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Seasonal variation of Zooplankton in Som Kamla Amba Reservoir in Dungarpur district of Southern Rajasthan, India

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Abstract

The present investigation of seasonal variation of Zooplankton in Som Kamla Amba Reservoir was conducted to check the zooplankton status in the reservoir and provide new insights into its ecology. The study was carried out during the period of one annual cycle i.e. February 2015 to January 2016. A total of 23 genera were found in this reservoir. Among these, rotifers comprise of 5 genera (28.9%), Cladocera 4 (19.638%), Copepods 3 (20.09%), Ostracoda 4 (19.317%) and Protozoa 7 (12.02%). The season wise zooplankton analysis showed that the number of population was highest during summer, followed by monsoon and lowest during winter.

Keywords: Som Kamla Amba Reservoir, Zooplankton, Seasonal variation, Dungarpur, Southern Rajasthan

1. Introduction

Zooplankton are the free floating and microscopic animals found in aquatic ecosystems. They invariably form an integral component for fresh water communities and contribute significant to biological productivity. Zooplankton forms a major link in the energy transfer at secondary level in aquatic food webs between autotrophs and heterotrophs [4]. Zooplankton respond quickly to aquatic environmental changes e.g., water quality such as pH, colour, odour and taste etc. for their short life cycle and are therefore used as indicators of overall health or condition of their habitats [25]. The aquatic ecosystems are affected by several health stressors that significantly deplete biodiversity. Zooplankton species have different types of life history influenced by seasonal variations of biotic factors, feeding ecology and predation pressure. In the future, a loss of biodiversity and its effects are predicted to be greater for aquatic systems than for terrestrial systems [16]. Various ecological aspects of zooplankton have been a subject of study in India by several workers [20, 17, 21]. In the present study an attempt was made to analyze seasonal variation of zooplankton in Som Kamla Amba reservoir of Dungarpur district of Rajasthan.

2. Materials and Methods

2.1 Study area

Som Kamla Amba Reservoir is situated in Aspur tehsil of Dungarpur, Rajasthan at 23⁰-56'N Latitude and 74⁰-02'E Longitude. The catchment area of Som Kamla Amba reservoir is semi-hilly and rocky. The reservoir has an elongated shape and the earthen dam is located toward south eastern end. This reservoir is a multipurpose used for different activities like drinking water supply, irrigation, fisheries, Cattle etc.

2.2 Collection of sample and preservation

Water samples were collected at three diversely located site of the reservoir on monthly basis for a period of one year from February 2015 to January 2016. Collection of Zooplankton was carried out by using plankton net. Sampling was done between 8.00 AM to 10.00 AM. Plankton net of bolting silk number 25 of mesh size 60 μ was used for collection of samples. 50 litres of surface water was measured in a graduated bucket and filtered through the net and permitted to settle and further concentrated to 30 ml by decantation and stored in a 100 ml bottle. 4% formalin was added for sample preservation and brought to laboratory for further studies.

2.3 Analysis of Plankton

Sedgwick Rafter counting cell was used for qualitative and quantitative analysis of plankton. Concentrated samples of planktons were transferred are transferred on the counting sell by using 1 ml bore pipette. All planktons are allowed to settle down for 10-15 minutes and then the counting cell is placed under microscope. Plankton were identified and counted by moving the Sedgwick Rafter cell under the microscope. The systematic identification of plankton was made by using standard keys of [1, 7, 2].

2.4 Calculation

The observed numbers of plankton are calculated by following formula:

$$N = \frac{(A \times 1000) \times C}{L}$$

Where

N=Number of plankton per liter of sample water

A=Average no of plankton in one small counting chamber of

Sedgwick Rafter cell

C=Plankton concentration factor in ml

L=Volume of original water filtered through net in liter.

3. Results and Discussion

Total 27 Zooplankton genus were recorded, out of them 7 belonged to Protozoa, 4 belonged to Cladocera, 3 belonged to Copepoda, 4 belonged to Ostracoda and 5 genera (9species) belonged to Rotifera were recorded. Monthly recorded variation of Zooplankton population is shown in Table 1.

The total numbers of species recorded were 2600 of which protozoa are 61.666 (3%), Cladocera 170.333 (7%), Copepods 1105.667 (45%), Ostracods 490.666 (20%) and Rotifera 600.333 (25%) Table 2.

Season wise predominance of zooplankton were as

Summer (Feb, Mar, Apr, May) : Rotifera > Copepoda > Ostracoda > Cladocera > Protozoa

Monsoon (Jun, Jul, Aug, Sept, Oct) : Copepoda > Rotifera > Ostracoda > Cladocera > Protozoa

Winter (Nov, Dec, Jan, Feb) : Copepoda > Ostracoda > Rotifera > Cladocera > Protozoa

Table 1: Monthly variation of zooplankton (No/Lit) at three stations (S₁, S₂, S₃) of Som Kamla Amba Reservoir Dungarpur, Rajasthan.

Month	Protozoa			Cladocera			Copepoda			Ostracoda			Rotifera		
	S ₁	S ₂	S ₃	S ₁	S ₂	S ₃	S ₁	S ₂	S ₃	S ₁	S ₂	S ₃	S ₁	S ₂	S ₃
Feb	6	3	6	15	19	-	-	33	-	6	12	33	12	76	58
Mar	5	7	6	15	22	-	137	27	-	7	14	24	16	93	94
Apr	3	8	7	75	-	-	221	180	-	9	12	198	23	106	124
May	1	5	5	65	-	-	256	175	-	10	28	145	21	158	173
Jun	2	5	9	54	-	-	241	192	1	5	29	141	28	130	126
Jul	9	9	4	70	-	-	247	132	1	4	18	116	12	78	60
Aug	7	6	4	67	-	-	188	118	-	6	13	110	18	33	27
Sept	6	2	1	17	-	-	138	49	-	7	15	91	10	25	26
Oct	1	2	1	46	-	-	226	98	-	11	26	75	7	22	20
Nov	3	5	7	18	-	-	144	79	-	5	36	85	18	38	31
Dec	7	6	4	12	-	-	142	84	-	4	22	75	11	29	19
Jan	10	6	7	16	-	-	126	82	-	11	19	50	12	40	27
Total	60	64	61	470	41	0	2066	1249	2	85	244	1143	188	828	785
Mean	61.6666667			170.3333333			1105.666667			490.6666667			600.3333333		

Table 2: Distribution of Zooplankton in Som Kamla Amba Reservoir

Sr. No	Group	No of organism	Percentage
1	Protozoa	61.67	3%
2	Cladocera	170.33	7%
3	Copepoda	1105.67	45%
4	Ostracoda	490.67	20%
5	Rotifera	600.33	25%
	Total	2428.67	

Table 3: Seasonal variation of zooplankton (No/Lit) in Som Kamla Amba Reservoir during February 2015 to January 2016

Sr. No	Seasons	Protozoa	Cladocera	Copepoda	Ostracoda	Rotifera
1	Summer	20.67	70.33	343	166	318
2	Monsoon	21.33	69.33	435.67	185	191
3	Winter	19.67	30.67	327	139.67	91.33

3.1 Protozoa

These are the very diverse group of unicellular eukaryotic organisms [9] any of which are motile in nature. In the present study, 7 genera of protozoa *Amoeba*, *Bursaria*, *Diffugia*, *Euglena*, *Euglypha*, *Paramecium* and *Phagus* were recorded. The population density was higher in monsoon season (21.33 No/Lit) and less in winter (19.6S7 No/Lit).

Similar observations of seasonal variations in the distribution of zooplanktons were made at Bhadra Reservoir, Karnatka [21]

where Rotifera, Cladocera, Copepoda, Ostracoda and Protozoa were found in maximum number during summer, followed by winter and minimum during monsoon. All over population of zooplankton was high in summer and winter season; and low in monsoon season. Rotifers and Cladocera were dominated over copepod, Ostracod and Protozoa by population throughout the year. Similar observations were reported at Tighra Reservoir, Gwalior [3, 6].

3.2 Cladocera

Cladocerans are the most useful and nutritive group of crustaceans for higher members of fishes in the food chain. In the present study, a total of 4 species were recorded. The dominant forms consisted of *Ceriodaphnia*, *Daphnia*, *Moina* and *Moinadaphnia*. The population densities of Cladocera were higher in summer season (70.33 No/Lit) and equal to monsoon while it was lower in winter (30 No/Lit.). Strikingly feature is seen at S₃, where no Cladoceran was observed throughout the study period. Similarly at station S₂, Cladoceran population is seen only in two months of the entire study period.

Abundance of Cladocera has also been earlier reported in summer season and lower in winter [6]. Cladocera were found maximum in summer months might be attributed to favorable temperature and availability of food. Cladocera is an order of small crustaceans commonly they are called by “water fleas” [15]. It has been reported that the density and biomass of cladocerans was primarily determined by food supply [18].

3.3 Copepods

Freshwater copepods constitute one of the major zooplankton communities occurring in all types of water bodies. They serve as food to several fishes and play a major role in ecological pyramids. In the present study, 3 species were recorded. The dominant forms consisted of *Cyclops*, *Nauplius larva* and *Diatomus*. Copepods showed higher population density in monsoon season (435.67 No/Lit) and lower in winter (327 No/Lit).

Abundance of copepods in summer and monsoon is due to the lake which is rich in organic matter supporting higher number of Cyclopoids, thus suggesting their preponderance in higher trophic state of water [14]. In present study at station S₃, population of Copepods are observed only during monsoon season. Copepoda domination may also be due to their feeding on diatoms, Rotifera and Cladocera and high reproduction capacity [9]. Similar observations are made in Masunda Lake [22].

3.4 Ostracoda

Ostracoda represented very low diversity and population density as compared to other groups of zooplankton. In the present study, 4 species of Ostracods were recorded. The dominant forms consisted of *Cypris*, *Cyprinotus*, *Heterocypris* and *Stenocypris*. The population density was higher in monsoon season (185 No/Lit) and less in winter (139.67 No/Lit). Similar result has also been observed by various researchers [23, 11]

3.5 Rotifera

Rotifers play a vital role in the trophic tiers of freshwater impoundments and serve as living capsule of nutrition (Sureshkumar *et al.*, 1999). In the present study they dominated with 09 species (5 genera) as compared to other groups of zooplankton. The dominant forms consisted of *Asplanchna*, *Brachionus angularis*, *Brachionus caudatus*, *Brachionus quadridantata*, *Brachionus falcatus*, *Filina*, *Keratalfa tropica*, *Keratalfa cochlears* and *filidina*. The population density of rotifers was rich in summer season (318 No/Lit) and less in winter season (91.33 No/Lit).

Taxonomic dominance has been reported in several water bodies [12, 10]. The number of Rotifers increased in summer which may be due to the higher population of bacteria and organic matter of dead and decaying vegetation [13].

Dominance of rotifer population which was due to its preference for warm waters [19]. Planktonic rotifers have a very short life cycle under favorable conditions of temperature, food and photoperiod. Since the rotifers have short reproductive stages they increase in abundance rapidly under favorable environmental conditions [5]. According to observation *Brachionus* species were very common in temperate and tropical waters and indicated the alkaline nature of water. Excess growth of rotifers in lakes and reservoirs indicated the eutrophic conditions [9].

4. Conclusion

Copepoda are the predominant groups of zooplanktons found in the majority of reservoir, constituting 45% of the total zooplankton present. In the current study area the population of zooplankton was found to be higher during the summer and lower during monsoon months. The study indicated that the temperature played an important role in the distribution of zooplanktons in the reservoir. The presence of four Rotifera species (*Brachionus angularis*, *B. calyciflorus*, *B. falcatus* and *Filinia longiseta*), and Cladocera species *Ceriodaphnia* reveal that the reservoir was being eutrophicated and polluted. It was understood that the various anthropogenic activities such as entry of agricultural runoffs (eg. insecticides, pesticides) from surrounding agricultural field and fishing activities was leading eutrophication. But the huge diversity of zooplankton in Som Kamla Amba reservoir indicated the fact that Som Kamla Amba Reservoir of Dungarpur district was least polluted and suggested for prevalence of proper biogeochemical cycles. Therefore, the water body was considered to be a suitable one for irrigation and natural fin-fish culture practices.

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