RESEARCH ARTICLE

Zooplankton diversity in fresh water Wunna lake.

Pradhan VP

Department of Zoology, St. Francis de Sales College, Nagpur 440 006 (MS) India

Address for correspondence email: pradhan.sfscollege@gmail.com.

Manuscript details:

Received: 27 July, 2014
Revised : 27 August, 2014
Revised received: 10 September, 2014
Accepted: 17 September, 2014
Published: 30 September, 2014.

Editor: Dr. Arvind Chavhan

Citation this article as:
Pradhan VP (2014) *Zooplankton diversity in fresh water Wunna lake. Int. J. of Life Sciences*, 2(3): 268-272.

ABSTRACT

Since times immemorial, fresh water has always been of vital importance to man and it is interesting to note that early habitations were within easy reach of lakes and rivers. Man's primary concern with water was thought to be for drinking, cooking food and as means of cleaning. But with the passing of time, man realized the inherent mysteries of aquatic phenomenon and that water is the basis of all life activities. The rise in human population exploits more natural resources and its demands are met through the growth of industries. The industries and the urban sprawl discharge their waste in to the rivers. The deforestation process itself aggravates the sedimentation transport into the streams. The use of chemicals in agriculture for better production contaminates water through percolation. All these sporadic degrading activities have led to gradual deterioration in the quality of surface and sub-surface water. Management of lentic water bodies and their ecosystems has become a necessity for mankind's endeavor to have a better quality of life. With the current development phase, every ecosystem is changing very fast and any such change exerts immense influence on the flora and fauna, hence physico-chemical and biological properties of a water body need to be monitored. The present study is aimed to study zooplankton diversity of a fresh water Wunna lake and its impact on the pollution status of the lake.

Key words: Zooplankton, sedimentation, lentic, ecosystem, fauna.

INTRODUCTION

A microscopic community of plants (phytoplankton) and animals (zooplankton), found usually free floating, swimming with or no resistance to water currents, suspended in water, non motile or sufficiently motile to overcome transport by water current are called as "Plankton". The qualitative and quantitative studies of plankton are an important factor to access the water quality (Shekhar *et al*., 2008). The plankton diversity responds to changes in aquatic environment. Zooplanktons are heterogeneous assemblage of minute floating animal forms found in water. They may bear some locomotory structures but are not capable of propelling against the water currents. They usually act as primary consumers and constitute an important link between primary producers (phytoplankton) and higher consumers like carnivore fish in aquatic food chain. The zooplankton mainly consume

primary producer and form the major food source for tertiary consumers. Certain species of zooplanktons are used as bio indicators of water quality. The estimation of plankton analysis helps in explaining the cause of color, turbidity, presence of odor, taste and visible particles in water. In the present study, along with plankton study computation of Shannon Weiner Diversity Index for monitoring the quality of water in Wunna Lake was carried out.

MATERIALS AND METHODS

Water sample for plankton analysis was collected fortnightly over a period of two years 2006 and 2007.The plankton were collected with plankton net. Immediately after collection of the sample.. The zooplankton were preserved by adding 4% formalin solution. The estimation was carried out in the laboratory with the help of a device called as Sedgwick –Rafter cell (SR cell). The method of strip counting was adopted as per the methodology of Michael (1986).

$$\text{No. of plankton/ml} = \frac{\text{No. of organisms counted in all the strips X 1000}}{\text{Volume of each strip x No. of strips counted}}$$

In the present study, computation of Shannon Weiner Diversity Index was also carried out for monitoring the quality of water in Wunna Lake.

RESULTS AND DISCUSSION

Fresh waters bodies constitute an extremely diverse assemblage of organisms represented by nearly by all phyla of invertebrates. They principally comprise of microscopic Protozoans, Rotifers, Cladocerans and Copepods which float on the surface of water and are carried along with the water current. The physical and chemical characteristics of water affect the abundance, species composition, stability and productivity of the indigenous population of aquatic organisms. The presence and dominance of zooplankton species plays an important role in the functioning of fresh water ecosystem. Zooplanktons occupy an intermediate position between the autotrophs and the carnivores in the food web. Many of them feed on algae and bacteria and in turn are fed by numerous invertebrates and fishes. They also constitute an important component of secondary production in aquatic system and plays a vital role in the energy allocation at different trophic levels. Zooplankton is an important component of ecosystem; they act as primary and secondary links in the food chain, (Hutchinson, 1967). The zooplankton communities are influenced by biological interactions, predation and interspecific competition for food resources (Neves *et al*., 2003; Sampaio *et al*., 2002). Zooplankton have long been used as indicator of eutrophication (Vandysh, 2004; Webber *et al*., 2005). Knowledge of the zooplankton communities and their population dynamics is a major requirement for better understanding of life processes in a fresh water body since eutrophication influences both the composition and productivity of zooplanktons (Bhora and Kumar, 2004). Zooplankton communities are very sensitive to environmental changes and thus are of considerable potential value as water quality indicators (Gannon and Stemberger, 1978).

In the present study Rotifera, Cladocera and Copepoda dominate the zooplankton population of Wunna Lake. The zooplankton were identified according to guidelines given by Ward and Wipple (1959); Ruttner –Kolisko (1974); Koste (1978); Victor and Fernando(1979); Seghal (1983).

Table 1: Zooplankton diversity in Wunna lake

Cladocera	Rotifera	Copepoda
Daphnia	*Branchionus*	*Cyclops*
Moina	*Keratella*	*Nauplius*
	Monostyla	
	Cyclops	

Rotifera:

The qualitative and quantitative analysis of zooplankton have been shown in Table 2 and 3. Rotifera showed an overall annual increasing trend (47%-67%) in the months May to August in 2006 and 20007 when the rains were abundant. However, after this till December 2006 a decreasing trend was observed when the percentage of Rotifers was recorded to be as low as 12% and 13 % in the year 2006 and2007 respectively. In the (winter) month of January in both the years there was an appreciable rise in Rotifera population (40%- 31%). In the year 2006 a steep decrease (12%) in the population of Rotifers was observed in the month of February in contrast to the high percentage recorded in the Year 2007 (51%).

The overall relationship found on the basis of quantitative analysis amongst the groups of zooplankton during the study period was

Rotifera > Copepoda > Cladocera

The month of May 2006 and 2007 showed a summer peak when maximum density of zooplankton was observed. The quantitative zooplankton analysis shows that the zooplankton density was more in summer in both the years and the Rotifera dominated the zooplankton population. According to George (1966), Rotifera have a numerical superiority over other plankton groups.

Copepoda:

The Copepoda dominate the summer months (march, april and may) in both the years (64%- 53%). The relationship found on the basis of quantitative analysis amongst the groups of zooplankton was

Copepoda >Cladocera> Rotifera

The similar trend continued till the month of June and July in the year 2006 but in the year 2007 a deviation from this trend was observed. With the onset of winter maximum percentage of Copepods was observed in both the years (75%- 66%). Datta *et al*., (1984) reported the abundance of zooplanktons during winter and summer months. In February 2006 the relationship in different groups was

Cladocera>Copepoda>Rotifera

Whereas in the year 2007 the relation showed a reversal

Rotifera>Copepoda>Cladocera

Table 2: Quantitative analysis of Zooplankton in Wunna lake in 2006

Month wise sampling	Total no. of Zooplankton count /m³	Percentage Composition of Zooplankton Groups			Shannon Wiener Diversity index
		Cladocera	Rotifera	Copepoda	
January	10,500	17%	40%	43%	2.7
February	6,750	57%	12%	31%	1.7
March	9,750	62%	15%	23%	2.2
April	10,500	42%	29%	29%	2.3
May	12,750	24%	23%	53%	2.6
June	8,250	9%	27%	64%	2.2
July	6,750	11%	33%	56%	2.5
August	11,250	21%	47%	32%	2.8
September	9,750	23%	47%	30%	2.6
October	6,750	21%	33%	46%	2.9
November	7,500	30%	20%	50%	2.8
December	6,000	13%	12%	75%	1.1

Table 3: Quantitative analysis of Zooplankton in Wunna lake in 2007

Month wise sampling	Total no. of Zooplankton count /m³	Percentage Composition of Zooplankton Groups			Shannon Wiener Diversity index
		Cladocera	Rotifera	Copepoda	
January	9,000	28%	31%	41%	2.6
February	7,500	23%	51%	26%	2.4
March	8,750	57%	12%	31%	2.5
April	10,750	15%	40%	45%	2.8
May	11,250	14%	33%	53%	2.7
June	6,750	10%	67%	27%	2.1
July	8,750	11%	56%	33%	2.6
August	10,000	16%	40%	56%	2.4
September	9,550	20%	54%	26%	2.5
October	8,050	29%	33%	38%	3.0
November	9,750	42%	15%	43%	2.4
December	6,500	21%	13%	66%	2.6

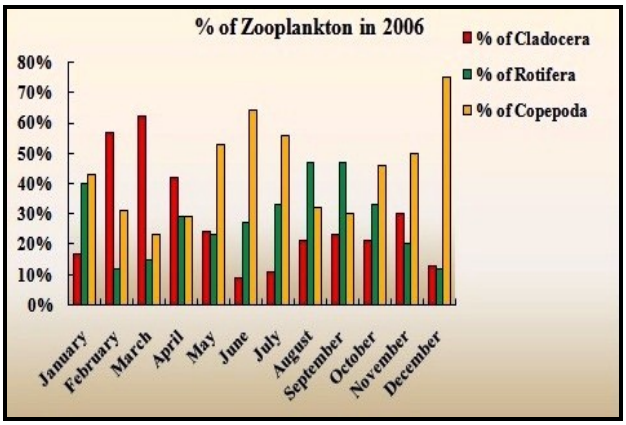

Fig. 1: Percentage of Zooplankton in samples of water collected from Wunna lake in the year 2006.

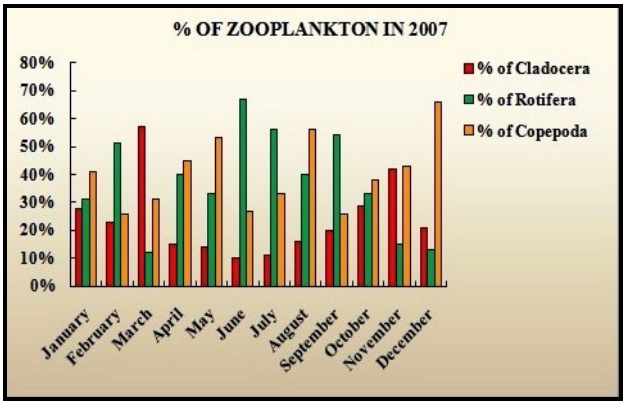

Fig. 2: Percentage of Zooplankton in samples of water collected from Wunna lake in the year 2007.

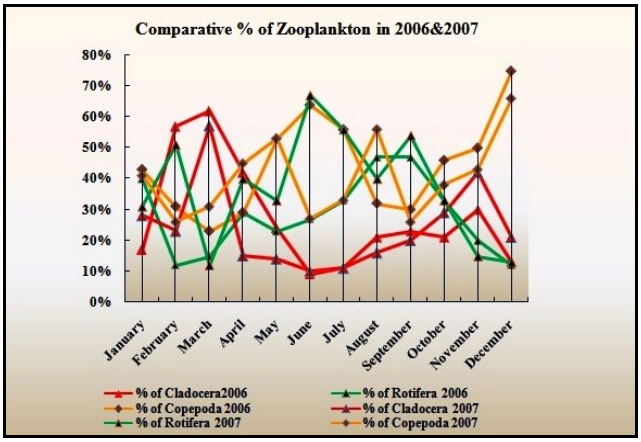

Fig. 3: Comparative Percentages of Zooplankton for samples of water collected from Wunna lake during the study period 2006-2007.

Cladocera:

The Cladocera were dominated by Copepoda and Rotifera in the years 2006 and 2007. In the month of March Cladocera was the dominant group (62% and 57%). There after the decreasing trend continued till the month of June when the Cladocerans were least in population. A gradual increasing trend was observed in corresponding months in both the years.

The relationship found on the basis of quantitative analysis amongst the groups of zooplankton is in the month of march was as follows:

Cladocera>Copepoda>Rotifera

Kedar and Patil (2006) investigated zooplankton population in Rishi lake, Karanja District Wahsim (M.S.) and found similar results.

The Shannon Wiener Diversity Index is commonly used to assess the impact of pollution which is based upon the plankton diversity. An index value of 2 and above was found to be prevalent throughout the period of study.

The zooplankton observed during the study are Rotifers, Copepods and Cladocerans. The quantitative analysis showed that the zooplankton density was more in summer in both the years and the Rotifera dominated the zooplankton population. The presence of larger numbers of Rotifers may be due static and lentic condition of water of Wunna Lake. Similar results have been obtained by Kumar (1994); Kaur *et al*., (1999); Pathak and Mudgal (2002). According to Pandit *et al*., (2007) the species richness was high in summer and was minimum in winter.

In the present observation quantity of zooplanktons was found more during winter season also. Abdus and Altaff (1995) have reported similar findings. The Cladocerans were comparatively in low profile in annual cycle and as such no definite pattern of their variation was observed. However, they were mostly abundant in winter and summer months.

The Shannon Wiener Diversity Index commonly used to assess the impact of pollution is based upon the plankton diversity.

An index value of
Value of 1: indicates maximum impact of pollution.

Value between 1 – 2: indicates medium impact of pollution.

Value > 2 : indicates lowest or no impact of pollution

Persual of Table 2 and 3 indicate that the values of Shannon Weiner index for zooplankton are mostly above two indicating that there is very low or no impact of pollution in Wunna Lake making the water potable.

CONCLUSION

In the present study Rotifera, Cladocera and Copepoda formed the zooplankton population of Wunna Lake. The Rotifera dominated the zooplankton population. The quantity of zooplanktons was found to be more during winter season. The cladocerans were comparatively in low profile in annual cycle and as such no definite pattern of their variation was observed.

The values of Shannon Weiner index for zooplankton were mostly above two indicating that there wsa very low or no impact of pollution in Wunna Lake making the water potable.

REFERENCES

Abdus Saboor and Altaff (1995) Qualitative and quantitative analysis of zooplankton population of tropical pond during summer and rainy season. *J. Ecobiol. J. Ecobiol.,* 7 (4): 269 – 275.

Bohra, Chandan and Arvind Kumar (2004) Plankton diversity in the wetlands of Jharkand. In Arvind Kumar (eds.) Biodiversity and Environment A.P.H. Publishing Corp. New Delhi. Pp 91 – 123.

Datta NC, Mondal N and Bandopadhyay BK (1984) Seasonal variations of primary productivity in relation of some physicochemical properties of a fresh water pond, Calcutta. *Int. J. Acad. Icthyol* (Proc. IV Aisi). 5: 113 - 120.

Gannon JE and Stemberger RS (1978) zooplankton especially crustaceans and rotifers as indicators of the water quality. *Trans. Am. Micrs. Soc*., 77: 16 – 35.

George, MG (1966) Comparative plankton ecology of five fish tanks in Delhi. India. *Hydrobiologia.* 27 (1–2)*:* 81–108.

Hutchinson EG (1967) A treatise on Limnology Vol. II. Introduction to lake biology and the limnoplankton. John Wiley and sons Inc. New York. 1115 p.

Kaur H,Bath KS, Mander G and Dhillon S (1999) Aquatic invertebrate diversity of Kunj Lake, Punjab. *Indian J. Env. and Ecoplan*. 2: (1): 37 - 41.

Kedar GT and Patil GP (2006) A preliminary report on zooplankton population in Rishi Lake, Karanja, (Lad). Dist. Washim (M.S.), India. *International oral conference in Zoology*, Bangalore, P- 50.

Koste W (1978) Rotatoria – Die Radertiere Mittleuropas. Begrundet Von Mox Voigt. Uberordnung Monogononta. Gebruder, Borntraoger Stuttgart.

Kumar A (1994) Periodicity and abundance of rotifers in relation to certain physico chemical characteristics of two ecologically different wetlands of Santal Pargana, Bihar. *Indian J. Ecol*., 21: 54 - 59.

Michael P (1986) Ecological methods for field and laboratory investigations. Tata Mc Graw Hill Publishing Co. Ltd. p. 142 - 145.

Neves IF, Rocha o, Roche KF and Pinto AA (2003) Zooplankton community structure of 2 marginal Lakes of River Cuiba (Mato Garraso, Brazil) with analysis of rotifera and cladocera diversity. *Braz. J. Biol*. 63 (3): 329 – 343.

Pandit SV, Vaidya VV and Joshi PP (2007) Studies on Zooplankton diversity of Pravara River near Sangamner city, Dist. Ahmednagar, Maharashtra. *J Aqua. Biol*., 22 (2): 33 – 38.

Pathak SK and Mudgal LK (2002) A preliminary survey of zooplankton of Virla reservoir and Khargone (M.P.), India. *Indian J. Envonment and Ecoplan*, 6 (2). 297 - 300.

Ruttner Kalisko A (1974) " Plankton Rotifers", Univ. Toronto Press. P 244 .

Sampio EV, Rocha O, Matsumura – Tundisi T, and Tundisi JG (2002**)** Composition and abundance of zooplankton in the limnetic zone of seven reservoirs of the Paranapanema River, *Brazil, Braz. J. Biol*., 62 (3): 525 – 545.

Seghal KL (1983) Planktonic Copepods of fresh water ecosystems. Interprint, Mehta House, Naraina II, New Delhi, India.

Shekhar RT, Kiran BR, Puttaiah ET, Shivaraj Y and Mahadevan KM (2008) Phytoplankton as index of water quality with reference to industrial pollution. *J. Environ. Biol*., 29**,** 233-236.

Vandysh OI (2004) Zooplankton as an indicator of state of Lake ecosystems polluted with mining wastewater in Kola Peninsula. *Russian J. Ecol*. 35 (2): 110 – 116.

Victor R and Fernando CH (1979) The fresh water Ostracods (Crustacea: Ostracoda) Of India. Records of the Zoological Survey of India.

Ward HB and Whipple GC (1959) Fresh biology, 2nd ed. John Wiley and sons, New York, USA.

Webber Mona, Myers, Elecia Edwards, Cambell C and Webber D (2005) Phytoplankton and zooplankton as indicators of water quality in Discovery bay Jamaica. *Hydrobiologia,* 545: 177 – 193.