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**ORIGINAL RESEARCH ARTICLE**

# Study on the Diversity and Seasonal Variation of Zooplankton in Mahendra Nath Pond, Siwan, Bihar

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## ABSTRACT

Diversity of zooplankton in the Mahendra Nath pond was studied during March 2010- Feb 2011. The population of zooplankton consisted of rotifers copepods and cladocerans. Total number of zooplankton recorded were 2335 per litre of which rotifers were 1461 (62.56%), cladocerans 226 (9.67%) and copepods 608 (27.75%). All the dominant groups of zooplankton present throughout the year. Diversity analysis showed that rotifers had 11 species cladoccrans four and copepode four species. High number of zooplankton was recorded in winter season. While low number was recorded in monsoon season.

**Key words:** Zooplankton, Shannon weaver index, Evenness, Bimodal distribution, Margalef richness and Diversity richness

## INTRODUCTION

Correct identification of freshwater organisms is essential to understanding their ecology. Aquatic organisms interact with environment to alter water quality and perform ecology “services” such as decomposition and nutrient cycling. Identification of zooplankton species in food webs is essential part of managing aquatic bodies. Diversity of zooplankton can be used to indicate chronic water pollution problem.

Zooplankton plays an important food item of omnivorous and carnivorous fishes *(Alam et al).*

Zooplankton supports the economically important fish populations. The study of zooplanktonic composition abundance and seasonal variation is helpful in planning and successful fishery management (Jhingran V.G) the physico – chemical factors and nutrient status of water play the most important role in governing the production of planktonic biomass.

A very few researcher worked on percentage composition seasonal variation and abundance in zooplankton in Mahendra Nath pond, Siwan, Bihar.

A number of workers such as Das (1956), Dhanapathi (2000), Gopal (1984), Nair (2009), Sugunan (2000) and zafar (1964) have reported on different aspect of zooplankton inhabiting Indian fresh waters. Bihar in spite of being recognized as a state of flood conditions is characterized by large number of water bodies both natural and manmade. Mahendra Nath pond (pokhra) is an important water body of Siwan, Bihar. It is an important source of pisciculture in addition to irrigation. But this water body is under constant threat due to tourist disposal, domestic sewage and increased human activities. It is therefore, urgent need to manage scientifically this water body to tap it maximum potentiality.

The aim of the present study is to know the diversity of zooplankton groups and their seasonal variation in Mahendranath pond.

## MATERIALS AND METHODS

Mahendra Nath pond is situated 4km from Mahendra Nath halt and about 115km away from Patna city. It has a catchments area of 35 acre. The studies were continued for a period of one year from March 2010 to February 2011. Zooplanktons were collected on monthly basis from five different sites of the pond. Sampling was made between 8.00am to 10.00am. The samples were preserved in 5% formalin. The quantitative analysis was done with the help of Sedgwick rafter plankton counting cells and the results were expressed as organism per litre. The identification of zooplankton was done with the help of standard texts and monographs (Battish 1998), Edmondson 1965, Needham & Needham 1978, Tonapi 1980 and APHA 1995. Diversity

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indices were calculated for zooplankton using following formulae:

(i) Shannon and weaver index (1949)

**$H^I$ = - Σpi in pi**

Where; $H^I$ = Shannon weaver index

Pi = ni/N

Σ = Sum

Ni = The number of individual of $i^{th}$ species

N = The total number of individuals.

2. Evenness (j)

**J = H / Hmax**

Where; J = evenness index

$H^I$ is the Shannon weaver index

H max = logs

S = the number of species.

**The species richness of zooplanktons were calculated by following formula**

1. Margalef (1969)

**$R_1$ = (s-1) /in N**

2. Menhinick (1964)

**Q $R_2$ = S/√N**

3. Odum , cantol and komicher (1960)

**$R_3$ = S/log N**

Where; S= the number of species

N = The total number of species individuals

## RESULTS AND DISCUSSION

Seasonal population densities of zooplankton showed a high degree of seasonality within and between the groups. Some species were present throughout the year while others make sporadic appearance. During present study only three groups of zooplankton were taken into consideration. The seasonal distributions of major groups of zooplankton (unit/l) and of the different species are presented in (**Table 1 & 2**).

Rotifers were quite common in this habitat. The rotifer mainly consists of four families. Distinct seasonal differences in the abundance of the various rotifers were observed during the study period.

A total of 11 species of rotifers were restricted to this habitat and their total number showed different seasonal trends in the year. The lowest populations density (60 u/l) was recorded in October and the maximum (1194 u/l) in june.

Generally cladocera was represented by family sididae Daphnidae moinidae and Bosminidae. The peak of total cladoceran population (41u/l) found in February and the lowest (2u/l) was recorded in May month of the study period. Copepod was commonly present in this habitat and was represented by two families Diplomaidae, cyclopidae and their nauplie. Copepod seasonal variations in abundance showed their lowest population (9u/L) in August and the highest peak (80 u/L) in February of the year.

The interpretation of zooplankton population dynamics assumes that the species co-occur and interact in space and time. During the present investigation the zooplankton showed a bimodal pattern of fluctuations with the primary peak in monsoon and secondary peak in winter month during the study period

**Table 1: Diversity of zooplankton species identified from the Mahendra Nath pond**

| Order and family | Species |
|---|---|
| Order: Rotifera | |
| Family: Asplanchnidae | *Asplanchna* |
| Family: Testidunellidae | *Testudinella sp*<br>*Filnia sp* |
| Family: Brachionidae | *Brachinous angularis*<br>*Brachionous caudatus*<br>*Brachionus diversicornis*<br>*Brachionus falcatus*<br>*Keratella lenzi*<br>*Keratella Tropicana*<br>*Notholaka sp* |
| Family: Lecanidae | *Lecane sp* |
| Order: Cladocera | |
| Family : sididae | *Diaphanosoma sp* |
| Family : Daphnidae | *Dophnia carinata* |
| Family: Moinidae | *Moina dubia* |
| Family: Bosminidae | *Bosmia sp* |
| Order: Copepoda | |
| Family: Diptomidae | *Diaptomus sp* |
| Family: Cyclopida | *cyelops sp*<br>*Cyclopid nauplius*<br>*Nauplli* |

According to the literature several researcher observed bimodal as well as unimodal peak from different water bodies of India. A bimodal peak was observed from the freshwater body of Uttarpradesh, the first peak in September while the second in April (Das and shrivastawa 1956). The bimodal type of annual Cycle of Rotifera has been reported by Gophen (1942) while a single peak in late April was recorded in a pond in West Bengal (Jana 1973). Abimodal distribution has been observed in the population of some rotifers in a freshwater pond at Ranchi (Sinha & Sinha 1986). The zooplankton species of Indian freshwater bodies were reported by several workers which was quite compatible. Sewell (1934) recorded 10 rotifera, 15 cladocera and 10 copepoda from a fresh water tank of Bengal. Nasar (1973, 77) recorded 16 Rotifera 8 cladocera and 3 copepoda from other pond of Bhagalpur. Laal (1984) found 10 Rotifera from freshwater pond of Patna. Sharma and pant (1985) recorded 66 Rotifera, 15 cladocera and 7 copepods from two kumaun Himalalyan lakes. During present investigation the number 11 species recorded of Rotifera 4 cladocera and 4 copepoda from Mahendra Nath Pond.

During the study period Rotifera was the dominant group composing 67.56% of total zooplankton, Cldocera 9.07% and copepada constitute only 27.75%. Species diversity was evaluated using shannon and weaver index (h), Evenness (J), margalef ($R_1$), menhinick ($R_2$) and odum ($R_3$).

As a result of this study the value below 1.0 (shannon and weaver index) indicate the low quality of aquatic body and less supportive to the life of zooplankton.

**Fig 1: Percentage of different group of zooplankton**

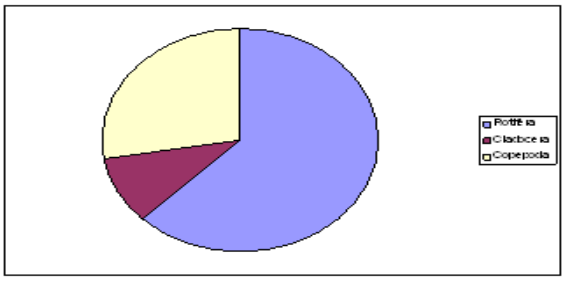


**Table 2: zooplankton species distribution and abundance at Mahendra Nath Pond**

| Zooplankton | Mar | April | May | June | July | Aug | Sep | Oct | Nov | Dec | Jan | Feb |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Rotifera** | | | | | | | | | | | | |
| *Asplanchna* | 17 | 8 | 3 | 3 | - | - | - | 7 | 11 | 45 | 38 | 22 |
| *Testudinella* | - | 3 | 16 | 10 | 8 | 3 | - | - | - | - | - | 2 |
| *Filnia* | 30 | 16 | 14 | 3 | - | - | - | - | - | - | 4 | 24 |
| *Brachious angularis* | - | - | - | - | - | - | 10 | 35 | 45 | 70 | 55 | 14 |
| *B. caudatus* | 35 | 50 | 55 | 25 | - | - | - | - | - | - | - | 10 |
| *B. diversicornis* | 5 | 40 | 10 | - | - | - | - | - | - | - | 5 | 15 |
| *B. Falcatus* | - | - | - | 55 | 75 | 50 | 19 | - | - | - | 8 | 6 |
| *Keratella lenzi* | 2 | 6 | 15 | 10 | - | - | - | - | - | - | - | 5 |
| *K. Tropicana* | - | - | - | 70 | 100 | 15 | 55 | 14 | 12 | 4 | 2 | 18 |
| *Notholca* | - | - | 3 | 15 | 3 | - | - | - | - | - | - | - |
| *Lecane* | - | - | - | 3 | 5 | 15 | 6 | 4 | - | - | - | - |
| Cladocera | | | | | | | | | | | | |
| *Diaphonosoma* | - | - | - | - | - | 8 | 6 | 8 | 11 | 6 | 3 | 3 |
| *Daphnia carinata* | 12 | 6 | 2 | 3 | - | - | - | - | - | - | 8 | 25 |
| *Moina dupia Bosmia* | 14 | 4 | - | - | 3 | 30 | 14 | 6 | 2 | - | 3 | 6 |
| Copepoda | | | | | | | | | | | | |
| *Diaptomus* | - | - | - | 30 | 34 | 90 | 25 | - | - | 10 | 19 | 35 |
| *Cyclops* | 25 | 15 | - | - | - | 15 | 30 | 9 | 10 | 15 | 27 | 22 |
| *Cyclopodi nauplius* | - | - | - | - | - | 6 | 10 | - | - | - | 6 | 4 |
| *Nauplli* | 45 | 75 | 90 | 18 | - | - | - | - | 2 | 16 | 20 | 25 |
| Total | 185 | 143 | 206 | 248 | 241 | 332 | 175 | 89 | 96 | 176 | 201 | 243 |

**Table 3: Value of zooplankton diversity in Mahendra Nath Pond (March 2010 – Feb. 2011)**

| | Diversity Index | |
|---|---|---|
| **Orders** | **Shannon Index ($H^1$) (1949)** | **Evenness (J)** |
| Rotifera | 0.2934 | 0.0378 |
| Cladocera | 0.2259 | 0.0291 |
| Copepoda | 0.3557 | 0.0458 |

**Table 4: Diversity richness in Mahendranath Pond (March 2010 – Feb. 2011)**

| | Diversity Index | | |
|---|---|---|---|
| **Orders** | **Margelef $R_1$, (1969)** | **Menhinick $R_2$, (1964)** | **Odum, cantlon and komicher $R_3$, (1960)** |
| Rotifera | 1.372 | 0.2877 | 3.4758 |
| Cladocera | 0.553 | 0.2660 | 1.6991 |
| Copepoda | 0.463 | 0.1571 | 1.4226 |

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