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A study of diversity, density, seasonality and productivity of zooplankton in Hardia wetland of Saran district of North Bihar, India

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Abstract: The role of zooplankton in the aquatic food chain is very important as it occupies the place of primary consumer and at the same time as secondary producer. The productivity of zooplankton will reflect the status of the aquatic system. Several works are available on the biomass and secondary production of zooplankton in lagoons, sea, fresh water ponds, lakes and reservoirs. Investigations on the zooplankton productivity of the wetlands are still scanty. Present investigation is related to the zooplankton productivity in Hardia wetland.

Keywords: Zooplankton productivity, Secondary production, Hardia wetland, Biomass, Primary consumer, Secondary producer.

INTRODUCTION

Zooplanktons are the primary consumer of the aquatic food chain. It has been extensively studied in different water bodies of our country. Notable among them are of Jana (1979)[1]; Sinha and Sahai (1978)[2]; Goel *et al.*, (1988)[3]; Sanjeev (1991)[4]; Selin and Hakkari (1982)[5]; Baruah *et al.*, (1993)[6]; Sharma and Munshi (1995)[7]; Murugan *et al.*, (1998)[8]; Patil *et al.*, (2008)[9]; Jayabhaye and Jadhav (2009)[10] and others. Present study is related to zooplankton community structure, density and seasonality of Hardia wetland.

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MATERIALS & METHODS

Collection of Zooplankton: It was collected through a continuous zooplankton and phytoplankton separator made out of nylon bolting silk.[11]

Secondary production: It was estimated following method suggested by Dalai and Parulekar (1986)[12] based on displacement volume and Mangas and Garcia (1991)[13].

BIOTIC ANALYSIS:

Plankton: The plankton (Both Zooplankton and Phytoplankton) were collected with the help of a plankton net made up of bolting silk (No. 25) by the hauling method. The plankton from the Shallower Zone were collected by filtering water through plankton net with the help of a 1 litre capacity beaker as in these areas it was difficult to

apply hauling method. The volume of water filtered was calculated.

Preservation: The above collected sample was preserved in 5% formalin.

Qualitative Analysis: The Qualitative analysis of plankton were done under a compound microscope with the help of available monograph and literature.[14-20]

Quantitative Analysis: Lackey drop micro transect method subsequently modified by Edmondson was used to enumerate plankton density quantitatively

This method involves the plankton enumeration in one drop of the concentrated sample taken on a slide. The concentrated sample was shaken thoroughly and a drop of it was put quickly on a clean slide with the help of a dropper holding it vertically. The whole drop was covered carefully under the cover slip. The slide was kept under the microscope and one edge of the cover slip was focused. The phytoplankton and zooplankton were counted while moving the slide with the help of a movable stage to other edge. The slide was shifted to the next field and the above process was repeated on the path parallel to the earlier one in the reverse direction. Number of transects were counted. Five drops of concentrated sample were examined to get average plankton density.

Calculation:

Organisms/drop= (Area of cover slip/Area of transect) x Individuals count recorded per transect.

Where; Area of cover slip= πr^2 (for round cover slip) Area of transect was measured with the help of stage and occular micrometer.

Total organisms/ml=Total no. of organisms/drop x No. of drops/ml.

Density (organism/l)=(axV)/L

Where; a= number of organisms

V= Volume of concentrates

L= Water filtered in litre

RESULTS AND DISCUSSION

Zooplanktons were represented by five groups- Rotifera, Cladocera, Copepoda, Ostracoda and Protozoa. Altogether 39 species of Zooplankton were recorded of which rotifer were dominant by 14 species followed by cladocera 10 species, protozoa 7 species, ostracods 5 species and copepod 3 species.

Table: 1 presents the species composition of Zooplankton. The percentage composition shows that Rotifera (36.59%) is dominant over other groups as follows:-

Rotifera (36.59%)>Cladocera (26.83%)>Protozoa (17.07%)> Ostracoda (12.19%) > Copepoda (7.32%)

Table 1: Zooplankton community structure of Hardia wetland

Protozoa	*Arcella discoides* *Arcella gibbosa* *Centropyxis* sp. *Centropyxis aculeate* *Difflugia* sp. *Eudorina* sp. *Euglypha* sp.
Rotifera	*Asplanchna* sp. *Brachionus angularis* *Brachionus calyciflorus* *Brachionus caudatus* *Brachionus forficula* *Filinia longiseta* *Filinia terminalis* *Lecane* sp. *Platyias* sp. *Polyarthra* sp. *Keratella cochlearis* *Keratella procurva* *Keratella tropica* *Synchaeta* sp.
Cladocera	*Alona* sp. *Bosmina* sp. *Ceriodaphnia* sp. *Chydorus* sp. *Daphnia carinata* *Daphnia lumholtzi* *Diaphanosoma* sp. *Moina* sp. *Scapholebris* sp. *Simocephalus* sp
Ostracoda	*Centrocypris* sp. *Cypris* sp. *Cypris subglobosa* *Haleocypris* sp. *Stenocypris* sp.
Copepoda	*Cyclops* sp. *Mesocyclops hyalinus* *Mesocyclops leuckarti*

The density of total zooplankton varied between 12u/l (september' 13) and 230 u/l (June' 13). It showed higher density during summer. Average monthly variation in zooplankton density is presented in Table:2, Fig:1. An abrupt decrease in their level was observed just after first shower of rain. The density of various group of zooplankton were in order of Copepoda> Rotifera> Cladocera> Protozoa> Ostracoda.

Table: 2: Monthly variation in Zooplankton Density (u/l) of Hardia wetland 2011-13

Month	Protozoa	Rotifera	Cladocera	Copepoda	Ostracoda	Total Zooplankton
Nov	0	0	6	22	8	36
Dec	2	2	9	40	0	53
Jan	4	3	9	80	0	96
Feb	6	6	12	130	0	154
Mar	12	12	14	85	0	123
Apr	26	32	14	85	0	157
May	30	90	20	88	0	228
Jun	26	59	19	87	0	191
Jul	12	60	12	88	0	172
Aug	10	40	8	68	0	126
Sep	4	6	3	17	0	30
Oct	3	6	0	24	0	33
Nov	9	6	2	7	7	31
Dec	11	17	4	36	4	72
Jan	11	36	9	40	0	96
Feb	13	47	36	41	0	137
Mar	14	53	43	43	0	153
Apr	17	64	49	48	0	178
May	19	73	53	45	0	190
Jun	31	90	60	49	0	230
Jul	6	9	10	10	0	35
Aug	4	6	6	9	0	25
Sep	2	4	3	3	0	12
Oct	3	4	4	9	0	20

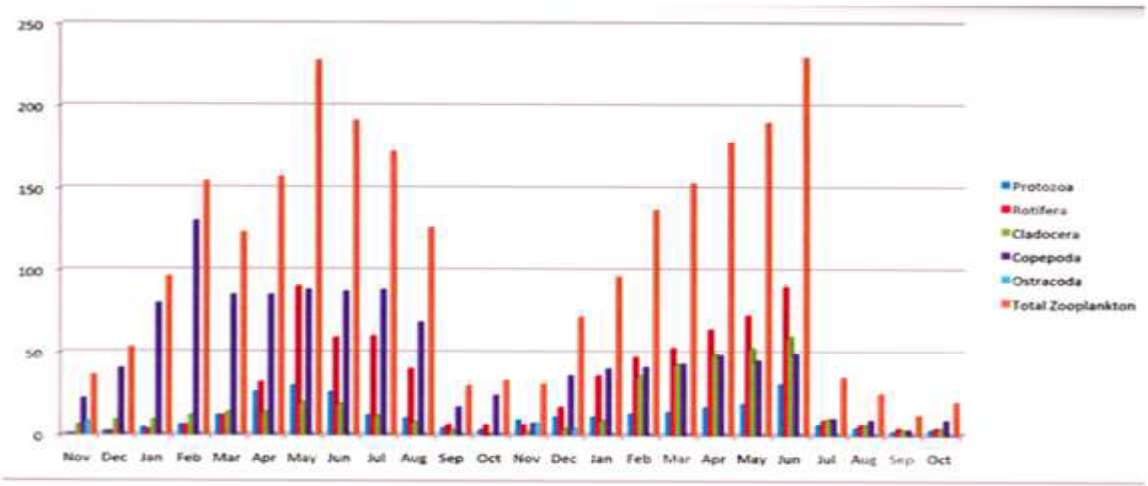

Fig.-1 : Monthly variation in Zooplankton Density (u/l) of Hardia wetland 2011-13

The Zooplankton biomass dry wt. was recorded maximum 799.368 μ g and minimum 105.180 μ g during May'2012 and Sept' 2012 of the first year of study while during second year the maximum 806.380 μ g was recorded in the month of June 2013 and minimum 42.072 μ g in September 2013.

An increasing trend in the biomass was observed from winter to summer in the first year and almost similar trend was observed in the second year of study. (Table: 3, Fig.:2)

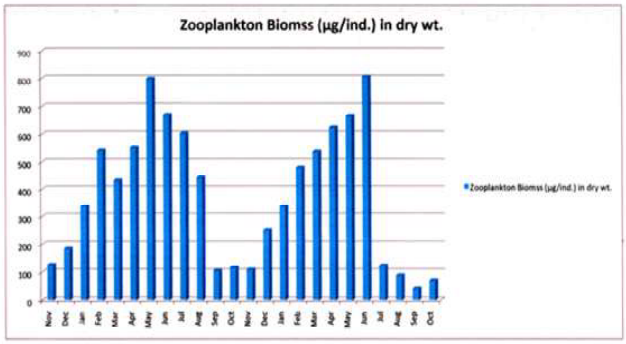

Fig.-2: Monthly variation in secondary productivity (Biomass) of Zooplankton of Hardia wetland 2011-13

Table 3: Monthly variation in Secondary Productivity (Biomass)of Zooplankton of Hardia wetland 2011-13

Month	Zooplankton Biomass (µg/ind.) in dry wt.
November	126.216
December	185.818
January	336.576
February	539.924
March	431.238
April	550.442
May	799.368
June	669.646
July	603.032
August	441.756
September	105.18
October	115.698
November	108.686
December	252.432
January	336.576
February	480.322
March	536.418
April	624.068
May	666.14
June	806.38
July	122.71
August	87.65
September	42.072
October	70.12

DISCUSSION

Highest biomass recorded in the June' 13 month of summer season as 806.38 μ g while lowest 42.072 μ g in the rainy season during September'13. Although highest during winter and lowest during rainy season has been reported by Al-Najjar and El-Sherbiny (2008)[21]. Lower productivity during rainy season can be attributed due to floods and dilution of water. Pre monsoon and post monsoon peaks of secondary production have been reported by Nayar *et al.,* (1999)[11]. Pre monsoon months observed highest production in June. A slight variation in the present study was observed and its single peak of production was recorded. This may be attributes to higher phytoplankton production.

Quantitatively copepod accounts for the bulk of zooplankton while ostracods were poorly represented.

Zooplankton showed maximum density during summer. Similar observations have been made by Michael (1969) in fresh water ponds and Baruah *et al.*, (1993)[6] in Kawar lake wetland. Summer increase may be due to favorable physico-chemical condition of water and higher phytoplankton density during summer. A sharp decline in zooplankton abundance and species composition during rainy season is due to rains, floods and dilution of water.

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