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## REVIEW

### STATUS OF STUDIES ON ZOOPLANKTON FAUNA OF ARUNACHAL PRADESH, INDIA

Bikramjit Sinha

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## STATUS OF STUDIES ON ZOOPLANKTON FAUNA OF ARUNACHAL PRADESH, INDIA

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**Abstract:** This paper gives a brief review of the studies on zooplankton fauna of Arunachal Pradesh, the major shareholder of the eastern Himalaya biodiversity hotspot. Altogether, 66 species of zooplankton (45 Rotifera, 20 Cladocera, & one Copepoda) have been recorded along with their distribution in the state, wherever available. It is apparent that there is a lack of serious taxonomic studies on all three major groups of zooplankton from this Himalayan state. The urgency and importance of documenting the zooplankton fauna of this biogeographically unique and biodiversity-rich state is highlighted in view of the fragility of the ecosystem as well as the effect of climate change.

**Keywords:** Arunachal Himalaya, Cladocera, Copepoda, Rotifera, zooplankton.

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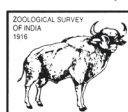
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## INTRODUCTION

Zooplankton is an important biotic component of aquatic ecosystems (Dadhick & Saxena 1999; Sinha & Islam 2002) acting as indicators of the trophic condition of an ecosystem (Gannon & Stemberger 1978; Sharma 1998). Changes in zooplankton abundance, species diversity, and community composition are considered as good indicators of environmental change (Sharma et al. 2008). Truly planktonic animals or zooplankton are dominated by three major groups in freshwaters, the Rotifera and the two groups of the subphylum Crustacea, namely, Cladocera & Copepoda. The present study, thus, concentrates on these three major groups.

Freshwater rotifers are represented by over 2000 species (Segers 2007, 2008) of which 419 species belonging to 65 genera are known from India (Sharma & Sharma 2017a). The Indian Rotifera diversity is relatively richer than other Southeast Asian countries like Thailand (Sa-Ardrit et al. 2013). Of the nearly 700 species of freshwater cladocerans known globally (Forro et al. 2008; Kotov 2013), 131 species in 47 genera have been reported from India (Chatterjee et al. 2013; Sharma & Sharma 2017b). Out of about 3000 species of freshwater copepods known globally, the Indian diversity is estimated to be nearly 200 species under 60 genera (Reddy 2017). Rotifera, Cladocera, and Copepoda, thus, share roughly 21%, 18%, and 7% of their respective global diversity till date.

Studies on Indian zooplankton began more or less at the beginning of the 20th century. Studies on Indian Cladocera was initiated with the description of *Daphnia newporti* Baird, 1860 (now it is a 'species inquirenda'). The momentum, however, picked up with the publication of two papers on Indian Cladocera at the beginning of the 20th Century (Gurney 1906, 1907). Though Indian Rotifera studies started near the end of the 19th Century with the report of 47 species from Calcutta and its surroundings by Anderson (1989), a clear impetus in Rotifera studies from India is evident with the works of Murray (1906), who reported 32 species from the Sikkim Himalaya (now a part of northeastern India), followed by quite a number of publications. Works of Gurney (1906, 1907) at the beginning of the last century were the first reports on Indian freshwater Copepoda.

The progress of studies on Indian zooplankton, encompassing all facets, is well- documented (see Sharma & Sharma 2017a for Rotifera; Sharma & Sharma 2017b & Chatterjee et al. 2013 for Cladocera; Reddy 2017 for Copepoda). While these studies dealt with individual groups, a common observation by them is

the non-homogeneity of the progress in space. All the biogeographic zones of the country are not equally studied including different ecosystems like hot springs and alpine regions. Also, studies from different regions as well as states of the country are disproportionate, a fact that can be attributed to the recorded low diversity in these groups in relation to global diversity. Within the Indian landmass, substantial work has been done from the northeastern region in terms of Rotifera and Cladocera while most of the studies on Indian copepods have been confined to the southern peninsula.

A similar trend of non-uniform coverage of all the states of northeastern India, too, is evident. Most of the zooplankton studies in the region have been confined to select states. About two-thirds (~280 species) of the Indian Rotifera are known from northeastern India. This rich rotifer diversity is mainly attributed to Assam (220 species), Manipur & Mizoram (162 species each), Meghalaya (161 species), and Tripura (152 species) (Sharma 2017a). There is no quantification of the rotifers from states like Arunachal Pradesh, Nagaland, and Sikkim though there are some occasional reports like those by Murray (1906) from Sikkim. Similarly, Assam (75 species), Meghalaya (58 species), Manipur (56 species), and Tripura (50 species) (Sharma 2017a) contributed to the relatively rich cladoceran diversity of the region. Not much is known about the Cladocera diversity of the remaining northeastern states except for sporadic reports. The copepod fauna of northeastern India as a whole is poorly studied with only a few reports (Reddiah 1964; Reddy 2013a,b) from the region. The only systematic study on the zooplankton fauna of Arunachal Pradesh is perhaps by Sharma et al. (2017a,b,) who reported seven species each of Rotifera and Cladocera from Tawang. But it neither mentioned the occurrence of other species in the district nor provided any details on the number and distribution of zooplankton in the state.

There is a complete dearth of studies exclusive to any of the three zooplankton groups from Arunachal Pradesh though it is a part of the eastern Himalaya global biodiversity hotspot (Myers et al. 2000) and is also among the 200 globally important ecoregions (Olson & Dinerstein 1998). Therefore, it is critically imperative to undertake comprehensive and dedicated studies on important aquatic faunal groups like zooplankton of Arunachal Pradesh that is ecologically fragile, especially due to the developmental pressure it is witnessing of late. This is upheld by the more sensitive nature of these tiny organisms. In this context, it is imperative to know the state of affairs of zooplankton fauna of

Arunachal Pradesh before undertaking a detailed study. This is what this study is aimed at, making a sincere effort to collate all the existing scattered information on zooplankton fauna of Arunachal Pradesh.

#### ARUNACHAL PRADESH: THE BIODIVERSITY MINE

The state of Arunachal Pradesh (26.4–29.5 °N & 91.5–97.5 °E; 83,743km<sup>2</sup>; Fig. 1) in northeastern India is uniquely situated in the transition zone between a) the eastern Himalaya & Indo-Burmese biodiversity hotspots, b) Palearctic & Oriental biogeographic region, and c) Himalaya & peninsular India. The state has an unmatched composition of biological diversity having representative elements of the different conjoining ecosystems as well as its own unique elements. Wide altitudinal range from 50 to >7000 m within the state has brought about a great diversity of habitat and forest types and climatic conditions from temperate to alpine or tundra that arguably support the evolution and existence of diverse forms of biota. The landscape is one of the richest in biological values in the world, high in endemism and holding a large number of rare and threatened species (Rao 1994; Baishya et al. 2001; Borang 2001). Frequent new discoveries and new records in almost all groups of flora and fauna from the state reinforces the above observations and the state can be rightly considered as a ‘biodiversity mine’ for its biodiversity potential.

This Himalayan state harbours a wide variety of both lotic and lentic freshwater biotopes, ranging from sub-tropical wetlands to hot-springs to high-altitude glacial lakes. The five major rivers, namely, Kameng, Subansiri, Siang, Dibang, and Lohit, along with another 123 rivers and streams (SAC 2009) constitute the lotic habitats accounting for 86% of the total wetland area of the state. The state has a total of 2,653 wetlands, natural as well as man-made, with a total area of 155,728ha that accounts for more than 2% of the total geographic area of the state. These vast wetland systems harbour diverse aquatic fauna including freshwater zooplankton, most of which are yet to be explored. There are about 1672 high altitude lakes (SAC 2009) in the state, most of which are set in some form of complexes like the Bhagajang Wetland Complex and Nagula Wetland Complex in Tawang District. The state also has a number of hot springs like Thingbu & Tsachu in Tawang, hot springs in Dirang, West Kameng District, and Kibitho & Walong in Anjaw District. There are records of zooplankton from these types of unique habitats from other parts of India as well as the world. For instance, Padhye & Kotov (2010) found two species of Cladocera in a hot water spring in the Western Ghats of India. Among all other organisms, the diaptomid *Arctodiaptomus jurisovitchi*, was the most widely distributed species recorded from high altitude mountain lakes at 4000–6000 m in the Khumbu Valley in



Figure 1. Location of Arunachal Pradesh in the eastern Himalaya biodiversity hotspot bordering Indo-Burma hotspot (adapted from Kamei et al. 2012)



the Nepal Himalaya (Manca et al. 1998).

#### ROTIFERA OF ARUNACHAL PRADESH

Rotifers are pseudocoelomate, multicellular, mostly microscopic organisms with size of about 40–250 µm. Though omnipresent, rotifers are primarily freshwater invertebrates, with about 95% of the species reported from freshwater habitats (Sharma 1996). At present, roughly a little over 2000 species of rotifers are known from the world and classified in to three main groups, the marine Seisonida (three species), the Monogononta (1,570 species), and the unique, exclusively parthenogenetic Bdelloidea with 461 clonal species (Segers 2007, 2008). Out of these, 419 species are known from India (Sharma & Sharma 2017a).

Though a majority of attempts on the systematics of Indian Rotifera are from the northeastern states (see Sharma & Sharma 2017a; Vanjare 2017), that from Arunachal Pradesh is very negligible. The first ever review of taxonomic studies on Indian Rotatoria (Sharma & Michael 1980) indicates no studies on rotifer fauna of Arunachal Pradesh till that time.

The report of three species of *Lepadella*, namely, *L. acuminata*, *L. ovalis* & *L. patella* by Sharma & Sharma (1987) was probably the earliest record of Rotifera from Arunachal Pradesh. While studying the distribution of lecanid rotifers in northeastern India, Sharma (1987a) recorded five species of *Lecane*, namely, *L. bulla*, *L. closterocerca*, *L. leontina*, *L. luna* & *L. lunaris*, from the state. Sharma (1987b) reported the occurrence of *Anuraeopsis fissa* from Arunachal Pradesh. While studying the zooplankton biodiversity of the amphibian habitats of Arunachal Pradesh, Sinha et al. (2002) recorded an additional 10 species of rotifers from eight districts of the state. At this time, altogether 19 species of rotifers are known from Arunachal Pradesh. Sharma & Sharma (2005), however, while studying the biodiversity of freshwater rotifers from northeastern India, reported the occurrence of 26 species of Rotifera in Arunachal Pradesh. But, no published information could be found for the remaining seven species, hence they are not considered.

Later, *Lecane quadridentata* and *Synchaeta oblonga* were added to the rotifer fauna of Arunachal Pradesh (Sharma 2008; Sharma & Sharma 2008). In the latest review on the diversity and distribution of Indian Brachionidae, Sharma & Sharma (2014a) mentioned the occurrence of 11 brachionid rotifers from Arunachal Pradesh including two new additions, namely, *Keratella serrulata* (Ehrenberg, 1838) & *Notholca squamula* (Müller, 1786). Recently, another 19 species were

added to the rotifer fauna of the state by Barik et al. (2014), bringing the total number of Rotifera known from Arunachal Pradesh to 42 species. Reportedly, 76 species of rotifers are known from Arunachal Pradesh (Sharma & Sharma 2014b). This figure, however, is based on unpublished data and hence not incorporated. Recently, Sharma et al. (2017) recorded seven species of Rotifera from Tawang District of Arunachal Pradesh. Out of these, three species, namely, *Euchlanis triquetra* Ehrenberg, 1838, *Polyartha vulgaris* Carlin, 1843, & *Trichocerca cylindrica* (Imhof, 1891) are new additions to the state's Rotifera list. Thus, the number of rotifer fauna of Arunachal Pradesh has been restricted to 45 species pending validation of the additional species.

#### CLADOCERA OF ARUNACHAL PRADESH

Cladocerans are small crustaceans in the range of 0.2–6 mm. They inhabit most types of continental fresh and saline water habitats, occurring more abundantly in both temporary and permanent stagnant waters (Forro et al. 2008). Nearly 700 species of cladocerans are known globally (Forro et al. 2008; Kotov 2013). Systematic studies on Indian Cladocera was initiated by Baird (1860) describing *Daphnia newporti* Baird, 1860 (Species inquirenda, Chatterjee et al. 2013) from Nagpur and surrounding areas. About 131 species of freshwater Cladocera are known from India (Chatterjee et al. 2013; Sharma & Sharma 2017b).

Within India, the cladoceran fauna of the northeast is the best known (Sharma & Sharma 1990, 2011). Studies on Cladocera of Arunachal Pradesh, however, is virtually lacking except for some scattered reports. The first record of Cladocera from Arunachal Pradesh was the report of *Alona costata* (*Flavalona costata* Sinev & Dumont, 2016) from the Kameng division (Biswas 1964). This, however, did not get reflected in the successive review (Sharma & Michael 1987), monograph (Michael & Sharma 1988), and checklist (Chatterjee et al. 2013) on Indian Cladocera. *Flavalona costata* (*Flavalona* is the new generic name of costata-group of *Alona* sensu lato (Sinev & Dumont, 2016)) is not included in the present list pending confirmation of its occurrence in the Indian subcontinent where an endemic form *F. cheni* is available. While studying the planktonic diversity of amphibian habitats, Sinha et al. (2002) recorded five species of Cladocera from Arunachal Pradesh. These are *Bosmina longirostris* (O.F. Muller, 1776) sensu lato, *Alona guttata* Sars, 1862, *Moina micrura* Kurz, 1874, *Moinodaphnia macleayi* (King, 1853) and *Diaphanosoma sarsi* Richard, 1894.

Gupta et al. (2013) recorded the occurrence of *Sida*

*crystallina* (O.F. Müller, 1776) sensu lato in the Apatani Plateau of Arunachal Pradesh. Another chydorid, *Flavlonia cheni* (Sinev, 1999), has been reported from Arunachal Pradesh (Sharma & Sharma 2013). Surprisingly, the latest checklist of Indian Cladocera (Chatterjee et al. 2013) did not mention the record of any Cladocera from Arunachal Pradesh. Seven more species of Cladocera have been reported (Barik et al. 2014) from the Tawang basin of the state. Out of these, *Macrothrix laticornis* (Jurine, 1820) sensu lato is not considered in this report as its record from India needs revalidation (Chatterjee et al. 2013). Recently, Sharma et al. (2017) recorded seven more cladocerans from Tawang, out of which the occurrence of two species, namely, *Chydorus pubescens* Sars, 1901 sensu lato & *Eurycercus lamellatus* (O.F. Müller, 1776) sensu lato, in India is doubtful (Chatterjee et al. 2013). These two species, however, are included in the present list as only a revision of the Indian population is required to validate the presence of one or more species of the genus. Thus, a total of 20 valid taxa of Cladocera are reported from Arunachal Pradesh.

#### COPEPODA OF ARUNACHAL PRADESH

Copepods are the largest among the three major groups of zooplankton, ranging from 0.5–15 mm in size. These are claimed to be numerically the most abundant metazoans on earth and conservative estimates reveal that they may outnumber the abundance of insects (Schminke 2007). Approximately, 2814 species of freshwater copepods under 257 genera are known globally (Boxshall & Defaye 2008).

Scientific reports on Indian freshwater copepods began to appear with the works of Gurney (1906, 1907). Nearly 200 species of freshwater copepods are known from India (Reddy 2017). Investigations on copepod diversity of northeastern India/eastern Himalaya, however, is completely lacking (Battish 1992), though some recent studies on diaptomids are reported (Reddy 2013a,b). These include a description of *Neodiaptomus prateek* Reddy, 2013 from Assam and a record of the little known *Tropodiaptomus signatus* Kiefer, 1982 from Manipur. As such, our knowledge of Copepoda from the northeastern region, in general, and Arunachal Pradesh, in particular, is virtually nil. The only record of copepods from Arunachal Pradesh is that by Sinha et al. (2002) who reported three copepods, namely, *Heliodiaptomus cinctus*, *Eucyclops speratus*, and *Mesocyclops leuckarti*, from the amphibian habitats of the state. The latter two species, however, are not included in the present list as their occurrence in the Indian landmass awaits

revalidation.

#### DISCUSSION

Scrutiny of available literature clearly indicates that virtually no taxonomic studies sensu stricto have been done on the zooplankton fauna of Arunachal Pradesh. Whatever is known about the zooplankton diversity of the state is ancillary to other studies; some are mentioned in the faunal inventories of other states, some in review of a particular taxon or a particular region, some in routine EIA studies, while others in either feeding behaviour studies of zooplankton consumers or limnological studies. Thus, there is a complete lack of comprehensive and exclusive studies on zooplankton fauna of Arunachal Pradesh.

Nonetheless, collation of whatever scattered reports that are available in the public domain reveals that zooplankton fauna of Arunachal Pradesh comprises of 45 species of Rotifera under 20 genera and 13 families, 20 species of Cladocera under 16 genera and 9 families, and only one species of Copepoda. As apparent, copepods are the least studied group (Table 1, Fig. 2) as only one species under one genera under one family is known so far from the state. This is purely an under-representation of the zooplankton diversity of the state which is otherwise well known for its rich and unique biodiversity. The poor zooplankton diversity of Arunachal Pradesh is in contrast to the established fact that within the Indian landmass, the highest diversity of Rotifera (Sharma & Sharma 2014b) and Cladocera (Sharma & Sharma 2011) have been documented from the northeastern region, which also includes this state. Low level of exploration

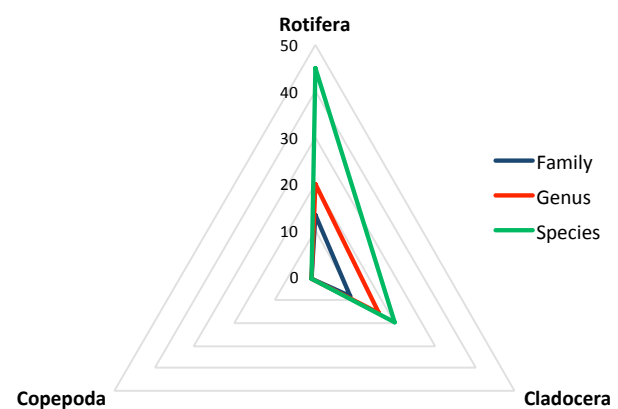


Figure 2. Composition of zooplankton fauna of Arunachal Pradesh depicting the number of species, genera & family known under each group

Table 1. Reported zooplankton fauna of Arunachal Pradesh

Taxa	District	Reference
<b>Phylum:</b> Rotifera		
<b>Class:</b> Eurotatoria		
<b>Subclass:</b> Monogononta Plate, 1889		
<b>Order:</b> Flosculariaceae Haring, 1913		
<b>Family:</b> Conochilidae Haring, 1913		
<i>Conochilus hippocrepis</i> (Schrank, 1803)	E. Kameng	Sinha et al. 2002
<b>Family:</b> Testudinellidae Haring, 1913		
<i>Testudinella emarginula</i> (Stenroos, 1898)*	Tawang	Barik et al. 2014
<i>T. patina</i> (Hermann, 1783)	Tawang	Barik et al. 2014
<b>Family:</b> Trochosphaeridae Haring, 1913		
<i>Filinia pejleri</i> Hutchinson, 1964	E. Siang	Sinha et al. 2002
<b>Order:</b> Ploima Hudson & Gosse, 1886		
<b>Family:</b> Brachionidae Ehrenberg, 1838		
<i>Anuraeopsis fissa</i> (Gosse, 1851)	NA	Sharma 1987b
<i>Brachionus calyciflorus</i> Pallas, 1766	E. Siang	Sinha et al. 2002
<i>B. ahlstromi</i> Lindeman, 1939	Papumpare	Sinha et al. 2002
<i>B. quadridentatus</i> (Hermann, 1783)	Tawang	Barik et al. 2014
<i>Keratella serrulata</i> (Ehrenberg, 1838)*	NA	Sharma & Sharma 2014
<i>Notholca squamula</i> (Müller, 1786)*	NA	Sharma & Sharma 2014
<i>Platinous patulus</i> (Muller, 1786)	E. Kameng	Sinha et al. 2002
<i>Platyias quadricornis</i> (Ehrenberg, 1832)	E. Kameng, E. Siang	Sinha et al. 2002
<b>Family:</b> Epiphanidae Haring, 1913		
<i>Epiphanes brachionus</i> (Rousselet, 1901)	Tawang	Barik et al. 2014
<b>Family:</b> Euchlanidae Ehrenberg, 1838		
<i>Euchlanis dilatata</i> (Ehrenberg, 1832)	Tawang	Barik et al. 2014; Sharma et al. 2017
<i>E. triquetra</i> Ehrenberg, 1838	Tawang	Sharma et al. 2017
<b>Family:</b> Lecanidae Remane, 1933		
<i>Lecane bulla bulla</i> (Gosse, 1851)	NA	
Tawang	Sharma 1987a;	
Sharma et al. 2017		
<i>L. closterocerca</i> (Schmarda, 1859)	NA	Sharma 1987a
<i>L. curvicornis</i> (Murray, 1913)	Tawang	Barik et al. 2014
<i>L. flexilis</i> (Gosse, 1886)	Tawang	Barik et al. 2014
<i>L. inopinata</i> Haring & Myers, 1926	E. Kameng, Papumpare, U. Subansiri, E. Siang	Sinha et al. 2002
<i>L. leontina</i> (Turner, 1892)	NA	Sharma 1987a
<i>L. luna</i> (O.F. Muller, 1776)	NA	Sharma, 1987a
<i>L. lunaris</i> (Ehrenberg, 1832)	NA	

Taxa	District	Reference
Tawang	Sharma 1987a;	
Sharma et al. 2017		
<i>L. papuana</i> (Murray, 1913)	Tawang	Barik et al. 2014; Sharma et al. 2017
<i>L. ploenensis</i> (Voigt, 1902)	E. Kameng	Sinha et al. 2002
<i>L. quadridentata</i> (Ehrenberg, 1832)	NA	Sharma, 2008
<i>L. signifera</i> (Jennings, 1896)*	Tawang	Barik et al. 2014
<b>Family:</b> Lepadellidae Haring, 1913		
<i>Colurella obtusa</i> (Gosse, 1886)	Tawang	Barik et al. 2014
<i>C. sulcata</i> (Stenroos, 1898)*	Tawang	Barik et al. 2014
<i>Lepadella acuminata</i> (Ehrenberg, 1834)	NA	Sharma & Sharma 1987
<i>L. cf. nartiangensis</i> (Sharma & Sharma, 1987)*	Tawang	Barik et al. 2014
<i>L. ovalis</i> (Muller, 1786)	NA	Sharma & Sharma 1987
<i>L. patella patella</i> (Muller, 1773)	E. Siang (Sinha et al. 2002)	Sharma & Sharma 1987
<i>L. quadricarinata</i> (Stenroos, 1898)	Tawang	Barik et al. 2014
<i>L. vandenbrandei</i> (Gillard, 1952)*	Tawang	Barik et al. 2014
<b>Family:</b> Mytilinidae Haring, 1913		
<i>Mytilina ventralis</i> (Ehrenberg, 1832)	Tawang	Barik et al. 2014
<b>Family:</b> Notommatidae Hudson & Gosse, 1886		
<i>Cephalodella gibba</i> (Ehrenberg, 1830)	Tawang	Barik et al. 2014
<b>Family:</b> Scardiidae Manfredi, 1927		
<i>Scardium longicaudum</i> (Muller, 1786)	E. Kameng	Sinha et al. 2002
<b>Family:</b> Synchaetidae Hudson & Gosse, 1886		
<i>Polyartha vulgaris</i> Carlin, 1843	Tawang	Sharma et al. 2017
<i>Synchaeta oblonga</i> Ehrenberg, 1832	NA	Sharma & Sharma 2008
<b>Family:</b> Trichocercidae Haring, 1913		
<i>Trichocerca bidens</i> (Lucks, 1912)*	Tawang	Barik et al. 2014
<i>T. cylindrica</i> (Imhof, 1891)	Tawang	Sharma et al. 2017
<i>T. porcellus</i> (Gosse, 1886)	W. Kameng	Sinha et al. 2002
<i>T. pusilla</i> (Jennings, 1903)*	Tawang	Barik et al. 2014
<i>T. weberi</i> (Jennings, 1903)	Tawang	Barik et al. 2014
<b>Phylum:</b> Arthropoda		
<b>Subphylum:</b> Crustacea		
<b>Class:</b> Branchiopoda Latreille, 1817		
<b>Order:</b> Cladocera Latreille, 1829		
<b>Family:</b> Bosminidae Baird, 1845		
<i>Bosmina longirostris</i> (O.F. Muller, 1776) s.lat.	E. Kameng	Sinha et al. 2002

Taxa	District	Reference
<b>Family:</b> Chydoridae Dybowski & Grochowski, 1894		
<b>Subfamily:</b> Aloninae Dybowski & Grochowski, 1894		
<i>Acroperus harpae</i> (Baird, 1834) s.lat.	Tawang	Sharma et al. 2017
<i>Alona affinis</i> (Leydig, 1860) s.lat.	Tawang	Barik et al. 2014
<i>A. guttata</i> Sars, 1862	E. Kameng	Sinha et al. 2002
<i>A. quadrangularis</i> (O.F. Müller, 1776) s.lat.	Tawang	Sharma et al. 2017
<i>Flavalona cheni</i> (Sinev, 1999)	NA	Sharma & Sharma 2013
<i>Karualona karua</i> (King, 1853) s.lat.	Tawang	Barik et al. 2014
<i>Leberis diaphanus</i> (King, 1853) s.lat.	Tawang	Barik et al. 2014
<b>Subfamily:</b> Chydorinae Dybowski & Grochowski, 1894		
<i>Alonella (Nanalonella) nana</i> (Baird, 1843)	Tawang	Barik et al. 2014
<i>C. parvus</i> Daday, 1898	Tawang	Sharma et al. 2017
<i>C. pubescens</i> Sars, 1901 s.lat.	Tawang	Sharma et al. 2017
<i>C. sphaericus</i> (O.F. Müller, 1776) s.lat.	Tawang	Sharma et al. 2017
<b>Family:</b> Daphniidae Straus, 1820		
<i>Daphnia tibetana</i> (Sars, 1903)	Tawang	Barik et al. 2014
<b>Family:</b> Macrotrichidae Norman & Brady, 1867		
<i>Macrotrich spinosa</i> King, 1853	Tawang	Barik et al. 2014
<b>Family:</b> Moinidae Goulden, 1968		
<i>Moina micrura</i> Kurz, 1874	E. Kameng	Sinha et al. 2002
<i>Moinodaphnia macleayi</i> (King, 1853)	E. Kameng	Sinha et al. 2002
<b>Family:</b> Euryceridae Kurz, 1875 sensu Dumont & Silva-Briano, 1998		
<i>Eurycerus lamellatus</i> (O.F. Müller, 1776) s.lat.	Tawang	Sharma et al. 2017
<b>Family:</b> Ilyocryptidae Smirnov, 1976 sensu Smirnov, 1992		
<i>Ilyocryptus spinifer</i> Herrick, 1882	Tawang	Sharma et al. 2017
<b>Family:</b> Sididae Baird, 1850		
<i>Diaphanosoma sarsi</i> Richard, 1894	E. Kameng	Sinha et al. 2002
<i>Sida crystallina</i> (O.F. Müller, 1776) s.lat.	L. Subansiri	Gupta et al. 2013
<b>Class:</b> Maxillopoda		
<b>Subclass:</b> Copepoda Milne-Edwards, 1840		
<b>Order:</b> Calanoida Sars, 1903		
<b>Family:</b> Diaptomidae Baird, 1850		
<i>Heliodiaptomus cinctus</i> (Gurney, 1907)	Papumpare, E. Siang	Sinha et al. 2002

of zooplankton fauna of Arunachal Pradesh is perhaps due to the mostly inaccessible terrain of the state and lack of experts in and around the state. The record of nine rare species of rotifers from the aquatic biotopes of Arunachal Pradesh, however, is an indication of the unique nature of zooplankton fauna that is yet to be explored in detail; a thorough exploration may reveal many more elements of biological, ecological, and evolutionary interest. Prevalence of the wide range of climatic conditions from temperate to alpine conditions and the phenomenal range of habitats owing to the unique biogeographic positioning of the state supports this hypothesis.

Studies on organisms like zooplankton in these extreme aquatic habitats may throw light on their adaption, thus helping us to understand the evolution of cryptic species group complexes like those in Lecanidae, Brachionidae, and similar others in Cladocera as well as Copepoda. Further, zooplankton are considered as 'beacons of climate change' (Richardson 2008) and studying them from high altitude areas like those in Arunachal Pradesh may provide better insight into understanding climate change impacts. These are just the glimpses out of many such opportunities we are missing out by not exploring the zooplankton fauna of a unique and critical region like Arunachal Himalaya.

## REFERENCES

- Anderson, H.H. (1889). Notes on Indian Rotifers. *Journal of the Asiatic Society of Bengal* 58: 345–358.
- Baishya, A.K., S. Haque, P.J. Bora & N. Kalita (2001). Flora of Arunachal Pradesh – an overview. *Arunachal Pradesh Forest News* 19(1&2) : 1–25.
- Baird, W. (1860). Description of the two new species of Entomostracous Crustacea from India. *Proceedings of the Zoological Society of London* 213–234.
- Barik, S.K., D. Adhikari, H.N. Pandey, S.K. Mishra, R. Tiwary, P.P. Singh, E. Kharlyngdoh, M.K. Lyngdoh, B.R. Suchiang, I.M. Nonghuloo, B.K. Sharma, S.N. Ramanujam, P. Ramanujam, D. Paul, H. Siangbood, N. Narah, A. Upadhaya, S. Barua, S. Lynser, N. Thapa, R.R. Gogoi, S. Dutta, S.K. Padhee, A. Anjaneyulu, V. Chembolu, L.N.V. Satish, R. Panda, I. Ali, R. Pathak, K. Haridasan, A. Sarmah & P. Chakraborty (2014). Perspective plan for development of Tawang river basin. Cumulative Impact Assessment of Proposed Hydel Power Projects, Determination of Basin Carrying Capacity and Landscape Level Biodiversity Management Plan, Vol. I. Main Report. Submitted to Government of Arunachal Pradesh, North Eastern Hill University, Shillong, 901pp.
- Battish, S.K. (1992). *Freshwater Zooplankton of India*. Oxford & IBH Publishing Co., New Delhi, 210pp.
- Biswas, S. (1964). Five species of Daphniidae (Crustacea: Cladocera) from Simla Hills in India, with a new record of *Alona costata* Sars, from NEFA. *Journal of Zoological Society of India* 16: 92–98.
- Borang, A. (2001). Mammalian fauna of Arunachal Pradesh (checklist and distribution in protected areas) – an overview. *Arunachal Pradesh Forest News* 19(1&2) : 43–82.



- Boxshall, G.A. & D. Defaye (2008). Global diversity of copepods (Crustacea: Copepoda) in freshwater. *Hydrobiologia* 595: 195–207.
- Chatterjee, T., A.A. Kotov, K. van Damme, S.V.A. Chandrasekhar & S. Padhye (2013). An annotated checklist of the Cladocera (Crustacea: Branchiopoda) from India. *Zootaxa* 3667(1): 1–89.
- Dadhick, N. & M.M. Saxena (1999). Zooplankton as indicators of trophic status of some desert waters near Bikaner. *Journal of Environmental Pollution* 6: 251–254.
- Ferro, L., N.M. Korovchinsky, A.A. Kotov & A. Petrusek (2008). Global diversity of Cladocerans (Cladocera; Crustacea) in freshwater. *Hydrobiologia* 595: 177–184.
- Gannon, J.E. & R.S. Stemberger (1978). Zooplankton (especially Crustaceans & Rotifers) as indicators of water quality. *Transactions of the American Microscopical Society* 97(1): 16–35.
- Gupta, B.D., T. Das & D.N. Das (2013). A preliminary investigation on planktonic communities in the rice-fish system of Apatani Plateau, Arunachal Pradesh, pp143–152. In: Singh, K.K., K.C. Das & H. Lalruatsanga (eds.). *Bioresources and Traditional Knowledge of northeast India*. Mizo Post Graduate Science Society & Pachunga University College, Aizawl, India, 424pp.
- Gurney, R. (1906). On some freshwater Entomostraca in the collection of the Indian Museum, Calcutta. *The Journal of the Asiatic Society of Bengal* 2(7): 273–281.
- Gurney, R. (1907). Further notes on Indian freshwater Entomostraca. *Records of the Indian Museum* 1: 21–33.
- Kamei, R.G., D. San Mauro, D.J. Gower, I. van Bocxlaer, E. Sherratt, A. Thomas, S. Babu, F. Bossuyt, M. Wilkinson & S.D. Biju (2012). Discovery of a new family of amphibians from northeast India with ancient links to Africa. *Proceedings of the Royal Society: Biological Sciences* 279(1737): 2396–2401.
- Kotov, A., L. Forró, N.M. Korovchinsky & A. Petrusek (2013). World checklist of freshwater Cladocera species. <http://fada.biodiversity.be/group/show/17>. Accessed on 17 July 2016.
- Manca, M., D. Ruggiu, P. Panzani, A. Asioli, G. Mura & A.M. Nocentini (1998). Report on a collection of aquatic organisms from high mountain lakes in the Khumbu Valley (Nepalese Himalayas), 77–98. In: Lami, A. & G. Giussani (eds.). *Limnology of High Altitude Lakes in the Mt. Everest Region (Nepal)*. Memorie dell Istituto Italiano di Idrobiologia 57.
- Michael, R.G. & B.K. Sharma (1988). *Fauna of India and adjacent countries, Indian Cladocera (Crustacea: Branchiopoda: Cladocera)*. Zoological Survey of India, Calcutta, 262pp.
- Murray, J. (1906). Some Rotifera of the Sikkim Himalaya. *Journal of Royal Microscopical Society, London* 2(9): 637–644.
- Myers, N., R.A. Mittermeier, C.A. Mittermeier, G.A.B. da Fonseca & J. Kent (2000). Biodiversity hotspots for conservation priorities. *Nature* 403: 853–858.
- Olson, D.M. & E. Dinersterin (1998). The global 200: a representation approach to conserving the Earth's most biologically valuable ecoregions. *Conservation Biology* 12: 502–515.
- Padhye, S. & A.A. Kotov (2010) Cladocera (Crustacea: Branchiopoda) in Indian hotspots. *Invertebrate Zoology* 7: 155–158.
- Rao, R.R. (1994). *Biodiversity in India: Floristic Aspects*. Bishen Singh Mahendra Pal Singh, Dehradun, 315pp.
- Reddiah, K. (1964). The copepod fauna of Assam (India) 1. *Neodiptomus kamakhiae* n. sp. from Kamarup District. *Crustaceana* 7: 161–166.
- Reddy, Y.R. (2013a). *Neodiptomus prateek* n. sp., a new freshwater copepod from Assam, India, with critical review of generic assignment of *Neodiptomus* spp. and a note on diaptomid species richness (Calanoida: Diaptomidae). *Journal of Crustacean Biology* 33: 849–865.
- Reddy, Y.R. (2013b). *Tropodiptomus signatus* Kiefer 1982, a little known species from Loktak lake, Manipur State, India (Copepoda: Calanoida: Diaptomidae). *Crustaceana* 86: 1675–1688.
- Reddy, Y.R. (2017). Crustacea: Copepoda — a note, pp243–245. In: Chandra, K., K.C. Gopi, D.V. Rao, K. Valarmathi & J.R.B. Alfred (eds.). *Current Status on Freshwater Faunal Diversity of India – An Overview*. Zoological Survey of India, Kolkata, 624pp.
- Richardson, A.J. (2008). In hot water: zooplankton and climate change. *ICES Journal of Marine Science* 65: 279–295.
- SAC (2009). National Wetland Atlas: Arunachal Pradesh, SAC/RESA/AFEG/NWIA/ATLAS/06/2009. Space Applications Centre (ISRO), Ahmedabad, India, 98pp.
- Sa–Ardrit, P., P. Pholpunthin, & H. Segers (2013). A checklist of the freshwater rotifer fauna of Thailand (Rotifera, Monogononta, Bdelloidea). *Journal of Limnology* 72(2): 361–375.
- Schminke, H.K. (2007). Entomology for the copepodologist. *Journal of Plankton Research* 29: 149–162.
- Segers, H. (2007). Annotated checklist of the rotifers (Phylum Rotifera), with notes on nomenclature, taxonomy and distribution. *Zootaxa* 1564: 1–104.
- Segers, H. (2008). Global diversity of rotifers (Rotifera) in freshwater. *Hydrobiologia* 595: 49–59.
- Sharma, B.K. & R.G. Michael (1980). Synopsis of taxonomic studies on Indian Rotatoria. *Hydrobiologia* 73: 229–236.
- Sharma, B.K. & R.G. Michael (1987). Review of taxonomic studies on freshwater Cladocera from India with remarks on biogeography. *Hydrobiologia* 145: 29–33.
- Sharma, B.K. & S. Sharma (1987). On species of genus *Lepadella* (Eurotatoria: Monogononta: Colurellidae) from northeastern India, with remarks on Indian taxa. *Hydrobiologia* 147: 15–22.
- Sharma, B.K. & S. Sharma (1990). On the taxonomic status of some cladoceran taxa (Crustacea: Cladocera) from Central India. *Revue d'Hydrobiologie Tropicale* 23: 105–113.
- Sharma, B.K. & S. Sharma (2005). Biodiversity of freshwater Rotifers (Rotifera: Eurotatoria) from north-eastern India. *Zoosystematics & Evolution* 81: 81–88.
- Sharma, B.K. & S. Sharma (2011). Faunal diversity of Cladocera (Crustacea: Branchiopoda) of Nokrek Biosphere Reserve, Meghalaya, northeastern India. *Journal of Threatened Taxa* 3(10): 2120–212; <https://doi.org/10.11609/JOTT.o2637.2120-7>
- Sharma, B.K. & S. Sharma (2014a). The diversity of Indian Brachionidae (Rotifera: Eurotatoria: Monogononta) and their distribution. *Opuscula Zoologica Budapest* 45(2): 165–180.
- Sharma, B.K. & S. Sharma (2014b). Northeast India: an important region with a rich biodiversity of Rotifera. *International Review of Hydrobiology* 99: 20–37.
- Sharma, B.K. & S. Sharma (2017a). Rotifera: Eurotatoria (Rotifers), pp93–113. In: Chandra, K., K.C. Gopi, D.V. Rao, K. Valarmathi & J.R.B. Alfred (eds.). *Current Status on Freshwater Faunal Diversity of India – An Overview*. Zoological Survey of India, Kolkata, 624pp.
- Sharma, B.K. & S. Sharma (2017b). Crustacea: Branchiopoda (Cladocera), pp199–223. In: Chandra, K., K.C. Gopi, D.V. Rao, K. Valarmathi & J.R.B. Alfred (eds.). *Current Status on Freshwater Faunal Diversity of India – An Overview*. Zoological Survey of India, Kolkata, 624pp.
- Sharma, B.K. (1987a). The distribution of lecanid rotifers (Rotifera: Monogononta: Lecanidae) in northeastern India. *Revue d'Hydrobiologie Tropicale* 20: 101–105.
- Sharma, B.K. (1987b). Rotifera: Eurotatoria: Monogonota (Freshwaters), pp323–340, In: Director, ZSI (ed.). *State Fauna Series No. 1, Fauna of Orissa, Part 1*. Zoological Survey of India, Calcutta, 340pp.
- Sharma, B.K. (1996). Biodiversity of freshwater Rotifera in India – a status report. *Proceedings of Zoological Society of Calcutta* 49(2): 73–85.
- Sharma, B.K. (1998). Rotifera, pp. 57–70, In: Alfred, J.R.B., A.K. Das, & A.K. Sanyal (eds.). *Faunal Diversity of India*. Zoological Survey of India, Calcutta, 497pp.
- Sharma, S. (2008). Freshwater monogonont rotifers (Rotifera: Eurotatoria: Monogononta), pp5–22. In: *Fauna of Kopili Hydro Electric Project Site, Umrong-North Cachar Hills District, Assam and Jaintia Hills District, Meghalaya, Wetland Ecosystem Series 9*. Zoological Survey of India, Calcutta, 91pp.
- Sharma, S. & B.K. Sharma (2008). Zooplankton diversity in floodplain lakes of Assam. *Records of Zoological Survey of India, Occasional Paper No. 290*, 307pp.

- Sharma, S. & B.K. Sharma (2013).** *Faunal Diversity of Aquatic Invertebrates of Deepor Beel (A Ramsar site), Assam, northeast India, Wetland Ecosystem Series 17.* Zoological Survey of India, Calcutta, 227pp.
- Sharma, S., J. Thilak & J. Chitra (2017).** Zooplankton, pp15–28. In: *Fauna of Tawang, Arunachal Pradesh.* Zoological Survey of India, Calcutta, 268pp.
- Sharma, V., M.S. Sharma, H. Malara, R. Sharma & B.S. Bafheal (2008).** Trophic status and zooplankton diversity of lake Jaisamand in relation to physicochemical characteristics, pp490–495. Proceedings of Taal 2007 - the 12th World Lake Conference.
- Sinev, A.Y. & H.J. Dumont (2016).** Revision of the *costata*-group of *Alona* s. lato (Cladocera: Anomopoda: Chydoridae) confirms its generic status. *European Journal of Taxonomy* 223: 1–38.
- Sinha, B. & M. Islam (2002).** Seasonal variation in zooplankton population of two lentic bodies and Assam State Zoo Cum Botanical garden, Guwahati, Assam. *Ecology, Environment & Conservation* 8: 273–278.
- Sinha, B., M.M. Borah & S.C. Bordoloi (2002).** Planktonic biodiversity in the amphibian habitats of eight districts of Arunachal Pradesh, India, pp338–344, In: Kumar, A. (ed.). *Ecology & Ethology of Aquatic Biota, Vol. II.* Daya Publishing House, Delhi, India, 901pp.
- Vanjare, A.I., C.A.V.N. Panikar & S.M. Padhye (2017).** Species richness estimate of freshwater rotifers (Animalia: Rotifera) of western Maharashtra, India with comments on their distribution. *Current Science* 112(4): 695–698.







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