RESEARCH ARTICLE

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Zooplankton Population Estimation in Medium Current Regime Selected Sites of Gandak River in Chapra

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ABSTRACT

Evaluation of Gandak River in various selected sites of Chapra District Bihar was made to assess the quality of water during 2012-2013 and 2013-2014. The qualitative and quantitative evaluation of the variation in River water showed high quality of zooplankton population throughout the study period. The water quality analyzed following standard methods and population parameters followed various previous investigations. The present study revealed that the water of River showed difference in both water quality and population dynamics is also varied with topography, flowing regime and anthropogenic activities of local persons residing nearby these sites.
***Key words**: Zooplankton, pollution, Gandak River, diversity, abundance, species richness*

INTRODUCTION

Zooplankton has short life span and they respond more quickly to environment leads to change in plankton communication in terms of tolerance, abundance, diversity and dominance in the habitat. Therefore zooplankton communities of numerous reservoirs, lakes and shallow water bodies have been used as indicators for the status of the lake (Christoferson, *et al.,* 1993; Jeppensen, *et al.,* 1999; Ramchandra, *et al.,* 2002). The variability observed in the distribution of zooplankton is due to abiotic parameters (Roff, *et al.,* 1988; Christou 1998; Escribano and Hidalgo, 2000; Beyst, *et al.,* 2001).

Hence the present investigation was carried out on the surface zooplankton population in the aquatic ecosystem of the Gandak River. The zooplankton population of Godawari River has been affected in terms of abundance and diversity.

MATERIALS AND METHODS

Zooplankton samples were collected for qualitative and quantitative analysis in between 8 a.m. to 10 a.m. by standard methods (APHA, 1985) two sampling sites over period of May 2009 to April 2010. The collected samples were fixed in 3-4 % formalin and brought to the laboratory for zooplankton analysis; counting and identification were done as per Battish (1992) and Species diversity index was obtained by following Shannon were methodology (Nath, 1997).

RESULTS AND OBSERVATIONS

DENSITY OF ZOOPLANKTON:

Zooplankton density of this site varies between 20-900 No/L, over the two years study period (Table 1 and Fig. 1). The high density of zooplankton, 840 No/L, was recorded in the month of August, 2013 followed by 900 No/L in September, 2013 and 800 No/L in November, 2013, which was the monsoon period. The reason for high density was due to high rotifer population from August, 2013 to September, 2013 (Fig. 1). The total zooplankton density was high during the period 2012-14 due to the increase in cladoceran population from 10-220 No/L. The reason for high zooplankton density is due

to the high in cladoceran population in the monsoon season of 2012-13 and summer and monsoon season of 2013-14. It was fluctuated over the two years period (Fig. 1). The copepod population was comparatively less than the rotifer and cladoceran population throughout the study period and in general the density of the zooplankton communities declined.

The rotifer population increased in the year 2012-14 due to the increasing number of *Brachionus forficula* (July to September), *Brachionus diversicornis* and *Keratella tropica* (August and September) and *Brachionus calyciflorus* (September).

During the period 2012-14, copepod population increased in summer and monsoon due to the presence of large number of *Mesocyclops leuckarti*. In general, the high density of zooplankton population in the site was due to the increasing number of the rotifer, cladocera and copepod species.

EVENNESS AT SELECTED SITES:

Similarly, the evenness (J) of the overall zooplankton community varies between 0.34-0.95. The high evenness was observed in the months of December, 2012 (J=0.95), January 2013 (J=0.90), May 2013 (J=0.80) and September 2013 (J=0.72), whereas very low evenness was found in the month of November, 2013 (J=0.34) and rest of the period the value was above 0.5 (Fig. 3).

The evenness (J) of zooplankton community of this site varies between 0.25-0.84, the more evenness in the month of January, 2013 (J=0.84). The evenness is less (J= 0.50 and J=075) in December, 2012 and 2013 respectively which represent winter season. The evenness values are equally high in both the years and particularly high during summer and monsoon (Fig. 3).

Evenness of the zooplankton was J= 0.48-1.00 (Table 1), less in the month of December 2012 and September 2013 (winter) and high during February and March 2013 (Fig. 5). Richness of the species obtained between 5- 23 (Table 1), high in November 2013 (23 species) and October 2012 (22 species).

SPECIES RICHNESS AT SELECTED SITES:

The species richness was between 8-24 numbers, highest in the month of February and May, 2013(S=24 numbers) representing late winter and peak summer seasons. Relatively, in the month of August, 2013 the number was also high (S=22). In remaining months it was less (S=08-17), especially, during 2013-14. During the summer months, May and June, 2014, it was 16 and 18 respectively. Less number of species recorded in winter and monsoon periods (Fig. 2).

Species richness value was between 8-28 numbers, high in summer (May, 2013) and less in monsoon (August, 2014). More species richness is observed in 2012-13 than in 2013-14 which shows that the species richness was declined and fluctuated during preeciding years (Fig. 4). High species richness was observed during the monsoon period (Fig. 4).

ABUNDANCE OF ZOOPLANKTONS AT SELECTED SITES:

Abundance of the zooplankton community which was high in the month of February, 2012 was 70%, and then in March and April, 2013 which were 60% and 60% respectively. During the rest of the period the dominance was less than 50% (Fig. 5). The period 2013-14 had less abundance than 2012-13, due to the dominance of cyclopoidae copepod, *Mesocyclops leuckarti*. The high abundance 24% was found in the month of February, 2012 and gradually decreased to 4.0% in the month of September 2014. The study period during 2013-14, show that the abundance values fluctuated with different seasons, where a high value was recorded in May, 2012 (48%). The overall abundance during 2013-14 was less than the 2012-13 (Fig. 5).

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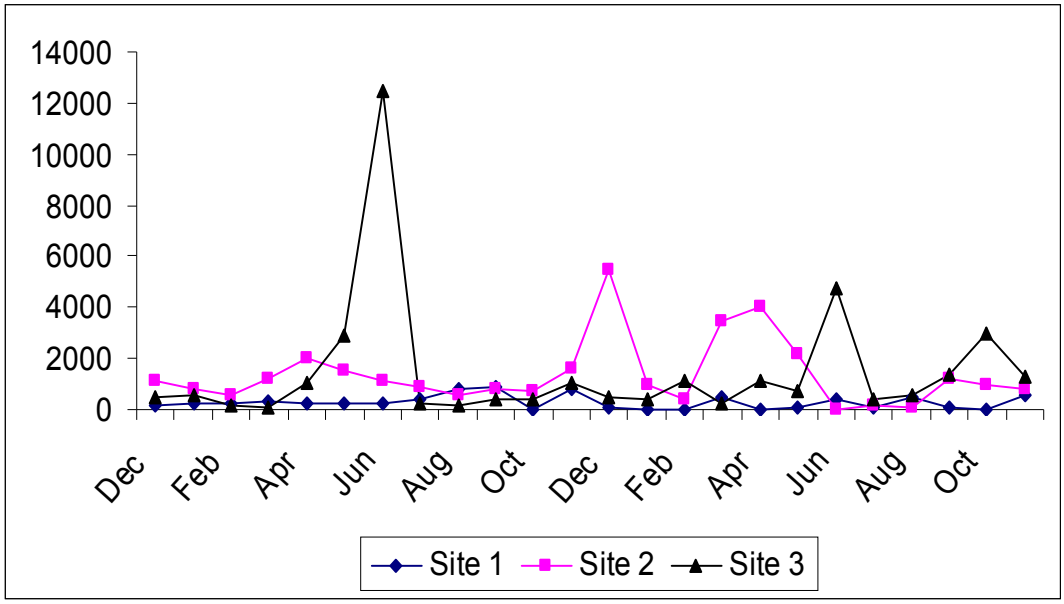
Table 1: Zooplankton Community analysis at Gandak River during 2012-14

Index	Duration	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Total zooplankton density	2012-13	160	220	210	300	280	240	220	400	840	900	40	800
	2013-14	60	30	20	500	30	60	400	100	460	60	40	600
Diversity	2012-13	2.5	2.4	2.8	2.5	2.5	2.4	2.3	2.1	2.3	1.9	2.4	0.8
	2013-14	2.7	2.3	2.2	1.4	1.6	2.4	2.2	2.0	1.3	2.2	2.3	1.8
Eveness	2012-13	.95	.90	.92	.90	.88	.80	.82	.84	.76	.72	.70	.34
	2013-14	.82	.90	.86	.56	.82	.86	.80	.82	.60	.90	.86	.76
Species richness	2012-13	15	18	25	22	23	24	20	13	22	15	13	16
	2013-14	12	12	10	10	8	16	18	12	10	10	14	14
Abundance	2012-13	42	40	70	60	58	48	40	30	32	20	22	06
	2013-14	20	24	22	8	12	48	18	10	6	4	14	12

Fig. 1: Overall Zooplankton density at selected sites during 2012-2014.



Similarly the abundance of zooplankton community is found between 5.00-50.0%. In the month of March, 2013 the value is 50% and less in the month of December and August, 2014 (5% and 6 %). Regarding abundance high values were observed in 2012-13, whereas less value was recorded in 2013-14. Summer and monsoon seasons have more abundance than winter season (Fig. 5).

Similarly the abundance was also high in November 2013 and October 2014, which was 74% and 60% respectively (Fig. 5). Dominance of zooplankton of the site varied between 18.6-74.1% and the values were reciprocal to the abundance. When the abundance was high the dominance was less and *vice versa* (Fig. 5).

Fig. 2: Zooplankton diversity at selected sites during 2012-2014

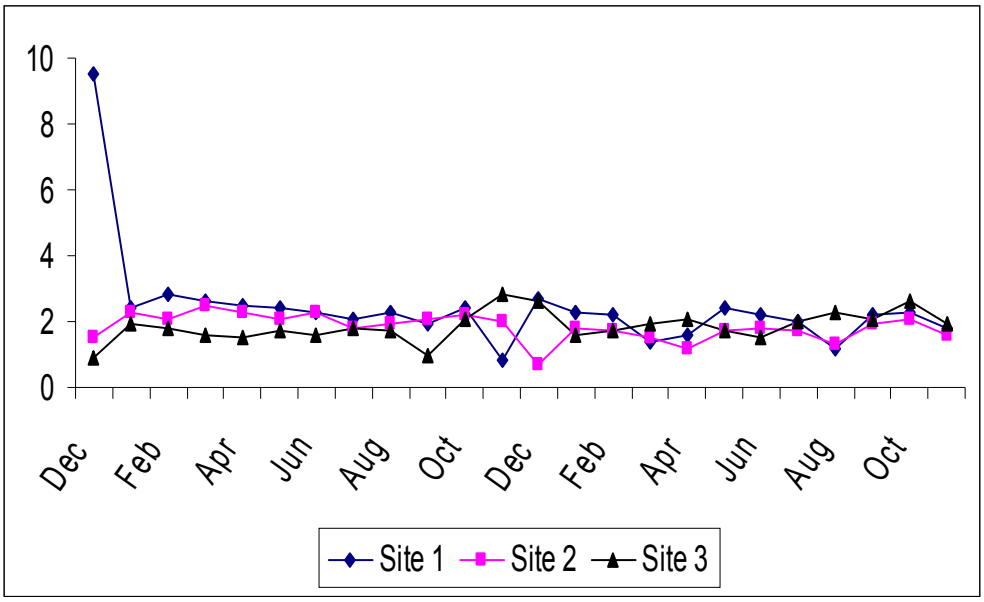


Fig. 3: Zooplankton Eveness at selected sites during 2012-2014

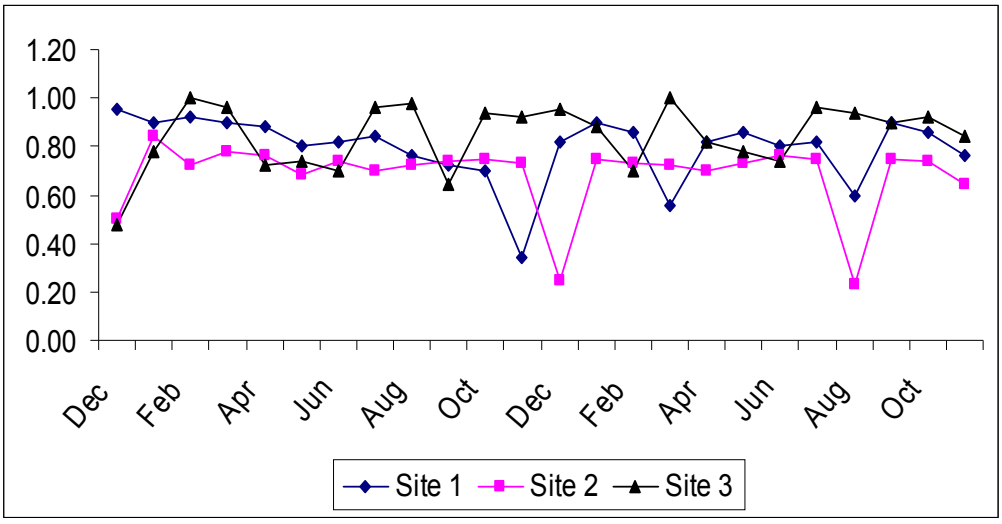


Fig. 4: Zooplankton Species richness at selected sites during 2012-2014

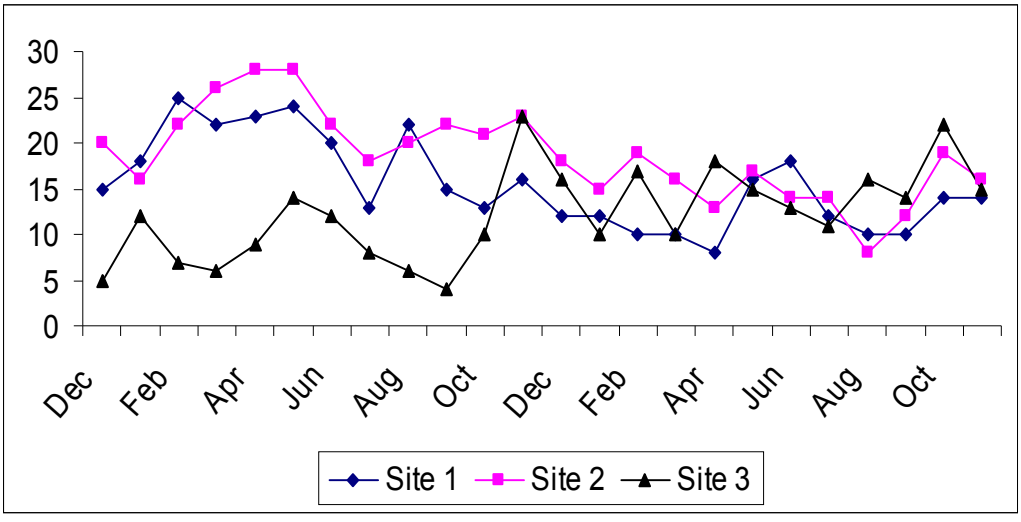
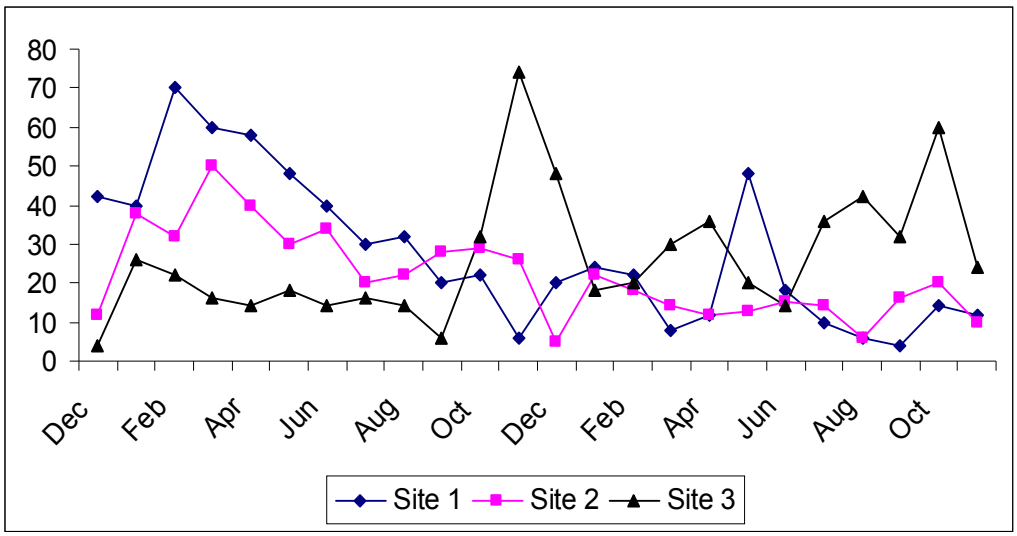


Fig. 5: Zooplankton Species Abundance at selected sites during 2012-2014.



DISCUSSIONS

It is concluded from this study that the zooplankton population of Gandak River at Chapra District is highly influenced by the anthropogenic disturbances at Sonpur site. The shift in the zooplankton community structure and dominance of pollution tolerant forms at discharge zone indicated deterioration of water quality in this stretch of the River.

In the present investigation, the zooplankton fluctuates monthly and its productivity was according to Rajshekhar *et al.*, (2010), the composition and relative abundance of species in the aquatic communities is influenced by the variation in tropic state and seasonal changes of physicochemical variables of water body. Dirican *et al.,* (2009) proposed permanent dominancy of rotifer species such as Brachionus and Keratella are indicative of eutrophic condition of lake. They studied Camligoze dam lake, Turkey and stated that rotifer are more abundant than other zooplankton groups and account for major portion of food chain. Chattopadhyay and Barik (2009) studied composition and diversity of net zooplankton from Krishnasayar lake and recorded high scores of species diversity and low scores of species richness amongst net zooplankton. They also recorded maximum relative abundance for rotifer and minimum for Decapoda.

According to Sousa *et al*., (2008) changes in water quality of water body have significant effect on structure of zooplankton assemblages that can potentially affect the functioning of ecosystem. Seasonal distribution of the population structure of zooplankton in connection with physicochemical parameters was studied by Sarkar and Chaudhary (1999). Hence, Zooplankton communities of numerous reservoirs, lakes and shallow water bodies have been used as indicators for the status of the lake (Christoferson *et al.,* 1993; Jeppensen *et al.,* 1999; Ramchandra *et al.,* 2006) and related with the concentration of total nitrogen, total phosphorus, algal biomass and the density and size of individuals. The variability observed in the distribution of zooplankton is due to abiotic parameters (e.g. climatic or hydrological limitation) and biotic parameter (predation, competition) or combination of both (Roff *et al.,* 1988; Christou, 1998; Escribano and Hidalgo, 2000; Beyst *et al.,* 2001). Hence, the use of zooplankton for environmental characterization of water body is potentially advantageous as the quality of water affects the species composition, abundance, productivity and physiological conditions.

Ferdous and Muktadir (2009) reviewed the potentiality of zooplankton as bio-indicator. They concluded that potentiality of zooplankton as bio-indicator is very high. Ramchandra *et al*., (2006) emphasized role of plankton in aquatic food chain and discussed zooplankton as bio-indicators. They carried hydrobiological investigation in selected Bangalore lakes.

CONCLUSIONS

The present study reveals that both abiotic and biotic interactions influencing population dynamics of zooplanktons in selected sites of Gandak River in the Chapra District of Bihar. There is also seasonal variation observed during study period. This study might would be useful to determine trophic status in such shallow water reservoir and proper management of these tiny crustaceans for enhancement of fish productivity to fulfil local market demands.

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