Correlations of Population with Some Physico-Chemical Parameters of a Manjira River, Maharashtra (India)

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Abstract

The Manjeera (or Manjara) is a tributary of the Godavari (also written Godavari). It traverses the states of Maharashtra, Karnataka, and Telangana. It rises at 823 meters above the Balaghat range of hills in the Ahmednagar district and flows southeast to join the Godavari River. Water samples were taken from the surface at five distinct places at regular intervals from October to March. Biological and physicochemical indicators were studied. Variations in physico-chemical parameters and the presence of 22 different plankton species (both phytoplankton and zooplankton) were also observed. Protozoan species such as Centropyxis spinosa, Arcella discoides, and Euglypha acanthaphora; rotifer species such as Lecane curvicornis; and cyclopoid nauplii were discovered to predominate.

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

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1. INTRODUCTION

Primary producers such as phytoplankton are essential to marine food webs and the biogeochemical cycling of aquatic environments, contributing around half of the world's primary output. The composition and quantity of phytoplankton are profoundly affected by the dispersion of environmental variables. It is widely documented from prior research that one or more environmental variables frequently restrict the development of phytoplankton. The long-term effects of global warming and human influences on the marine environment are an active area of study, and scientists are turning to the phytoplankton population as an indicator. The environmental effects of these numerous water bodies are both temporally and geographically variable and complicated. Phytoplankton are the aquatic ecosystem's primary producers. They are an integral element of the marine, estuarine, and freshwater ecosystems and are considered autotrophic members of the plankton community. Ecologically, these species are just as important. The majority of aquatic food webs may be traced back to them. As a result, academic interest in these areas has persisted for the better part of the previous two centuries.

2. LITERATURE REVIEW

Y. Seeta et.al (2020) Krishna, Godavari, and Manjira rivers have been studied for their varying algal communities and high-water quality. Two years of research on water quality have been completed (March 2017 to February 2019). Some physicochemical properties were measured by analyzing water samples. Benthic algae were collected and tested at the same time. The evaluation of river water quality was based on the physicochemical and biological features of the water. Average physicochemical characteristics are well within the ranges allowed by ISI and other international water quality standards. Diatoms were the most common kind of algae in all three rivers. The majority of the algae seen are considered to be excellent pollution indicators, suggesting that the water is rather clean.

Khaire B. S. (2020) This report investigates the zooplankton population fluctuations at Chandani Dam in Maharashtra's Osmanabad district from June 2018 to May 2019, as well as the relationships between those fluctuations and certain physical and chemical parameters. Some of the water quality indicators that have been looked at include: temperature, transparency, specific conductance, pH, total dissolved solids, dissolved oxygen, carbon dioxide, alkalinity, hardness, chlorides, and more. Numerous physicochemical parameters regulate the variety and population dynamics of zooplankton. Zooplankton numbers rise and fall as a function of changing physical and chemical conditions. Twenty different genera of zooplankton were identified, spread throughout four different classes: Rotifera, Cladocera, Copepoda, and Ostracoda. December and January had the highest zooplankton concentrations. In this study, we found that zooplankton abundance was positively correlated with parameters like dissolved oxygen (DO), oxidation reduction potential (COR 2), transparency, and conductivity, and negatively correlated with water temperature, total dissolved solids (TDS), pH, chlorides, and alkalinity.

Narasimman Manickam et.al (2018) Due to their responsiveness to environmental changes, zooplankton biodiversity may be used as an ecological indicator of the aquatic environment. This research looked at how different seasons affected the zooplankton population in Ukkadam Lake, which is located near Coimbatore, Tamil Nadu, India (at 10 degrees north latitude and 76 degrees east longitude). Seasonal changes in the variety of zooplankton species were examined from late 2011 through late 2012. There were a total of 28 different zooplankton species seen during this time, including 9 different Rotifera species, 9 different Cladocera species, 5 different Copepoda species, and 5 different Ostracoda species. The current study indicated that Rotifera accounted for 35% of the overall abundance, followed by Cladocera (29%), Copepoda (29%), and Ostracoda (7%). Population densities of several types of zooplankton were measured, and the results revealed a clear pecking order. The order is: Rotifera > Copepoda > Cladocera > Ostracoda. Summer and the beginning of the monsoon season had the highest and lowest population densities, respectively. Summertime's larger zooplankton population in Ukkadam Lake may be a result of the lake's sudden warming. According to the results of the current research, higher summer temperatures in Ukkadam Lake led to greater zooplankton production. This finding suggests that temperature has a role in shaping zooplankton species composition. Therefore, the generation of zooplankton may be affected by the rise in temperature associated with global warming. The future health (water quality) and richness (fishery production) of this lake system may be tracked via assessments of zooplankton biodiversity.

Mona Hamed Ahmed et.al (2017) This research was conducted in Nozha hydro drome, Alexandria, between December 2015 and November 2016 to evaluate the effect of physico-chemical factors on zooplankton community structure and diversity. Physical and chemical parameters such as water temperature, pH, dissolved oxygen, total alkalinity, total hardness, nitrite, nitrate, total nitrogen, orthophosphate, and total phosphorus were found to fluctuate significantly from one month to the next. Fifteen separate genera from four different classes of zooplankton were found. The Rotifera taxonomic family was the most numerous, accounting for 82.59 percent of all zooplankton. This was followed by the Copepoda (12.33 percent), Cladocera (3.88 percent), and the Ostracoda (1.22 percent). January had the greatest zooplankton density (mean: 2504.5 org/ l), while July saw the lowest (mean: 44.25 org/ l). According to the findings, water temperature, total alkalinity, total hardness, ammonia, nitrite, nitrate, and total nitrogen were the most influential water factors on zooplankton composition and dispersion. Hydro drome suffers from organic pollution as shown by a low Shannon diversity index value, high values for several water parameters, and the predominance of pollution-tolerant zooplankton.

Narasimman Manickam et.al (2017) This study was conducted in two lakes near Coimbatore, in the southern Indian state of Tamil Nadu: Sulur and Ukkadam. From March 2012 to February 2014, at monthly intervals representing each of the four seasons (summer, pre-monsoon, monsoon, and post-monsoon), the species composition and diversity of zooplankton were analyzed to determine their seasonal fluctuations. Sulur lake had a total of 29 zooplankton species, including 11 Rotifera, 10 Cladocera, 7 Copepoda, and 6 Ostracoda; Ukkadam lake had 28 zooplankton species, including 10 Rotifera, 8 Cladocera, 6 Copepoda, and 4 Ostracoda. Among the zooplankton in Sulur Lake, Rotifera accounted for 34%, followed by Cladocera (31%), Copepoda (25%), and Ostracoda (10%). In Ukkadam Lake, Rotifera accounted for 35%, followed by Cladocera (30%), Copepoda (27%), and Ostracoda (8%). The zooplankton population density in Ukkadam Lake was 89,385 ind./L, whereas in Sulur Lake it varied from 51,895 to 1,07,505 ind./L. The zooplankton population in the lakes of Sulur and Ukkadam was found to be highest in the summer months (March to May-2013), lowest in the monsoon months (September to November-2012), and intermediate in the post-monsoon season. This finding indicated that zooplankton productivity was rather high. Therefore, if adequate water quality management techniques are used in the lakes environment, it might be continually used for the inland aquaculture objectives. Therefore, public and governmental entities should implement frequent monitoring of water quality, effective maintenance, and lake management strategies to preserve these ecosystems for future generations.

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

At regular intervals throughout, researchers gathered water samples from the Lake's predetermined locations in clean one-liter plastic bottles to analyze later. pH, free CO2, transparency, alkalinity (Carbonate and bicarbonate), and dissolved oxygen were some of the water quality metrics that were assessed. The hydrogen ion concentration (pH) was measured using a digital pH meter (HANNA-pHep), the total dissolved solids (TDS) were measured using a standard Secchi disc (20 cm in diameter), and the results were reported in parts per million (ppm) or milligrams per liter (mg/l). However, 500-ml vials were used to transport samples to the lab for analysis of COD, BOD, sulphate, phosphates, and nitrate within 24 hours. The Standard Method was used to examine these physicochemical characteristics. The samples had been stored in the fridge up to this point.

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

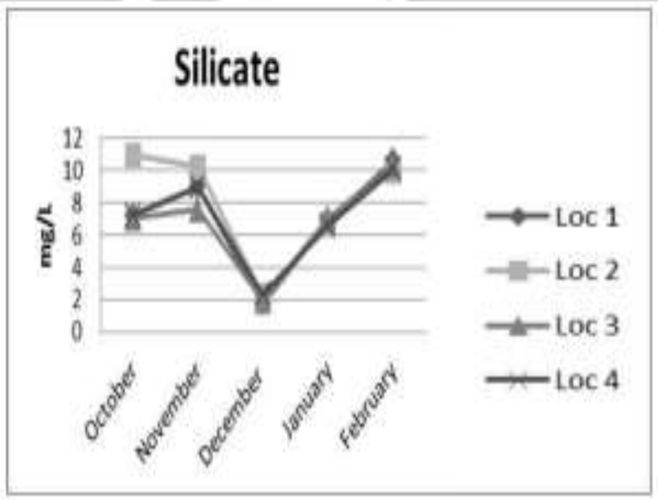
Once a month, a nylon plankton net (200 meshes/cm) was used to capture samples of plankton. When filtering 50 liters of water through the net, we collected enough plankton for qualitative and quantitative examination, which we then stored in 4% formalin with a minor quantity of glycerin in 100 ml plastic bottles. 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's common knowledge that the physicochemical properties of water are crucial to aquatic life. Several physicochemical parameters, including pH, dissolved oxygen, free carbon dioxide, electrical conductance, total dissolved solids, total alkalinity, sulfates, phosphates, nitrates, chemical oxygen demand, and biological oxygen demand, were measured at four distinct locations. While the average values for electrical conductance (0.3523), total dissolved solids (230.5mg/l), total hardness (172.25mg/l), and total alkalinity (202.15mg/l) were all low, the water's pH remained fairly alkaline (7.5). The average nitrate concentration was 3.10 mg/l while the average phosphate concentration was 2.59 mg/l. The average dissolved oxygen concentration was 5.65 mg/l. With this, we agree with the finding of Chavhan and lonkar (2010). From these four locations, we analyzed the physicochemical parameters Free CO2, sulphates, phosphates, nitrates, chemical oxygen demand, and biological oxygen demand. Site D had the highest summertime Free CO2 levels (7.31 mg/L), whereas site A recorded the lowest (2.40 mg/L) during the monsoon. Site A had the lowest sulphate content (5.2 g/L) during the winter, whereas site C had the highest (13.45 g/L) during the monsoon. The highest concentrations of phosphate were measured at sites C and D during the monsoon, with levels of 0.33 and 0.27 mg/L, respectively. At site A, the concentration of dissolved organic matter in the wintertime falls to a low of 0.031 mg/L. Nitrate concentrations ranged from a high of 1.21 mg/L at site C during the monsoon to a low of 0.25 mg/L at site A during the heat of the summer. The lowest BOD was recorded in winter at site A, at 1.35 mg/L, whereas the highest was recorded in summer at site C, at 6.25 mg/L. Site A had the lowest COD concentration in the summer (3.43 mg/L), whereas site C had the highest concentration in the winter (9.52 mg/L). Multiple physicochemical factors and their effects on phytoplankton diversity were investigated. The current study found that the majority of the phytoplankton (42 out of 58 species) are members of the Chlorophyceae, Bacillariophyceae, and Cyanophyceae families.

Zooplankton, by their heterotrophic activity, play a crucial part in the cycling of organic materials in aquatic environments and are employed as bioindicators. Rotifera, Cladocera, Copepoda, and Ostrocoda were found among the zooplankton. The need to keep an eye on the surface waters and the creatures that call them home is expanding in light of growing concerns about the effects of human pollution on the aquatic environment. More evidence of river eutrophication may be shown in the latest research. More eutrophication should be avoided in this delicate habitat. Sorenson index (48.1%) and Jaccard index (31.87%) values were lower for the rotifera group than they were for the ostracoda group (S=85.7% and CJ=75.%).

During the course of the research period, the pH of the surface water was measured, and it remained within the usual range of 7.46 conc. to 7.85 conc., and it exhibited no discernible color or odor. Temperature readings ranged from 26 to 33 degrees Celsius at the water's surface. A range of 0.1 NTU to 9.6 NTU was observed for turbidity. In December, the concentration was at its peak, and in January, it was at its lowest. The dissolved oxygen concentration ranged from 1.0 mg/L to 1.1 mg/L. In January, the salinity seldom deviated from a value of 0.1 to 1.2 parts per thousand. In January, nitrate levels were at 2 mg/L, and by October, they had risen to 7.42 mg/L. Very little shifts in phosphate levels were also seen, with readings ranging from 0.012 to 1.12 mg/L. The silicate value saw large swings in October (10.94 mg/L) and December (1.76 mg/L), both of which were outside of the normal range (Figure 1).



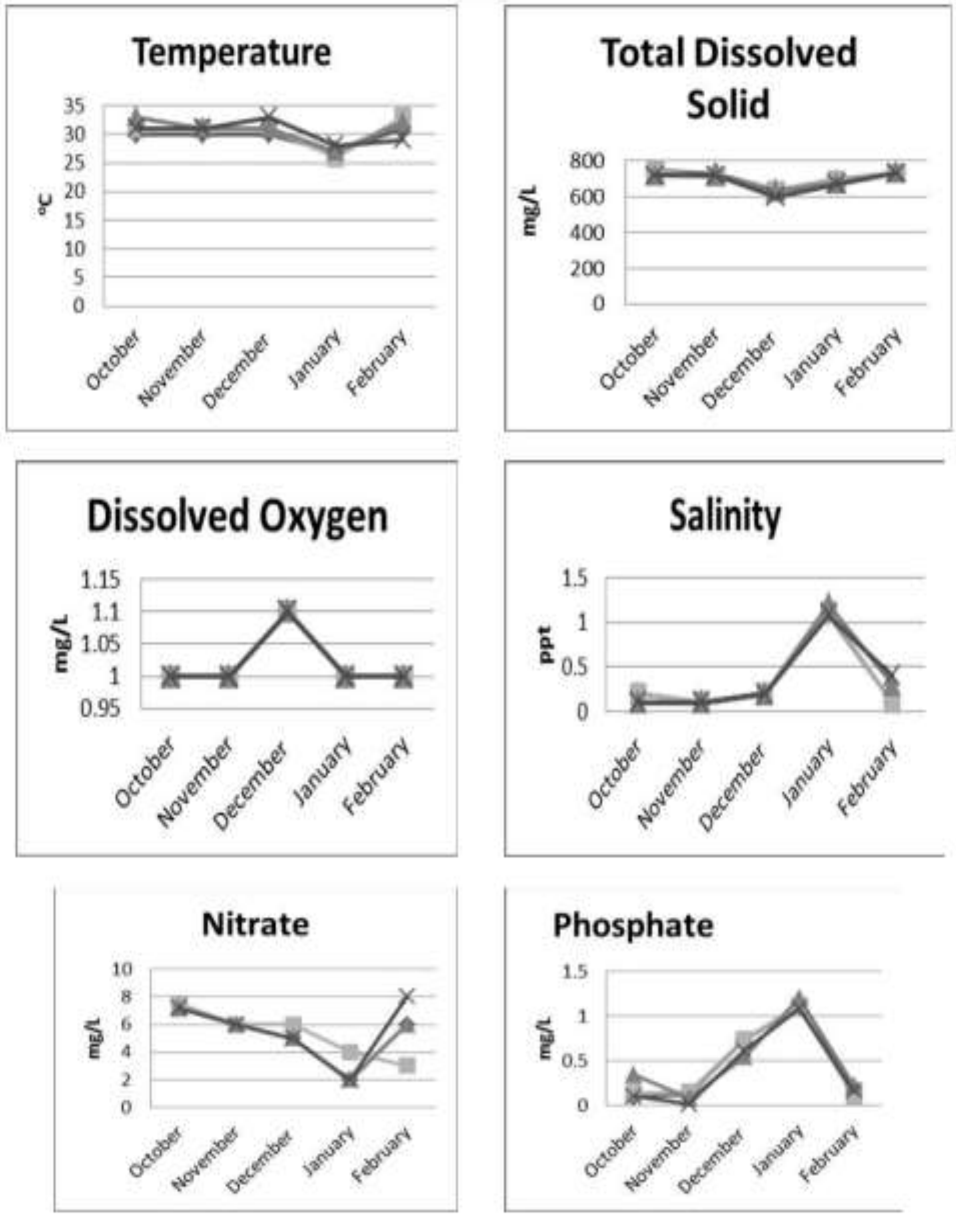


Figure 1. Physico-chemical parameters of Manjira River during the study period.

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	-	+	-	+	+	-

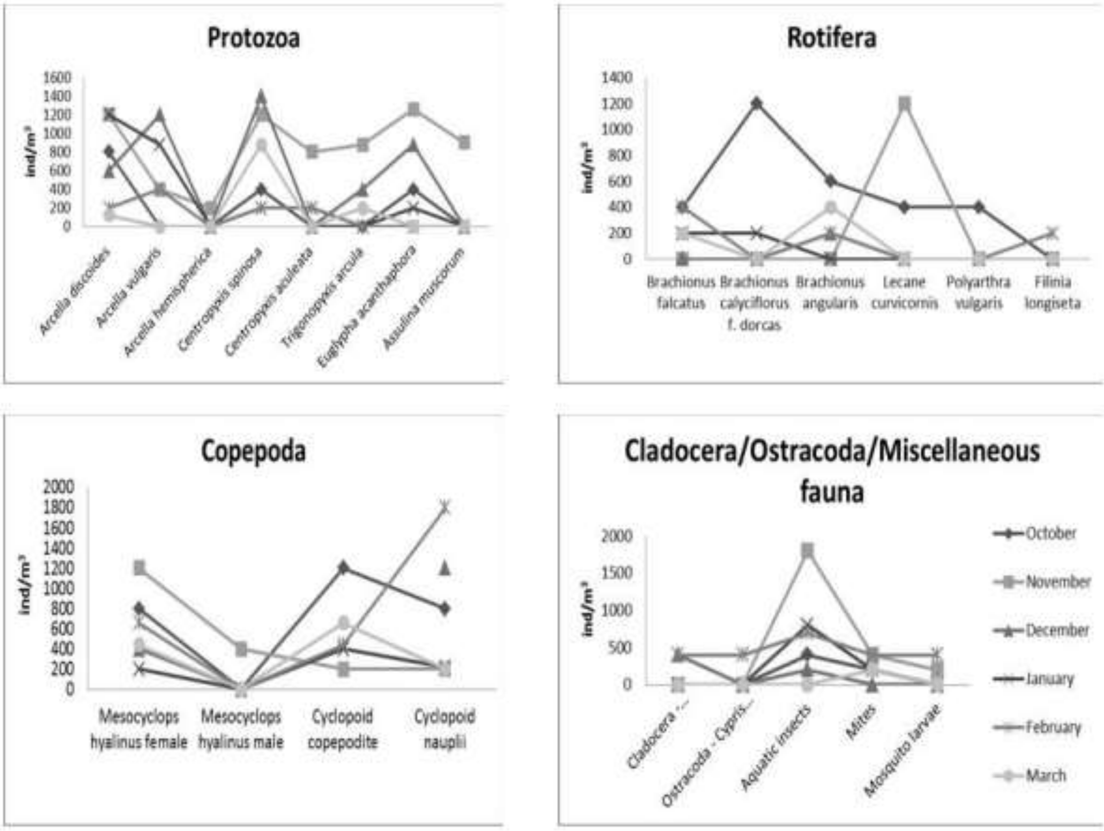


Figure 2. Total abundance of zooplankton (Protozoa, Rotifera, Copepoda, Cladocera and Ostracoda) during the study at Manjira River.

5. CONCLUSION

Human activity in the environment and excessive use of natural resources have led to a decline in biodiversity during the last ten years. However, the wellbeing has been negatively impacted by the biodiversity losses and the shifts in ecosystem service. The variety of plankton (species) in the Manjira River is of interest to limnologists. This pilot research on river pasteurization improves the quality of water and the aquatic zooplankton, both of which are crucial components of the food web, leading to a greater yield of fish and crustaceans. More in-depth research of aquatic fauna and ecological characteristics are needed to properly conserve the River as an important aquatic system in the Tributary in Maharashtra.

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