

## SPECIES COMPOSITION AND OCCURRENCE OF CLADOCERA IN KEENJHAR LAKE, SINDH, PAKISTAN

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### ABSTRACT

Zooplankton samples were collected from Keenjhar Lake to study cladocera during 2006, 2007 and 2008. A total of 15 genera were identified comprising of *Diaphanosoma*, *Ceriodaphnia*, *Bosmina*, *Bosminopsis*, *Macrothrix*, *Moina*, *Alona*, *Alonella*, *Cydorus*, *Ilyocryptus*, *Camptocercus*, *Simocephalus*, *Leydigia*, *Dunhevedia* and *Sida crystallina*. They were captured highest in November and lowest in March (2006- 2008). Among all these the most abundant genus was *Bosmina* sp. while least abundant was *Camptocercus* sp. (2006 to 2008).

**Key words:** Species composition, cladocera, Keenjhar Lake, Sindh.

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### INTRODUCTION

Cladocera are very important zooplanktons that indicate the ecological status of a water body. Many workers have worked on zooplankton of different water bodies of Pakistan. Among them are Siddique *et al.*, (1973), Baqai *et al.*, (1974) and Iqbal and Baqai (1975) that extensively surveyed and studied abundance of cladocera, ecology and biological complex of Keenjhar Lake.

Baloch *et al.*; (1998) examined species composition, seasonal variation and vertical distribution of zooplankton in Lake Unagi, Japan. Baloch (2000) identified 08 species of zooplankton from river Indus at Kotri Barrage. Jahangir *et al.*; (2000) investigated *Ceriodaphnia cornuta*, *Bosminopsis deitersi*, *Diaphanosoma brachyurum*, *Bosmina longirostris* from Kalri Lake. Mahar (2008) recorded five species of planktonic cladocerans *Ceriodaphnia setosa*, *Bosminopsis deitersi*, *Moina chankensis*, *Moina rectirostris* and *Ilyocryptus bhardwaji* from the fish pond of Jamshoro. Baloch and Suzuki (2009) reported five cladocerans species in lake Ikeda, Japan.

The present work aims to provide information about the cladoceran species composition in Keenjhar Lake.

### MATERIAL AND METHODS

For the sampling of biomass, horizontal hauls were made for about 20 minutes from a boat at a slow speed 0.1 meter/sec. by using silk bolting cloth plankton net No.20 (335  $\mu$  mesh size), with 0.25 meter in diameter at regular monthly intervals from January 2006 to December 2008. The plankton samples were preserved immediately in 4% formalin (in lake water). Cladocera were identified upto genus level with the help of keys by Ward and Whipple (1959) and Battish (1992). Cladocerans were counted and mean, SD and percentage were taken out.

### RESULTS AND DISCUSSION

In Keenjhar Lake cladocerans were dominant over other zooplanktons. A total of 15 genera *Diaphanosoma*, *Ceriodaphnia*, *Bosmina*, *Bosminopsis*, *Macrothrix*, *Moina*, *Alona*, *Alonella*, *Cydorus*, *Ilyocryptus*, *Camptocercus*, *Simocephalus*, *Leydigia*, *Dunhevedia* and *Sida crystallina* were captured. They were captured in highest quantity in November (2006 to 2008) and lowest in March during all the studied years (Fig.1). In huge presence of inedible phytoplankton during summer months, contributed in decline of zooplankton density as the available food was limited (Sommer *et al.*, 1986).

The most abundant genus was *Bosmina* sp. and frequently found in all the three years while least frequently found genus was *Camptocercus* (2006 to 2008). Maximum population of *Bosmina* sp. was observed in August may be due to monsoon rainfall that brings nutrient (Chowdhury *et al.*, 2007), whereas minimum numbers were noted in February might be due to less available food (Table 1,2,3,4).

*Bosminopsis* sp. showed variation in population as highest quantity was noted in June (2006 to 2008) whereas lowest percentage was noticed in August (2006) and July (2007 and 2008). The maximum population of *Chydorus* sp. was observed in July (2006 to 2008) while least individuals were noted in January (2006) and October (2007 and 2008). This might be due to availability of food as a controlling factor (Baloch *et al.*, 1998). *Bosminopsis* sp. was absent in February and March, 2006.

Table 1. Occurrence of Cladocera in Keenjhar Lake during January to December 2006.

| Cladocera %             | Jan.  | Feb.  | Mar.  | Apr.  | May   | Jun.  | Jul.  | Aug.  | Sept. | Oct.  | Nov.  | Dec.  |
|-------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| <i>Diaphanosoma</i> sp. | 4.35  | 0.00  | 0.00  | 4.69  | 5.56  | 0.00  | 0.00  | 0.00  | 5.26  | 0.00  | 11.68 | 4.55  |
| <i>Ceriodaphnia</i> sp. | 13.04 | 0.81  | 33.33 | 56.25 | 0.00  | 6.00  | 1.26  | 4.46  | 2.63  | 0.00  | 40.61 | 34.09 |
| <i>Bosmina</i> sp.      | 26.09 | 0.81  | 33.33 | 9.38  | 22.22 | 18.00 | 19.50 | 73.25 | 52.63 | 59.38 | 15.23 | 18.18 |
| <i>Bosminopsis</i> sp.  | 17.39 | 0.00  | 0.00  | 3.13  | 33.33 | 48.00 | 5.03  | 2.55  | 17.11 | 31.25 | 24.37 | 13.64 |
| <i>Macrothrix</i> sp.   | 2.17  | 3.23  | 0.00  | 1.56  | 0.00  | 0.00  | 0.00  | 1.27  | 1.32  | 0.00  | 0.51  | 0.00  |
| <i>Moina</i> sp.        | 2.17  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 2.52  | 0.00  | 2.63  | 0.00  | 1.02  | 2.27  |
| <i>Alona</i> sp.        | 8.70  | 13.71 | 33.33 | 1.56  | 27.78 | 6.00  | 4.40  | 5.73  | 5.26  | 3.13  | 0.00  | 0.00  |
| <i>Chydorus</i> sp.     | 2.17  | 29.84 | 0.00  | 3.13  | 0.00  | 10.00 | 60.38 | 11.46 | 2.63  | 3.13  | 6.60  | 13.64 |
| <i>Ilyocryptus</i> sp.  | 2.17  | 0.00  | 0.00  | 0.00  | 0.00  | 6.00  | 2.52  | 0.00  | 0.00  | 1.56  | 0.00  | 0.00  |
| <i>Camptocercus</i> sp. | 0.00  | 0.00  | 0.00  | 1.56  | 0.00  | 4.00  | 0.00  | 0.00  | 1.32  | 0.00  | 0.00  | 0.00  |
| <i>Simocephalus</i> sp. | 13.04 | 25.00 | 0.00  | 10.94 | 0.00  | 2.00  | 1.26  | 0.00  | 2.63  | 0.00  | 0.00  | 2.27  |
| <i>Alonella</i> sp.     | 4.35  | 25.81 | 0.00  | 4.69  | 5.56  | 0.00  | 0.00  | 0.00  | 3.95  | 1.56  | 0.00  | 0.00  |
| <i>Leydigia</i> sp.     | 2.17  | 0.00  | 0.00  | 1.56  | 0.00  | 0.00  | 1.89  | 0.00  | 1.32  | 0.00  | 0.00  | 4.55  |
| <i>Dunhevedia</i> sp.   | 0.00  | 0.81  | 0.00  | 0.00  | 5.56  | 0.00  | 1.26  | 0.64  | 0.00  | 0.00  | 0.00  | 2.27  |
| <i>Sida crystallina</i> | 2.17  | 0.00  | 0.00  | 1.56  | 0.00  | 0.00  | 0.00  | 0.64  | 1.32  | 0.00  | 0.00  | 4.55  |

Table 2. Occurrence of Cladocera in Keenjhar Lake during January to December 2007.

| Cladocera %             | Jan.  | Feb.  | Mar.  | Apr.  | May   | Jun.  | Jul.  | Aug.  | Sept. | Oct.  | Nov.  | Dec.  |
|-------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| <i>Diaphanosoma</i> sp. | 1.72  | 0.83  | 0.00  | 1.82  | 0.00  | 0.00  | 0.73  | 0.00  | 2.67  | 1.32  | 9.45  | 2.38  |
| <i>Ceriodaphnia</i> sp. | 6.90  | 0.00  | 11.76 | 54.55 | 0.00  | 4.76  | 0.00  | 7.97  | 0.00  | 1.32  | 43.78 | 23.81 |
| <i>Bosmina</i> sp.      | 10.34 | 1.67  | 5.88  | 9.09  | 8.70  | 30.95 | 29.93 | 70.29 | 68.00 | 55.26 | 15.92 | 33.33 |
| <i>Bosminopsis</i> sp.  | 18.97 | 3.33  | 17.65 | 5.45  | 34.78 | 45.24 | 3.65  | 5.80  | 21.33 | 30.26 | 19.40 | 19.05 |
| <i>Macrothrix</i> sp.   | 3.45  | 2.50  | 0.00  | 0.00  | 4.35  | 0.00  | 0.73  | 0.72  | 0.00  | 2.63  | 0.00  | 2.38  |
| <i>Moina</i> sp.        | 0.00  | 0.83  | 0.00  | 1.82  | 0.00  | 0.00  | 1.46  | 0.00  | 1.33  | 1.32  | 0.50  | 4.76  |
| <i>Alona</i> sp.        | 3.45  | 10.00 | 0.00  | 1.82  | 17.39 | 4.76  | 2.92  | 3.62  | 2.67  | 3.95  | 0.50  | 0.00  |
| <i>Chydorus</i> sp.     | 15.52 | 36.67 | 35.29 | 9.09  | 30.43 | 7.14  | 57.66 | 8.70  | 1.33  | 1.32  | 8.46  | 4.76  |
| <i>Ilyocryptus</i> sp.  | 1.72  | 0.00  | 5.88  | 0.00  | 0.00  | 2.38  | 0.00  | 0.00  | 0.00  | 0.00  | 0.50  | 0.00  |
| <i>Camptocercus</i> sp. | 0.00  | 0.83  | 0.00  | 3.64  | 0.00  | 2.38  | 0.00  | 0.72  | 0.00  | 0.00  | 0.00  | 2.38  |
| <i>Simocephalus</i> sp. | 8.62  | 20.00 | 0.00  | 7.27  | 0.00  | 0.00  | 0.73  | 0.00  | 1.33  | 1.32  | 0.50  | 0.00  |
| <i>Alonella</i> sp.     | 25.86 | 23.33 | 11.76 | 1.82  | 0.00  | 0.00  | 0.73  | 0.72  | 1.33  | 0.00  | 0.50  | 0.00  |
| <i>Leydigia</i> sp.     | 3.45  | 0.00  | 5.88  | 0.00  | 0.00  | 0.00  | 0.73  | 0.72  | 0.00  | 0.00  | 0.50  | 0.00  |
| <i>Dunhevedia</i> sp.   | 0.00  | 0.00  | 5.88  | 0.00  | 4.35  | 0.00  | 0.73  | 0.72  | 0.00  | 0.00  | 0.00  | 4.76  |
| <i>Sida crystallina</i> | 0.00  | 0.00  | 0.00  | 3.64  | 0.00  | 2.38  | 0.00  | 0.00  | 0.00  | 1.32  | 0.00  | 2.38  |

The peak population of *Ceriodaphnia* sp. was noted in April (2006 to 2008) while least quantity was found in February (2006 and 2008) and October (2007). According to Dawidowicz and Pijanowska, (1984) food and predation affect the abundance of cladoceran.

Table 3. Occurrence of Cladocera in Keenjhar Lake during January to December 2008.

| Cladocera %             | Jan.  | Feb.  | Mar.  | Apr.  | May   | Jun.  | Jul.  | Aug.  | Sept. | Oct.  | Nov.  | Dec.  |
|-------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| <i>Diaphanosoma sp.</i> | 1.82  | 1.77  | 0.00  | 2.08  | 0.00  | 2.70  | 0.78  | 0.00  | 2.86  | 2.60  | 7.89  | 2.94  |
| <i>Ceriodaphnia sp.</i> | 5.45  | 0.88  | 26.32 | 52.08 | 0.00  | 2.70  | 0.00  | 5.15  | 0.00  | 5.19  | 44.74 | 23.53 |
| <i>Bosmina sp.</i>      | 10.91 | 1.77  | 5.26  | 8.33  | 4.76  | 27.03 | 25.58 | 72.79 | 60.00 | 50.65 | 17.37 | 32.35 |
| <i>Bosminopsis sp.</i>  | 27.27 | 4.42  | 10.53 | 4.17  | 28.57 | 45.95 | 3.10  | 6.62  | 25.71 | 32.47 | 18.95 | 20.59 |
| <i>Macrothrix sp.</i>   | 1.82  | 1.77  | 5.26  | 0.00  | 9.52  | 0.00  | 0.78  | 1.47  | 0.00  | 1.30  | 0.53  | 5.88  |
| <i>Moina sp.</i>        | 0.00  | 1.77  | 0.00  | 2.08  | 4.76  | 0.00  | 1.55  | 0.00  | 1.43  | 0.00  | 0.53  | 5.88  |
| <i>Alona sp.</i>        | 3.64  | 8.85  | 0.00  | 2.08  | 14.29 | 2.70  | 2.33  | 2.94  | 4.29  | 2.60  | 1.05  | 0.00  |
| <i>Chydorus sp.</i>     | 14.55 | 35.40 | 26.32 | 14.58 | 28.57 | 5.41  | 63.57 | 6.62  | 1.43  | 1.30  | 6.32  | 2.94  |
| <i>Ilyocryptus sp.</i>  | 1.82  | 0.00  | 10.53 | 0.00  | 0.00  | 2.70  | 0.00  | 0.74  | 0.00  | 0.00  | 0.53  | 0.00  |
| <i>Camptocercus sp.</i> | 0.00  | 0.88  | 0.00  | 2.08  | 0.00  | 5.41  | 0.00  | 0.74  | 0.00  | 1.30  | 0.00  | 0.00  |
| <i>Simocephalus sp.</i> | 7.27  | 19.47 | 0.00  | 6.25  | 0.00  | 0.00  | 1.55  | 0.00  | 1.43  | 0.00  | 0.53  | 0.00  |
| <i>Alonella sp.</i>     | 21.82 | 23.01 | 5.26  | 2.08  | 0.00  | 2.70  | 0.00  | 0.74  | 2.86  | 0.00  | 0.53  | 0.00  |
| <i>Leydigia sp.</i>     | 1.82  | 0.00  | 5.26  | 0.00  | 4.76  | 0.00  | 0.78  | 1.47  | 0.00  | 1.30  | 1.05  | 0.00  |
| <i>Dunhevedia sp.</i>   | 1.82  | 0.00  | 5.26  | 0.00  | 4.76  | 0.00  | 0.00  | 0.74  | 0.00  | 0.00  | 0.00  | 2.94  |
| <i>Sida crystallina</i> | 0.00  | 0.00  | 0.00  | 4.17  | 0.00  | 2.70  | 0.00  | 0.00  | 0.00  | 1.30  | 0.00  | 2.94  |

Table 4. Standard Deviation and Mean of Cladocera at Keenjhar Lake from 2006-2008.

|                         | 2006              | 2007              | 2008              |
|-------------------------|-------------------|-------------------|-------------------|
| Cladocera               | Mean $\pm$ SD     | Mean $\pm$ SD     | Mean $\pm$ SD     |
| <i>Diaphanosoma sp.</i> | 2.91 $\pm$ 6.47   | 2.25 $\pm$ 5.31   | 2.16 $\pm$ 4.10   |
| <i>Ceriodaphnia sp.</i> | 12.75 $\pm$ 23.49 | 12.33 $\pm$ 25.34 | 11.58 $\pm$ 24.13 |
| <i>Bosmina sp.</i>      | 24.58 $\pm$ 31.93 | 25.5 $\pm$ 28.77  | 23.41 $\pm$ 28.54 |
| <i>Bosminopsis sp.</i>  | 11.58 $\pm$ 13.68 | 12.25 $\pm$ 10.60 | 12.16 $\pm$ 10.43 |
| <i>Macrothrix sp.</i>   | 0.83 $\pm$ 1.19   | 0.91 $\pm$ 0.99   | 1.08 $\pm$ 0.79   |
| <i>Moina sp.</i>        | 0.83 $\pm$ 1.26   | 0.75 $\pm$ 0.75   | 0.83 $\pm$ 0.83   |
| <i>Alona sp.</i>        | 4.41 $\pm$ 4.83   | 3.00 $\pm$ 3.24   | 2.58 $\pm$ 2.64   |
| <i>Chydorus sp.</i>     | 15.16 $\pm$ 27.62 | 15.5 $\pm$ 23.22  | 14.5 $\pm$ 23.75  |
| <i>Ilyocryptus sp.</i>  | 0.75 $\pm$ 1.35   | 0.33 $\pm$ 0.49   | 0.5 $\pm$ 0.67    |
| <i>Camptocercus sp.</i> | 0.33 $\pm$ 0.65   | 0.5 $\pm$ 0.67    | 0.5 $\pm$ 0.67    |
| <i>Simocephalus sp.</i> | 4.16 $\pm$ 8.77   | 3.08 $\pm$ 6.78   | 2.75 $\pm$ 6.21   |
| <i>Alonella sp.</i>     | 3.5 $\pm$ 9.05    | 4.16 $\pm$ 8.57   | 3.75 $\pm$ 7.74   |
| <i>Leydigia sp.</i>     | 0.66 $\pm$ 0.98   | 0.5 $\pm$ 0.67    | 0.75 $\pm$ 0.75   |
| <i>Dunhevedia sp.</i>   | 0.5 $\pm$ 0.67    | 0.5 $\pm$ 0.67    | 0.41 $\pm$ 0.51   |
| <i>Sida crystallina</i> | 0.5 $\pm$ 0.67    | 0.41 $\pm$ 0.66   | 0.41 $\pm$ 0.66   |

*Alona sp.* showed one distinct maxima in May (2006 to 2008), while minimum populations were noted in April (2006 and 2007) and November (2008). *Simocephalus sp.* showed highest population in February (2006-2008) while lowest numbers were noticed during July (2006) and November (2007 and 2008). The maximum population of *Alonella sp.* was noted highest in February (2006 and 2008) and January (2007) whereas minimum percentages were

observed in October (2006) and November (2007 and 2008). It was absent in few months. *Diaphanosoma* sp. was not found continuously throughout the years. Highest population was noted in November (2006-2008) while least numbers were observed in January (2006) and July (2007 and 2008). The most favorable period for growth of zooplankton is from the August to November due to increase phytoplankton production (Ali, 2010). *Macrothrix* sp., *Moina* sp., *Ilyocryptus* sp., *Comptocercus* sp., *Leydigia* sp., *Dunhevedia* sp. and *Sida crystallina* showed very scanty population and were observed in few months of 2006 – 2008 (Table 1,2,3).

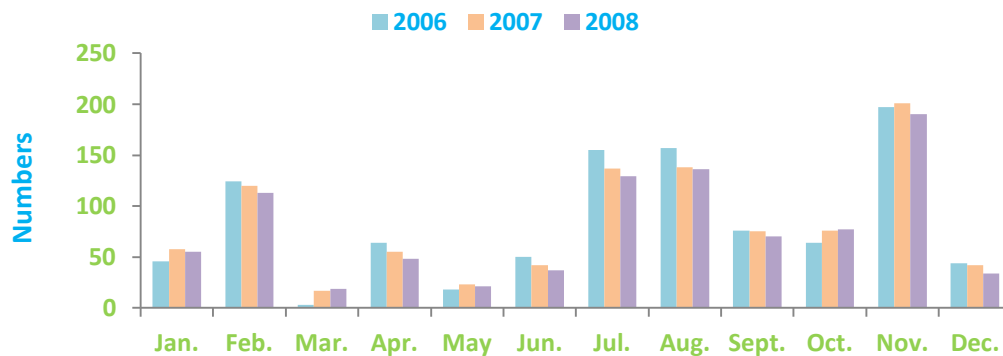


Fig. 1. Monthly variation of total number of Cladocera in Keenjhar Lake during 2006, 2007 and 2008.

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