

## STUDIES ON PHYSICO-CHEMICAL ASPECTS AND ZOOPLANKTON DIVERSITY OF A FRESHWATER WETLAND IN CACHAR, ASSAM

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**Abstract:** Zooplankton are the intermediate link between the primary producers and the higher trophic level as they are grazers on the phytoplankton and are main food base of the larvae of most carnivorous and omnivorous fishes as well as other aquatic vertebrates and invertebrates. The present study was conducted for a period from July, 2016 to March, 2017 covering three seasons in Malini Beel, Silchar, Cachar, Assam. Present study revealed the presence of three groups of Zooplankton in the study site. Rotifers were reported maximum in numbers with 8 taxa followed by that of Cladocera with 5 taxa and that of Copepoda with 3 taxa, making total of 16 taxa. The seasonal percentage composition of various groups of Zooplankton revealed 45% of Rotifera, 35% of Cladocera and 20% of Copepoda. Almost all the groups of Zooplankton were found to be highest in monsoon season. During the study period, Rotifera was reported to be the most dominant group of which *Brachionus* sp. and *Testudinella* sp. shows the highest abundance. Certain physico-chemical parameter during the study period revealed that the water temperature, pH, DO, FCO<sub>2</sub>, TA were found to be highest during the monsoon season and lowest during pre-monsoon season. The detailed aspect of the physico-chemical parameters and Zooplankton composition of the study site during the study period are discussed herein.

**Keywords:** Zooplankton, Beel, Rotifera, Brachionus.

### Introduction

Life in an aquatic environment is largely governed by its physico-chemical characteristics and its stability. Biological production in any aquatic body is directly correlated with its physico-chemical status (Sharma *et. al.*, 2013). Physico-chemical parameters are the most appropriate source to measure the water quality of any aquatic body. A slight change in the physico-chemical properties affects the biodiversity of the ecosystem. Investigations have been made to correlate plankton distribution with physicochemical parameters. Correlation between physico chemical factors and planktons has been studied by many workers (Harsha and Malammanavan, 2004; Ayoade *et al.*, 2009; Lashkar and Gupta, 2009). The species composition of the Planktons, on the otherhand are a great indicator of water quality, because of their quick response to environmental changes.

Among planktons, zooplanktons are important link in the transformation of energy in an aquatic food web because of their drifting nature, large density, high species diversity and tolerance to the stress (Bhat *et al.*, 2014). It forms a major link in transfer of energy at secondary level between autotrophs and heterotrophs in an aquatic food web. They are the integral part of aquatic food web and contribute significantly to aquatic biological productivity in freshwater ecosystem (Nimbalkar *et al.*, 2013).

Several works on freshwater zooplankton composition and distribution are carried out throughout the country in recent years, worth mentioning that of Sharma and Sharma, 2002, 2008; Nimbalkar *et al.*, 2013; Bhat *et al.*, 2014; Dede and Deshmukh, 2015; Balakrishna *et al.*, 2013; Sharma *et al.*, 2015. But the studies on zooplankton in north-east part of the country, especially in South Assam is scanty except some worth mentioning works in recent years that of Kar, 2007, 2013, 2016; Kar and Barbhuiya, 2004; Kar and Kar, 2013, 2016, 2016; Das *et al.*, 2014; Das and Kar, 2013; Das and Kar, 2013, 2016; Kar *et al.*, 2015; Kar *et al.*, 2016. Since, recent years, the Malini Beel has been a victim of different problems like sedimentation, urbanization and growth of various small scale industries; thereby, leading to its siltation, eutrophication and pollution, including health problems to fishes, notably, Epizootic Ulcerative Syndrome or EUS (Kar, 2015). Nevertheless, not much works had been done on the limnology of this biotope including planktonic aspects. Hence, an attempt was made to study the physico-chemical parameters and zooplankton diversity of this wetland situated in the Cachar district of Assam.

### **Material and methods**

**Study Area:** The present area of study, Malini beel, is a floodplain wetland located at Cachar district of Assam. It lies between 24°49'33.1"N and 92°46'24.8"E and is about 6 km from the main town of Silchar. It has potentialities of being an ideal site for culture fishery and tourism.

**Sampling and Analysis:** The water samples were collected seasonally from the study site during the investigation period (July, 2016 to March, 2017). The samples collected were thus investigated in the laboratory following standard methods of APHA, 2005; Kar, 2007, 2013. The collection protocol for zooplankton included weekly sampling of zooplankton from the site following standard methods and literature of Battish, 1992. The zooplankton samples were collected from the site during early hours of the day (6 am to 8 am). The zooplankton samples were then brought to laboratory for further qualitative verification and quantitative estimation. Then the sample were filtered and placed in Tarson (100 ml) container and

subsequently fixed in Lugol's solution and stored in cool and dark place. Further for identifying the zooplankton and studying their diversity, a drop of preserved zooplankton sample were placed in Sedgwick-Rafter counting chamber and observed under a light microscope under required magnification (X 10 initially, followed by X 40). The zooplanktons were then identified following standard literature of Edmondson 1992; Battish, 1992; Michael and Sharma, 1998; Sharma, 1998; Sharma and Sharma, 2008.

### Results and discussion

Malini Beel had an area of around 3000 acres during British period according to the traditional knowledge available. The whole town of Silchar, was basin like at the beginning until urbanization took its rule. But the present aquatic capacity of Malini beel has undergone huge shrinkage and the beel has been converted to several pond like bodies of area of 133sq.m (pond 1), 182 sq.m (pond 2), 103 sq. m (pond 3).

Limnological analysis are summarized in Table 1. The water temperature, pH, DO, FCO<sub>2</sub>, TA were found to be highest during the monsoon season and lowest during pre-monsoon season.

**Table 1: Physico-chemical parameters of Malini Beel during the study period**

PARAMETERS	MONSOON	POST-MONSOON	PRE-MONSOON
Water Temperature (°C)	30 ± 1.7	23 ± 1.5	21 ± 1.7
pH	6.8 ± 0.1	6.6 ± 0.2	6.7 ± 0.1
Dissolved Oxygen, DO (mg/l)	7.7 ± 0.1	7.3 ± 0.3	6.6 ± 0.1
Free Carbon Dioxide, FCO <sub>2</sub> (mg/l)	0.9 ± 0.1	0.6 ± 0.1	0.7 ± 0.1
Total Alkalinity, TA (mg/l)	57 ± 2.1	57 ± 3.5	54 ± 1.0

The zooplankton diversity and abundance of the study site are summarized in Table 2. A total of 16 taxa were recorded from the study site during the study period of which 5 taxa were reported from Cladocera group, 3 taxa were from Copepoda group and highest of 8 taxa were recorded from Rotifera group. Similar studies on zooplankton were reported in recent years throughout the country. Nimbalkar *et. al.*, 2013 reported 15 rotifers, 12 cladocerans and 6 copepods from Ambe Ghosale lake, Thane city of Maharashtra. 23 species of zooplankton were reported from Bhadra reservoir, Karnataka, India. A total number of 54 genera were observed during the study of Verma *et. al.*, 2013 in an anthropogenic pond in Madhya Pradesh. Kar and Kar 2013 reported 26 species of Zooplankton from an oxbow lake of Cachar, Assam. Manickam *et. al.*, 2014 reported 55 species of zooplankton in a perennial reservoir at Dharmapur district, South India. Pawar, 2014 reported 66 species of Zooplankton

in some freshwater bodies around Satara district of Maharashtra, India. 40 genera of zooplankton were reported by Kar and Kar, 2016 from a freshwater wetland of Cachar, Assam. Kar *et al*, 2015 reported 6 genera of zooplankton in Ramnagar Anua, 15 genera of zooplankton in Tapang Haor, 8 species of zooplankton in Srikona Beel. Das and Kar, 2016 reported 36 genera of zooplankton from three wetlands of Barak valley, Assam. 26 different genera of zooplankton were reported by Das and Kar, 2013. Das and Kar, 2016 reported 30 genera of zooplankton from a typical pond ecosystem of Cachar district, Assam. During the present study, rotifera showing highest percentage is supported by other works in the recent years where rotifera were found to be dominating over other groups of zooplankton. Verma *et. al.*, 2013 reported highest population percentage of rotifera over other groups of zooplankton reported from the investigated site. Similarly Kar and Kar, 2016 reported highest abundance percentage of rotifera over other groups of zooplankton in Sat Beel, Cachar, Assam.

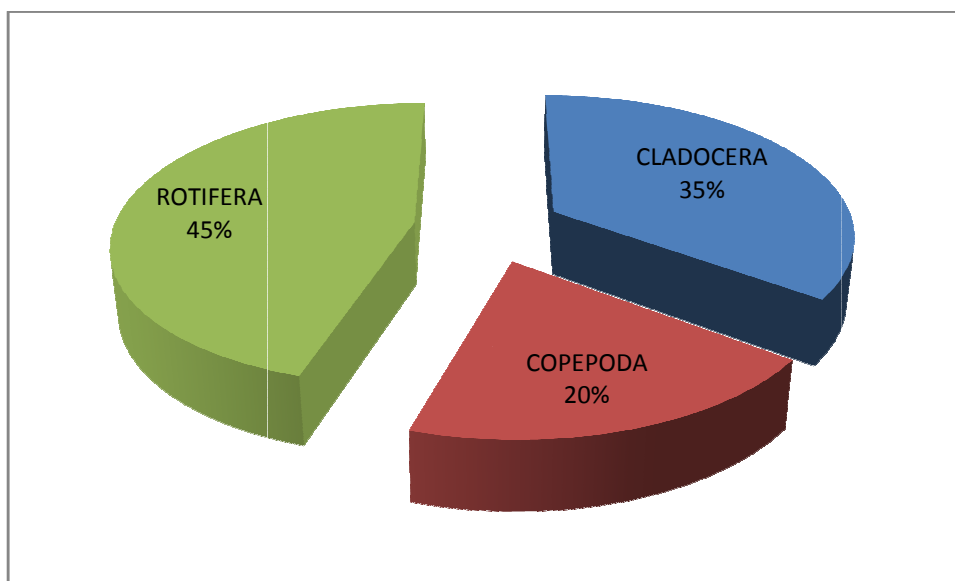
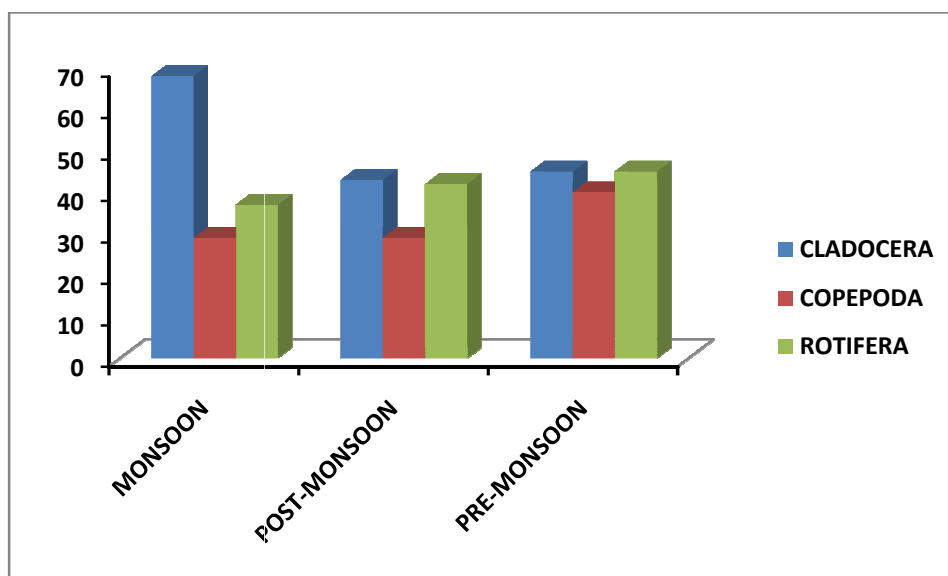
The abundance of total Zooplankton count was found to be highest during the monsoon season which may be because of favourable physico-chemical parameters during the monsoon especially the temperature as the optimal temperature is known to favour the growth of plankton in any aquatic body. The distribution pattern of Zooplankton in different seasons revealed the abundance of Cladocera > Rotifera > Copepoda (Table 1). Among Cladocera, the most abundant species found to dominate in almost all seasons were *Moina* sp. and *Bosmina* sp. Copepoda group reported from Malini Beel was dominated by *Mesocyclops* sp. The Rotifers exhibit a wide range of morphological variations and are known as good indicator of water quality. During the study period, Rotifera was reported to be the most dominant group of which *Brachionus* sp. and *Testudinella* sp. shows the highest abundance. The dominance of *Brachionus* sp. over other may be the indicator of pollutants and domestic sewage discharges in the water body as the dissolved solids are known to increase the growth of minute Zooplankton especially various species of *Brachionus* (Goswami and Mankodi, 2012).

**Table 2: Composition of Zooplankton in Malini Beel during the study period**

ZOOPLANKTON	MONSOON	POST-MONSOON	PRE-MONSOON
<b>CLADOCERA</b>			
<i>Bosmina</i> sp.	10	8	9
<i>Bosminopsis</i> sp.	3	2	4

<i>Moina</i> sp.	26	18	17
<i>Diaphanosoma</i> sp.	9	7	6
<i>Chydorus</i> sp.	4	4	3
<b>TOTAL</b>	<b>68</b>	<b>43</b>	<b>45</b>
<b>COPEPODA</b>			
<i>Mesocyclops</i> sp.	10	12	21
<i>Thermocyclops</i> sp.	7	10	10
<i>Heliodiaptomus</i> sp.	12	7	9
<b>TOTAL</b>	<b>29</b>	<b>29</b>	<b>40</b>
<b>ROTIFERA</b>			
<i>Brachionus</i> sp.	17	10	11
<i>Lecane</i> sp.	7	3	3
<i>Keratella</i> sp.	7	6	3
<i>Filinia</i> sp.	8	5	6
<i>Asplanchna</i> sp.	5	3	4
<i>Testudinella</i> sp.	12	10	11
<i>Ascomorpha</i> sp.	3	3	3
<i>Scaridium</i> sp.	8	7	5
<b>TOTAL</b>	<b>37</b>	<b>42</b>	<b>45</b>

Percentage composition of Zooplankton during the study period in Malini Beel revealed that Rotifer shows highest percentage composition of 45% followed by Cladocera with 35% and that by Copepoda with 20% composition of total Zooplankton (Fig 1). Zooplankton population density, composition and abundance varies according to the water body and the season depending on its biotic and abiotic factors. Variation of Zooplankton abundance in different season are depicted in Fig 2. The result of present study indicated that Zooplankton were found to be maximum in monsoon season. The present information on Zooplankton composition and seasonal variation from the Malini Beel, Cachar, Assam is helpful for further studies in Zooplankton as well as it will be also helpful for the conservation and maintenance of such aquatic ecosystem.

**Fig 1:** Percentage composition of Zooplankton in Malini Beel during the study period**Fig 2:** Variation of Zooplankton in different in Malini Beel during the study period

## Conclusion

The study period was of small duration still the diversity and abundance of Zooplankton can be well observed indicating somewhat favourable physico-chemical parameters. The beel has faced acute shrinkage due to urbanization and dumping. The release of human and animal faeces contributes to water quality deterioration. Authorities should take necessary action for preserving the water of Malini Beel, people residing should be made educated about the eutrophication of the water body and about its destruction. People should avoid bathing and washing animals, clothes and households to preserve the water quality.

## References

- [1] APHA. (2005). Standard methods for the examination of water and waste water. 21st Edn Washington DC, USA.
- [2] Ayoade, A.A., Agarwal, N.K. and Solanki, A.C. (2009). Changes in physico-chemical features and plankton of two regulated high altitude rivers Garwal Himalaya, India. Euro. J. of Sci. Res. 27(1):77-92.
- [3] Battish, S.K.(1992). Freshwater Zooplankton of India. Oxford and IBH Publishing Co., Ltd. (New Delhi), India.
- [4] Balakrishna, D.; Mahesh,T.; Samatha. D and Ravinder Reddy, T. (2013).Zooplankton Diversity Indices of Dharmasagar Lake, Warangal District (A.P.). International Journal of Research in Biological Sciences; 3(3): 109-111
- [5] Bhat, N.A.; Wanganeo, A. and Raina, R. (2014). The composition and diversity of net zooplankton species in a tropical waterbody (Bhoj Wetland) of Bhopal, India. International Journal of Biodiversity and Conservation; 6(5): 373-381.
- [6] Das, B.K.; Boruah, P. and Kar, D. (2014). Study of seasonal variation of water quality of River Siang in Arunachal Pradesh, India. IOSR Journal of Environmental Science, Toxicology and Food Technology 8 (2): 11-20.
- [7] Das, B.K. and Kar, D. (2015). Physico-chemical parameters and drainage types of River Siang in Arunachal Pradesh, India. In: Mishra GC (Ed.) Conceptual Framework and Innovations in Agroecology and Food Sciences, Krishi Sanskriti Publications, New Delhi, India. 3-56.
- [8] Das, P. and Kar, D. (2013). Studies on zooplankton diversity and physico-chemical parameters of Ramnagar anua, Cachar, Assam, International Journal of Current Research, 5: 3058-3062.
- [9] Das, P. and Kar, D. (2016). Composition ,abundance and diversity of zooplankton population from three different wetlands from Barak Valley, Assam. International Journal of Applied and Natural Sciences (IJANS ); 5(5) : 41-46.
- [10] Das, U. and Kar, D. (2013). A Comparative Study On Qualitative And Quantitative Analysis Of Zooplankton In Relationship With Physico-Chemical Properties Of Water Between Karbala Lake And Baram Baba Pond Of Cachar District, Assam. International Journal of Current Research, 5: 3038-3041.

- [11] Dede A.N. and Deshmukh, A.L. (2015). Study on Zooplankton Composition and Seasonal Variation in Bhima River near Ramwadi Village, Solapur District (Maharashtra), India: *International journal of current microbiology and applied science*; 4 (3): 297-306.
- [12] Edmondson, W.T. (ed.). (1992). *Freshwater Biology*. 2nd edition (Indian Reprint). International Books & Periodicals Supply Service, New Delhi, p. 1248.
- Goswami, A.P. and Mankodi, P.C. (2012). Study on Zooplankton of Fresh Water Reservoir Nyari – II Rajkot district, Gujarat, India. *ISCA Journal of Biological Sciences*; 1(1):30-34.
- [13] Harsha, T.S. and Malammanver, S.G. (2004). Assessment of phytoplankton density in relation to environmental variables on Gopaldaswamy pond at Chitradurga, Karnataka. *J. Environ. Biol.* 25(1):113-116.
- [14] Kar, D and Barbhuiya, M.H. (2004). Abundance and diversity of zooplankton in Chatla Haor, a floodplain wetland in Cachar district of Assam. *Environment and Ecology*, 22 (1). 247-248.
- [15] Kar, D. (2007). *Fundamentals of Limnology and Aquaculture Biotechnology*. Daya Publishing House, xiv+609.
- [16] Kar, D. (2013). *Wetlands and Lakes of the World*. Springer, London, xxx + 687.
- [17] Kar, D. (2015). *Epizootic Ulcerative Fish disease Syndrome*, Elsevier (Academic Press, USA), xix+293. ISBN:9780128025048.
- [18] Kar, D. (2016). Wetland, rivers, fish, plankton resource and fish disease and aquaculture in North- East India: An overview. *Lake 2016: Conference on Conservation and Sustainable Management of ecologically sensitive regions in Western Ghats (2016)*.
- [19] Kar, S. and Kar, D. (2013). Studies on Zooplankton Diversity of an oxbow lake of South Assam. *International Journal of Current Research*;5(12):3652:3655.
- [20] Kar, S. and Kar, D. (2016). Zooplankton Diversity in A Freshwater Lake of Cachar, Assam. *International Journal of Applied Biology and Pharmaceutical Technology*; 7(1): 301-305.
- [21] Kar, S. and Kar, D. (2016). Zooplankton Diversity In A Freshwater wetland of Cachar, Assam. *International Journal of Advanced Biotechnology and research*; 7(2): 614-620.
- [22] Laskar H.S. and Gupta S. (2009). Phytoplankton diversity and dynamics of Chatla floodplain lake, Barak Valley, Assam, North Eastern India-a seasonal study. *J. Environ. Biol.*; 30: 1007–1012.
- [23] Maibam, B; Das, U.; Das, P.; Kar, S. Singh, O.S.; Kar, D. and Aditya, G.(2016). Rotifer species assemblages in three freshwater habitats of Manipur, India. Berlin.Springer.



- [24] Manickam, N.; Saravana Bhavan, P.; Santhanam, P.; Muralisankar, T.; Srinivasan, V.; Radhakrishnan, S.; Vijayadevan, K.; Chitrarasu, P. and Jawahar Ali, A. (2014). Seasonal Variations of Zooplankton Diversity in a Perennial Reservoir at Thoppaiyar, Dharmapuri District, South India. *Austin J Aquac Mar Biol.*;1(1): 7.
- [25] Michael, R.G. and Sharma, B.K. (1998). Indian Cladocera (Crustacea: Branchiopoda: Cladocera). *Fauna of India and adjacent countries Series – Zool. Surv. India, Calcutta.*
- [26] Narzary, A.; Das, S.; Das, B.K.; Singh, R.; Kar, S.; Das, P; Dutta, B. Kar, D.(2015). A preliminary study on zooplankton diversity of Ramnagar Anua, Srikona Beel and Tapang Haor of Cachar district, Assam, India: A Project Report. *Journal of Chemical, Biological and Physical Sciences*; 5(3):2809-2817.
- [27] Nimbalkar, R.K.; Kamtikar, V.N.; Shinde, S.S. and Wadikar, M.S. (2013). Studies On Zooplankton Diversity In Relation To Water Quality of Ambe Ghosale Lake Of Thane City, (Ms) India. *Bioscience Discovery*; 4(1):124-127.
- [28] Pawar, S.M. (2014). Zooplankton Diversity and Density in Some Freshwater Bodies around Satara (M.S) India. *Journal of Environments*, 1(2): 64-67.
- [29] Sharma, B.K. (1998). Freshwater Rotifers (Rotifera: Eurotatoria). *Fauna of West Bengal. State Fauna Series*; 3(11): 341-461.
- [30] Sharma, B.K. and Sharma, S. (2008). Zooplankton diversity in floodplain lakes of Assam. *Records of Zoological Survey of India. Occasional paper no 290*: 1-307.
- [31] Sharma, R.; Sharma, V.; Sharma, M.; Verma, B.K.; Modi, R. and Gaur, K.S. (2011). Studies on Limnological Characteristic, Planktonic Diversity and Fishes (Species) in Lake Pichhola, Udaipur, Rajasthan (India). *Universal Journal of Environmental Research and Technology*;1(3): 274-285.
- [32] Sharma, S.; Solanki, C.M.; Sharma, D. and Pir, Z. (2013). Distribution and diversity of zooplanktons in Madhya Pradesh, India, *International Journal of Advanced Research* 1(1) 16-21.
- [33] Sharma, K.K.; Kour, S. and Antal, N. (2015). Diversity of Zooplankton and Macroinvertebrates of Two Perennial ponds in Jammu Region. *Journal of Global Biosciences*; 4(2): 1382-1392.
- [34] Verma, H.; Pandey, D.N. and Shukla, S.K. (2013). Monthly Variations of Zooplankton In A Freshwater Body, Futera Anthropogenic Pond Of Damoh District (M.P.). *International Journal of Innovative Research in Science, Engineering and Technology*; 2(9): 4781-4788.