E-ISSN: 2706-8927
P-ISSN: 2706-8919
www.allstudyjournal.com
IJAAS 2024; 6(1): 25-28
Received: 10-11-2023
Accepted: 16-12-2023

Satyendra Singh Chouhan
Research Scholar, Department of Zoology, Pt. S.N.S. University, Shahdol, Madhya Pradesh, India

Kaushlendra Kumar
Assistance Professor, Department of Zoology, Pt. S.N.S. University, Shahdol, Madhya Pradesh, India

Corresponding Author:
Satyendra Singh Chouhan
Research Scholar, Department of Zoology, Pt. S.N.S. University, Shahdol, Madhya Pradesh, India

Study of physicochemical parameters in reference to zooplankton diversity in Narmada River water district Dindori (M.P.) India

Satyendra Singh Chouhan and Kaushlendra Kumar

DOI: https://doi.org/10.33545/27068919.2024.v6.i1a.1097

Abstract
The current study sought to assess the water quality of the Narmada River in the heavily populated area of Dindori, Madhya Pradesh. Over a period of six months, from January 2023 to June 2023, samples were collected for analysis. These samples underwent testing for various physicochemical parameters, following the established protocol set by APHA (1998) [1]. These parameters encompassed pH, temperature, hardness, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, total dissolved solids, total suspended solids, electrical conductivity, nitrate, phosphate, chloride, carbonate, bicarbonate, and others. The observed values for these parameters were significantly higher than the standard values recommended by different agencies, such as BIS (1991) [2] and WHO (1997) [3], indicating the polluted state of the water. Additionally, a study on zooplankton was conducted using a separate set of samples from the same location, which revealed a low diversity and density of zooplankton, further suggesting the high pollution levels in the river water.

Keywords: Physicochemical parameters, hardness, conductivity, zooplankton diversity

Introductions
Water is a vital resource for the preservation of life and the natural world on our planet (Mishra and Bhatt, 2008) [6]. The presence of water is crucial within ecosystems as it is necessary for the survival of every organism (WHO, 2004) [4]. It plays an essential role in sustaining life and maintaining the balance of our environment (Dikio, 2010) [5]. Furthermore, water serves as a habitat for numerous aquatic creatures. The availability of freshwater resources is of utmost importance for the continuation of human civilization, as our daily activities rely heavily on its presence (Mishra *et al*., 2008) [6]. These bodies of water, which have been created by humans for storage purposes, can be seen as semi-natural ecosystems (Yadav *et al*., 2013) [7]. It is no wonder, then, that human settlements have historically been established in close proximity to these invaluable water resources.
The zooplanktons, small organisms that float in bodies of water, are of great importance to the maintenance of aquatic ecosystems (Murugan *et al*., 1998) [8]. While some of these organisms are microscopic, others are large enough to be seen with the naked eye. Occupying the second trophic level, they play a critical role in various ecosystem functions such as food chains and energy flow (Ramachandra, 2008) [9]. The density and diversity of zooplankton species are influenced by climate change and changes in the physical and chemical characteristics of water bodies (Neves *et al*., 2003) [10]. Furthermore, the diversity of zooplankton species is directly related to the physicochemical characteristics of the aquatic environment (Brraich and Kayr, 2005) [11]. In fact, zooplanktons are often used as bio indicator species to assess the pollution levels in water bodies (Mikschi, 1989) [12].
In recent times, there has been a notable focus on studying the effects of changing water conditions on organisms. The examination of physicochemical parameters provides valuable insights into the quality of water and aids in assessing pollution in aquatic systems. With this in mind, the present investigation aimed to analyze the physicochemical parameters and the diversity of zooplankton species in the river water of Dindori.

Materials and Methods: The Narmada River, previously also known as *Narbada* or anglicised as *Nerbudda*, is the 5th longest river and overall longest west-flowing river in India.

It is also the largest flowing river in the state of Madhya Pradesh. This river flows through the states of Madhya Pradesh and Gujarat in India. It is also known as the "Life Line of Madhya Pradesh and Gujarat" due to its huge contribution to the two states in many ways. The Narmada River rises from the Amarkantak Plateau in Anuppur district Madhya Pradesh. It forms the traditional boundary between North India and South India and flows westwards over a length of 1,312 km (815.2 mi) before draining through the Gulf of Khambhat into the Arabian Sea, 30 km (18.6 mi) west of Bharuch city of Gujarat.

Three different sampling sites were selected near industrial area named as sampling station I, II and III. Water sample were collected on monthly basis regularly from January 2023 to June 2023. Samples were taken in plastic bottles (0.5L and 1L) and brought to laboratory for estimation of physicochemical parameters using APHA standard methods (APHA, 1998) [1]. Plankton collection was done using plankton collecting net.

Results and Discussion

Results of the present study are given in table 1 and table 2 that represent measurement of various physicochemical parameters and occurrence of zooplankton species respectively. These results are discussed below.

Table 1: Showing values of various physicochemical parameters during study period at Narmada river in Dindori district

Parameters	Sampling stations	Jan.2023	Feb.2023	Mar.2023	Apr.2023	May2023	Jun.2023
Temp. (°C)	I	20.2	21.7	30.6	31.3	35.1	37.5
	II	18.1	23.4	27.4	28.7	32.6	37.1
	III	19.8	22.9	26.6	30.2	33.2	36.9
pH	I	8.6	8.4	7.8	8.5	7.7	7.8
	II	7.5	7.2	7.6	7.7	8.3	8.4
	III	8.3	8.1	8.9	8.1	8.5	8.2
Electrical conductivity (µmhos/cm)	I	412	449	421	404	392	351
	II	424	442	431	411	388	362
	III	457	446	427	407	394	358
Dissolved Oxygen (mg/l)	I	0.82	0.85	0.80	0.68	0.56	0.46
	II	0.69	0.78	0.70	0.60	0.48	0.38
	III	0.91	0.81	0.79	0.72	0.53	0.41
TSS (mg/l)	I	144	164	149	140	149	164
	II	148	158	162	146	154	176
	III	142	155	159	141	153	186
Hardness (mg/l)	I	207	225	231	244	247	267
	II	294	257	279	295	32.4	31.9
	III	240	264	286	292	30.6	30.6
COD (mg/l)	I	27.94	29.45	30.47	32.33	47.5	50.42
	II	27.6	28.11	32.25	38.45	42.16	44.14
	III	28.12	28.95	31.55	35.47	39.57	41.62
BOD (mg/l)	I	47.6	51.2	50.5	44.3	41.0	41.5
	II	46.8	47.0	47.9	38.9	30.14	39.6
	III	56.8	42.6	48.2	37.8	32.4	41.6
Chloride Conc. (mg/l)	I	14.45	15.13	14.64	16.21	16.93	17.05
	II	15.93	16.66	16.77	17.22	18.10	18.95
	III	15.01	16.60	16.20	17.01	17.96	18.30
Phosphate concentration (mg/l)	I	0.33	0.38	0.22	0.44	0.50	0.54
	II	0.40	0.42	0.30	0.37	0.48	0.66
	III	0.30	0.60	0.33	0.41	0.55	0.58
Nitrate concentration (mg/l)	I	0.88	0.87	0.92	1.02	1.12	1.46
	II	0.79	0.68	0.81	0.83	1.22	1.26
	III	0.77	0.82	0.78	0.80	1.18	1.32
TDS (mg/l)	I	330.8	324.4	356.5	351.7	365.2	421.5
	II	328.2	326.9	351.2	359.5	374.5	435.2
	III	333.4	329.2	354.7	360.8	368.4	446.8

Table 2: Zooplankton percentage of different groups in different sampling site at Narmada river in Dindori district

Group	Site-1	Site-2	Site-3
Rotifer	44%	47%	40%
Cladocera	35%	32%	36%
Copepod	14.5%	13%	17%
Ostracod	6.5%	8%	7%

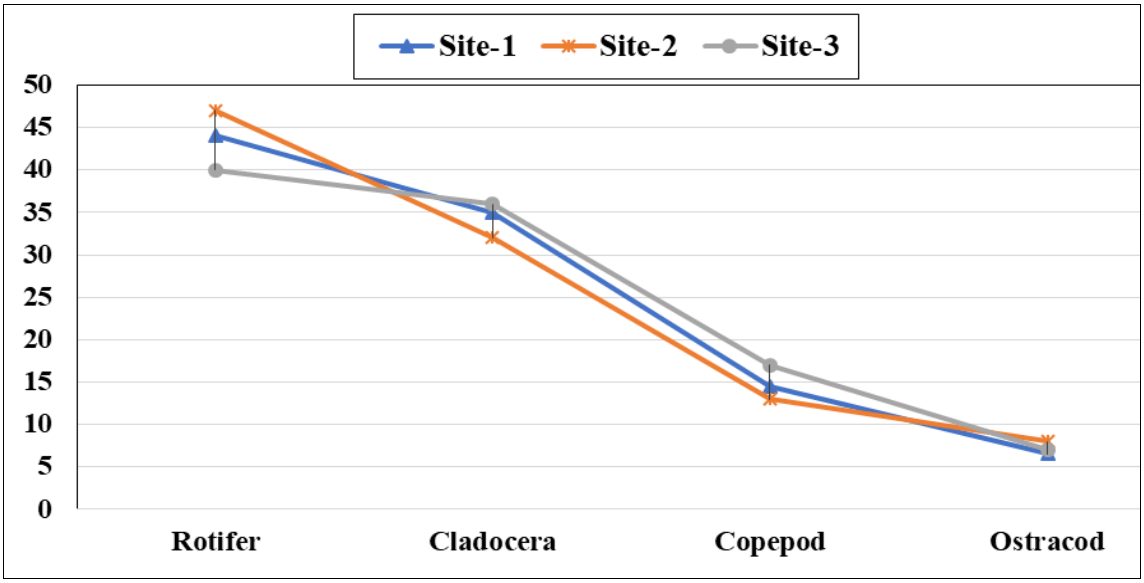

Fig 1: Graph analysis of Zooplankton percentage of different groups in different sampling site at Narmada river in Dindori district

Temperature value in present study shows upward trend from January to June. Desired limit of temperature to sustain life is 28-30 ºC. Minimum value was recorded in January (18.1 ºC) and maximum was observed in June (37.5 ºC). The pH value ranges between 7.2 to 8.9 in water samples which indicates alkaline nature of water mainly due to carbonate and bicarbonate. According to BIS (Bureau of Indian Standard) [1] the permissible limit of pH should be 6.5-8.5. Dissolved Oxygen (DO) value indicated the high pollution level as it was very less than the required amount (2-4mg/L) of oxygen to sustain life (Francis-Floyd 2003) [13]. The total hardness values found in range of 207-334 mg/L. The maximum value was found in May and minimum in January. Maximum recorded value of Biochemical Oxygen Demand (BOD) was 56.8mg/L in month of January and minimum value was 30.14mg/L recorded in month of May. Chemical Oxygen Demand (COD) COD value were found in range of 27.6-50.42 mg/l in which minimum value observed in January and maximum in June. Recorded value of EC (Electrical Conductivity) were ranged from 351 to 457 Ω/cm. The maximum value of conductivity was found in January. Total Solids represents both dissolved solid and suspended form. Total dissolved solids (TDS) in present study water found in between 324.4-446.8 mg/ L. minimum value of TDS was observed in February. Total Suspended Solid (TSS) values were found in range of 140 to 186 mg/L. Phosphate concentration was maximum in June (0.66 mg/L) and minimum was found in March (0.22 mg/L). Nitrate concentration is affected by action of microorganisms. Maximum concentration was found in June (1.46 mg/L) where as minimum was observed in February (0.68mg/L). Chloride concentration value ranged between 14.45-18.95 mg/L. Highest concentration observed in June and the lowest recorded value of chloride was in January.

The diversity and abundance of zooplankton are intricately linked to the physicochemical properties of water, as noted by Poongodi *et al.* (2009) [14]. Throughout the course of the study, meticulous efforts were made to regularly identify and quantify various species of zooplankton. The collected samples revealed the presence of four distinct groups of zooplankton, as outlined in Table 2. Among these groups, rotifers emerged as the most prevalent, while ostracoda were found to be the least populous. Interestingly, it was observed that the highest density of zooplankton occurred during the summer season, specifically in June. This can be attributed to the heightened activity of plankton resulting from the elevated temperatures, as expounded upon by Dhanasekaran *et al.* (2017) [15].

Conclusion

This study demonstrates the exceeding of permissible limits for various physicochemical parameters, thereby indicating the polluted state of the water. The scarcity of plankton diversity and reduced population further signifies the high pollution levels in aquatic environments. Through the analysis of these physicochemical parameters, the assessment of water quality becomes possible, providing valuable information for the implementation of pollution mitigation strategies to prevent the adverse health effects associated with contaminated water. Additionally, the examination of zooplankton species assumes significance as they serve as reliable indicators of pollution.

Acknowledgement

Author are thankful to Head, Department of Zoology, Pt. S.N.S. University Shahdol (M.P.) for providing facility to conduct this research work.

References

1. APHA. Standard methods for examination of water and waste water, American Public health Association, Washington DC; c1998.
2. BIS. Indian Standards for Drinking Water. Bureau of Indian Standards, New Delhi; c1991.
3. WHO. Standards for Drinking Water Quality. World Health Organisation, Geneva; c1997.
4. WHO. Water sanitation and hygiene links to the health facts and fishes Genera, Switzerland. World Health Organization, Geneva, Switzerland; c2004.
5. Dikio ED. Water quality evaluation of Vaal River, Sharpeville and Bedworth lakes in the Vaal Region of South Africa. Research Journal of Applied Sciences, Engineering and Technology. 2010;2(6):574-579.
6. Mishra A, Bhatt V. Physico-Chemical and Microbiological Analysis of under Ground Water in V.V Nagar and Nearby Places of Anand district,

Gujarat, India. Journal of Chemistry. 2008;5(3):487-492.
7. Yadav P, Yadav AK, Khare PK. Physico-Chemical characteristics of a freshwater pond of Orai, U.P., Central India. Journal of Bioscience. 2013;1(2):177-184.
8. Murugan NP, Murugavel, Koderkar MS. Freshwater cladocera, Indian Association of Aqua. Biologists (IAAB). 1998;1:1-47.
9. Ramachandra TV. Spatial Analysis and Characterization of Lentic Ecosystems: A Case Study of Varthur Lake, Bangalore. International Journal of Ecology and Development. 2008;9:(W08):39-56.
10. Neves IF, Recha O, Roche KF, Pinto AA. Zooplankton community structure of two marginal lakes of the river Cuiaba (Mato Grosso, Brazil) with analysis of Rotifera and Cladocera diversity, Brazilian Journal of Biology. 2003;63:1-20.
11. Brraich OS, Kayr R. Phytoplankton community structure and species density of Nangal wetland, Punjab, India. International research Journal of Biological Sciences. 2005;4(3):76-83.
12. Mikschi E. Rotifer distribution in relation to temperature and oxygen content. Hydrobiol. 1989;186(1):209-214.
13. Francis-Floyd R. Dissolved Oxygen for Fish Production. Fact Sheet FA 27. Florida: Department of Fisheries and Aquaculture, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida; c2003.
14. Poongodi R, Bhavan PS, Vijayan P, Kannan S, Karpagam S. Population of zooplankton in relation to physico-chemical parameters of a seasonal pond. Research in Environment and Life Sciences. 2009;2:105-110.
15. Dhanasekaran M, Bhavan SP, Manickam N, Kalpana R. Physico-chemical characteristics and zooplankton diversity in a perennial lake at Dharmapuri (Tamil Nadu, India). Journal of Enomology and Zoology Studies. 2017;5(1):285-292.