# NEW CLADOCERAN RECORDS FROM LAKE PARANOÁ, CENTRAL BRAZIL

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## ABSTRACT

The zooplanktonic community of Lake Paranoá has been studied for more than thirty years. Until 1998, when it was considered eutrophic, only three cladoceran species were known from the reservoir. Since 1999, when Lake Paranoá underwent intentional flushing, definite changes in species diversity and composition were identified. At the same time, exploratory studies on littoral cladoceran species were being done. The present study aims to provide additional information on the cladoceran species composition of Lake Paranoá. Seven new species records are presented, four of them also representing the first record from the Federal District (Brasília). The population previously considered as belonging to *Bosmina longirostris* was reconsidered and re-identified as *Bosmina freyi*. Figures and comments on species taxonomy and distribution are also provided.

*Key words*: Cladocera, species composition, tropical reservoir.

## RESUMO

### Novos registros de ocorrência de cladóceros no Lago Paranoá, Brasil central

A comunidade zooplanctônica do Lago Paranoá vem sendo objeto de estudo há mais de 30 anos. Até 1998, quando o reservatório era considerado eutrófico, apenas 3 espécies de cladóceros haviam sido registradas. Com a aceleração do processo de reoligotrofização, a comunidade planctônica apresentou pronunciadas modificações. Ao mesmo tempo, estudos exploratórios das espécies litorâneas de cladóceros foram desenvolvidos. O objetivo do presente trabalho é apresentar informações adicionais sobre a composição de cladóceros do Lago Paranoá. São apresentados sete novos registros de ocorrência, sendo quatro deles também o primeiro para o Distrito Federal. A espécie anteriormente identificada como *Bosmina longirostris* foi revista, o que acarretou sua reidentificação como *Bosmina freyi*. Ilustrações e comentários sobre a taxonomia e distribuição das oito espécies são apresentados.

*Palavras-chave*: Cladocera, composição de espécies, reservatório tropical.

## INTRODUCTION

Zooplankton of Lake Paranoá have been studied over the last 30 years. The first taxonomic study recorded the presence of large-bodied cladocerans belonging to the genera *Ceriodaphnia* and *Daphnia* (Oliveira & Krau, 1970). Since the 1970s, the reservoir has undergone an intense eutrophication process due to urban occupation in its catchment area and inadequate sewage treatment (Mattos *et al.*, 1992; Fellizato *et al.*, 2000). The phytoplankton community was dominated by a monoculture of filamentous bluegreen algae, *Cylindrospermopsis raciborskii*, and several blooms of *Microcystis aeruginosa*. From 1976 to 1994, analysis of the zooplanktonic community revealed the presence of three species of cladocerans: *Bosmina longirostris*, *B. hagmanni*, and *Diaphanosoma birgei* (Mattos *et al.*, 1997; Branco & Senna, 1996).

In 1993, a restoration program began focusing on nutrient loading reduction. In 1995, notwithstanding phosphorus reduction (Cavalcanti *et al*., 1997), no change in zooplankton community structure was recorded (Mattos *et al*., 1997).

From 1996 to 1999, five species were added to the Lake Paranoá cladoceran species list: *Moina micrura*, *Daphnia gessneri*, *Ceriodaphnia cornuta*, *Bosminopsis deitersi*, and *Bosmina tubicen* (Padovesi-Fonseca *et al*., 2001; Mendonça-Galvão, 2001). Recently, Elmoor-Loureiro (2002) reported the occurrence of *Kurzia polyspina* in the littoral zone.

Since 1999, when Lake Paranoá was intentionally flushed, the reoligotrophication process has intensified and conspicuous changes in the zooplanktonic community have been observed, as well as water quality improvement (Pereira, 2001).

The aim of the present study is to provide additional information on cladoceran species composition in Lake Paranoá.

***Study area***

Lake Paranoá (15°48'S, 47°47'W) is a large, relatively shallow reservoir (area 38.1 $km^2$, volume 498.6 x $10^6$ $m^3$, max. depth 40 m, mean depth 13 m) situated in the urban region of Brasília, Central Brazil. The regional climate has two well-defined periods: a cool, dry winter (from May to September) and a warm, rainy summer (from October to April). The lake has a central area and four extended branches, corresponding to the valleys of former tributaries. Although the littoral zone is not well developed, some aquatic macrophytes are present, with *Eichhornia crassipes* and *Pistia stratiotes* as the predominant species.

## MATERIAL AND METHODS

The specimens were collected in the littoral and pelagic zones. Sampling in the pelagic zone was carried out in both dry (August-September, 1997-1999) and rainy seasons (January- February, 1998-2000) at a fixed collection station located in the Torto branch of the reservoir (15°44'57.7"S, 47°49'42.1"W). Samples were taken by vertical hauls (in the euphotic layer) with a 68 μm mesh plankton net. Formalin-sucrose solution was added as a fixative. Samples from the littoral zone (15°50'29.7"S, 47°53'55.1"W; 15°43'59.6"S, 47°53'13.3"W) were taken from March 2001 to May 2002. The cladocerans associated with *Eichhornia* roots were sampled using an adapted plankton net (130 μm mesh). The net was shaken and drawn through the macrophyte roots. The samples were fixed with ethanol 70%.

Some selected individuals were mounted on permanent slides in PVL medium (Reid, 1999) and deposited in the collections of the Laboratory of Zoology (UCB) and the Laboratory of Limnology (UnB).

## RESULTS

The present study added seven species to the cladoceran list of Lake Paranoá. Furthermore, a species already known from this water body was re-examined and its identification revised. The list of these species is presented below with comments about their distribution in Brazil, which are based on Elmoor-Loureiro (1997, 1998, 2000).

**Diaphanosoma spinulosum *Herbst, 1967 (Fig. 1)***

*Diaphanosoma birgei* was the only sidid species recorded from Lake Paranoá until the present (Padovesi-Fonseca *et al*., 2001). The coexistence of *D. birgei* and *D. spinulosum* in the planktonic community had been reported before (Lansac-Tôha *et al*., 1997; Espíndola *et al*., 1996).

These two species are similar in general shape and in posterior-ventral margin of the carapace, which presents large spines with delicate ones between them. Nevertheless, they are easily distinguished by their carapace ventral margin, that is infolded in *D. spinulosum* (a "*duplicadura*", as named by Paggi, 1978) but not in *D. birgei*.

**Simocephalus *(*Coronocephalus*)* serrulatus *(Koch, 1841) (Figs. 2 and 3)***

This planktonic species presents a serrulated frons and a basal claw outer side without spines (fine setules present), which are diagnostic features for subgenera *Coronocephalus*. Orlova-Bienkowskaja (1998) differentiated this species from *Simocephalus semiserratus* Sars, 1901 by the carapace posterior-dorsal projection, which is larger and better marked in *S. serrulatus*. Considered a cosmopolitan species, it had already been recorded for Central Brazil (Lansac-Tôha *et al.*, 1999), but this is the first instance for the Federal District.

**Bosmina *(*Sinobosmina*)* freyi *De Melo & Hebert, 1994 (Figs. 4 and 5)***

This is really not a new occurrence in Lake Paranoá. In fact, this population had previously been identified as *Bosmina longirostris* (Elmoor-Loureiro, 1988). Because the re-evaluation of the North-American *Bosmina* species (De Melo & Hebert, 1994) had revealed problems in distinguishing between *B. longirostris* and species of the *Sinobosmina* subgenus, the other American *B. longirostris* records should be considered as suspicious.

For this reason, individuals presumed *longirostris* in samples dating from 1983 and 1997-2000 were re-examined. The analysis revealed that the Lake Paranoá population presents the lateral head pore between the posterior branching of the forked line of the fornix, which is a diagnostic feature for *Sinobosmina*, rather than near the edge of the head shield. In addition, the proximal pecten of the claw has 7 spines (the two distalmost being more prominent), permitting specimen identification as *Bosmina freyi*.

This result suggests the necessity of revising the other *B. longirostris* records from Brazil (cf. Elmoor-Loureiro, 1998, 2000).

**Ilyocryptus spinifer *Herrick, 1882 (Figs. 6)***

The occurrence of *I. spinifer* in the Federal District region had already been reported, but this is the first documented record from Lake Paranoá, where the species was found in the community associated with macrophyte roots. This species is very common in Brazil, being recognized by an incomplete moult and postabdominal armature (in particular by 4-5 long lateral spines located exclusively on the post-anal margin).

**Macrothrix elegans *Sars, 1901 (Figs. 7, 8 and 9)***

Few specimens were found in all macrophyte root samples, which represent the first record from the Federal District region.

For a long time, this species had been considered as a junior synonym of *Macrothrix triserialis* Brady, 1886, but recently Dumont *et al*. (2002) showed that it is a valid species. As a member of the *triserialis* group, *M. elegans* presents the postabdominal setae implanted on a proeminence. It can be differentiated from any other species of the group by its enlarged subapical denticle on scrappers 4 and 5 on the second trunk limb and the huge epipodite on fifth trunk limb. It is also characterized by the two strong spines in the middle section of the largest antennal setae. Therefore, we suggest that the *M. triserialis* Brazilian records (cf. Elmoor-Loureiro, 1998) should be revised.

**Macrothrix laticornis *sensu lato (Figs. 10 and 11)***

Up until the time of this research, *Macrothrix laticornis* had not yet been reported from the Federal District, although it had been frequently recorded for Brazil.

Only one individual, found in a plankton sample, was observed. As the *Macrothrix* habitat is associated with a substrate (Fryer, 1974), we believe that its occurrence in the planktonic community should be considered accidental.

Silva-Briano *et al.* (1999) presented evidence that *Macrothrix laticornis* (Jurine, 1820) is a European taxon. These authors also described two new species of the *laticornis* group, supporting the idea (Smirnov, 1992) that records from other continents rightly belong to different species. The Paranoá specimen does not seem to belong to any of these three species, but it is premature to conclude, based on only one observation, that this is a new taxon.

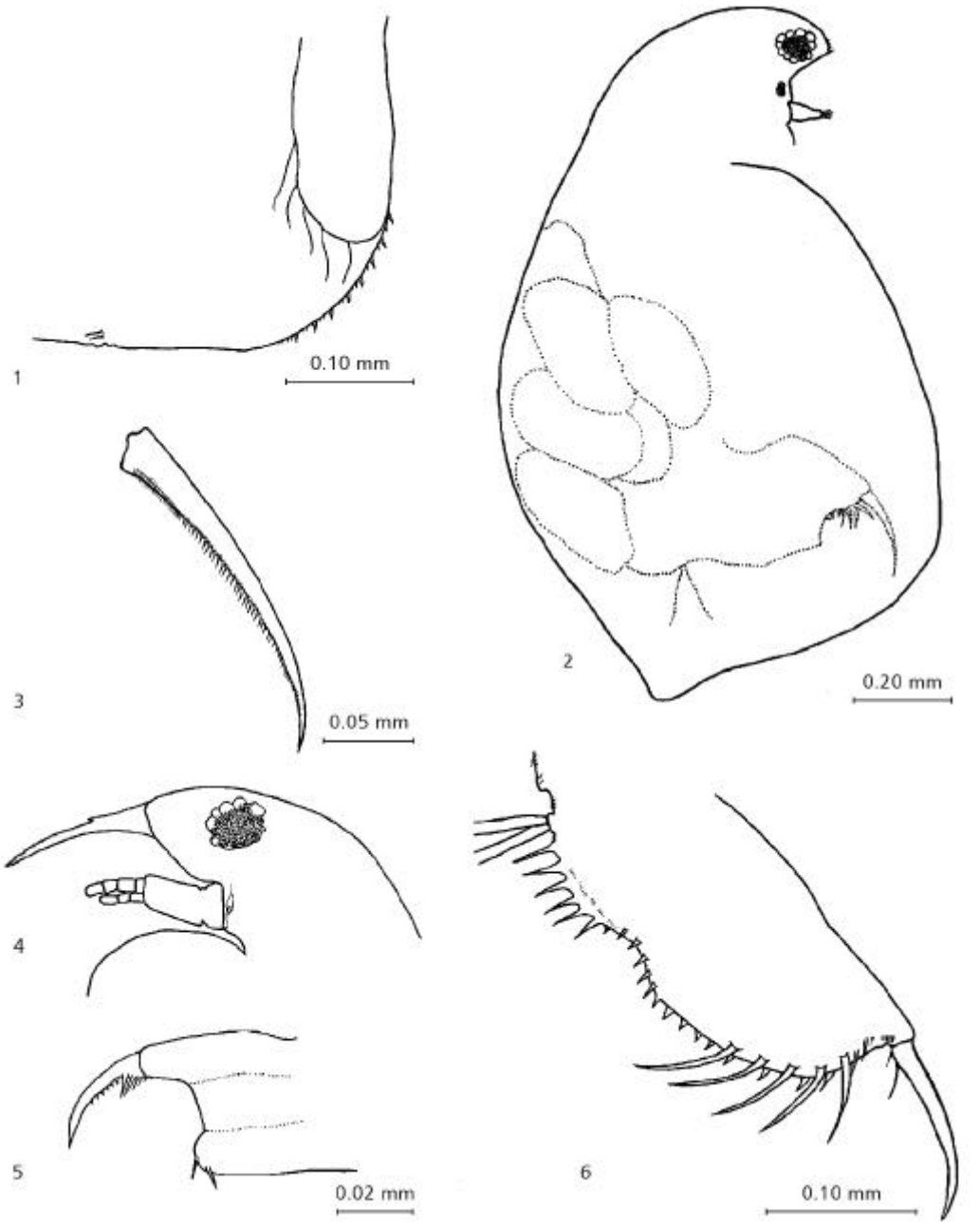
**Alona glabra *Sars, 1901 (Figs. 12 and 13)***

The present is the first *Alona glabra* record from the Federal District. Two specimens were found: one associated with macrophyte roots and one in a plankton sample. Being a typical chydorid species, its occurrence in plankton should be considered accidental.

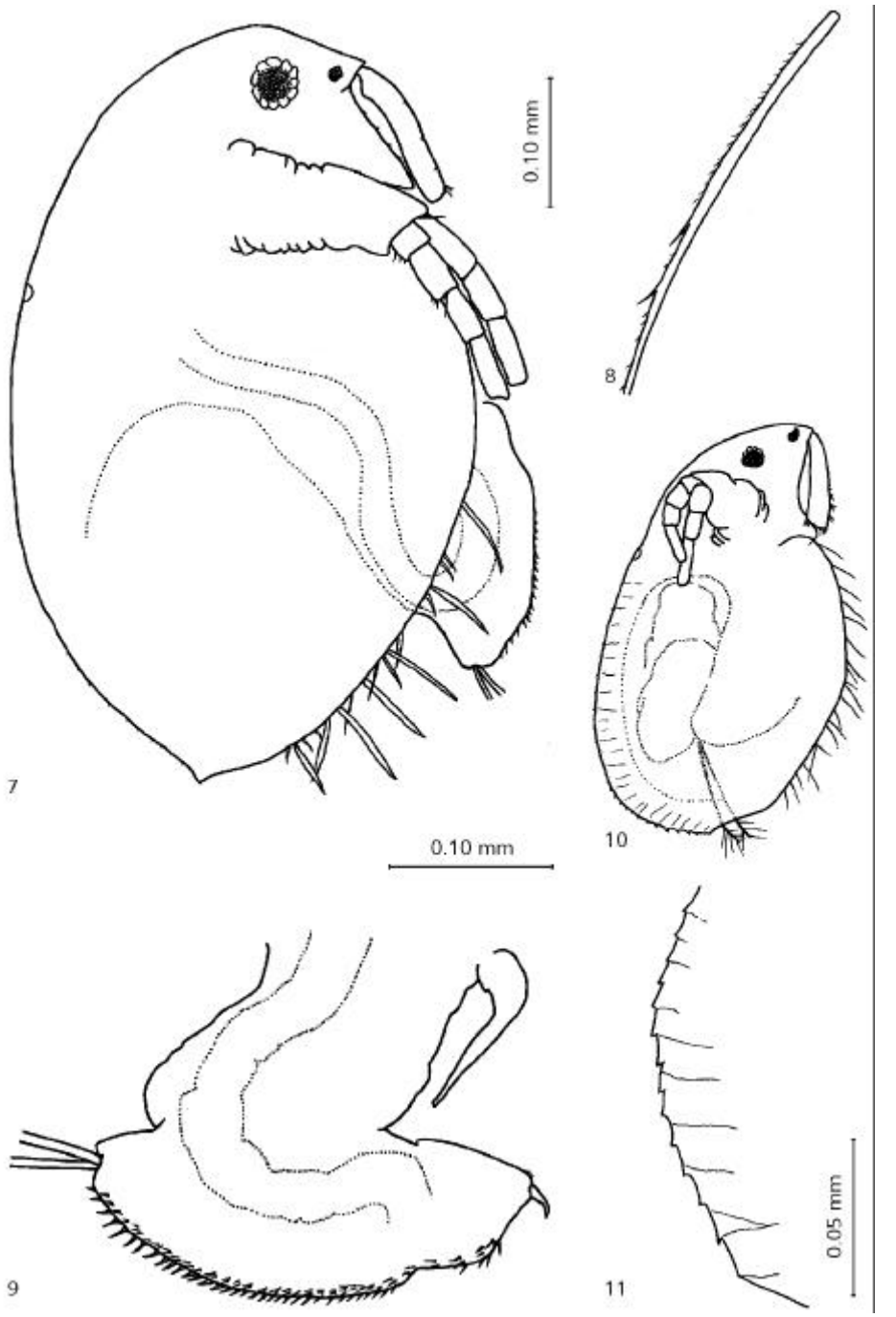
*Alona glabra* is very similar to, and frequently confused with *Alona cambouei* and *Alona pulchella*. The recent revision of the *A. pulchella*-group (Sinev, 2001a, b) revealed that these are three separate species having different distributions, to wit, while *A. glabra* is a South American species, *A. pulchella* and *A. cambouei* are found in the Old World. Consequently, *A. pulchella* and *A. cambouei* records from Brazil, listed by Elmoor-Loureiro (1997), probably belong to *A. glabra*.

**Euryalona orientalis *(Daday, 1898) (Figs. 14 and 15)***

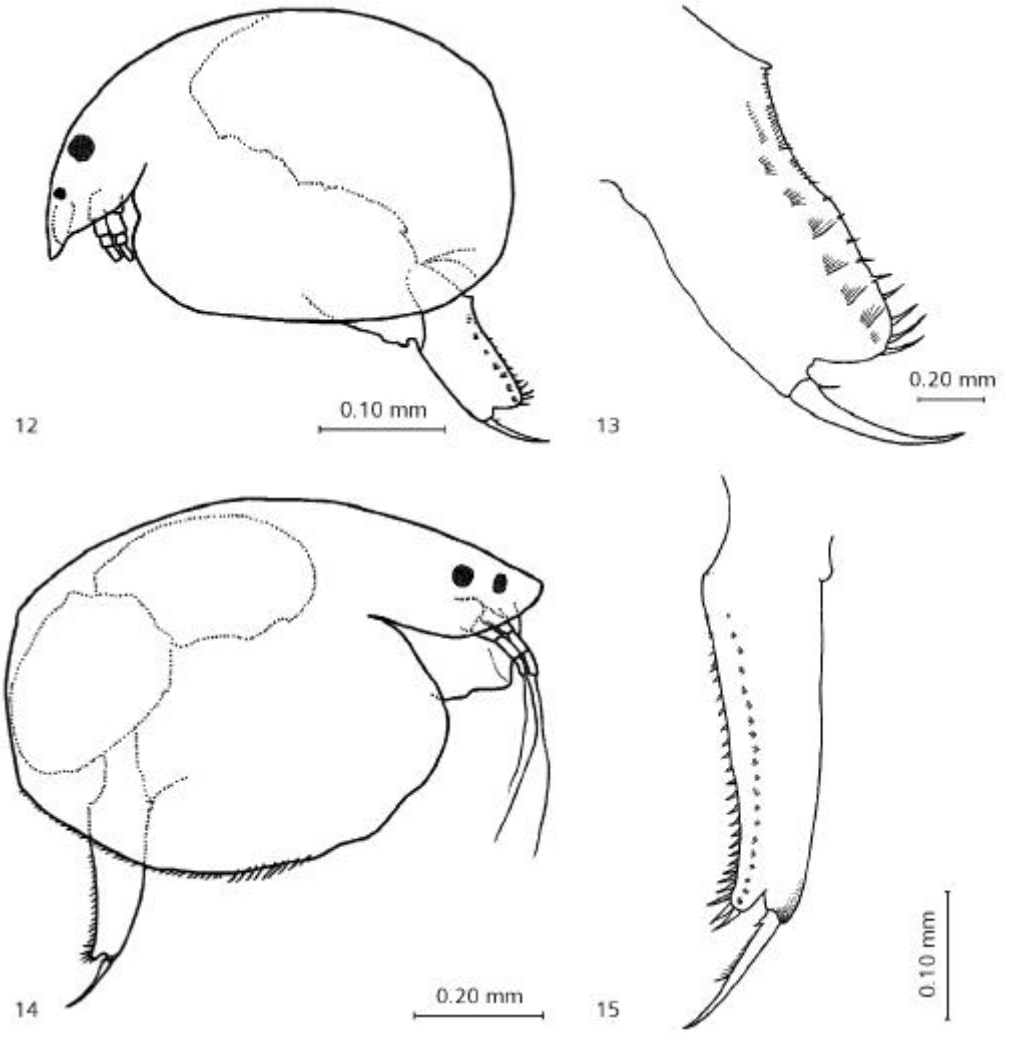
Although frequently recorded from northern to southern Brazil, this species that was presumed to be cosmopolitan has not been previously found in the Federal District and its vicinity. The unique head pore and postabdomen are the most distinguishing characters of this species, sampled from macrophyte roots (points 2 and 3).




**Figs. 1-6 —** Cladocerans from Lake Paranoá. 1 – *Diaphanosoma spinulosum*, lateral and posterior carapace margins; 2-3 – *Simocephalus serrulatus*, lateral view and post-abdominal claw; 4-5 – *Bosmina (S.) freyi*, head and post-abdomen; 6 – *Ilyocryptus spinifer*, post-abdomen.




**Figs. 7-11 —** Cladocerans from Lake Paranoá. 7-9 – *Macrothrix elegans*, lateral view, largest antennal seta and postabdomen; 10-11 – *Macrothrix laticornis* sensu lato, lateral view and dorsal carapace margin.




**Figs. 12-15 —** Cladocerans from Lake Paranoá. 12-13 – *Alona glabra*, lateral view and post-abdomen; 14-15 – *Euryalona orientalis*, lateral view and post-abdomen.

## DISCUSSION

The present study almost doubled the number of cladoceran species known from Lake Paranoá. Such richness increase could be related to increased sampling effort due to littoral zone exploration and an increase of plankton volume filtered, as well as to water quality improvement.

Samples taken from macrophyte roots, in the littoral zone, seem to be at least partially responsible for, at least, some of the new species recorded from Lake Paranoá. In fact, five of the seven species reported are typically non-planktonic. This emphasizes the importance of the littoral zone in assessing cladoceran fauna richness.

The richness increase could also be related to the greater volume filtered for plankton samples. While in previous studies only 5 L were filtered for zooplankton samples (e.g., Branco & Senna, 1996; Cavalcanti *et al*., 1997), we filtered 70 L (1997 and

1998) to 210 L (1999 and 2000) of water for sampling in the pelagic zone.

Changes in species compositon in European lakes have been related to water quality improvement (e.g., Gaedke, 1998; Jeppesen *et al*., 2002). The same tendency may be underway in Lake Paranoá, as significant reductions in nutrient loads have been observed since 1993.

It could be possible that the littoral species composition has also been affected by the water quality improvement verified in Lake Paranoá, but lack of previous studies prevents further conclusions. A few *Kurzia polyspina* (Elmoor-Loureiro, 2002) and *Ilyocryptus spinifer* (Elmoor-Loureiro, unpublished data) individuals were found in a single sample taken from macrophyte roots in 1987, but such meager data allows no inferences.

In conclusion, revision of the *Bosmina longirostris* and *Macrothrix triserialis* records from Brazil, here suggested by the occurrence of *B. freyi* and *M. elegans* in Lake Paranoá, would contribute to better understanding of the distribution of these species.

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