmail.com ,
2. Professor, Department of Zoology, LNCT University, Bhopal, Madhya Pradesh, India

Abstract: Environmental physicochemical factors cause zooplankton populations to fluctuate, and water quality variables including temperature, light penetration, nutrient enrichment, herbivores, and heterotrophic bacteria all play a role in determining zooplankton density. The presence of aroma, taste, turbidity, and visible particles in water may therefore be better comprehended by using plankton analysis values. Their contributions to the biological output of ecosystems are substantial, and they also play an essential role in the lentic community. Most zooplankton populations in freshwater habitats are made up of rotifers, cladocerans, and copepods. Not only do these creatures provide a substantial amount of food for invertebrates and planktivorous fish, but they also play an important part in the energy transfer and nutrient cycling processes that occur within aquatic food webs. There can be unexpected changes in population size in the event of a disturbance due to the complex interactions that these organisms maintain with their surroundings throughout their lifetimes. Which is why changes in their population size, species diversity, or community composition could tell us a lot about environmental health.

Keywords: Physicochemical, Characteristics, Fauna , Zooplankton , Betwa , River

---------------------------X---------------------------

INTRODUCTION

The importance of zooplankton to food webs makes quantitative and qualitative studies of these organisms relevant to water quality assessment. Their significance in the aquatic food chain is due to the fact that they serve as both primary consumers and mediators between the major producers of the system—phytoplankton—and higher consumers, such as predatory fish. Their contributions to the biological output of ecosystems are substantial, and they also play an essential role in the lentic community. There can be unexpected changes in population size in the event of a disturbance due to the complex interactions that these organisms maintain with their surroundings throughout their lifetimes. Which is why changes in their population size, species diversity, or community composition could tell us a lot about environmental health. This is why they might be useful as a bio-indicator species to measure pollution levels in water. Environmental physicochemical factors cause zooplankton populations to fluctuate, and water quality variables including temperature, light penetration, nutrient enrichment, herbivores, and heterotrophic bacteria all play a role in determining zooplankton density. The presence of aroma, taste, turbidity, and visible particles in water may therefore be better comprehended by using plankton analysis values.

The situation with water contamination in India is currently dire. These days, pollution has reached dangerous levels in almost every river system in India. Diseases caused by water kill around 1.8 million people annually in underdeveloped nations, the vast majority of them being children. There were 1,53,000 villages in India with contaminated water supplies, according to recent research. Ninety percent of the worlds potable water is contaminated in some way. There is no river on Earth filthier than the Ganga.

Rotifers, also known as Rotatories, are small fish that live in freshwater habitats and are pelagic. Their distinctive corona, which rotates frontward like a wheel, serves as a means of identification..

At the base of the food chain, zooplankton biomass provides an abundance of feed for fish larvae (Sherman et al., 2002) and primary production guarantees carbon generation, which in turn supports commercial fisheries (Nixon et al., 1986).

Recruitment of fish and their interactions with zooplankton

In the 1980s, people began talking about how zooplankton affected fish recruitment. Research into the North Sea's zooplankton biomass abundance revealed a steep fall about the same time when commercial fish stocks were drying up (Reid, 1984). Since a lack of food is likely to have a devastating effect on fisheries, the zooplankton drop that has happened as a result of climate change may also be an appropriate explanation for the fall in stocks (Reid, 1984).

Another important region for commercial fish populations is the Barents Sea. During the mid-1980s and mid-1990s, there was a significant decrease in the recruitment of capelin, a species of Mallotus villosus, because juvenile herring were a major predator of capelin larvae. In the Barents Sea, where capelin play an important role in the ecosystem, their decline affects higher-trophic level animals like guillemots, cod, and harp seals (Dalpadado et al., 2002).

Interactions between fish and zooplankton

Zooplankton biomass has fluctuated during those years as well, perhaps as a result of changes in horizontal transit and strong predatory pressures (Skjoldal and Rey, 1989). Research has shown that there are interactions between fish and zooplankton, as well as between cod, herring, and capelin, suggesting that these variations could be signs of future changes in the ecosystem

A short succession of species, starting with diatoms and progressing through krill, capelin, and finally cod, defines the food chain in the Barents Sea. The fact that trophic level shifts occur demonstrates how powerful these biological interactions are and how quickly they may alter the state of an ecosystem (Dalpadado et al., 2002).

The case study carried out in the Black Sea provides an intriguing illustration of how gelatinous zooplankton negatively impact fish recruitment. Significant changes impacted the Black Sea's ecosystem health, which seemed weak and less stable, according to time-series data from 1960 to 2001 (Grishin et al., 2007).

The eruption of the gelatinous zooplankton Mnemiopsis leidyi and the jellyfish Aurelia aurita were both aided by these circumstances. Grishin et al. (2007) found that from 1988 to the late 1990s, the zooplankton biomass was controlled by Mnemiopsis leidyi. This control had an effect on the stocks of many abundant commercial fish species.

OBJECTIVES OF THE STUDY

1. To study on Recruitment of fish and their interactions with zooplankton
2. To study on Interactions between fish and zooplankton

RESEARCH METHOD

Zooplankton and Physicochemical Studies

When it comes to disaster preparedness, partnerships between medical supply chains, government agencies, and international groups like the Red Cross and the World Health Organisation (WHO) are crucial. Governments can organise response operations and make resources more available, while international bodies can contribute greater resources and technical help.

Study Area:

The Betwa, a Yamuna tributary, flows north from the Kumra (Jhirri) hamlet in Raisen, Madhya Pradesh. The drainage basin lies between 77°10' E and 80°20' E and 22°54' N and 26°00' N. From its headwaters to its Yamuna confluence, the river runs 590 km, with 232 km in Madhya Pradesh and 358 km in Uttar Pradesh.

Physico-chemical analysis

Temperature affects zooplankton metabolism, making it crucial. TDS measure water's inorganic and organic concentrations. Water turbidity will be measured with a turbidity meter. Any chemical or biological process may be pH-tested in natural water. Water will be measured in the field using a Sacchi disc. The main water quality indicator captures its physical and biological activities. Next, B.O.D. was determined using titrimetric technique..

The following parameters were verified using their designated measuring instruments. The subsequent physico-chemical parameters were examined monthly (APHA, 1991)..

Temperature- According to Sontakke et al. (2014), temperature is a major component that affects zooplankton metabolism. After gathering a sample of water in a plastic beaker, its temperature was recorded. A mercury thermometer measured surface temperature at 10 cm deep...

Turbidity- A turbidity meter measured water turbidity...

pH- Any chemical or biological process may have its pH measured in natural water. A solution's acid-base activity can be expressed as its pH, or as the negative common logarithm of the hydrogen ion concentration. It was measured using a portable multiparameter meter (PCSTestr 35 - Eutech Instruments) right there on the ball field..

Zooplankton collection and analysis

Qualitative analysis:

From 8:00 in the morning until 11:00 in the morning, two samples with three replicates were obtained from three different locations along the Betwa river and one location near the dam. The fishermen cast their nets into the lake and hauled them in towards the shore. At least five times, this was done.

Quantitative analysis:

The same 50-micron plankton net filtered 50 litres of water.. An attached 100 ml water bottle served as the vessel for collecting the filtered water sample. Before storing the collecting vial for future use, we preserved the sample in 4% formalin and made sure to label it correctly. A small amount of glycerine was applied to the samples to prevent them from drying out.

Laboratory analysis and identification

Identification: The samples were subsequently identified and analysed in a laboratory setting. Zooplankton were identified by examining them with compound and stereo microscopes. Edmondson (1959), Tonapi (1980), Michael and Sharma (1988), Pennak (1989), Dhanapati (2000), and Segers (2007) were among the sources used to identify specimens using conventional taxonomic keys.

Counting: A counting apparatus, namely a Sedgewick Rafter cell, was used to tally the zooplankton. A 50 mm x 20 mm x 10 mm cell holds 1 ml of liquid. A micropipette or Pasteur pipette transmitted one millilitre of material to the slide. The cover slip for the Sedgwick rafters was stored in the cell.

DATA ANALYSIS

Analyzed the physicochemical characteristics, zooplankton fauna variety of Betwa river.

Over the course of two years, researchers analysed the physicochemical characteristics, zooplankton fauna variety, and significance of the kolar dam and Betwa river. All of kolar dam's physicochemical characteristics were found to be within the range of acceptable values set by the relevant regulatory bodies. No pollution has been detected in the water that flows through the Kolar River, making it safe to drink.

Over the course of the two-year investigation, 34 different species of zooplankton were identified. Compared to the kolar dam, the research found that the Betwa river had a more diverse community of zooplankton. This can be because to favourable environmental factors, stable habitats, and food availability. The samples that were taken included all four categories of zooplankton. There were 19 species belonging to the phylum Rotifera, and 9 species to the microcrustacean group Cladocera. Also observed were a small number of copepod species. Because they are a benthic group, ostracods were under-represented.

Table 1. Number of varied species

Year/Group	Rotifera	Cladocera	Copepoda	Ostracoda
2016-17	14	4	2	2
2017-18	15	4	4	2

Table 2: Zooplankton diversity- kolar dam

Year/Group	Rotifera	Cladocera	Copepoda	Ostracoda
2016-17	19	9	4	2
2017-18	17	8	4	2

Table 3: Zooplankton diversity- Betwa river

Number of species present every month, broken down by year and location

Month	Kolar dam		betwa river	
	2016-17	2017-18	2016-17	2017-18
August	15	22	15	22
September	28	26	28	27
October	25	28	25	28
November	22	24	22	24
December	16	19	15	18
January	21	25	21	25
February	24	28	24	28
March	24	28	25	28
April	20	22	20	22
May	16	18	15	18
June	7	9	6	7

July	7	10	7	8

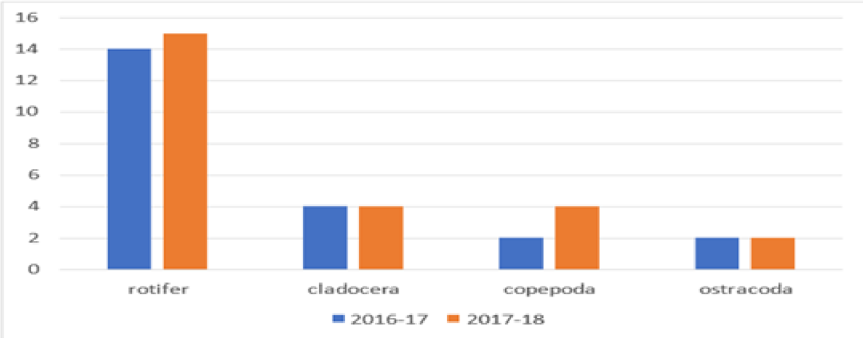

Figure 1 : Diversity of rotifers, Cladocera, copepods, and ostracods species - kolar dam

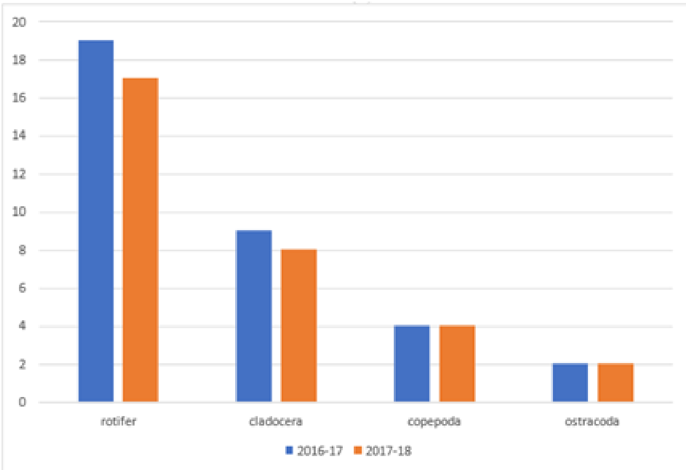

Figure 2: Diversity of rotifers, Cladocera, copepods, and ostracods species .- Betwa river

Physico-Chemical characteristics Of Kolar Dam And Betwa River

Table 4: Monthly temperature fluctuation from 2016–2017.

Months	kolar DAM (TEMP.Oc)				BETWA RIVER (TEMP. Oc)			
	Site 1	Site 2	Site 3	Mean/SD	Station 1 Nayapura:	Station 2 Jhirri:	Station 3: Mandideep	Mean/SD
AUG	22.9	23.2	23.0	23.05 ±0.21	23.4	23.1	23.3	23.27±0.15
SEP	25.0	25.5	26.0	25.50 ±o.50	26.0	26.0	26.2	26.07±0.12

Oct.	26.2	26.3	26.3	26.27 ±0.06	26.4	26.5	26.5	26.47±0.06
Nov.	27.4	27.4	27.4	27.40 ±0.0	27.4	27.7	27.2	27.43±0.25
Dec	24.2	24.4	24.3	24.30 ±0.10	24.3	24.4	24.5	24.40±0.10
Jan	23.4	23.4	23.4	23.40 ±0.0	23.5	23.4	23.5	23.47±0.06
Feb	26.3	26.2	26.4	26.30 ±0.10	26.3	26.5	26.5	26.43±0.12
Mar	27.4	27.3	27.2	27.30 ±0.10	27.3	27.4	27.6	27.43±0.15
APRIL	28.1	28.3	28.2	28.20 ±0.10	28.2	28.4	28.1	28.23±0.15
	28.5	28.6	28.5	28.53 ±0.10	28.2	28.4	28.1	28.23±0.15
Jun	27.2	27.3	27.2	27.23 ±0.06	27.5	27.4	27.6	27.50±0.10
Jul	24.5	24.4	24.6	24.50 ±0.10	24.6	24.7	24.7	24.67±0.06

Table 5 Monthly difference in Temperature from Aug. 2017 to July 2018.

Months	**kolar DAM (TEMP.Oc)**				**BETWA RIVER (TEMP. Oc)**			
	Site 1	**Site 2**	**Site 3**	**Mean/SD**	**Station 1 Nayapura: NAGAR 1**	**Station 2 Jhirri:**	**Station 3: Mandideep 3**	**Mean/SD**
AUG	24.2	24.5	24.4	24.37 ±0.15	24.3	24.4	24.2	24.30 ±0.10
SEP	25.1	25.2	25.0	25.10 ±0.10	25.3	25.4	25.5	25.40 ±0.10
OCT	26.3	26.1	26.4	26.27 ±0.15	26.5	26.6	26.5	26.53 ±0.06
NOV	26.7	26.8	26.8	26.77 ±0.06	27.0	27.1	27.2	27.10 ±0.10
DEC	24.1	24.2	24.2	24.17 ±0.06	24.2	24.3	24.4	24.30 ±0.10
JAN	23.3	23.2	23.5	23.33 ±0.15	23.4	23.5	23.6	23.50 ±0.10

FEB	27.0	27.2	27.0	27.07 ±0.12	27.1	27.0	27.2	27.10 ±0.10
MAR	27.6	27.7	27.6	27.63 ±0.06	27.4	27.7	27.7	27.60 ±0.17
APRIL	28.0	28.1	28.0	28.03 ±0.06	28.0	28.2	28.2	28.13 ±0.12
MAY	30.0	29.0	29.0	29.33 ±0.58	28.0	30.0	31.0	29.67 ±1.53
JUN	27.1	27.2	27.3	27.20 ±0.10	27.4	27.4	27.5	27.43 ±0.06
JUL	24.6	24.5	24.5	24.53 ±0.06	24.6	24.5	24.8	24.63 ±0.15

Temperatures at kolar dam (TEMP. Oc) varied between 23.2 and 30 degrees Celsius in 2017 and 2018 compared to 2016 and 2017. For two years, it fluctuated between 23.2 and 30 degrees Celsius.

In the 2016–17 season, the Betwa River experienced temperatures between 23.1 and 28.4 degrees Celsius, while in the 2017–18 season, the temperature range was 23.4 to 31 degrees Celsius. In the span of two years, it fluctuated between 23.1 and 31.0 degrees Celsius.

DISCUSSION

Temperature, , alkalinity, pH, SO4, PO4, turbidity, and transparency all rose over the summer months at the dam, but DO, Mg, and Cl fell. The growth of rotifer at the dam in the summer happened at the same time. River A well had a little uptick. In both years, the number of Cladocera was highest after the monsoon in Dam. In the dam, the number of copepods peaked after the rain. The dam's ostracod population peaked over the winter and early spring. At the dam, ostracods didn't show up during the summer or monsoon. Tiwari et al. (2004), Jayaraman et al. (2003), and Manickam (2014) all reach similar conclusions. River temperature, biochemical oxygen demand (BOD), dissolved organic carbon (DOC), turbidity, alkalinity, pH, magnesium, and chloride all increased throughout summer, whereas these values decreased. Concurrently, the summer and winter peaks occurred. In 2017, the diversity of rotifers remained unchanged. During the wet season, both the rotifer population and physicochemical characteristics were reduced. Summer and post-monsoon see the river's two cladoceran peaks. Ananthan (1994) states that the pH rises during the summer because photosynthesising organisms consume carbon dioxide. Ahmad et al. (2012) found results that were similar to the pond's TDS. Summertime low DO levels were also observed in Zirpurwadi Lake, Yavatmal, by Shinde (2002). Summer bacteria break down organic waste, which lowers the percentage of dissolved oxygen.

CONCLUSION

A major problem in India is the country's rapidly expanding population. A wealthy land with destitute people is a common theme in India's narratives. We cannot stress enough the interconnected nature of poverty and environmental deterioration. Last but not least, the ecological situation of the Betwa River is reportedly getting worse over time. A significant reduction in the river's ability to self-purify will occur in the absence of constructive measures to enhance it. Therefore, it is now abundantly evident that research combining abiotic characteristics with community investigations are necessary. The overall number of species at both sites during 2016–18 was consistent, however it fluctuated from month to month. All zooplankton species thrived in the summer and after winter, but the monsoon season was disastrous for their development. Every month, the zooplankton richness would shift dramatically. With almost half of the overall zooplankton richness, rotifera were the most species rich category. With 10 species, the Brachionidae family has the most representation among the rotifers, while the Daphniidae had three. The three genera that made up the Brachionidae family also had a plethora of species. Two families of copepods and one family of ostracods were found. Over the course of two years, researchers at both locations examined eighteen distinct water qualities. There was an almost threefold decrease in the values of environmental variables in the dam compared to the river, including BC, BOD, COD, Mg, and TH. Although the pH levels were comparable in the two bodies of water, WTr was greater in Dam.

References

1. Arak, G. V. (2015) Ecobiology of rotifers and copepods around Aurangabad region. PhD Thesis pp 245.
2. Anon. (2003). Protecting Lake Taupo. A Long-Term Strategic Partnership. Environment Waikato, Hamilton
3. Arimoro, F. O. (2006). Culture of the freshwater rotifer, Brachionus calyciflorus, and its application in fish larviculture technology. African Journal of Biotechnology, 5(7), 536-541.
4. Ashok, K. (2014) Studies on Zooplankton Diversity with special reference to Similarity and Dissimilarity Index in glacial fed mountainous Goriganga River of Kumaun Himalaya, Uttarakhand, India. Research Journal of Animal, Veterinary and Fishery Sciences. 2(3), 22-29.
5. Bhatnagar Chhaya., Vinita Sharma., Karnika Jani and Nidhi gill (2007): Plankton and Icthyo-Fauna of Jhamri Dam, Udaipur; Rajasthan. NSL: 236-238.
6. Bogut, I., Adámková, I., Novoselić, D., Bukvić, Ž., Milaković, Z., & Kralik, D. (2000). Influence of lysine on weight gain of carp fry (Cyprinus carpio) in cage and fishpond farming. Czech Journal of Animal Science, 45(4), 179-184.
7. Boxshall, G. A., & Halsey, S. H. (2004). An introduction to copepod diversity. Ray Society.
8. Boxshall, G. A., & Defaye, D. (2007). Global diversity of copepods (Crustacea: Copepoda) in freshwater. Hydrobiologia, 595: 195–207.
9. Charjan A. P., D. S. Dabhade & R. A. Malu, (2001) Population trends of rotifers in Washim District, Maharashtra. Souvenir of Nat. Conf. on Fish and Fisheries: challenges in the millennium, at P. G. College of science, Osmania University, Hyderabad, Abstract No. 66. pp. 14-15.
10. Chilmawati, D., Hutabarat, J., Anggoro, S., & Suminto, S. (2020). Effects of Aeration Flow Rate in the Culture Medium on the Growth Performance and Egg Production of Copepod Oithona similis Fed with Fermented Organic Diet. In E3S Web of Conferences, 147: 01006.

11. Dhere, R. M., & Gaikwad, J. M. (2006). Physico-chemical characteristics of Karpara reservoir dist. Parbhani, Maharashtra. Journal of Aquatic Biology, 21(2), 86-88.

12. Dhert, P., 1996. Rotifers. In: Lavens, P. and Sorgeloos, P. (Eds.), Manual on the Production and Use of Live Food for Aquaculture. FAO Fisheries Technical Paper, vol.361. FAO, Rome, pp. 49– 78.

13. Dodson, S. (1992). Predicting crustacean zooplankton species richness. Limnology and Oceanography, 37(4), 848-856.

14. Dodson, S. L., Cáceres, C. E., & Rogers, D. C. (2010). Cladocera and other Branchiopoda. In Ecology and classification of North American freshwater invertebrates (pp. 773-827). Academic Press.