Environment Conservation Journal 14(3) 169-171 , 2013
ISSN 0972-3099 (Print) 2278-5124 (Online)
Abstracted and Indexed

Zooplankton composition and Status of Paniyala water Pond in Roorkee Uttarakhand

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Received: 12.06.2013 **Revised: 28.08.2013** **Accepted: 17.09.2013**

Abstract

The influence of water quality of Paniyala fish pond on its zooplankton composition and abundance were investigated at four stations for one year between January 2008 and December 2009. Diversity was not high: five groups of zooplankton were found which include Protozoa, Rotifera, Cladocera, Copepoda and Ostracoda. Rotifera dominated numerically (65.75±40.60 Unit/L), followed by protozoa (57.71±37.69 Unit/L) and Cladocera (47.31±28.73 Unit/L). The zooplankton was more prevalent during winter season and there were variations in the composition and abundance along the reservoir continuum. Factors such as temperature, nutrients, food availability, shape and hydrodynamics of the reservoir, as well as reproductive strategies of the organisms, strongly influence the composition and population density of zooplankton. Seasonal trends in zooplankton community composition were also related to changes in environmental characteristics of the river. Our results indicate that the changing water quality status of the Paniyala water pond affected the zooplankton diversity and abundance and such measure could be used as a biomonitoring tool to determine the ecological health of the pond. Prevention of ecological deterioration of this water body would greatly result in a more productive water body, rich in zooplankton and with better fisheries.

Keywords: *Ecological, Hydrodynamics, Paniyala, Rotifera, Zooplankton*

Introduction

Zooplankton are microscopic free floating animals which play a vital role in aquatic food web. They are choice food of fishes in general and juveniles in particular. They graze heavily on algae, bacteria and minute invertebrates. Zooplankton communities are typically diverse and occur in almost all lakes and ponds. These are highly sensitive to environmental variation, as a result change in their abundance, species diversity or community composition can provide important indication of environmental change or disturbance. Due to their short life cycle, these communities often respond quickly to environmental change (Maruthanayagam, *et al*. 2003). Zooplankton plays an important ecological role in lakes and ponds, feeding on non-living organic matter, phytoplankton and bacteria, and in turn being eaten by secondary consumers such as fish. The physico-chemical parameters of an aquatic ecosystem are very important in assessing the composition of any aquatic biota and also their sensitivity to pollution (Okogwu and Ugwumba, 2006). Therefore, a major interest in zooplankton investigation is to understand environmental factors that influence their diversity. Certain knowledge of the responses of zooplankton to changes in water quality could therefore constitute an important tool to be used to rapidly assess the health of the water bodies. Also the zooplankton community characteristics will be utilized in assessing the recovery of the pond following stress caused by anthropogenic activities. This paper aims to partly fill an existing gap in zooplankton biodiversity knowledge of the zooplankton composition and status of Paniyala water pond in Roorkee Uttarakhand.

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Material and methods

Roorkee town in the district Haridwar is located at the bank of Ganga canal. The Paniyala fish pond is situated at the village Paniyala which is 7 km away fro Roorkee. The source of water in the pond is rain water and quite a bit from ground water. The Paniyala pond is at the height of 268.00 meter from the mean sea level (longitude 77°53" E and Latitude 29°51" N). The maximum depth of the pond is 2.80 meter and minimum 0.60 meter, mean

depth is 1.70 meter having a surface area of 292,500 square meter.For present study of the Paniyala pond, the water samples were collected monthly from four different sampling sites during March 2007 to February 2008 in morning hours. The collection and analysis of water samples was done using standard methods with the help of Welch (1948), Trivedi and Goel (1986), APHA, (1985) and Khanna and Bhutiani, (2003). The zooplankton of pond water was collected by fine plankton collection net. A known amount of water was filtered through plankton collection net and concentrated in desired quantity inside collection tube. The sample was preserved in 4% formaldehyde solution. 1 ml of concentrate was taken and placed in Sedgwick rafter counting cell, a glass slip was placed over it avoiding any kind of bubble. Calculation of the organisms was done by applying the following formula:

Calculation

Zooplankton (Unit/L) = (a x 1000) C/L

Where, a: Average number of zooplankton in one small counting chamber of Sedgwick rafter counting cell

C: ml of plankton concentrate

L: Volume of original water filtered in litre

Results and Discussion

The pattern of monthly variation in total zooplankton analysis is given in table No 1. The maximum density of zooplankton was noticed in month of January and minimum density was observed in the month of July and August. Maximum potential of zooplankton appeared in winter, moderate in summer and minimum in rainy period. The zooplankton identified during the present study belonged to five taxa which include protozoa, rotifera, Cladocera, copepoda and ostracoda. Qualitatively, the fauna was dominated by rotifers followed by protozoa, cladocera, ostracoda and copepoda. The protozoa was reported with maximum of 125.0 Unit/l in the month of January and minimum of 12.75 Unit/l in the month of August with an average of 57.71±37.68 Unit/l. The rotifera was observed with the maximum of 139.75 Unit/l in the month of January and minimum of 17.50 Unit/l in the month of July with an annual average of 65.75±40.60 Unit/l. According to Chaurasia and Adoni, (1985) the rotifera was noted to be main and first dominating group among total zooplankton round the year. The rotifer fauna was more representative taxa in terms of diversity and abundance.

Table 1: Average number of different taxa among zooplankton (Unit/L) in the Paniyala pond during 2008-2009

Month	Protozoa	Rotifera	Cladocera	Copepoda	Ostracoda
January	125.00	139.75	89.50	43.00	68.33
February	95.50	114.00	95.75	21.25	82.00
March	77.25	103.00	81.75	14.25	57.00
April	74.75	89.50	26.00	11.25	25.33
May	53.75	68.75	8.50	3.00	27.33
June	30.00	29.00	5.75	2.25	11.00
July	13.00	17.50	7.00	1.50	5.67
August	12.75	18.75	13.75	3.50	9.33
September	16.00	30.25	28.75	8.75	20.33
October	35.25	40.00	43.75	11.25	33.33
November	57.50	53.00	58.00	14.00	60.33
December	101.75	85.50	36.00	21.25	80.33
Avg.±S.D	57.71±37.68	65.75±40.60	47.31±30.98	12.94±11.68	40.03±28.06

The present data of rotifera coincide with the finding of Dumont (1981). The only taxa that was recorded with minimum density throughout year was copepoda which was reported with the maximum of 43.0 Unit/l in the month of January and minimum of 1.50 Unit/l in the month of July with an average of 12.94±11.68 Unit/l. The present study revealed that zooplankton densities depend on the quantitative changes of organic decaying materials and temperature, the same view was given by El-Bassat and Taylor (2007). The Cladocera was found with an average of

47.31±30.98 Unit/l with the maximum of 95.75 Unit/L in the month of February and minimum of 5.75 Unit/l in the month of June. Once the natural community of invertebrates and other organisms can be predicted, deviations due to organic and anthropogenic activities can be more easily accused (Akin-Oriola, 2003). In our study, zooplankton abundance increased with increase in winter. This may be due to the less turbidity and low temperature that will accelerate primary production and as a consequence, zooplankton production and abundance. During present study revealed that ostracoda was reported with the maximum of 82.0 Unit/L in the month of February and minimum of 5.67 Unit/l in the month of July with an average of 40.03±28.06 Unit/l. During the present investigation the overall diversity of zooplankton was low in the Paniyala pond and this might be due to the impact of industrial and municipal discharges on the pond which effect the growth and reproduction of zooplanktonic population.

Conclusions

This study revealed that zooplankton communities responded to changes in water quality and this was seen in changes in composition, assemblages and abundance during the study. Abattoir wastes, domestic wastes and residential urban settlements around Paniyala pond were suspected to negatively influence of environmental conditions thus adversely affecting the zooplankton composition structure. The high zooplankton abundance and diversity was reported during winter with dominance of rotifers observed throughout the study period. Overall, our results showed that changes in water quality of pond have significant effects on the structure of zooplankton assemblages. This feature could be used for biomonitoring to ensure the protection of the aquatic biota. Considering the usefulness of this pond to the community, waste water treatment should be applied in order to minimize the influence on water quality.

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