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Original Article

Ecosystem diversity of Cladocera (Crustacea: Branchiopoda) of the floodplain lakes of Majuli River Island, the Brahmaputra river basin, northeast India

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Abstract: Plankton and semi-plankton samples collected from twelve floodplain lakes (beels) of Majuli River Island of the Brahmaputra river basin, Upper Assam reveal rich Cladocera assemblage of 48 species belonging to 32 genera and 7 families. This report assumes biodiversity value as ~65.0% and ~37.0% of the species, and ~78.0% and ~72.0 of genera of the taxon known from Assam state of northeast India (NEI) and India, respectively. *Picripleuroxus quasidenticulatus* (Smirnov) is a new record from the Indian sub-region. Biogeographically important elements include one Australasian, three Indo-Chinese and two Oriental species. Total cladoceran richness in individual beels ranged between 16-38 (26 ± 6) species while monthly and seasonal richness in six beels each varied between 8 ± 3-13 ± 3 species and 11 ± 4-17 ± 3 species, respectively and showed lack of any pattern of temporal variations. The community similarities (40.1-86.5% *vide* Sørensen's index) and the hierarchical cluster analysis affirm heterogeneity in Cladocera composition in different beels. Individual abiotic factors indicated insignificant influence on richness except for significant positive correlation with alkalinity only in Khorkhoria beel.

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Introduction

Freshwater Cladocera have been documented from distant parts of India since the initial study by Baird (1860) but little is yet known about their ecosystem diversity in inland environs of this country (Sharma, 2010). Some notable studies on the latter aspect (Sharma and Sharma, 2008, 2009, 2010, 2014) are limited to the floodplain lakes (beels or pats) of northeast India (NEI) while fewer other ad-hoc studies elsewhere from India are riddled with incomplete species inventories for meaningful analysis.

The present study on Cladocera assemblages of twelve beels of Majuli, the largest river island of the world situated in the upper reaches of the river Brahmaputra in Upper Assam, thus deserves ecology value. We provide an inventory of the examined cladoceran species from different beels of this geographically interesting landform of fluvial geomorphology faced with extinction due to alarming rate of erosion by the Brahmaputra flood waters. Comments are made on their composition and richness, interesting elements, community similarities and influence of abiotic parameters. The present report is of biodiversity interest and for following meta-analyses on the cladoceran fauna of Majuli studied earlier vides Sharma and Sharma (2014).

Materials and Methods

This study is based on water and plankton samples collected, during September, 2010-August, 2012, from twelve floodplain lakes (beels) of Majuli River Island (93°-95°E, 25°-27°N), upper Assam (Fig. 1, Table 1). The sampled beels possessed different aquatic macrophytes' namely *Eichhornia crassipes*,

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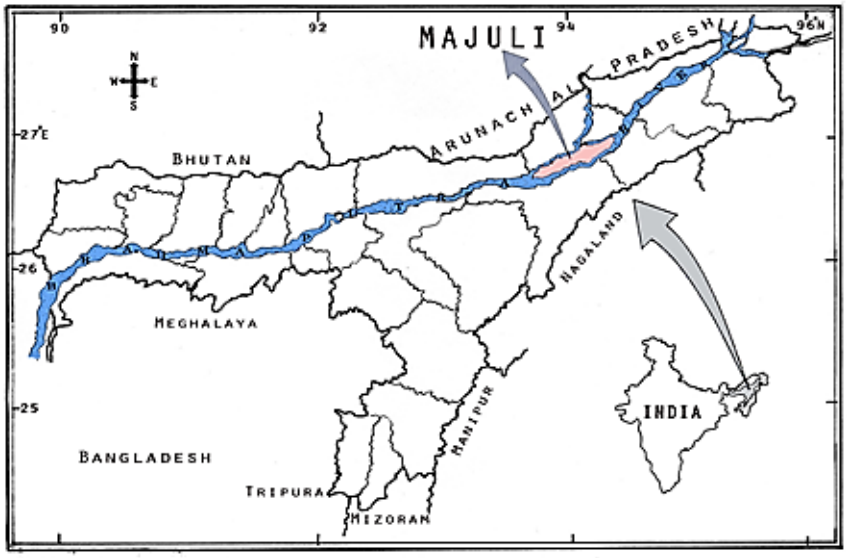

Figure 1. District map of Assam state indicating location of Majuli River Island (insert Map of India indicating Assam state of northeast India).

Table 1. The sampled floodplain lakes (beels) and their Abiotic parameters (Mean ± SD) (after Sharma et al., 2015).

Parameters↓ Beels→	**Bhereki***	**Ghotonga***	**Holmari***	**Chela***	**Chakuli***	**Khorkhoria***
Latitude	26°57′09.1″N	27°01′52.7″N	26°59′17.3″N	27°04′58.2″ N	26°56′40.3″N	26° 56′47.4″N
Longitude	94°12′23.0″E	94°15′28.7″E	94°12′30.6″E	94°17′51.9″ E	94°09′01.9″E	94°12′28.8″E
Altitude	67 m ASL	73 m ASL	75 m ASL	89 m ASL	69 m ASL	74 m ASL
Water Temperature °C	23.7 ± 1.7	23.9 ± 1.7	23.6 ± 1.7	23.4 ± 1.9	23.6 ± 1.9	23.9 ± 1.8
pH	6.67 ± 0.23	6.51 ± 0.16	6.87 ± 0.13	7.04 ± 0.19	6.82 ± 0.18	6.80 ± 0.24
Sp. Conductivity µS/cm	140.7 ± 24.4	121.4 ± 26.8	173.6 ± 32.5	210.4 ± 41.3	180.8 ± 37.8	172.1 ± 44.4
Dissolved oxygen mg/l	6.3 ± 0.9	6.2 ± 1.0	7.1 ± 0.8	7.8 ± 0.7	6.2 ± 0.8	6.4 ± 1.2
Free CO_2 mg/l	13.6 ± 4.0	13.8 ± 3.4	10.2 ± 2.8	10.3 ± 2.4	14.8 ± 4.6	13.9 ± 5.0
Total Alkalinity mg/l	70.3 ± 20.7	62.2 ± 13.4	92.3 ± 14.2	113.5 ± 24.6	105.8 ± 29.0	90.2 ± 29.9
Total Hardness mg/l	69.8 ± 20.3	60.8 ± 13.6	89.3 ± 16.9	113.0 ± 23.8	104.0 ± 26.2	88.8 ± 27.2
Parameters↓ Beels→	**Doriya**	**Dubori**	**Tuni**	**Baatomaari**	**Jur**	**Chereki**
Latitude	26°57′27.7″N	26°57′01.9″N	26° 58′35.3″N	26°59′25.9″N	26°59′45.3″N	26°58′25.4″N
Longitude	94°10′02.4″E	94°16′13.8″E	94°15′57.8″E	94°13′08.0″E	94°14′34.4″E	94°10′38.7″E
Altitude	70 m ASL	70 m ASL	67 m ASL	71 m ASL	71 m ASL	67 m ASL
Water Temperature °C	24.2 ± 2.3	24.1 ± 1.9	23.9 ± 2.1	24.0 ± 1.9	23.9 ± 2.5	24.2 ± 1.7
pH	6.70 ± 0.32	6.61 ± 0.19	6.69 ± 0.14	6.87 ± 0.13	6.71 ± 0.14	6.62 ± 0.21
Sp. Conductivity µS/cm	110.2 ± 20.8	132.4 ± 18.6	123.6 ± 23.0	114.2 ± 20.5	130.8 ± 24.6	128.2 ± 33.2
Dissolved oxygen mg/l	5.8 ± 1.2	7.0 ± 0.9	5.1 ± 1.8	6.2 ± 0.9	5.9 ± 1.1	6.1. ± 1.0
Free CO_2 mg/l	12.0 ± 5.2	11.8 ± 4.2	12.2 ± 1.9	11.4 ± 1.9	12.7 ±3.5	12.1 ± 3.6
Total Alkalinity mg/l	67.3 ± 12.2	72.2 ± 11.4	82.3 ± 12.3	91.5 ± 16.2	88.9 ± 12.9	90.8 ± 16.6
Total Hardness mg/l	62.8 ± 12.6	70.8 ± 10.6	79.1 ± 15.6	89.0 ± 12.8	81.4 ± 12.0	86.9 ± 17.0

* Sampled monthly; the rest sampled during winter (December/January), pre-monsoon (March-May), monsoon (June-August) and post-monsoon (September-October)

Hydrilla verticellata, *Utricularia flexuosa*, *Trapa natans*, *Lemna major*, *L. minor*, *Pistia striates*, *Salvinia* sp., *Nymphaea* spp., *Nymphoides* spp., *Potamageton* spp., *Azolla pinnata*, *Euryale ferox*, and *Sagittaria* sp.

The collections were obtained monthly from six beels (marked with*) and seasonally from rest of the beels (Table 1). Water samples were examined for abiotic parameters, including water temperature, specific conductivity and pH were recorded by the field probes; DO was estimated by Winkler's method while free CO_2, total alkalinity and total hardness were analyzed following APHA (1992). The qualitative plankton samples were collected by

towing a plankton net (#50 µm) from the littoral, limnetic/semi-limnetic regions of different beels,

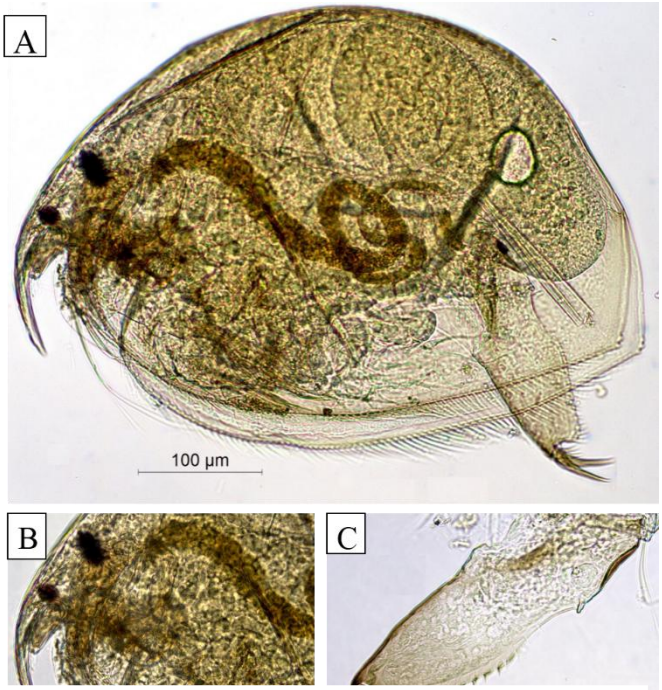

Figure 2. *Picripleuroxus quasidenticulatus* (Smirnov, 1996), parthenogenetic female, (B) Head, parthenogenetic female, (C) postabdomen, parthenogenetic female.

preserved in 5% formalin and were screened with a Wild-stereoscopic binocular microscope. Various cladocerans and their disarticulated appendages were mounted in Polyvinyl alcohol-lactophenol mixture, and observed with a Leica (DM 1000) stereoscopic phase contrast microscope fitted with an image analyzer. Cladocera species were identified following Smirnov (1971, 1976, 1992, 1996), Michael and Sharma (1988), Korovchinsky (1992), Sharma and Sharma (1999), Orlova-Bienkowskaja (2001), and Sharma and Sharma (2008, 2013).

The percentage similarities between cladoceran communities of different beels were calculated *vide* Sørensen's index (Sørensen, 1948) and their hierarchical cluster analysis was performed using SPSS (version 20). Ecological relationships between abiotic factors and rotifer richness were determined by Pearson's correlation coefficients (r); their P values were calculated *vide* http://faculty.vassar.edu/lowry/tabs.html and significance was ascertained after use of Bonferroni corrections. The reference collections were deposited in the holdings of Freshwater Biology Laboratory, Department of Zoology, North-Eastern Hill University, Shillong.

Results

The details of the sampled beels and their basic abiotic parameters (Mean ± SD) are indicated in Table 1. Water temperature ranged between 23.4 ± 1.9-24.2 ± 2.3°C, pH between 6.51 ± 0.16-7.04 ± 0.19, specific conductivity between 110.2 ± 20.8-210.4 ± 41.3 µS/cm, DO between 5.1 ± 1.8-7.8 ± 0.7 mg/l; free CO_2 between 10.3 ± 2.4-14.8 ± 4.6 mg/l; total alkalinity between 62.2 ± 13.4-113.5 ± 24.6 mg/l; and total hardness between 60.8 ± 13.6-113.0 ± 23.8 mg/l.

A total of 48 Cladocera species belonging to 32 genera and 7 families are documented. *Picripleuroxus quasidenticulatus* (Smirnov) is a new addition (Fig. 2, A-C) to the Indian Cladocera. The species composition of the taxon of sampled beels is indicated in Appendix I. Total richness in individual beels ranged between 16-38 (26 ± 6) species and recorded 40.1-86.5% community similarities *vide* Sørensen's index (Table 2). The monthly and seasonal richness in six beels each varied between 8 ± 3-13 ± 3 species and 11 ± 4-17 ± 3 species, respectively. The hierarchical analysis between Cladocera assemblages in different beels is shown in Figure 3.

Discussion

The sampled beels are characterized by slightly acidic to circum-neutral, 'moderately hard' to 'hard' well-oxygenated waters with 'bicarbonate alkalinity' and occurrence of free CO_2, and are notable for their low specific conductivity (refer Sharma et al., 2015). The last salient feature, indicating low ionic concentrations, warrants inclusion of these floodplain lakes under 'Class I' category of trophic classification *vide* Talling and Talling (1965).

Forty-eight species of Cladocera, spread over 32 genera and seven families, observed in our plankton and semi-plankton collections from twelve beels of Majuli River Island reveal rich and diverse

Table 1. Percentage similarities between Cladocera assemblages of Majuli beels.

Beels	1	2	3	4	5	6	7	8	9	10	11	12
1	-	68.1	60.5	68.4	77.8	54.5	58.6	54.5	63.6	62.5	64.0	59.6
2		-	72.0	70.8	69.8	82.3	64.6	58.1	62.7	69.1	63.1	59.3
3			-	74.4	73.8	72.3	59.0	48.3	59.6	54.9	56.6	40.1
4				-	86.5	84.4	57.6	71.1	57.8	61.2	62.7	50.0
5					-	75.0	48.1	54.9	55.0	59.1	60.9	46.5
6						-	61.3	67.8	58.3	65.4	66.7	54.9
7							-	82.2	64.5	63.6	79.4	76.9
8								-	64.4	66.7	76.9	71.0
9									-	69.2	66.7	62.7
10										-	75.9	61.8
11											-	66.7
12												-

1-Bhereki, 2-Ghotonga, 3-Holmari, 4-Chakuli, 5-Chela, 6-Khorkhoria, 7-Doriya, 8-Dubori, 9-Tuni, 10-Baatomari, 11-Jur, 12-Chereki

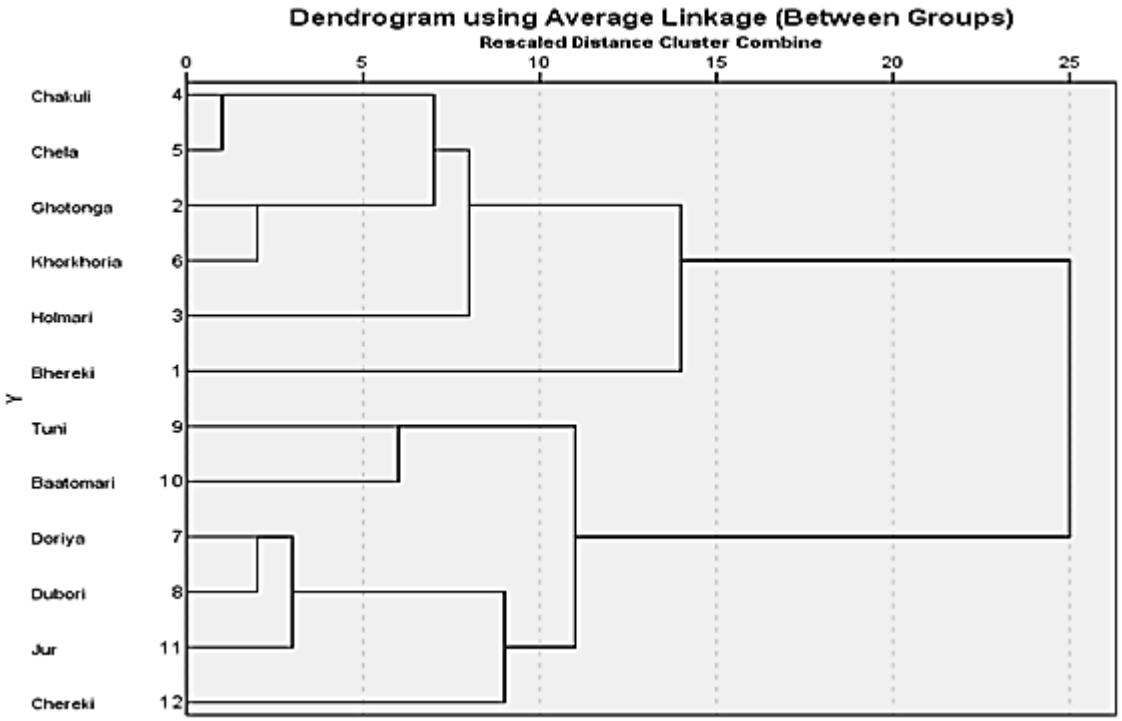

Figure 3. Hierarchical cluster analysis of Cladocera assemblages of Majuli beels.

assemblage of the taxon in South Asia. Total richness is of biodiversity value as ~65.0% and ~37.0% of the species, and ~78.0% and ~72.0 of genera of the taxon known from Assam state (NEI) and India, respectively. This report affirms the hypothesis of Sharma and Sharma (2008, 2013, 2014) on the floodplains of the Brahmaputra basin to be Cladocera rich habitats of the Indian sub-region. Though based on observations from much limited geographical location, these results merit biodiversity value in light of a conservative estimate of occurrence of up to 60-65 cladoceran species from tropical and subtropical parts of the India subcontinent (Fernando and Kanduru, 1984; Sharma and Michael, 1987).

Picripleuroxus quasidenticulatus (Smirnov) is a new record from India; this erstwhile Australasian species is now known (Sinev and Sanoamuang,

2013) from Thailand, Vietnam and the Far East of Russia. The present study further extends its distribution to the Indian sub-region within the Oriental region. Further, in consideration of this record, we suggest re-examination of all earlier reports of the congener *P. denticulatus* (Birge) from India. The biogeographically important elements include the Australasian *Disperalona caudata*; three Indo-Chinese species namely *Alona cheni*, *A. kotovi* and *Chydorus angustirostris*; and two Oriental endemics: *Celsinotum macronyx* and *Kurzia* (*Rostrokurzia*) *brevilabris*. Of these, *D. caudata* is an important link between the Cladocera faunas of NEI, Southeast Asia and Australia while the rest endorse affinity of NEI Cladocera with SE Asia (Sharma and Sharma, 2007, 2014). Of these, *A. kotovi* and *C. angustirostris* are recent additions (Sharma and Sharma, 2014) to the cladoceran faunas of India and NEI, respectively; Sinev and Korovchinsky (2013) extended the distribution of the latter as well as erstwhile Indian endemic to Vietnam imparting it an Indo-Chinese character.

Total Cladocera richness is distinctly higher than the reports of only 11 species from two floodplain lakes (Khan, 1987) of Kashmir; 9 species from 65 wetlands of 24-Parganas district (Nandi et al., 1993) of West Bengal; 4 species (Sinha et al., 1994) and 12 species (Sanjer and Sharma,1995) from the floodplains of Bihar; 14 species from 37 floodplain lakes (Sarma, 2000) of Assam, 36 species from 20 wetlands from the floodplains of south-eastern West Bengal (Khan, 2003) and 30 species from 30 wetlands of Keoladeo National Park (Venkataraman, 1992). We, however, caution against over-emphasis on comparisons with poor richness of certain reports because of inadequate sampling or incomplete species inventories.

Cladocera assemblages of individual beels recorded 40.1-86.5% community similarities (vide Sørensen's index) with ~67% instances indicating 51-70% similarities and <70% similarity only in ~24.0% instances in the matrix. This generalization suggests relatively lower similarity and more heterogeneity in species composition of these micro-crustaceans amongst different beels. The former is in contrast to higher similarities reported in certain floodplain lakes of Assam (Sharma and Sharma, 2008; Sharma and Sharma, 2008, 2013) and Manipur (Sharma and Sharma, 2009, 2010). Peak similarity is observed between Chakuli and Chela beels while a lowest value is noticed between Holmari and Chereki beels. The hierarchical cluster analysis endorses closeness in cladoceran communities of the first two beels. On the contrary, Bhereki reflected most divergence in its species composition and is followed by Tuni, Chereki and Holmari in the stated order.

Total cladoceran richness in individual Majuli beels ranged between 16-38 (26 ± 6) species; maximum richness in Doriya beel is followed by 35 and 30 species in Dubori and Jur beels, respectively, while six beels in all recorded more than average number of species. In general, our report broadly concurs with total richness of 15 beels (21-29 species) of Assam (Sharma and Sharma, 2008) and 14 pats (21-31 species) of Manipur but notwithstanding the report of 51 species from Loktak lake - A Ramsar site (Sharma and Sharma, 2010). The monthly and seasonal richness in six beels each varied between 8 ± 3-13 ± 3 species and 11 ± 4-17 ± 3 species, respectively and showed lack of any pattern of temporal variations; the former is attributed to growth of *Eichhornia crassipes* affirming the recent remarks on Rotifera of these floodplains (Sharma et al., 2015). Referring to the influence of individual abiotic factors, our report of significant positive correlation with alkalinity only in Khorkhoria beel ($r = 0.561$, $p = 0.0022$) is in contrast to their importance noticed earlier from Assam (Sharma and Sharma, 2010; Sharma and Sharma, 2008) and Manipur (Sharma and Sharma, 2010).

The present observations affirm remarks of Sharma and Sharma (2014) on occurrence of weed-associated biota in general and member of the family Chydoridae (62% of total richness), Macrothricidae and Sidiidae in particular, common occurrence of *Macrothrix* spp., *Simocephalus mixtus* and

Guernella raphaelis, a relative paucity of members of the Bosminidae and Moinidae and lack of *Daphnia*. The common occurrence of the members of the former three families is attributed to the prevalence of the littoral-periphytonic conditions; this generalization concurs with the report from inland swamps of Southern Thailand (Van Damme et al., 2013).

In conclusion, the rich and diverse nature of Cladocera of Majuli Beels affirms their environmental heterogeneity, shows interesting elements and records heterogeneity in their assemblages. The Cladocera-aquatic macrophytes associations in fluvial wetlands, the flushing influence of the Brahmaputra waters and their re-colonization in these flood-prone environs merits future attention in light of complete lack of such works from India.

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Appendix I: Systematic list of examined Cladocera taxa

Super-class: Crustacea

Class: Branchiopoda

Super-order: Cladocera (*sensu strictu*)

Order: Ctenopoda

Family: Sididae

1. *Diaphanosoma excisum* Sars, 1885
2. *Diaphanosoma sarsi* Richard, 1895
3. *Diaphanosoma senegal* Gauthier, 1951
4. *Pseudosida szalayi* (Daday, 1898)
5. *Sida crystallina* (O. F. Muller, 1776)

Order: Anomopoda

Family: Daphniidae

6. *Ceriodaphnia cornuta* Sars, 1885
7. *Scapholeberis kingi* Sars, 1901
8. *Simocephalus (Echinocaudus) acutirostratus* (King, 1853)
9. *Simocephalus* (*Coronocephalus*) *serrulatus* (Koch, 1841)
10. *Simocephalus* (*Simocephalus*) *mixtus* Sars, 1903

Family: Bosminidae

11. *Bosmina longirostris* (O. F. Muller, 1776) s. lato
12. *Bosminopsis deitersi* Richard, 1895

Family: Moinidae

13. *Moina micrura* Kurz, 1874
14. *Moinodaphnia macleayi* (King, 1853)

Family: Macrothricidae

15. *Macrothrix laticornis* (Fischer, 1857)
16. *Macrothrix triserialis* (Brady, 1886)
17. *Guernella raphaelis* Richard, 1892
18. *Grimaldina brazzai* Richard, 1892

Family: Ilyocryptidae

19. *Ilyocryptus spinifer* Herrick, 1882

Family: Chydoridae

Subfamily: Chydorinae

20. *Alonella* (*Alonella*) *clathratula* Sars, 1886
21. *Alonella* (*Alonella*) *excisa* (Fischer, 1854)
22. *Chydorus angustirostris* Frey, 1987
23. *Chydorus sphaericus* (O. F. Muller, 1776) s.lat
24. *Chydorus ventricosus* Daday, 1898
25. *Dadaya macrops* (Daday)
26. *Disperalona caudata* Smirnov, 1996
27. *Dunhevedia crassa* King, 1853
28. *Dunhevedia serrata* Daday, 1898
29. *Ephemeroporus barroisi* (Richard, 1894)
30. *Picripleuroxus quasidenticulatus* (Smirnov, 1996)*
31. *Picripleuroxus similis* Vavra, 1900

Subfamily: Aloninae

32. *Alona cheni* Sinev, 1999
33. *Alona guttata tuberculata* Kurz, 1875
34. *Alona kotovi* Sinev, 2012
35. *Anthalona harti* Van Damme et al.
36. *Camptocercus uncinatus* Smirnov, 1973
37. *Celsinotum macronyx* (Daday, 1898)
38. *Celsinotum rectangula* (Sars, 1862) s.lat
39. *Euryalona orientalis* (Daday, 1898)
40. *Graptoleberis testudinaria* (Fischer, 1854)
41. *Karualona karua* (King, 1853)
42. *Kurzia* (*Kurzia*) *latissima* Kurz, 1874

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* New record from India

43. *Kurzia* (*Rostrokurzia*) *brevilabris* Rajapaksa & Fernando,1986
44. *Kurzia* (*Rostrokurzia*) *longirostris* (Daday, 1898)
45. *Leberis diphanus* (King, 1853)
46. *Leydigia acanthocercoides* (Fischer, 1854)
47. *Notoalona globulosa* (Daday, 1898)
48. *Oxyurella singalensis* (Daday, 1898)

Appendix II: Species composition of Cladocera of beels of Majuli River Island.

Super-class: **Crustacea** Class: Branchiopoda Super-order: Cladocera (*sensu strictu*)												
Taxa↓ Beels Sr. No.→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Order: Anomopoda												
Family: Bosminidae												
1. *Bosmina longirostris* (O. F. Muller)	-	+	-	-	-	-	+	+	-	+	-	+
2. *Bosminopsis deitersi* Richard	-	-	-	-	-	-	+	+	-	-	-	-
Family: Chydoridae												
Subfamily: Aloninae												
3. *Alona affinis* (Leydig) s.lat	-	-	-	-	-	-	+	-	+	+	+	-
4. *Alona cheni* Sinev	-	+	-	-	-	+	+	+	+	+	+	+
5. *Alona guttata tuberculata* Kurz	+	-	+	+	+	+	-	+	-	+	+	-
6. *Alona kotovi* Sinev	-	-	-	-	-	-	+	+	-	-	+	+
7. *Anthalona harti* Van Damme et al.	-	-	-	-	-	-	+	-	-	-	+	+
8. *Camptocercus uncinatus* Smirnov	+	+	-	-	-	+	+	+	+	+	+	+
9. *Celsinotum macronyx* (Daday)	-	+	-	-	-	+	-	+	-	+	-	-
10. *Celsinotum rectangula* (Sars) s.lat	+	-	+	-	-	-	+	+	+	-	+	-
11. *Euryalona orientalis* (Daday)	-	+	+	+	+	+	+	+	+	+	+	-
12. *Graptoleberis testudinaria* (Fischer)	-	+	+	-	-	-	+	-	-	-	-	+
13. *Karualona karua* (King)	+	+	+	+	+	+	+	+	+	+	+	+
14. *Kurzia brevilabris* Rajapaksa & Fernando	-	-	-	-	-	-	+	+	-	-	-	-
15. *Kurzia latissima* Kurz	-	+	+	-	-	-	-	+	+	-	-	-
16. *Kurzia longirostris* (Daday)	+	+	-	+	-	+	+	+	+	+	+	+
17. *Leberis diphanus* (King)	-	-	-	-	-	-	+	-	-	-	-	+
18. *Notoalona globulosa* (Daday)	+	+	+	+	+	+	+	+	+	+	+	+
19. *Oxyurella singalensis* (Daday	-	-	-	-	-	-	+	+	+	+	+	+
Subfamily: Chydorinae												
20. *Alonella clathratula* Sars	-	+	+	+	+	+	+	+	-	-	+	-
21. *Alonella excisa* (Fischer)	+	+	+	+	+	+	+	+	+	+	+	+
22. *Chydorus angustirostris* Frey	+	+	-	+	+	+	+	+	-	-	+	+
23. *Chydorus sphaericus* (O. F. Muller)	+	+	+	+	+	+	+	+	+	+	+	+
24. *Chydorus ventricosus* Daday	-	+	+	+	-	+	+	+	-	-	+	-
25. *Dadaya macrops* (Daday)	-	-	-	-	-	-	-	+	-	+	-	+
26. *Disperalona caudata* Smirnov	+	-	+	+	-	+	+	-	+	-	-	-
27. *Dunhevedia crassa* King	-	-	-	-	-	-	+	+	+	+	+	+
28. *Dunhevedia serrata* Daday	+	+	-	-	-	+	+	+	-	-	-	+
29. *Picripleuroxus quasidenticulatus* (Smirnov)*	-	-	-	-	-	-	+	-	-	-	+	+
30. *Picripleuroxus similis*	+	+	+	+	+	+	+	+	+	+	+	+
Family: Daphniidae												
31. *Ceriodaphnia cornuta* Sars	+	+	+	+	+	+	-	-	-	+	+	-
32. *Scapholeberis kingi* Sars	+	+	-	+	+	-	-	-	+	+	-	-
33. *Simocephalus acutirostratus* (King)	-	-	+	-	-	-	+	+	-	-	-	-
34. *Simocephalus serrulatus* (Koch)	+	+	+	+	+	+	+	+	-	-	-	-
35. *Simocephalus mixtus* Sars	+	+	-	+	+	+	+	+	+	+	+	+

Appendix II: Species composition of Cladocera of beels of Majuli River Island (contd.)

Taxa↓ Beels Sr. No.→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Family: Ilyocryptidae												
36. *Ilyocryptus spinifer* Herrick	-	-	-	-	-	-	-	+	-	-	+	-
Family: Macrothricidae												
37. *Grimaldina brazzai* Richard	-	-	-	-	-	-	+	-	-	+	-	-
38. *Guernella raphaelis* Richard	-	-	+	-	-	-	+	+	+	-	-	+
39. *Macrothrix laticornis* (Fischer)	+	+	+	+	+	+	+	+	+	+	+	+
40. *Macrothrix spinosa* King	-	-	-	-	-	-	+	+	-	-	+	+
41. *Macrothrix triserialis* (Brady)	+	+	+	+	+	+	+	+	+	+	+	+
Family: Moinidae												
42. *Moina micrura* Kurz	-	+	+	+	-	+	-	-	-	+	-	-
43. *Moinodaphnia macleayi* (King)	-	+	+	-	-	-	+	-	-	+	+	-
Order: Ctenopoda												
Family: Sididae												
44. *Diaphanosoma excisum* Sars	+	+	+	+	+	+	+	+	+	+	+	+
45. *Diaphanosoma sarsi* Richard	+	-	-	+	-	-	+	+	-	+	+	+
46. *Diaphanosoma senegal* Gauthier	-	-	-	-	-	-	-	-	+	-	-	+
47. *Pseudosida szalayi* (Daday)	-	-	-	-	-	-	+	+	+	+	+	-
48. *Sida crystallina* (O. F. Muller)	-	+	+	-	-	+	-	-	+	+	-	-
Total Richness (species)	**20**	**27**	**23**	**21**	**16**	**24**	**38**	**35**	**24**	**28**	**30**	**27**

1-Bhereki, 2-Ghotonga, 3-Holmari, 4-Chakuli, 5-Chela, 6-Khorkhoria, 7-Doriya, 8-Dubori, 9-Tuni, 10-Baatomari, 11-Jur, 12-Chereki

* New records from India