International Multidisciplinary E- Conference On Contribution of Various Aspects In Nation Building
In Association with International Journal of Scientific Research in Science and Technology
Volume 9 | Issue 5 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X (www.ijsrst.com)

Impact of Wastewater Disposal on Zooplankton Diversity in Kham River of Aurangabad City (MH) India

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ABSTRACT

Zooplankton is a diverse group of heterotrophic organisms that consume phytoplankton, regenerate nutrients via their metabolism, and transfer energy to higher trophic levels. It plays an important role in recycling nutrients as well as cycling energy within their respective environment. These are the main sources of natural food for fish which is directly related to their survival and growth and are base of food chains and food webs in all aquatic ecosystems. They are the essential food item of omnivorous and planktivorous fishes and the most essential for fish larvae culture.

Aurangabad is a fastest growing city in Asia, which is the district of Maharashtra State. Kham river flows 72 km towards the southeast and connects to the Godavari River. It receives enormous amount of domestic sewage and industrial effluents.

In present research work the abundance and diversity of zooplankton has been studied in relation to sewage pollution in Kham River. Various physico-chemical parameters of Kham river water at the different stations were analysed. The results revealed that the negative impacts of domestic and industrial sewage on Kham river. In the Kham river water, Ostracods dominant with Cypris, Eucypris virenus, Metacypris maracoensis. The overall population of zooplanktons found in Kham river, arranged in an increasing order it shows Copepoda > Rotifera > Cladocera > Ostracoda.

Keywords: Sewage pollution, zooplankton, Kham river, physico-chemical parameters

I. INTRODUCTION

The biota of aquatic systems affects directly or indirectly human beings. Among all the freshwater aquatic biota, zooplankton is able to reflect the physical and chemical parameters as well as secondary productivity potential of aquatic systems.1 Zooplankton provides several advantages as indicators of environmental quality in lotic and lentic water bodies.2 Zooplankton distribution shows wide spatio-temporal variations because of the various limnological factors on individual species.

Zooplankton species inhabit all freshwater habitats, including polluted industrial and municipal wastewaters. Zooplankters, especially planktonic rotifers, are not only used as bioindicators for the detection of pollution load (Gannon and Stemberger, 1978), but are also helpful for ameliorating polluted waters (Ejsmont-Karabin,

2013).Water quality provides current information about the concentration of various solutes at given place and time. It deals with the physical, chemical and biological characteristics in relation to other hydrological properties (Tiwari, 2004).

Aurangabad city, a district in Maharashtra State, is one amongst the fastest growing cities in Asia. Aurangabad is one of the cities from Marathwada region with historic significance. The total area of Aurangabad city is about 138.5 sq.km. Aurangabad is situated on the Kham River. Its geographical location is latitude 19° 5′north and longitude 75°20' east. Kham River flows 72 km towards the southeast and connects to the Godavari River. The historic engineering marvel - city's water supply was developed by Malik Ambar which had canals and nahars running along the Kham River. This river flows with freshwater in monsoon only. Rest of the year it receives wastewater from the city. Kham River receives enormous amount of domestic sewage and industrial effluents. The Kham River receives sewage from the nallas flowing through densely populated areas of Aurangabad district. According to the study of WQI; it is noted that Kham River Water comes in to Bad Quality of water and unsuitable for drinking and domestic purpose. (Padme Y. L. 2019)

In present study the water samples were collected from different stations from the point where there is discharge of untreated wastewater into the river. The physico-chemical parameters of collected samples and wastewater were analyzed. The results were compared with the ISI standards. The abundance and diversity of zooplankton has been observed in relation to sewage pollution in Kham River

II. MATERIAL AND METHODS

The water samples were collected from four different stations of Kham River flows in to the Aurangabad city, where is discharge of wastewater into Kham River. **Station A** - Harsul area, **Station B -** Near Begampura , **Station C** - Padampura, **Station D** - Waluj area. Water samples were collected in plastic cans of five liters capacity in the morning session. The parameters like temperature, pH, DO were analyzed at the sampling sites and the samples were transferred to the laboratory for further analysis of the other parameters. The parameters were analyzed by standard methods prescribed by APHA (1998), Trivedy and Goel (1984) and Kodarkar (2006). The abundance and diversity of zooplankton has been identified by Altaff K.2004 and observed in relation to sewage pollution in Kham River.

III. RESULT AND DISCUSSION:

Table no.1: Average physico-chemical analysis of water samples at various sites of Kham River

Sr. No.	Parameter	Station A	Station B	Station C	Station D
1	Temp (°C)	30.4	30.5	31.1	31.7
2	Turbidity	87.8	93.8	98.8	105.5
3	TS(mg/l)	979.9	999.9	1176.8	**1447.6**
4	TDS(mg/l)	813.5	841.9	999.4	**1253.9**
5	TSS(mg/l)	158	166.4	177.4	**193.7**
6	Electrical Conductivity ($\mu mhos^{-1}$)	337.7	343.8	358	**373.3**
7	pH	7.81	7.92	8.06	8.2

8	DO(ppm)	6.02	4.81	1.23	**0.9**
9	BOD(ppm)	18.4	19.72	21.4	**26.77**
10	COD (ppm)	23.97	27.74	30.54	**33.43**
11	Alkalinity(mg/l)	432	459.7	478.9	**563.3**
12	Total Hardness(mg/l)	331.1	339.8	346.4	**358.3**
13	Nitrate (mg/l)	2.8	3.2	3.69	**5.04**
14	Phosphate (mg/l)	0.939	1.07	1.10	**1.19**
15	Sulphate (mg/l)	144.8	168.8	209.7	**231.1**
16	Chlorides (mg/l)	453.2	464.8	473.2	**487.3**

Table no.2 : Average population of zooplankton (per ml) at various sites

Sr. no.	Species	Site A	Site B	Site C	Site D
1	**Rotifera**				
	Brachionus falcatus	1.87	1.41	1.16	0.83
	Keratella quadrata	3.33	2.91	1	1
	Testudinellamucronata	1.5	1.41	1.5	1.33
	Filinia terminalis	2.4	2.08	1.083	1.08
	Keratella tropica	1.08	0.91	1.66	1.41
	Branchionus diversicornis	1.72	0.91	1.5	1.16
	Echlanis dilatata	1	0.91	1.16	1.08
	Total	**11.6**	**10.58**	**9.08**	**7.91**
2	**Cladocera**				
	Daphnia rosea	1.41	2.83	1	0.75
	Cerodaphnia quadrangular	2.66	2.91	1.25	1.16
	Moina brachiate	1.66	1.66	1.08	1.08
	Alona affinis	1.75	2.66	1	0.66
	Cerodaphnia reticulate	1.75	1.91	1.41	1.16
	Total	**9.25**	**12**	**5.75**	**4.83**
3	**Copepoda**				
	Diaptomus	2.91	3.83	1.16	1
	MesoCyclopsedax	8.66	12.66	0.83	0.83
	Macrocyclops distinctus	9.75	13.08	0.91	1
	Napulii	6.5	9.66	1.58	1.58
	Paracyclop affinis	4.5	5.5	1.91	1.91
	Total	**32.33**	**44.75**	**6.41**	**6.33**
4	**Ostracoda**				
	Cypris	1.5	1.25	1.16	1.16
	Eucypris virens	0.75	0.75	1.58	1.25

	Metacypris maracoensis	1.25	1.25	1.16	0.91
	Total	**3.5**	**4.8**	**3.91**	**3.33**

In present study the maximum value of Electrical Conductivity was recorded as **373.3** $\mu mhos^{-1}$ at Station D. It represents the total concentration of soluble salts/mineral salts in water (Trivedy and Goyal 1984). The minimum DO level was decreased by **0.9 ppm** the introduction of oxygen demanding materials either organic or inorganic into water causes depletion of the DO. The DO levels recorded in the study area varied according to the rate of respiration and decomposition of the organic materials in the water. At the very low temperature the diversity of various species of zooplanktons was less. The similar results were observed by Shinde. *et al* 2011. The BOD values of all the stations were above the ISI standard, clearly indicates increasing load of pollution towards downstream of river. High BOD and COD indicate high degree of organic pollution. The high value of BOD was recorded at the Station D as 33.43 ppm as compared to Station A, B and C. Similar results were also observed by Shinde *et al* 2011 and 2017 in Kham River. The high COD values is found at the Station D (26.77 ppm), which may be due to the mixing of domestic and industrial waste. All Stations having high value of COD as compared to the ISI standards. The level alkalinity was high at all the Stations as compared to ISI standard. The high alkalinity is recorded as **563.3** mg/l at Station D. The high alkalinity is because of addition of waste. Mishra and Saksena (1989), Pandey *et al*. (1993), Jesudass and Akia (1995) reported variation in the values of total alkalinity which interferes with the water quality. The high phosphate value is recoded at Station D as 1.19 mg/l. It could be attributed to the mixture of effluent. The high Suphate value is recoded as 231 mg/l at Station D as compared to the Station A, B. and C. The Nitrate, Phosphate and Sulphate increases towards downstream due to influx of domestic sewage, detergents, agricultural effluents and industrial effluents.

Discharged wastes have increased the quantities of various chemicals that enter the aquatic ecosystems, which considerably alter their physicochemical and biological characters. Recent studies (Mukhopadhyay et al., 2007; Roy et al., 2008) focused on the effects of the various contaminants on these aquatic systems, for both physicochemical and biological components. In present research work there were 4 groups consisting of 20 genera of zooplankton in the sample scanned throughout the study period. 7 genera of Rotifer, 5 genera of Cladocera, 5 genera of Copepoda and 3 genera of were observed. The maximum species of Rotifera, Cladocera, Copepoda and Ostracoda were observed at the site A and site B. Whereas minimum species were observed at the site D and Site C due to the high pollution load at these sites. In the Kham river water, Ostracods dominant with *Cypris, Eucypris virenus, Metacypris maracoensis.* The overall population of zooplanktons found in Kham river, arranged in an increasing order it shows Copepoda > Rotifera > Cladocera > Ostracoda.

IV. CONCLUSIONS

The distribution of zooplankton community depends on a complex of factors such as change of climatic conditions, physical and chemical parameters such as water temperature, pH, dissolved oxygen and nitrate.44 In the present study, abundance and distribution of zooplankton was found to dependent on physical and chemical parameters of water.

The present study reveals that the Kham River is heavily polluted at Station D (at Waluj) and then Station C as compared to Station A and B. The river water is contaminated due to continuous discharge of untreated

domestic sewage and mixing of industrial wastewater. It continuously affecting on to the distribution and productivity of zooplanktons and ecosystem of Kham river water body. It is necessary the constant monitoring of water disposal and to control the incoming industrial waste and wastewater from the city by redesigning the infrastructure to protect the river.

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