International Advance Journal of Engineering, Science and Management (IAJESM)
ISSN -2393-8048, January-June 2022, Submitted in June 2022, iajesm2014@gmail.com

Exploring the Relationships between Population Factors and Selected Physico-Chemical Parameters in the Manjira River

Raosaheb Rameshrao Pawar, Research Scholar, Department of Zoology, OPJS University, Rajasthan
Dr. Ravindra Pal Singh, Associate Professor, Department of Zoology, OPJS University, Rajasthan

Abstract

A tributary of the Godavari, also called Godavari, is the Manjeera (or Manjara). It passes across Telangana, Karnataka, and Maharashtra states. It rises at an elevation of 823 meters in the Ahmednagar district, above the Balaghat range of hills, and flows southeast to meet the Godavari River. From October through March, surface water samples were collected at five different locations on a regular basis. Indicators that are physicochemical and biological were examined. Along with the existence of 22 distinct plankton species (both phytoplankton and zooplankton), there were variations in the physico-chemical parameters. It was found that rotifer species like Lecane curvicornis, protozoan species like Centropyxis spinosa, Arcella discoides, and Euglypha acanthaphora, and cyclopoid nauplii dominated.

Keywords: Zooplankton, Physico-Chemical, Phytoplankton, Manjira River.

1. INTRODUCTION

Primary producers, which account for around half of the world's primary production, are crucial to marine food webs and the biogeochemical cycling of aquatic environments. The distribution of environmental factors has a substantial impact on the amount and composition of phytoplankton. The growth of phytoplankton is often restricted by one or more environmental conditions, as has been extensively established in previous study. Scientists are actively studying the long-term impacts of human activity and global warming on the marine environment, and they are using the phytoplankton population as an indicator. These many bodies of water have complex, changeable environmental influences that vary across time and space. The main producers in the aquatic environment are phytoplankton. They are regarded as autotrophic members of the plankton community and are an essential component of freshwater, marine, and estuarine ecosystems. In terms of ecology, both species are equally significant. They may be the source of most aquatic food webs. Consequently, throughout the larger part of the last 200 years, there has been scholarly interest in these fields.

2. LITERATURE REVIEW

Y. Seeta et.al (2020) Studies have been conducted on the diverse algal populations and good water quality of the Krishna, Godavari, and Manjira rivers. Water quality study was conducted for two years, from March 2017 to February 2019. Water samples were analyzed in order to determine certain physicochemical parameters. Simultaneous testing and collection of benthic algae were conducted. The physicochemical and biological characteristics of the water were used to assess the quality of the river water. The limits permitted by ISI and other international water quality standards for average physicochemical properties are considerably within reach. The most prevalent kind of algae in all three rivers was diatoms. Most of the algae are thought to be good indicators of pollution, indicating that the water is not too dirty.

Khaire B. S. (2020) This study looks at the variations in the zooplankton population at Chandani Dam in the Osmanabad region of Maharashtra between June 2018 and May 2019, as well as the connections between those variations and certain physical and chemical characteristics. A number of water quality indicators have been examined, such as specific conductance, temperature, alkalinity, hardness, carbon dioxide, total dissolved solids, pH, clarity, and more. A multitude of physical and chemical factors control the diversity and population dynamics of zooplankton. The amount of zooplankton fluctuates in response to changing chemical and physical environments. Twenty distinct zooplankton genera were found to be distributed throughout the four classes Copepoda, Ostracoda, Cladocera, and Rotifera. The greatest densities of zooplankton were seen in December and January. The results of this study showed that the abundance of zooplankton was negatively correlated with water temperature, total dissolved solids (TDS), pH, chlorides, and alkalinity, and positively correlated with parameters such as dissolved oxygen (DO), oxidation reduction potential (COR 2), transparency, and conductivity.

Narasimman Manickam et.al (2018) The richness of zooplankton may be used as an ecological indicator of the aquatic environment because of their sensitivity to environmental changes. The

study examined the seasonal variations in the zooplankton population of Ukkadam Lake, which is situated at 10 degrees north latitude and 76 degrees east longitude, close to Coimbatore, Tamil Nadu, India. From late 2011 to late 2012, seasonal variations in the diversity of zooplankton species were investigated. Over the course of this observation, 28 distinct zooplankton species were seen, including 9 Rotifera species, 9 Cladocera species, 5 Copepoda species, and 5 Ostracoda species. According to the present research, Ostracoda (7%), Copepoda (29%), Cladocera (29%), and Rotifera (35%), accounted for the total abundance. Measurements of the population densities of several zooplankton species showed a distinct pecking order. Rotifera > Copepoda > Cladocera > Ostracoda is the sequence. The seasons with the greatest and lowest population densities were summer and the start of monsoon, respectively. Ukkadam Lake's summertime zooplankton population may be higher due to the lake's abrupt warming. The present study's findings indicate that increased summertime temperatures in Ukkadam Lake increased the amount of zooplankton that was produced. This result implies that the species composition of zooplankton is influenced by temperature. Thus, the increase in temperature linked to global warming may have an impact on zooplankton production. Assessments of zooplankton biodiversity may be used to monitor the future richness (fishery productivity) and health (water quality) of this lake system.

Mona Hamed Ahmed et.al (2017) Between December 2015 and November 2016, this study was carried out at the Nozha hydrodrome in Alexandria to assess the impact of physico-chemical variables on the diversity and structure of zooplankton communities. It was discovered that there were considerable monthly variations in a number of physical and chemical parameters, including water temperature, pH, dissolved oxygen, total alkalinity, total hardness, nitrite, nitrate, total nitrogen, orthophosphate, and total phosphorus. There were discovered fifteen distinct genera belonging to four distinct groups of zooplankton. With 82.59 percent of all zooplankton belonging to the Rotifera taxonomic family, it was the most abundant. Then came the Cladocera (3.88 percent), the Ostracoda (1.22 percent), and the Copepoda (12.33 percent). The highest zooplankton density was recorded in January (mean: 2504.5 org/l), while the lowest was recorded in July (mean: 44.25 org/l). Water temperature, total alkalinity, total hardness, ammonia, nitrite, nitrate, and total nitrogen were shown to be the most significant water parameters influencing the composition and dispersion of zooplankton. A low Shannon diversity index value, high values for many water parameters, and the preponderance of pollution-tolerant zooplankton indicate that hydrodrome suffers from organic pollution.

3. METHODS

Study Area

Bassein creek, Manori creek, Versova creek, Mahim creek, Vashi creek, and Dharamtar creek are major influxes of domestic wastes and industrial effluents (from fertilizers, automobile, petroleum, leather, food, chemical, and nuclear industries) into the coastal waters of the highly urbanized and industrialized metropolis of Maharastra. Domestic and industrial effluents, including fish discards and fish-related wastes from fish landing hubs, are brought to the coastal town of Ratnagiri (CSIR-NIO, 2018). Waters from Kalbadevi Creek and Bhatye Creek make up the bulk of the inflow to the Manjira River's shore. Off the coastlines of Mumbai and Ratnagiri, sampling stations were set up in two depth zones (20 m and 40 m). Mumbai- Station I (these coordinates) is where we'll be taking samples (at 20 m depth contour) Station II, 18° 5149.2″ N 72° 4131.1″ E (at 40 m depth contour) Ratnagiri: Station I (at 20 m depth contour) 17° 03' 26.3"N 73° 12' 43.3"E, Station II (at 40 m depth contour) 17° 03' 59.7"N 73° 06' 48.7"E; 18° 55' 38.9" N 72° 32' 36.9" E. This river's catchment area is 914.98 ha, and its length is 3,018 m, so it's clear that it gets its water from somewhere. It is used for irrigation and also gets several anthropogenic inputs from the nearby enterprises. To make matters worse, the people also used the lake for domestic purposes, leading to the current situation in which the lake is threatened by flooding owing to encroachment.

For the purpose of physical and chemical examination, surface water samples were collected in a polypropylene container that had been previously cleaned. Dissolved oxygen was measured in the field by putting samples in 250 ml BOD bottles and fixing them with manganese sulfate and alkaline iodide.

Physico-Chemical Parameters

Water samples from the Lake's designated places were taken at regular intervals by researchers and stored in pristine one-liter plastic bottles for further analysis. Water quality variables that were evaluated included pH, free CO2, clarity, alkalinity (carbonate and bicarbonate), and dissolved oxygen. A digital pH meter (HANNA-pHep) was used to test the hydrogen ion concentration (pH), and a standard Secchi disk (20 cm in diameter) was used to assess the total dissolved solids (TDS). The findings were reported in milligrams per liter (mg/l) or parts per million (ppm). Nonetheless, samples were sent to the lab in 500 ml vials so that COD, BOD, sulphate, phosphates, and nitrate could be examined in less than a day. These physical and chemical properties were investigated using the Standard Method. Up until now, the samples had been kept in the refrigerator.

Phytoplankton

Four locations were randomly chosen for sample collection. Microscopical examination and reference materials from the scientific literature were used to positively identify phytoplankton. Lucky's drop technique was used for the quantitative assessment of phytoplankton. The mean was derived by averaging the results of three separate counts. Finally, the mean data from each location were used to get the overall count per liter. The invertebrate microscope and Ward and Whipple's freshwater plankton keys were used for the identification and count.

Zooplankton

Once a month, a nylon plankton net (200 meshes/cm) was used to capture samples of plankton. When filtering 50 liters of water through the net, we collected enough plankton for qualitative and quantitative examination, which we then stored in 4% formalin with a minor quantity of glycerin in 100 ml plastic bottels. It was possible to study certain live samples outside of a lab setting. The taxonomic identification of the rotifers was seen using a key and monographs, and was then validated with the kind assistance of specialists from the Zoological Survey of India (Western Regional Station, Pune, Maharashtra). The Sedgwick-Rafter cell technique was used for the quantitative examination of planktons, per liter.

4. RESULT AND DISCUSSION

It is well known that aquatic life depends critically on the physicochemical characteristics of water. There were four different places where various physicochemical parameters were examined, such as pH, dissolved oxygen, free carbon dioxide, electrical conductance, total dissolved solids, total alkalinity, sulfates, phosphates, nitrates, chemical oxygen demand, and biological oxygen demand. The water's pH remained somewhat alkaline (7.5), despite the low average values for electrical conductivity (0.3523), total dissolved solids (230.5 mg/l), total hardness (172.25 mg/l), and total alkalinity (202.15 mg/l). The average content of phosphate was 2.59 mg/l, while the average concentration of nitrate was 3.10 mg/l. 5.65 mg/l was the average dissolved oxygen content. In light of this, we concur with Chavhan and Lankar's (2010) conclusion. We examined the physicochemical characteristics of free CO2, sulfates, phosphates, nitrates, chemical oxygen demand, and biological oxygen demand from these four sites. Site A reported the lowest free CO2 levels (2.40 mg/L) during the monsoon, whereas Site D had the highest values (7.31 mg/L) during the summer. During the winter, site A had the lowest sulfate concentration (5.2 g/L), whereas during the monsoon, site C had the highest (13.45 g/L). During the monsoon, sites C and D had the greatest phosphate concentrations, measuring 0.33 and 0.27 mg/L, respectively. During the winter, the concentration of dissolved organic matter at site A drops to 0.031 mg/L. Site C had the highest nitrate concentrations (1.21 mg/L) during the monsoon, whereas site A had the lowest amounts (0.25 mg/L) at the height of summer. Site A recorded the lowest BOD in the winter, 1.35 mg/L, whereas Site C recorded the highest BOD in the summer, 6.25 mg/L. In the summer, site A had the lowest COD content (3.43 mg/L), whereas site C had the highest concentration (9.52 mg/L) in the winter. The impact of many physicochemical parameters on phytoplankton diversity were studied. According to the present research, 42 out of 58 species of phytoplankton belong to the groups Chlorophyceae, Bacillariophyceae, and Cyanophyceae.

Because of their heterotrophic nature, zooplankton are used as bioindicators and are essential to the aquatic environment's organic matter cycle. Among the zooplankton were Cladocera,

Ostrocoda, Copepoda, and Rotifera. As worries about the impact of human pollution on the aquatic environment mount, so does the need to monitor surface waters and the animals that live there. Recent studies may provide further proof of river eutrophication. It is best to prevent further eutrophication in this sensitive ecosystem. The rotifera group had lower Sorenson index (48.1%) and Jaccard index (31.87%) values than the ostracoda group (S=85.7% and CJ=75.%). When the pH of the surface water was monitored during the duration of the study period, it showed no color or odor and stayed within the typical range of 7.46 conc. to 7.85 conc. At the surface of the sea, temperature measurements varied from 26 to 33 degrees Celsius. Turbidity levels ranged from 0.1 NTU to 9.6 NTU, as observed. The concentration reached its maximum in December and its minimum in January. The range of the dissolved oxygen content was 1.0–1.1 mg/L. The salinity in January seldom varied from 0.1 to 1.2 parts per thousand. Nitrate levels were 2 mg/L in January and increased to 7.42 mg/L by October. Phosphate levels showed very little variation as well, with measurements ranging from 0.012 to 1.12 mg/L. October (10.94 mg/L) and December (1.76 mg/L) witnessed significant fluctuations in the silicate value, both of which were outside of the typical range (Figure 1).

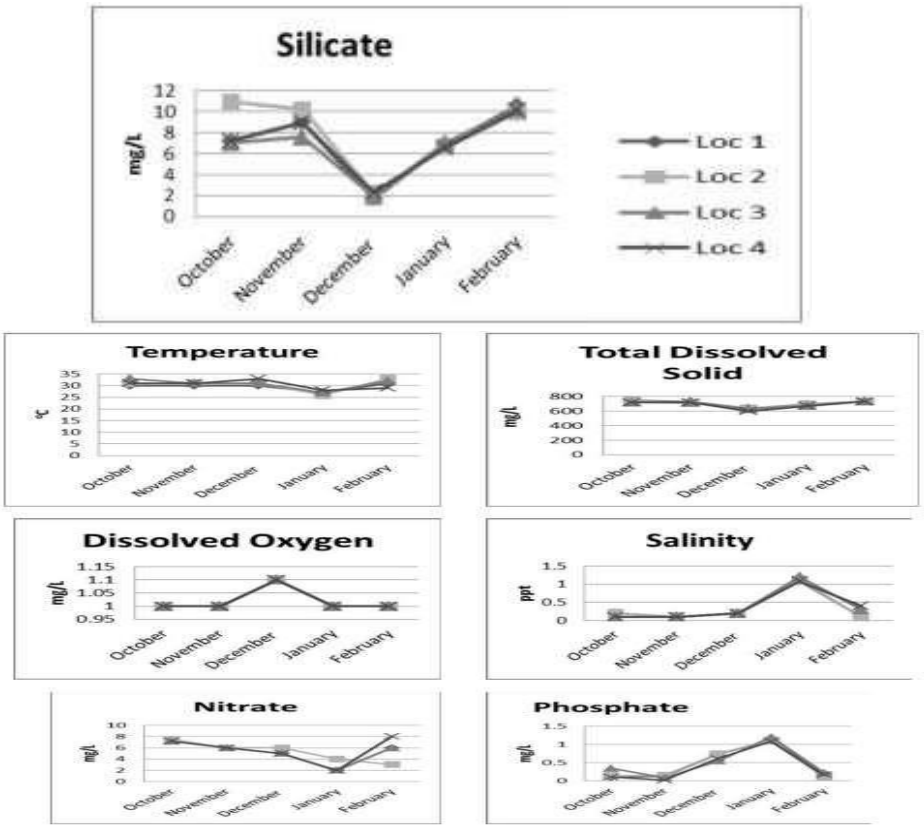

Figure 1. Physico-chemical parameters of Manjira River during the study period.

During the research period, 22 different types of plankton were isolated from the samples (Table 1). During the course of the investigation, five different types of phytoplankton were detected. Protozoa, rotifers, copepods, Cladocera's, and ostracods were identified and classified among the zooplankton (Figure 2). Eight different species of protozoa, including Arcella discoides and Centropyxis spinosa, were detected throughout the research period. The most numerous species were Centropyxis spinosa (1,350 ind/ m3) in December, followed by Arcella discoides and Euglypha acanthophora (1,200 ind/ m3) in November. Six different rotifer an species contributed to the group's total, with the most common being Lecane curvicornis and the least common being Filinia longiseta and Polyarthra vulgaris in February. Mesocyclops hyalinus, a species of copepod, was found widely distributed. In the same vein, cyclopoid nauplii of copepoda were discovered to be widespread and numerous (1800 ind/m3) in the month of March. Two species of animals, Chydorus sphaericus from the cladocera and Cypris subglobosa from the ostracoda, were seen during the research. From January through March, clams and ostracods were the most numerous species. In addition to the plankton, a few water insects, mosquito larvae, and mites

were seen.

Table 1. List of species occurrence encountered from Manjira River

S. No.	SPECIES ENCOUNTERED	Oct	Nov	Dec	Jan	Feb	Mar
	PHYTOPLANKTON						
1.	*Oscillatoria subbrevis* Schmidle	+	+	-	+	+	+
2.	*Pediastrum duplex* Meyen 1929	+	-	+	+	+	+
3.	*Spirogyra* sp.	+	+	+	+	+	+
4.	*Navicula rhynchocephala* Kutzing 1844	+	+	+	+	+	+
5.	*Microcystis aeruginosa* Kutzing 1846	-	+	-	-	-	-
	ZOOPLANKTON						
	Protozoa						
6	*Arcella discoides* Ehrenberg, 1843	+	+	+	+	+	+
7	*Arcella vulgaris* Ehrenberg, 1830 (Ehrenberg, 1832)	-	+	+	+	+	-
8	*Arcella hemispherica* Perty, 1809	-	+	-	-	-	+
9	*Centropyxis spinosa* (Cash & Hopkinson, 1905) Deflandre, 1929	+	+	+	+	+	-
10	*Centropyxis aculeata* (Ehrenberg, 1832) Stein, 1857	-	+	-	+	+	+
11	*Trigonopyxis arcula* (Leidy, 1879) Penard, 1912	-	+	+	-	-	-
12	*Euglypha acanthaphora* (Ehrenberg, 1842) Perty,1849	+	+	+	+	-	-
13	*Assulina muscorum* Greef 1888	-	+	+	-	-	-
	Rotifera						
14	*Brachionus falcatus* Zacharias 1898	+	-	-	+	+	+
15	*Brachionus calyciflorus f. dorcas* (Gosse 1851)	+	-	-	+	-	-
16	*Brachionus angularis* Gosse, 1851	+	-	-	-	+	-
17	*Lecane curvicornis* (Murray, 1913)	+	+	+	-	-	+
18	*Polyarthra vulgaris* Carlin, 1943					+	
19	*Filinia longiseta* (Ehrenberg, 1834)					+	
	Copepoda						
20	*Mesocyclops hyalinus* (Rehberg, 1880) female	+	+	+	+	+	+
21	*Mesocyclops hyalinus*(Rehberg, 1880) male		+				
22	Cyclopoid copepodite	+	+		+	+	+
23	Cyclopoid nauplii	+	+	+	+	+	+
	Cladocera						
24	*Chydorus sphaericus*(Muller, 1776)	-	-	+	-	+	-
25	Ostracoda	-	-	-	-	-	-
26	*Cypris subglobosa* Sowerby, 1840	-	-	-	-	+	-
27	Miscellaneous - Aquatic insects	+	+	+	-	+	-
28	Mites	+	+	-	+	+	+
29	Mosquito larvae	-	+	-	+	+	-

5. CONCLUSION

Over the last 10 years, biodiversity has decreased as a result of excessive use of natural resources and environmental human activities. However, the decline in biodiversity and the changes in ecosystem services have had a detrimental effect on people's well-being. Limnologists are interested in the diversity of plankton (species) found in the Manjira River. The aquatic zooplankton and water quality are both enhanced by this pilot study on river pasteurization, which is beneficial to the food web and increases the production of fish and crustaceans. To appropriately protect the River as a significant aquatic system in the Tributary in Maharashtra, further in-depth study of the aquatic fauna and ecological traits is required.

REFERENCES

1. Narasimman Manickam et.al **"**Impact of seasonal changes in zooplankton biodiversity in Ukkadam Lake, Coimbatore, Tamil Nadu, India, and potential future implications of climate change" Manickam et al. The Journal of Basic and Applied Zoology (2018) 79:15 https://doi.org/10.1186/s41936-018-0029-3
2. Mona Hamed Ahmed et.al "Impact of physico-chemical parameters on composition and diversity of zooplankton community in Nozha hydrodrome, Alexandria, Egypt" Egyptian

Journal of Aquatic Biology & Fisheries Zoology Department, Faculty of Science, Ain Shams University, Cairo, Egypt. ISSN: 1110 - 6131 Vol. 21(1): 49- 62 (2017)

3. Manickam N, Bhavan PS, Santhanam P (2017) Seasonal Variations in Species Composition and Community Structure of Zooplankton in A Two Perennial Lakes of Coimbatore, Tamil Nadu, Southern India. J Aquat Res Mar Sci 2017: 1-12. doi: https://doi.org/10.29199/ARMS.101013
4. Khaire B. S. **"**Correlations of Zooplankton Population with Some Physico-chemical Parameters of Chandani Dam, Maharashtra (India)." IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 7 Issue 11, November 2020
5. Y. Seeta et.al "ALGAL DIVERSITY AND WATER QUALITY IN THE RIVERS OF TELANGANA"

International Journal of Recent Scientific Research Vol. 11, Issue, 03 (A), pp. 37702-37704, March, 2020

6. Hosmani, S.P., Vanasanthakumar, L. and Partha, S. 1999. Ecological significance of biochemical parameters in certain fish water lakes of Mysore. Journal of Environmental Biology, 20(2): 121-124.
7. Moreno-Ostos, E., Cruz-Pizarro, L., Basanta, A., Glen, G.D.(2008). The spatial statistical techniques for the evaluation of spatial and temporal variation in waterquality of Mahanadi river-estuarine system (India) a case study. Environmental Geochemistry and Health 28: pp317-330.
8. Nabila R. Hussein ,(2012). Studies on spatio-temporal dynamics of phytoplankton Report. World Health Organization/United Nations Children's Fund, New York Sagar. pp. 1-166.
9. Shashi Shekhar, T.R., B.R. Kiran, E.T. Puttaiah, Y. Shivaraj and K.M. Mahadevan, (2008). Phytoplankton as index of water quality with reference to industrial pollution. J. Environ. Biol., 29, 233- 236.
10. Sugunan, V.V. (1995). Reservoir fisheries in India. FAO Fisheries Technical Paper No. 345. Rome, FAO. 423 pp.
11. Ying Oxyang, (2005). Evaluation of water quality monitoring stations by principal component analysis. Water Research, 39: 2621- 2635.
12. American Public Health Association (APHA), Standard methods for the examination of water and wastewater, American Public Health Asso. Soc. Pub., Washington D.C., 1998.
13. R. Santhanan, P. Velayutham, G. Jegatheesan, In: A Manual of Freshwater Ecology: An aspect of fishery environment (Daya Publishing House, India, 1989) 63-76.
14. V.B. Sakhare, Reservoir Fisheries and Limnology, Narendra Publishing House, New Delhi, India, 2007.
15. S.K. Battish, Freshwater Zooplankton of India, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, India, 1992.