A Review on Zooplankton Studies of Freshwater Bodies of India

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Review Article

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ABSTRACT

Zooplanktons are the primary consumers of aquatic ecosystem. Zooplanktons are the plankton consisting of small animals and the immature stages of larger animals. Zooplanktons play a significant role in food chain and also assess the ecological status of water bodies. Zooplanktons are the bio indicators of pollution and water quality. Present study reveals on the freshwater zooplanktons in India. Zooplankton population is very valuable indicators of food web stability. Zooplanktons are affected by many environmental factors such as pH, temperature, salinity; oxygen etc. Zooplanktons are playing important role on food chain, energy transfer between primary and tertiary trophic levels. Zooplanktons are also important role in analysis of health status of water bodies.

Keywords: Zooplankton; Rotifera; Copepoda; Cladocera; Ecosystem

INTRODUCTION

The zooplankton community is a vital role of the aquatic food chain. These organisms serve as an intermediary species in the food chain, transferring energy from planktonic algae to the larger invertebrate predators and fish who in turn feed on them. Zooplankton are highly sensitive to changes in aquatic ecosystems. The effects of environmental turbulences can be detected through changes in species composition, abundance and body size distribution. Zooplanktons are the bio indicators of environment for pollution, physical, chemical and biological status of aquatic system. Water bodies like reservoir contain wide variety of zooplankton. These organisms by virtue of their adaptability are present in all the possible environmental conditions and are used as indicators of pollution. Zooplankton have attracted attention of many ecologists because of their wide distribution in all kinds of water and abundance in which, they frequently occur. Zooplankton play an important role in secondary food web of an aquatic ecosystem and form an intermediate link between tertiary producers. Therefore, aim of this paper is to review on zooplankton of freshwater bodies and its play important role in ecosystem from the study area.

LITERATURE REVIEW

Methodology

A literature review methodology, which involves the examination of academic articles, books and other relevant materials to provide a description, summary, and critical evaluation of the existing works on a specific subject, field of study, or theory. Various sources, including scientific articles, organizational and government websites, published surveys, reports, and research papers, were analysed to assess the research methodologies

Zooplanktons review

Darvekar have studied diversity, seasonal variation and zooplankton community of freshwater, ramadeshwar lake, district-Nagpur, Maharashtra, India [1]. He has concluded that 26 species were found belonging to Rotifera, Cladocera and Copepoda inhabit all four sampling stations. Rotifera included 13 species and dominated in all the months with average composition of 39.52% in summer, 41.27% in monsoon and 44.16% in winter. Cladocera included 8 species with average composition of 24.15% in summer, 25.2% in monsoon and 23.69% in winter. Whereas, Copepoda comprised 5 species with average composition 36.27% in summer, 33.45% in monsoon and 32.53% in winter with an intermediate range of population. The values of Shannon Wiener Diversity Index (1.42 in summer, 1.65 during monsoon and 2.2 in winter) for the four sampling locations, indicate a Mesotropic to Eutrophic status of water body, that is detrimental for swimming, anthropogenic activities and irrigation of crops due to microbial contamination.

Hashim have studied distribution and seasonal spread of zooplankton in Iraqi waters [2]. He has concluded that zooplankton is able to withstand the environmental conditions of each site, and from this we find that zooplankton can be a vital guide to identifying the nature of the environmental conditions that dominate each region. Anbalagan has studied the freshwater zooplankton biodiversity and physico-chemical parameters of mayanur dam, Tamil nadu, India [3]. The studies have concluded that a total of 22 species of zooplankton belonging to Protozoa, Rotifera, Cladocera, Copepoda, Ostracoda and Anostraca. A percentage comparison among the various zooplankton species reveals that the rotifers were the dominant group forming 50% of the zooplankton followed by cladocerans and copepods representing 13.7% each. This was followed by Ostracoda and Protozoa representing 9% each followed by Anostraca forming 4.6% of the total zooplankton.

Bhandarkar has studied the trophic status in freshwater lentic ecosystem of Dhukeshwari Temple Pond Deori with reference to zooplanktonic assemblage [4]. The studies have concluded that 83 species, and consists of members from Rotifera (46) belonging to 15 families from 03 orders Cladocera (27) belonging to 06 families; Copepoda (6) and Ostracoda (04). The zooplankton consists of Rotifera, Cladocera, Copepoda and Ostracoda. Balamurugan reported six species of copepods belonging to order Cyclopoida from water body with heavily loaded organic enrichment due to influx of sewage [5].

Kurasawa have noticed the dominance of Copepoda in oligotrophic lakes but Cyclopoid-Copepods were dominant in Eutrophic lakes of tropical region [6]. Bhandarkar and Paliwal, reported 9 species of copepods from various water bodies in Lakhani, in which 1 species of Diaptomidae and 8 species of Cyclopidae reveals that the water bodies of Lakhani are Eutrophic [7]. Yadav and Singh were studied the zooplankton diversity of Chhapakaiya pond Birgunj Nepal [8]. A total 27 taxa from different classes of zooplankton were identified. The zooplankton was reported maximum (774.4 unit/L) during summer and minimum (539.2 unit/L) during rainy season in Chapakaiya pond. Savitha have studied on abundance of zooplanktons in lakes of Mysore, India [9]. She had concluded that Rotifer (281 Org l-1), Cladocerans (27 Org l-1) and total abundance of zooplankton (343 Org l-1) were more and significantly different in Dalvoy lake; whereas, in Kalale lake the mean abundance of Rotifer (19 Org l-1), Cladocerans (3 Org l-1)

and total abundance of zooplankton (79 Org l-1) and in Alanahalli lake the mean abundance of Rotifer (84 Org l-1), Cladocerans (9 Org l-1) and total abundance of zooplankton (149 Org l-1) were significantly less. Gahlaut have studied Zooplankton community in a freshwater pond in Jammu and Kashmir [10]. He was observed that the common group of zooplankton includes, cladocera, copepods, rotifers and protozoans. The environmental condition of the pond and the surrounding area shows the dominancy of rotifers zooplankton. The investigation clearly showed that the maximum density and diversity was observed in summer and minimum was seen in rainy season.

Sharma have studied Zooplankton diversity of Anas river at Jhabua, Madhya Pradesh, India [11,12]. He has observed that total of 31 zooplankton species were recorded belonging to 8 orders which belong to 5 group Protozoa, Rotifera, Copepoda, Cladocera, Ostracoda. Zooplankton population was represented by Rotifera group followed by Cladocera, Copepoda, Protozoa, Ostracoda. Maximum density of zooplankton was recorded in the summer month, while minimum density of zooplankton was recorded in winter and monsoon. Gaike have studied biodiversity of zooplankton communities in Kasura dam partur Dist-Jalna [13]. He has concluded that a total number 38 species recorded with Cladocera–17, Copepoda–05, Rotifera–13, Ostracoda-03. In the Rotifers the genus *Brachionus* is the dominant group.

Bala have studied the diversity and community structure of freshwater zooplankton and Ichthyofaunal in Kumaraswamy Lake, Coimbatore [14]. He concluded that the population density of zooplankton was recorded in the range between 3,840 and 4,535 ind./l at Kumaraswamy lake. The minimum population density was noticed in the following order: January>February>March>April. In the present observation, zooplankton percentage composition shows that the Rotifer holds the top rank at Kumaraswamy lake. The groups Rotifera were found in predominant with (34%) followed by species of Cladocera (26%), Copepoda (22%) and Ostrocoda with (18%).

Dandawate have studied zooplankton diversity in Bhima river, Maharashtra, India [15]. He has observed that total, 13 species of zooplanktons belonging to families and 4 classes *viz*. Rotifera, Cladocera, Copepoda and Ostracoda were recorded from the Bhima River in karjat shrigonda tehsil area. The dominance of Rotifera was observed among all zooplankton groups in all seasons. The study of seasonal variation of zooplankton analysis shows an in-winter season species number are more.

Jose have studied seasonal variations in the zooplankton diversity of river Achencovil [16]. He has observed that zooplankton community of Achencovil river comprised of 28 species belonging to Cladocera (11 sps), Copepoda (9 sps) and Rotifera (8 sps). Cladocerans showed dominance both in number and diversity, followed by Copepods and Rotifers. This study also reveals that different groups of zooplanktons have their own peak periods of density, which is affected by local environmental conditions prevailing at that time. Islam has studied checklist of zooplankton of the Halda river [17]. He identified that a total of 71 species of zooplankton under 37 genera belonging to 9 groups. The dominant group of zooplankton was 44 species of Rotifers (61.98%) followed by 12 species of Copepods (12.68 %), 5 species of Cladocerans (7.05%), 3 species of Protozoans (4.22%), 2 species of Mollusks larvae (2.82%), 2 species of Insects (2.82%), 1 species of Cnidarian (1.41%), 1 species of Nematode (1.41%) and 1 species of Ostracod (1.41%). Therefore, the water body of the Halda is eutrophic in its nature.

Yannawar have observed and identified freshwater zooplankton in Godavari river concerning food chain in aquatic ecosystem of Nanded [18]. She has observed that the biodiversity of zooplankton taxa was studied with various population densities of the zooplankton groups, and it was found to be in like this order Rotifera>Copepoda>Cladocera> Ostracoda. The high and low population densities were obtained in the summer and early monsoon season respectively. This higher zooplankton population density in summer might be the reason for the temperature. Researched that zooplankton population was dominated by rotifera (39%), cladocera (33%),

copepoda (19%), and ostracoda (9%) respectively. Dede has studied zooplankton composition and seasonal variation in Bhima river. He has observed that total of 21 species were found in river. Among these 9 species belong to rotifera, 5 species copepoda, 5 species cladocera and 2 species ostracoda. Yalavigi has studied zooplankton diversity and desity in Chikodi (Halatti) Tank [19]. He observed that 33 species of zooplanktons, Rotifera was taxonomically dominant group. Both Rotifera and Copepoda were equally dominant in density the pond was in eutrophic or hypereutrophic condition throughout our study period except between June and July.

Shivaraju have studied Limnological characteristics and zooplankton diversity in Durgadahalli and Mydala lakes of Tumakuru, Karnataka state, India [20]. He has concluded that Mydala lake recorded 26 species of zooplankton among which 17 are rotifers, 7 are cladocera's and 2 are copepods. In rotifers, family Brachionidae contains highest number of species (10 species), in which genus *Brachionus* (08 species) represents the highest number. Most commonly occurring species are *Brachionus angularis, B. caudatus, Keratellatropica, Filinia longiseta, Ceriodaphnia cornuta, Ceriodaphnia cornuta, Diaphanosoma sarsi and Moina micrura*. The highest zooplankton population was recorded in rotifera and lesser in copepod in both the lakes. Khan has studied zooplankton diversity in triveni lake at Amravati (M.S) [21]. This study concluded that the zooplankton of Triveni lake water is represented by five different groups like Protozoa, Rotifera, Cladocera, Copepoda, Ostracods with 19 different species were identified and recorded in Triveni lake. Rotifera was found dominant among zooplankton and this indicates the polluted nature of the lake water. Bhavimani have studied zooplankton and some physico-chemical parameters analysis of madikoppa and benachi ponds, alnavar, Dharwad [22]. She observed that Rotifer was dominated followed by cladocera, copepoda and ostracoda. Presence of *Brachionus* Sp, *Cyclops* Sp, *Mesocylops* Sp, etc. are indicators of pollution. Awareness among local people and effective co-ordination of concerned authority are essential for present use and future management of ponds.

Patel has studied zooplankton diversity of a freshwater perennial pond in Wani city of Yavatmal [23]. He has observed 42 species belonging to five different classes from zooplankton diversity. The class wise dominance of zooplankton was Rotifera>Cladocera>Copepoda>Ostracoda>Protozoa. *Keratella cochlearis* was found to be dominant species belonging to rotifera among other zooplankton species. Chaturvedi studied the seasonal density of zooplankton in the Ken river [24]. They were strongly affected by environmental conditions and responds quickly to change in environmental quality. Hence, qualitative and quantitative study of zooplanktons is of great importance.

Chandrasekhar studied freshwater diversity of Andhra Pradesh and concluded that zooplanktons in general are very sensitive to changes in environment and also, they are important part of aquatic food chain [25]. Therefore, any adverse effect on zooplankton will reflect on productivity of water system. He also concluded that they are most suitable indicator group for assessment of any kind of aquatic pollution. Maruthayanagam studied the zooplankton diversity along with the physicochemical parameters of Tamil Nadu and stated that higher density of zooplankton was recorded during the rainy season, with copepods forming the dominant group followed by cladocera, rotifera and ostracoda. Five species of rotifera, four species of cladocera and three species each of ostracoda and copepoda were recorded [26]. The ostracods even though tolerate wide range of ecological factors, did not occur in polluted waters. The lower density of zooplankton during the summer months than in the rainy months was attributed to higher temperature, decrease in the nutrients and thereby the phytoplankton population.

Dutta investigated freshwater diversity of Jammu and collected 51 species of zooplankton [27]. Out of all the orders the maximum dominance was shown by protozoans (35 sp.) followed by crustaceae (8 sp. and 2 larvae), rotifera (5 sp.), porifera (1 sp.), platyhelminthes (1 sp.) and annelidae (1 sp.). Zafar and Sultana during the study of river Ganga at Kanpur studied the zooplankton and macroinvertebrate diversity and observed that the quality of the water was

responsible for quantitative and qualitative variations in zooplanktons [28]. Ankathi and Piska studied the zooplankton diversity of Julur Nalgonda district and collected 26 genera of zooplankton [29]. Out of which 8 genera were represented by rotifers, 5 by copepod, 12 by cladocera and 1 by ostracod. The rotifer *Branchionus* sp. was dominant among zooplanktons. Among all the orders rotifer was dominant with a total percentage of 74.21% followed by copepod (17.27%), cladocera (4.90%) and ostracod (3.63%). Negi and Negi studied the zooplankton diversity of Hinval freshwater stream at Shivpuri of Garhwal region (Uttarakhand) and reported a total of 16 genera among which rotifers constituted the major zooplanktonic diversity (7 genera) followed by protozoans (4 genera), cladocerans (4 genera) and nemata (1 genus) [30].

CONCLUSION

Based on the assessment above, it can be stated that while a great deal of work has been done on freshwater resources, there is still more to be done to address changing environmental and climatic conditions. It is a disgusting fact that over time, climate change affects many elements of nature, including naturally occurring freshwater bodies. This warrants careful research using novel strategies and cutting-edge tools. In order to provide information regarding the appropriate management of aquatic ecosystems, zooplankton have to be regularly monitored.

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