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INTERESPAÇO
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Rotifera community in the area impacted by a hydroelectric plant in the transition ecotone Cerrado-Brazilian Eastern Amazon

Comunidade de rotifera da área impactada por uma usina hidrelétrica no ecótono de transição Cerrado-Amazônia Oriental Brasileira

La comunidad de rotifera en la zona impactada por una planta hidroeléctrica en el ecotono de transición del Cerrado-Amazonía Oriental Brasileña

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Abstract
The species richness, abundance, and biomass of the rotifer community of the Tocantins River were analyzed from a spatiotemporal perspective, in the context of environmental parameters and the phytoplankton flora. Samples of the rotifer and phytoplankton communities were collected

from the surface water with plankton nets a 68 µm mesh at 20 points (10 upstream and 10 downstream) in the area of influence of the Estreito hydroelectric dam. The most frequent rotifers were *Keratella americana, K. cochlearis*, and *Brachionus zahniseri*. The rotifers *Filinia camasecla*, *Plationus patulus machocanthus*, and *P. patulus* foram dominantes no rainy season, enquanto *Ptygura libera*, *Conochilus unicornis*, and *Trichocerca cylindrica* dominaram no dry season. Microphagic rotifers predominated during the dry season, while raptorial species were more common in the rainy season in the reservoir at the sampling points closest to the dam, and near the mouths of tributaries on the river downstream from the dam. The Canonical Redundancy Analysis indicated that seasonal factors have a strong influence on the variation in the biomass of rotifers.

Keywords: Zooplankton; Tocantins River; Functional group; Tropical Region.

Resumo

A riqueza, abundância e biomassa de espécies da comunidade de rotíferos do rio Tocantins foram analisadas sob uma perspectiva espaço-temporal, no contexto de parâmetros ambientais e da flora fitoplanctônica. Amostras das comunidades de rotíferos e fitoplanctônicos foram coletadas nas águas superficiais com redes de plâncton com malha de 68 µm em 20 pontos (10 a montante e 10 a jusante) na área de influência da hidrelétrica Estreito. Os rotíferos mais freqüentes foram *Keratella americana*, *K. cochlearis* e *Brachionus zahniseri*. Os rotíferos *Filinia camasecla*, *Platationus patulus machocanthus* e *P. patulus* foram dominantes na estação chuvosa, enquanto *Ptygura libera*, *Conochilus unicornis* e *Trichocerca cylindrica* dominaram a estação seca. Os rotíferos microfágicos predominaram durante a estação seca, enquanto espécies raptoriais foram mais comuns na estação chuvosa no reservatório nos pontos de amostragem mais próximos à barragem e perto da foz dos tributários no rio a jusante da barragem. A Análise de Redundância Canônica indicou que os fatores sazonais têm forte influência na variação da biomassa dos rotíferos.

Palavras-chave: Zooplâncton; Rio Tocantins; Grupo funcional; Região Tropical.

Resumen

Se analizó la riqueza, abundancia y biomasa de especies de la comunidad de rotíferos del río Tocantins desde una perspectiva espacio-temporal, en el contexto de parámetros ambientales y de la flora fitoplanctónica. Se recolectaron muestras de comunidades de rotíferos y fitoplancton en aguas superficiales con redes de plancton de malla de 68 µm en 20 puntos (10 aguas arriba y 10 aguas abajo) en el área de influencia de la central hidroeléctrica Estreito. Los rotíferos más frecuentes fueron *Keratella americana*, *K. cochlearis* y *Brachionus zahniseri*. Los rotíferos *Filinia camasecla*, *Platationus patulus machocanthus* y *P. patulus* fueron dominantes en la época de lluvias, mientras que *Ptygura libera*, *Conochilus unicornis* y *Trichocerca cylindrica* dominaron en la época seca. Los rotíferos microfágicos predominaron durante la estación seca, mientras que las especies rapaces fueron más comunes en la temporada de lluvias en el embalse en los puntos de muestreo más cercanos a la presa y cerca de las desembocaduras de los afluentes en el río aguas abajo de la presa. El análisis de redundancia canónica indicó que los factores estacionales tienen una fuerte influencia en la variación de la biomasa de rotíferos.

Palabras clave: Zooplancton; Río Tocantins; Grupo funcional; Región Tropical.

Introduction

The construction of reservoirs has a profound impact on the trophic structure of aquatic ecosystems due to alterations in the input of nutrients and organic compounds, caused by the decomposition of plant material, the lixiviation of the submerged soil, and the increased residence time of the water (Aoyagui et al., 2003; Han et al., 2011).

Alterations of the physicochemical characteristics of the water tend to be associated with shifts in the composition of species in a given environment, resulting in modifications of the trophic dynamics due to the formation of new mesoenvironments (Matsumura-Tundisi, 1999; Bini et al., 2008; Takahashi et al., 2009).

The zooplankton community responds actively to these changes, with its diversity and structure being directly with the formation of novel conditions in the environment (Bini et al., 2007; Paavola et al., 2003). Determining the responses of different zooplankton groups to novel environmental conditions contributes to the understanding and evaluation on the potential of environmental variables as drivers of the structure of the local fauna (Sant'anna; Azevedo, 2000; Paszkowski ; Tonn, 2001; Bessa et al., 2011).

Rotifers are considered to be opportunist organisms due to their high feeding rates and the assimilation of a considerable diversity of alimentary resources. The evaluation of the trophic preferences of the rotifer community permits inferences on the trophic status of the environment and the possible interaction of environmental variables with community structure (Hampton; Schindler, 2006; Obertegger et al., 2008). The microphagic rotifer species feed on an enormous variety of suspended organic particles, such as bacteria, seston, and microalgae, while raptorial rotifers are active hunters of small organisms such as protozoans, other rotifers, and microcrustacean larvae (Wallace et al., 2006). As they often colonize environments undergoing stabilization and typically present high species richness and dominance, rotifers have been widely used to characterize environmental impacts on aquatic systems (Matsumura-Tundisi, 1999; Rodríguez; Matsumura-Tundisi, 2000).

The present study investigated the structure of the rotifer assemblage of the area influenced by the Estreito hydroelectric dam on the Tocantins River between the Brazilian states of Maranhão and Tocantins and the influence of environmental and phytoplankton communities variables.

Material and methods

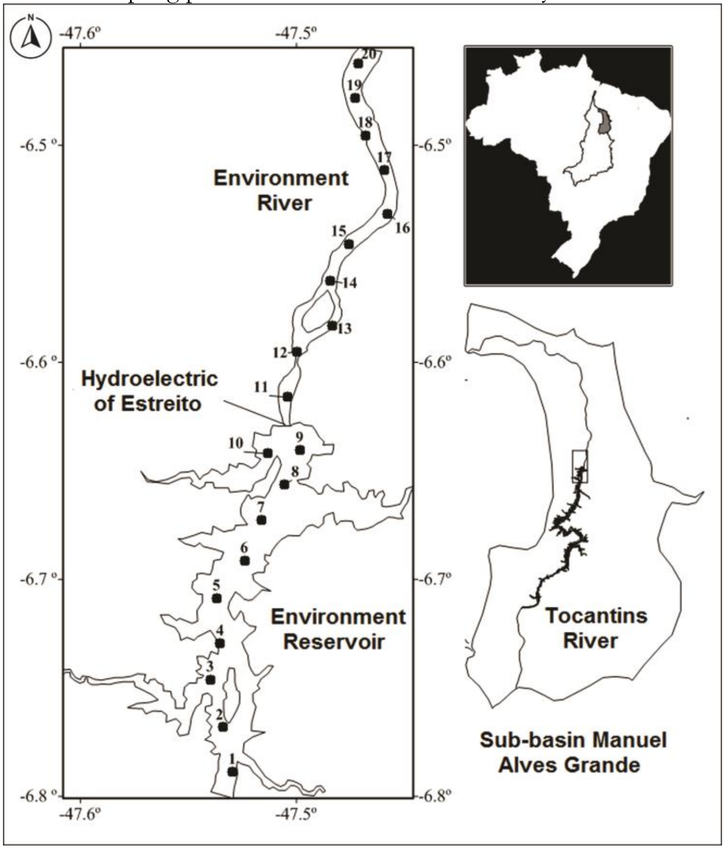
Study area

The study was conducted in the area of the Tocantins River basin influenced by the Estreito reservoir in the state of Maranhão, Brazil. The study area is located within the marginal Maranhão–Piauí savanna of northern Brazil (IIEGA, 2004), and has a humid tropical climate, with a rainy season between October and March, when 85% of the annual precipitation is recorded, and a dry season, from April to September. Mean temperatures in the region vary from 24 to 35.4ºC. The Estreito dam is part of a series of hydroelectric plants on the Tocantins River, and is located upstream from the Tucuruí dam, in the Brazilian state of Pará, and downstream from the Luiz Eduardo Magalhães, Serra da Mesa, Peixe and Angical dams, in the states of Tocantins and Goiás (Figueiredo; Bianchini, 2008).

Sampling

In this research are were 20 sampling stations were established within the area of influence of the Estreito dam, 10 in an 18-km stretch of the reservoir, and 10 on the Tocantins River, in the 19 km downstream from the dam. Samples were collected during the rainy season (February) and the dry season (August) (Figure 1). Zooplankton samples were collected by horizontal trawls at the surface of the limnetic region with a 68 µm mesh net coupled to a mechanical flowmeter. The organisms collected were narcotized by CO_2 saturation and fixed in 4% neutral formaldehyde. The following environmental variables were measured *in situ* using a Hydrolab DS5 probe: temperature (°C) at the water surface, electrical conductivity ($\mu S.cm^{-1}$), dissolved oxygen ($mg.L^{-1}$), pH, Chlorophyll-*a* ($\mu g.L^{-1}$) concentration and turbidity (NTU).

Figure 1 – Location of the sampling points in the area of the Estreito hydroelectric dam in Maranhão, Brazil



Source: Authors (2023).

Five liters of water were collected at each collection point and fixed in 4% formaldehyde for to determine the density of phytoplankton of the most common classes (Bacilariophyceae, Cyanophyceae, Chlorophyceae and Dinophyceae) by the Utermohl method. The Rotifera were analyzed using a Sedgwick-Rafter counting chamber in an inverted microscope, with the density being expressed as the number of individuals per cubic meter of water (ind.m^{-3}) and dry biomass (µg.m^{-3}), estimated as 10% of the biovolume, based on the comparison of the shape of the organism with the most similar geometric form (McCauley, 1984; Ejsmont-Karabin, 1998). The organisms were identified to the lowest possible taxonomic level, based on the specialized literature (Koste, 1978; Caspers, 1980; Segers, 1995; Nogrady; Hendrik, 2002). The validation of the taxa was done based on The Rotifer World Catalog (Jersabek; Leitner, 2013).

Data analysis

The frequency of occurrence of the planktonic rotifers was estimated based on the procedure adapted by Bezerra et al. (2015), with four categories: (V) very frequent (> 75%); (F) frequent (50–75%); (U) uncommon (25–50%), and (R) rare (< 25%). Diversity was estimated by the Shannon-Wiener (*H'*), and equitability (*J'*) indices (LANDE, 1996). The Bray-Curtis dissimilarity values were evaluated using the Univariate Permutational Analysis of Variance (PER-ANOVA) to verify the fluctuations in the structure of the rotifer assemblage and environmental parameters in relation to collection period (rainy and dry) and type of environment (lake and river) (Anderson; Ter Braak, 2003).

The environmental variables were standardized by log (x+1) tranformation, while the biological parameters (density and biomass) were transformed by the square root and Hellinger distance, which is one of the most adequate procedure for biological data in ordination analyses, given that the asymmetry of the Hellinger distance reduces the weighting of the more abundant species without being influenced by the zeros present in the matrix (Legendre; Gallagher, 2001; Legendre; Legendre, 2012; Legendre; Cáceres, 2013).

A Canonical Redundancy Analysis (RDA) was run on the biological matrix (biomass) in relation to environmental, temporal, and spatial parameters, which were significant in the Monte Carlo permutation test, with 9999 interactions, for the analysis of variance partitioning (Bocard et al., 1992). These analyses were run in the PAST v.3 (Hammer et al., 2001) and CANOCO 5 (Lepš; Šmilauer, 2003) programs.

Classification of rotifer feed guilds was based on the feeding strategies employed by each genus. Based on the proposed by Obertegger et al. (2011), genera with cardate, forcipate, incudate, uncinate, or virgate trophi that show an active grasping, piercing, or pumping action to catch single food items were designated as raptorials and genera with a malleate, malleoramate, or ramate trophi that collect multiple food items were designated as microphagous. The relationship between the rotifer trophic guilds (GR) was evaluated using the equation of Smith et al. (2009), where: GR = Σ(raptorial biomass - microphage biomass)/Σ(total rotifer biomass). A GR value of less than zero indicates a predominance of microphages, while a value higher than zero reflects a dominance of raptors (Obertegger; Manca, 2011).

Results

The highest mean water temperatures (29.7±0.1°C) and pH (8.0±0.1) were recorded in the reservoir during the dry season, while the highest turbidity (6.8±0.5 NTU) was recorded in the river during the rainy season. The highest electrical conductivity (19.6±2.4 $mS.cm^{-1}$) was also recorded during this period at the reservoir. The highest mean chlorophyll concentrations were recorded during the rainy season in the reservoir (9.2±0.7 $\mu g.L^{-1}$) and during the dry season in the river (10.1±0.7 $\mu g.L^{-1}$). The highest mean dissolved oxygen concentrations were recorded in the river, reaching 7.9±0.2 ppm during the rainy, and 7.4±0.1 ppm during the dry season.

Significant variation was found in these environmental parameters, both between habitats (reservoir and river) and seasons. The PER-ANOVA indicated a significant interaction between habitat and season, in relation to conductivity, turbidity, and dissolved oxygen and chlorophyll *a* concentrations, but not water temperature or pH. The outliers recorded in the reservoir were from the sampling points associated with the basins of the Curicaca, Santana, and Mosquito streams, the Estreito dam. In the river, the outliers were associated with the dam and the mouth of the Itaueiras River, upstream from the town of Porto Franco, Maranhão.

Overall, 86 rotifer taxa were recorded, representing 17 families (Suplement 1). The Brachionidae was the richest, with 25 taxa, followed by the Lecanidae, with 15 species, and the Synchaetidae, with 10 species. Richness varied significantly (p = 0.01), only in relation to the type of habitat, with 15 planktonic rotifer species being recorded exclusively in the river, and nine in the reservoir. The highest richness (55 taxa) was recorded in the reservoir the rainy season, while 21 rotifer taxa were exclusive the dry season, and 12 were recorded only the rainy season (Table 1).

Most of the rotifer species recorded in the present study were rare (n = 68), while *Brachionus falcatus*, *B. zahnisesi*, *Collotheca mutabilis*, *Keratella americana*, and *K. cochlearis* were the most common species throughout the study period. Two of the species classified as frequent, *Filinia camasecla* and *Conochilus unicornis*, presented the highest densities during the rainy and dry seasons, respectively.

Table 1 – The *IndVal* of the rotifer species with significant values ($p < 0.05$) in relation to the type of habitat (reservoir, river) and season (rainy, dry) in the area of influence of the Estreito hydroelectric dam on the Tocantins River in the Brazilian states of Maranhão and Tocantins. Microf – microphagic habit; Rapto – raptorial habit.

Taxóm	**Grupo Trófico**	**Sazonalidade**		**Ambi.**	**Ambiente e Sazonalidade**		
		Chuv.	**Seco**	**Lago**	**Lago Chuv.**	**Lago Seco**	**Rio Seco**
Brachionidae							
Brachionus dolabratus dolabratus	*Microf*	-	82,5	-	-	41.6	-
Brachionus falcatus	*Microf*	-	73,7	64,2	-	55.9	-
Brachionus miriu	*Microf*	59,5	-	-	-	-	-
Brachionus Zahniseri	*Microf*	-	64,4	-	-	41.2	-
Euchlanis sp	*Microf*	-	-	54,2	46.5	-	-
Keratella americana	*Microf*	-	64,8	67,4	-	41.8	-
Plationus patulus	*Microf*	82,1	-	66,3	68.7	-	-
Plationus patulus macracanthus	*Microf*	98,8	-	-	**75.1**	-	-
Conochilidae							
Conochilus unicornis	*Microf*	-	**97,5**	-	-	**65.1**	-
Filinidae							
Filinia camasecla	*Microf*	**99,7**	-	-	**52.5**	-	-
Flosculariidae							
Collotheca mutabilis	*Rapto*	-	86,6	-	-	47.8	-
Collotheca trilobada	*Rapto*	-	-	44,4	-	-	-
Ptygura libera	*Microf*	-	**99,6**	-	-	**73.3**	-
Gastropodidae							
Gastropus hyptopus	*Rapto*	-	94,5	-	-	77.5	-
Gastropus sp	*Rapto*	-	70	-	-	63.1	-
Lecanidae							
Lecane bulla	*Microf*	-	-	-	51.5	-	-
Synchaetidae							
Polyarthra remata	*Rapto*	62,2	-	-	50.6	-	-
Polyarthra vulgaris	*Rapto*	50	-	-	55.8	-	-
Trichocercidae							
Trichocerca cylindrica	*Rapto*	-	80,7	-	-	-	**68.0**

Organization: Authors (2023).

The diversity of planktonic rotifers (*H'*) was 2.4±0.13 bit.ind^{-1}, while equitability (*J'*) was 54.2±6.5% (Tab. 2). Diversity varied most in the river, ranging from 1.27±0.19 bit.ind^{-1} in the rainy season to 2.0±0.05 bit.ind^{-1} in the dry season. The dry season diversity indices (H') were significantly higher ($p < 0.01$) than the rainy season values recorded in both habitats, while mean equitability was also higher the dry season in both habitats. The diversity and equitability recorded in the river during the rainy season were significantly higher than those recorded in the reservoir. The opposite pattern was recorded during the dry season, although the difference in the diversity indices between habitats was not significant.

Table 2 – Overall and mean diversity (Shannon-Wiener, *H'*) and equitability (*J'*) indices of the planktonic rotifer community by habitat (reservoir, river) and season (rainy, dry) in the area of influence of the Estreito hydroelectric dam on the Tocantins River in the Brazilian states of Maranhão and Tocantins.

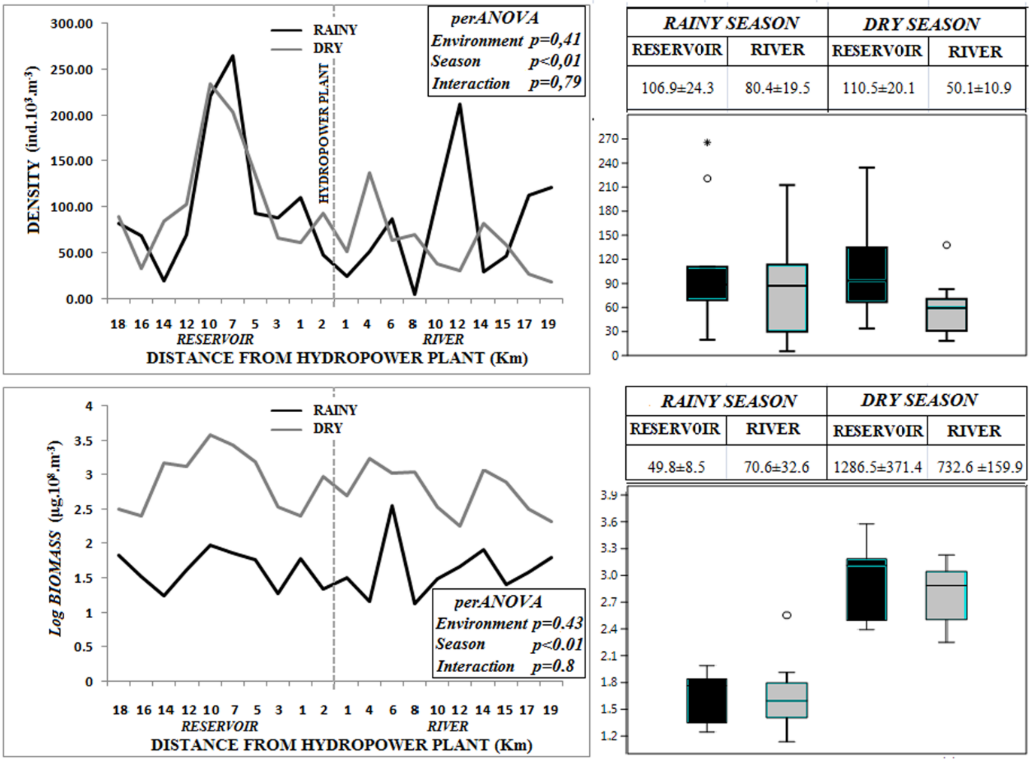
Parameter	Rainy Period		Dry Period		Total
	Reservoir	River	Reservoir	River	
H' (nat.ind^{-1})	1.42±0.17	1.28±0.21	1.85±0.12	2.01±0.07	2.42±0.14
J' (%)	48.1±5.3	47.2±7.4	65.8±4.3	73.5±2.3	53.9±6.7

Organization: Authors (2023).

Rotifer density and biomass both varied significantly ($p < 0.01$) between seasons. However, neither the type of habitat nor the association between habitat and season had any significant influence on either the density or biomass of planktonic rotifers in the study area (Figure 2). The highest mean densities were recorded in the reservoir during both seasons, 106.9x10^{3} ±24.3x10^{3} ind.m^{-3} during the rainy season and 110.5x10^{3} ±20.1x10^{3} ind.m^{-3} the dry season, while the lowest mean rotifer density (50.1x10^{3} ±10.9x10^{3} ind.m^{-3}) was recorded in the river during the dry season.

The dry season was characterized by the highest biomass of planktonic rotifers in both habitats, in the reservoir. During the rainy season, mean biomass was higher in the reservoir than in the river. The sampling points the Curicaca basin, between 7 and 12 km upstream from the dam the highest overall densities of planktonic rotifers, with the (85.6±6.4%) rainy season taxa being *F. camasecla*, *K. americana*, *P. patulus* and *P. patulus macrocanthus*, while *C. unicornis*, *K. americana*, *P. libera*, *B. falcatus*, and *G. hyptopus* contributed 80.1±4% of the rotifer density during the dry season. The rotifer biomass was consistent with the density recorded at these points both seasons, with *T. cylindrica*, *F. camasecla*, *Euchlanis* sp., *P. patulus*, *P. patulus macrocanthus*, *K americana*, and *B. falcatus* representing 82.4±0.5% of the biomass in the rainy season, and *C. unicornis*, *T. cylindrica*, and *B. falcatus*, contributing 99.2±0.5% of the biomass during the dry season.

Figure 2 – Variation in the mean density and biomass of planktonic rotifers in the area of influence of the Estreito hydroelectric dam (upstream and downstream) on the Tocantins River in the Brazilian states of Maranhão and Tocantins.



Organization: Authors (2023).

The sampling points located near the mouth of the Itaueiras River, between 10 km and 12 km downstream from the Estreito dam the highest rotifer densities for the river habitat, with 88.1±3.3% of this density being contributed by *F. camasecla*, *P. patulus* and *P. patulus macrocanthus*. However, 97.8±0.2% of the rotifer biomass at these points was provided by *C. unicornis* and *F. camasecla*. At the mouth of the Itaueiras River during the dry season, *C. unicornis*, *K. coclearis*, *K. americana*, *P. libera* and *C. mutabilis*, represented 79.3±0.2% of the rotifer density, while *C. unicornis* and *T. cylindrica* made up 98.3±0.9% of the biomass.

The pH, conductivity, water temperature, and turbidity were all significantly correlated ($p < 0.05$) with rotifer biomass (total, microphagic, and raptorial). In the case of rotifer density, a significant correlation with these environmental parameters was recorded only for the raptors (Table 3).

Table 3 – Significance of the correlations between the density and biomass of planktonic rotifers and the environmental variables and algal density in the area of influence of the Estreito hydroelectric dam on the Tocantins River in the Brazilian states of Maranhão and Tocantins.

Parameter	*Density*			*Biomass*		
	Microphagic	*Raptorial*	*Total*	*Microphagic*	*Raptorial*	*Total*
Temperature	0.43	***<0.01***	0.20	***<0.01***	***0.01***	***<0.01***
pH	0.90	***<0.01***	0.65	***<0.01***	***<0.01***	***<0.01***
Conductivity	0.29	***<0.01***	0.65	***<0.01***	***<0.01***	***<0.01***
Dissolved oxygen	0.62	0.46	0.43	0.78	0.84	0.65
Turbidity	0.46	***<0.01***	0.82	***<0.01***	***<0.01***	***<0.01***
Chlorophyll a	0.60	0.23	0.52	0.15	0.75	0.22
Chlorophyceae	0.41	***0.01***	0.27	***<0.01***	0.10	***<0.01***
Cyanophyceae	0.52	0.33	0.52	0.46	0.45	0.28
Dinophyceae	0.80	***<0.01***	0.54	***<0.01***	***0.01***	***<0.01***
Bacillariophyceae	0.32	0.28	0.45	0.45	0.48	0.35
Total Algae	0.52	0.43	0.52	0.26	0.73	0.15

Organization: Authors (2023).

The density of raptorial rotifers correlated significantly with the densities of the Chlorophyceae and Dinophyceae, although a significant correlation with rotifer biomass was recorded only for the Dinophyceae. The total rotifer and the microphages biomass correlated significantly with the densities of both these algal classes (Chlorophyceae and Dinophyceae). The microphagic rotifers were the most abundant in both habitats and seasons. During the rainy season, the high biomass of the microphagic *C. unicornis* was responsible for the dominance of this trophic group.

Only the density of raptorial rotifers varied significantly between habitats and seasons, but not with the combination of these parameters (Tab. 4). The total density of rotifers varied significantly only in relation to habitat. Total biomass, and the biomass of microphagic and raptorial rotifers all varied significantly by season, but not habitat. The relative contribution of the two trophic guilds (GR) at the different sampling points indicated an increase in raptorial biomass nearest the dam, with the exception of the point located 2 km upstream (Figure 3).

The redundancy analysis (RDA) tested the associations between the environmental, spatial and temporal variables, and planktonic rotifer biomass. Overall, eight of the environmental variables, and three temporal parameters presented a significant ($p < 0.05$) association with rotifer biomass, although no significant association was found with any of the spatial variables tested. The first four significant canonical axes explained 27.5% of the variance in the biomass (Figure 4).

Table 4 – Results of the PER-ANOVA of the density and biomass of rotifers (microphages, raptors, and total) by habitat and season in the area of influence of the Estreito hydroelectric dam on the Tocantins River in the Brazilian states of Maranhão and Tocantins.

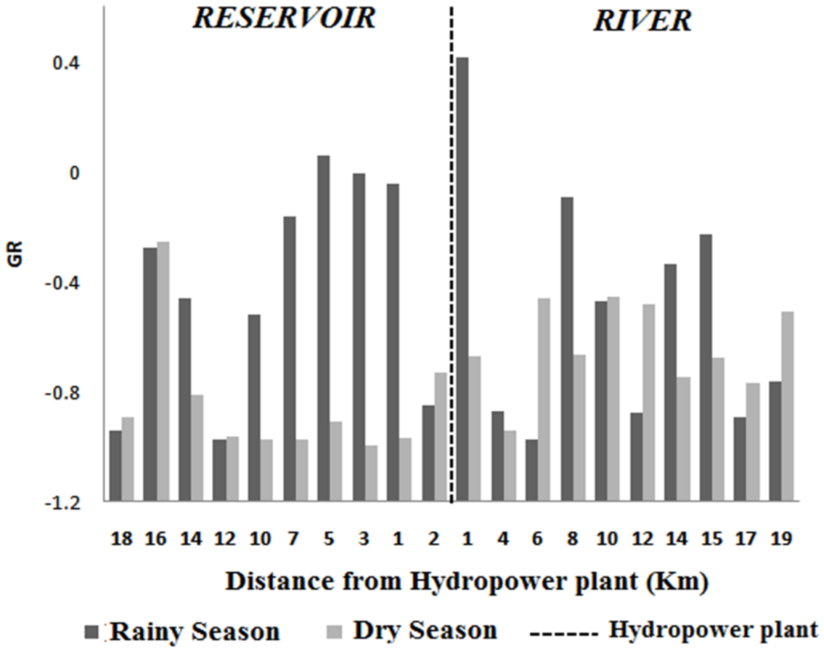
Rotifers		Environment		Seasonality		Interaction	
		F	*p*	*F*	*p*	*F*	*p*
Density	**Microphagic**	3.17	0.05	1.14	0.30	0.62	0.52
	Raptorial	3.38	**0.03**	3.02	**0.05**	0.60	0.58
	Total	3.40	**0.04**	1.53	0.20	0.68	0.51
Biomass	**Microphagic**	0.65	0.55	35.69	**0.00**	0.76	0.48
	Raptorial	0.59	0.61	34.37	**0.00**	0.94	0.40
	Total	0.56	0.60	39.10	**0.00**	0.81	0.45

Organização: Autores (2023).

The first canonical axis represented the seasonal gradient, marked by the correlation between *F. camasecla* and *P. patulus macrocanthus* and the rainy season, and between *C. unicornis* and *P. libera* and the dry season. While none of the spatial variables tested presented a significant role in the RDA, the second axis, which explains 3.7% of the variance in the biomass, can be interpreted as a pattern of spatial distribution, given that it is strongly related to the density of algae, which presented a well-defined pattern of spatial dispersion, especially during the rainy season.

The two groups of explanatory variables that presented a significant association, and the density of the algae of the classes Dinophyceae and Clorophyceae were evaluated using an analysis of variance partitioning to determine their individual and combined influence on the biomass of the assemblage of planktonic rotifers. The combined influence of environmental and temporal variables (16.3%) was the principal factor responsible for the variation observed in the rotifer community.

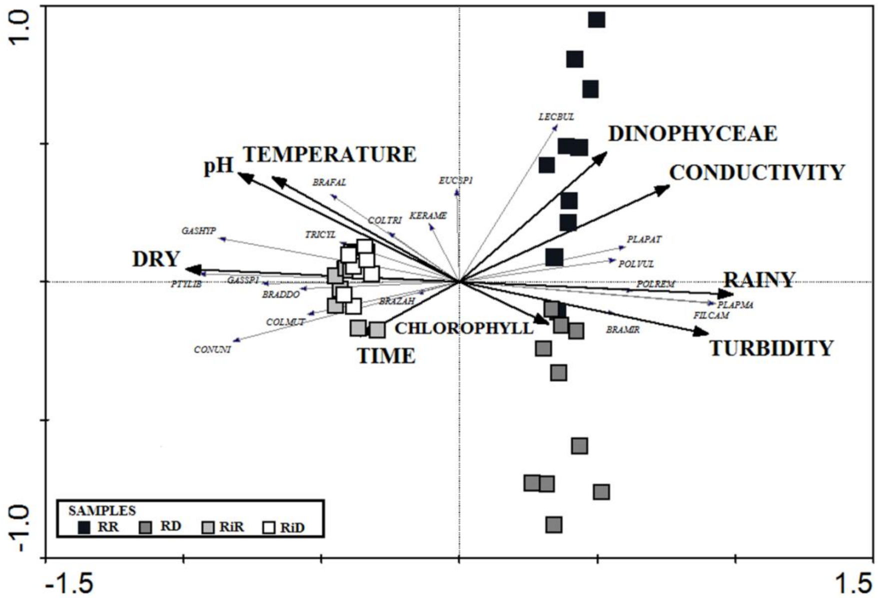
Figure 3 – Spatial and seasonal variation in the relative contribution of the different trophic guilds of rotifers (GR) upstream and downstream from the Estreito hydroelectric dam on the Tocantins River in the Brazilian states of Maranhão and Tocantins. When GR < 0, microphages predominate, and when GR > 0, raptorial rotifers predominate.



Organization: Authors (2023).

It was not possible to account for the majority (68.3%) of the variation observed in the biomass by the variables analyzed. The variation in the biomass explained exclusively by environmental parameters (3.0%) was similar to that due to temporal parameters (2.8%) and algal density (2.2%). The combined influence of these three factors accounted for 6.6% of the variance observed in the biomass of planktonic rotifers.

Figure 4 – Ordination plot of the Canonical Redundancy Analysis. Projection of the samples and the taxa with significant IndVals for the explanatory variables, relative to the biomass of planktonic rotifers.



RR – Reservoir in rainy season; RD – Reservoir in dry season; RiR – River in rainy season; RiD – River in dry season; BRADDO - *Brachionus dolabratus dolabratus*; BRAFAL – *B. falcatus*; BRAMIR – *B. mirus;* BRAZAH – *B. Zahniseri*; COLMUT - *Collotheca mutabilis*; COLTRI – *C. trilobada*; CONUNI - *Conochilus unicornis*; EUCSP1 - *Euchlanis* sp; FILCAM - *Filinia camasecla*; GASHYP - *Gastropus hyptopus*; GASSP1 - *Gastropus* sp; KERAME - *Keratella americana*; LECBUL - *Lecane bulla*; PLAPAT - *Plationus patulus*; PLAPMA – *P. patulus macracanthus*; POLREM - *Polyarthra remata*; POLVUL – *P. vulgaris*; PTYLIB - *Ptygura libera*; TRICYL - *Trichocerca cylindrica*.

Discussion

The highest densities of rotifers were associated with the influence of tributaries, both in the reservoir and the river compartments, especially during the rainy season. The input of nutrients at these points altered the trophic status of the reservoir, and had a direct effect on the density of rotifers (Hobæk et al., 2002; Aoyagui et al., 2003; Špoljar, 2013). The strong correlations found between the density of raptorial rotifers and that of algae, in particular in the rainy season, reinforces this conclusion. A similar pattern was observed at the first sampling point downstream from the dam in the rainy season, where nutrients would be resuspended by the movement of the water through the turbines (Takahashi et al., 2009; Bessa et al., 2011).

Occurring from large permanent lakes to small temporary puddles, rotifers are present in almost all types of freshwater habitats (Segers, 2008). The endemism of many known species of this group of planktonic organisms, makes it necessary to expand the knowledge about the biodiversity of this group in the neotropical region (Brandorff; Hardy, 2009; Souza et al. 2011; Nova et al., 2014). In present study, the richness of planktonic rotifers was greater than that registered in other reservoirs in the same hydrographic basin, with Espíndola et al. (2000) and Bezerra et al. (2015) in the Tucuruí reservoir downstream from the study area, and De Filippo (1999) and Bessa et al. (2011) in regions upstream of the Estreito reservoir dam.

However, the dominance of the families Brachionidae and Lecanidae was an important factor influencing the results of Bezerra et al. (2015), on the Tocantins River, and Rocha *et al.* (1995), in other areas of the Amazon basin, reinforcing the importance of these two families in the rotifer assemblages of the tropical region (Starling, 2000). The brachionids *Brachionus mirus, Keratella americana, Plationus patulus* and *P. patulus macrocanthus* appear to be very common in many tropical reservoirs, where they have a major influence on the structure of the aquatic biota (Almeida et al., 2006, 2009; Sendacz et al., 2006; Takahashi et al., 2009; Serafim-Júnior et al., 2010, Bessa et al., 2011; Pedrozo et al., 2012; Perbiche-Neves et al., 2013; Bezerra et al., 2015).

The predominance of microphagic rotifers is related directly to the high availability of nano- and microalgae, bacteria, and detritus suspended in the water (Bessa et al., 2011; Pedrozo et al., 2012), which is common in reservoirs subject to a process of consolidation, and can be considered to be an indicator of the trophic status of the ecosystem (Špoljar et al., 2011; Tasevka et al., 2012; Špoljar, 2013). The increased biomass of raptorial rotifers recorded in some areas of the Estreito reservoir during the rainy season may be related to the shift in the structure of the planktonic community through the increase in the density of larger, colonial microalgae provoked by the input of allochthonous material and nutrients (Matsumura-Tundisi, 1999; Almeida et al., 2006; Bezerra et al., 2015), a process controlled fundamentally by seasonal variables.

Despite the growth in research on the bodies of freshwater of the tropical region, the diversity and structure of the resident rotifer communities are still poorly understood (Serafim-Júnior et al., 2010; Bessa et al., 2011; Bezerra et al., 2015; Ouéda et al., 2017). Further studies are required to understand the trophic relationships of these communities and the functional roles of these organisms in the límnic environment. These studies will be fundamental to the more systematic understanding of the influence of anthropogenic impacts on rivers, in particular impoundment, on the structure of the assemblages of planktonic rotifers and the other organisms related directly or indirectly to these bodies of water in the tropical region.

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REFERÊNCIAS

ALMEIDA, V. L. S.; DANTAS, E. W.; MELO-JÚNIOR, M.; BITTENCOURT-OLIVEIRA, M. C.; MOURA, A. N. Zooplanktonic community of six reservoirs in northeast Brazil. **Brazilian Journal of Biology**, v. 69, n. 1, p. 57-65, 2009. Disponível em: <http://dx.doi.org/10.1590/S1519-69842009000100007>. Acesso em: 20 jan. 2024.

ALMEIDA, V. L. S.; LARRAZÁBAL, M. E. L.; MOURA, A.; MELO-JÚNIOR, M. Rotifera das zonas limnética e litorânea do reservatório de Tapacurá, Pernambuco, Brasil. **Iheringia, Série Zoologia**, v.96, n.4, p.445-451, 2006. Disponível em: <http://dx.doi.org/10.1590/S0073-47212006000400009>. Acesso em: 20 jan. 2024.

ANDERSON, M.J.; TER BRAAK, C. J. F. Permutation tests for multi-factorial analysis of variance. **Journal of Statistical Computation and Simulation**, v. 73, p. 85–113, 2003. Disponível em: <http://dx.doi.org/10.1080/00949650215733>. Acesso em: 20 jan. 2024.

AOYAGUI, A. S. M.; BONECKER, C. C.; LANSAC-TÔHA, F.A.; VELHO, L. F. M. Estrutura e dinâmica dos rotíferos no reservatório de Corumbá, Estado de Goiás, Brasil. **Acta Scientiarum: Biological Sciences**. Maringá, v. 25, n. 1, p.31-39, 2003. Disponível em: <http://dx.doi.org/10.4025/actascibiolsci.v25i1.2079>. Acesso em: 20 jan. 2024.

BESSA, G. F.; VIEIRA, L. C. G.; BINI, L. M.; REIS, D. F.; MORAIS, P. B. Concordance patterns in zooplankton assemblages in the UHE - Luís Eduardo Magalhães Reservoir in the Mid-Tocantins River, Tocantins State, Brazil. **Acta Scientiarum Biological Sciences**, v. 33, n. 2, p.179–184, 2011. Disponível em: <http://dx.doi.org/10.4025/actascibiolsci.v33i2.7336>. Acesso em: 20 jan. 2024.

BEZERRA, M. F. C.; SENA, B. A.; MARTINELLI-FILHO, J. E.; NAKAYAMA, L.; OHASH, O. M. Composição e variabilidade da comunidade de rotifera em um reservatório tropical. **Boletim do Insituto de Pesca**, v. 41, n. 3, p. 493–506, 2015.

BINI, L. M.; SILVA, L. C. F.; VELHO, L. F. M.; BONECKER, C. C.; LANSAC-TOHA, F. A. Zooplankton assemblage concordance patterns in Brazilian reservoirs. **Hydrobiologia**, v. 598, n. 1, p. 247–255, 2008. Disponível em: <http://dx.doi.org/10.1007/s10750-007-9157-3>. Acesso em: 20 jan. 2024.

BINI, L. M.; VIEIRA, L. C. G.; MACHADO, J.; VELHO, L. F. M. Concordance of species composition patterns among microcrustaceans, rotifers and testate amoebae in a shallow pond. **International Review of Hydrobiology**, v. 92, n. 1, 9–22, 2007. Disponível em: <http://dx.doi.org/10.1002/iroh.200610865>. Acesso em: 20 jan. 2024.

BOCARD, D.; LEGENDRE, P.; DRAPEAU, P. Partialling out the spatial component of ecological variation. **Ecology**, v. 73, n. 3, p.1045-1055, 1992. Disponível em: <http://dx.doi.org/10.2307/1940179>. Acesso em: 20 jan. 2024.

CASPERS, H. Rotatoria. Die Rädertiere Mitteleuropas. Ein Bestimmungswerk, begründet von MAX VOIGT. Überordnung Monogononta. 2. Auflage. Neubearbeitet von WALTER KOSTE. I. Textband: 673 8. mit 63 Abb., 11. Tafelband: 276 S. mit 234 Tafeln. Berlin-Stuttgart: Gebrüder Borntraeger 1978. **Int. Revue Ges. Hydrobiol. Hydrogr.**, v. 65, 310-311 p., 1980. Disponível em: <http://dx.doi.org/10.1002/iroh.19800650226>. Acesso em: 20 jan. 2024.

DE FILIPPO, R.; GOMES, E.; LENZ-CÉSAR, J.; SOARES, C.; MENEZES, C. As alterações na qualidade da água durante o enchimento do reservatório de UHE Serra da Mesa-GO. In: **Ecologia de Reservatórios**: Estrutura, função e aspectos sociais. São Paulo: FAPESP; FUNDIBIO, 1999. p. 321-346.

DUFRENE, M.; LEGENDRE, P. Species Assemblages and Indicator Species: The Need for a Flexible Asymmetrical Approach. **Ecological Monographs**, v. 67, n. 3, p. 345-366, 1997. Disponível em: <http://dx.doi.org/10.1890/0012-9615(1997)067[0345:SAAIST]2.0.CO;2>. Acesso em: 20 jan. 2024.

EJSMONT-KARABIN, J. Empirical equations for biomass calculation of planktonic rotifers. **Polskie Archiwum Hydrobiologii**, v. 45, p. 513-522. 1998.

ESPÍNDOLA, E. L. G.; MATSUMURA-TUNDISI, T.; RIETZLER, A. C.; TUNDISI, J. G. Spatial heterogeneity of the Tucuruí Reservoir (State of Pará, Amazônia, Brazil) and the distribution of zooplanktonic species. **Revista Brasileira de Biologia**, v. 60, n. 2, p. 179-194, 2000. Disponível em: <http://dx.doi.org/10.1590/S0034-71082000000200001>. Acesso em: 20 jan. 2024.

FIGUEIREDO, D. M.; BIANCHINI-JR, I. Limnological patterns of the filling and stabilization phases in the Manso multiple-use reservoir (MT). **Acta Limnol. Bras.**, v. 20, n. 4, p. 277–290, 2008.

GORNI, G. R.; ALVES, R. G. Oligochaetes (Annelida, Clitellata) in a neotropical stream: a mesohabitat approach. **Iheringia, Sér. Zool.**, Porto Alegre, v. 102, n. 1, p. 106-110, 2012. Disponível em: <http://dx.doi.org/10.1590/S0073-47212012000100015>. Acesso em: 20 jan. 2024.

HAMMER, Ø.; HARPER, D. A. T.; RYAN, P. D. PAST: Paleontological Statistics Software Package for Education and Data Analysis. **Palaeontologia Electronica**, v. 4, n. 1, 9p. 2001.

HAMPTON, S. E.; SCHINDLER, D. E. Empirical evaluation of observation scale effects in community time series. **Oikos**, v. 113, p. 424–439, 2006. Disponível em: <http://dx.doi.org/10.1111/j.2006.0030-1299.14643.x>. Acesso em: 20 jan. 2024.

HAN, J.; KUMAR, H. K.; LEE, J. H.; ZHANG, C.; KIM, S.; LEE, J.; KIM, S. D.; AN, K. Integrative trophic network assessments of a lentic ecosystem by key ecological approaches of water chemistry, trophic guilds, and ecosystem health assessments along with an ECOPATH model. **Ecological Modelling**, v. 222, n. 19, p. 3457–3472. 2011. Disponível em: <http://dx.doi.org/10.1016/j.ecolmodel.2011.08.001>. Acesso em: 20 jan. 2024.

HOBÆK A.; MARINA, M.; ANDERSEN, T. Factors influencing species richness in lacustrine zooplankton. **Acta Oecol.**, v. 23, p. 155–163, 2002. Disponível em: <http://dx.doi.org/10.1016/S1146-609X(02)01147-5>. Acesso em: 20 jan. 2024.

IIEGA (Instituto Internacional de Ecologia e Gerenciamento Ambiental). **Análise global do projeto de monitoramento do reservatório de Lajeado (TO), desde a fase rio até a fase lago, compreendendo o período de 1998 a 2003**. São Carlos: Série relatórios bimestral. 2004. (Relatório Técnico Final do PBA-09).

LEGENDRE, P.; CÁCERES, M. Beta diversity as the variance of community data: dissimilarity coefficients and partitioning. **Ecology Letters**, v. 16, p. 951–963, 2013. Disponível em: <http://dx.doi.org/10.1111/ele.12141>. Acesso em: 20 jan. 2024.

LEGENDRE, P.; GALLAGHER, E. D. Ecologically meaningful transformations for ordination of species data. **Oecologia**, v. 129, p. 271–280. 2001. Disponível em: <http://dx.doi.org/10.1007/s004420100716>. Acesso em: 20 jan. 2024.

LEGENDRE, P.; LEGENDRE, L. **Numerical ecology**. 3rd. Edition. Elsevier. 2012.

LEGENDRE, P. Indicator Species: Computation. In: LEVIN, S. (Ed.). **Encyclopedia of Biodiversity**, v. 4, n. 2, 264-268, 2013.

LEPŠ, J.; ŠMILAUER, P. **Multivariate Analysis of Ecological Data using CANOCO**. Cambridge Press, 2003. Disponível em: <http://dx.doi.org/10.1017/CBO9780511615146>. Acesso em: 20 jan. 2024.

MATSUMURA-TUNDISI, T. **Diversidade de zooplâncton em represas do Brasil**, pp. 39-54. In: R. Henry (ed.), Ecologia de reservatórios: estrutura, função e aspectos sociais. Botucatu: FUNDIBIO/FAPESP, 1999. 799 p.

MCCAULEY, E. The estimation of the abundance of biomass of zooplankton in samples. In A manual on methods for the assessment of secondary productivity in freshwaters. In: DOWNING, J. A.; RIGLER, F. (Ed.). **Blackwell Sci. Publishers**. London: 1984. p. 228–265.

MCCUNE, B.; MEFFORD, M. J. PC-ORD. **Multivariate Analysis of Ecological Data**. Version 6. MjM Software, Gleneden Beach, Oregon, U.S.A. 2011.

NOGRADY, T.; HENDRIK, S. **Asplanchnidae, Gastropodidae, Lindiidae, Microcodidae, Synchaetidae, Trochosphaeridae**. Guides to the identification of the microinvertebrates of the continental waters of the world. Leiden: Backhuys, 2002. 264 p.

NOVA, C. C.; LOPES, V. G.; SOUZA, L. C. E.; KOZLOWSKY-SUZUKI, B.; PEREIRA, T. A. A.; BRANCO, C. W. C. The effect of seasonality on the structure of rotifers in a black-water shallow lake in Central Amazonia. **Anais da Academia Brasileira de Ciências**, v. 86, n. 3, p. 1359-1372. Epub August 12, 2014. Disponível em: <http://dx.doi.org/10.1590/0001-3765201420130323>. Acesso em: 20 jan. 2024.

OBERTEGGER, U.; FLAIM, G.; SOMMARUGA, R. Multifactorial nature of rotifer water layer preferences in na oligotrophic lake. **Journal of Plankton Research**, v. 30, p. 633–643, 2008. Disponível em: <http://dx.doi.org/10.1093/plankt/fbn027>. Acesso em: 20 jan. 2024.

OBERTEGGER, U.; MANCA, M. Response of rotifer functional groups to changing trophic state and crustacean community. **J. Limnol.**, v. 70, n. 2, p. 231-238, 2011. Disponível em: <http://dx.doi.org/10.3274/JL11-70-2-07>. Acesso em: 20 jan. 2024.

OBERTEGGER, U.; SMITH, H. A.; FLAIM, G.; WALLACE, R. L. Using the guild ratio to characterize pelagic rotifer communities. **Hydrobiologia**, v. 662, n. 1, p. 157–162, p. 2011. Disponível em: <http://dx.doi.org/10.1007/s10750-010-0491-5>. Acesso em: 20 jan. 2024.

OUÉDA, A.; OUÉDRAOGO, I.; OUÉDRAOGO, I.; ZONGO, F.; BOUNGOU, M.; GUENDA, W.; KABRÉ, G. B. Zooplankton species as indicators of hydrological variations in south-saharan reservoirs, Burkina Faso. **Annale de l'Université Ouaga**, 013. 2017.

PAAVOLA, R.; MUOTKA, T.; VIRTANEN, R.; HEINO, J.; KREIVI, P. Are biological classifications of headwater streams concordant across multiple taxonomic groups? **Freshwater Biology**, v. 48, n. 10, p. 1912–1923, 2003. Disponível em: <http://dx.doi.org/10.1046/j.1365-2427.2003.01131.x>. Acesso em: 20 jan. 2024.

PASZKOWSKI, C. A.; TONN, W. M. Community concordance between the fish and aquatic birds of lakes in northern Alberta, Canada: the relative importance of environmental and biotic factors. **Freshwater Biology**, v. 43, n. 3, p. 421–437, 2001. Disponível em: <http://dx.doi.org/10.1046/j.1365-2427.2000.00512.x>. Acesso em: 20 jan. 2024.

PEDROZO, C. S.; SCHNECK, F.; SCHWARZBOLD, A.; FARIAS, R. N. Respostas da comunidade zooplanctônica à formação do reservatório de Dona Francisca, Rio Grande do Sul. **Iheringia, Série Zoologia**, v. 102, n. 2, p. 142-149, 2012. Disponível em: <http://dx.doi.org/10.1590/S0073-47212012000200005>. Acesso em: 20 jan. 2024.

PERBICHE-NEVES, G.; FILETO, C.; LAÇOPORTINHO, J.; TROGUER, A.; SERAFIM-JÚNIOR, M. Relations among planktonic rotifers, cyclopoid copepods, and water quality in two Brazilian reservoirs. **Latin American Journal Aquatic Research**, v. 1, p. 138-149, 2013. Disponível em: <http://dx.doi.org/103856/vol41-issue1-fulltext-11>. Acesso em: 20 jan. 2024.

ROCHA, O.; SENDACZ, S.; MATSUMURA-TUNDISI, T. Composition, biomass and productivity of zooplankton in natural lakes and reservoirs of Brazil. In: Tundisi, J.B., Bicudo, CE., Matsumura-Tundisi, T.(Ed.). **Limnology in Brazil**. Rio de Janeiro: ABC/SLB, 1995. p. 151-165.

RODRÍGUEZ, M. P.; MATSUMURA-TUNDISI, T. Variation of density, species composition and dominance of rotifers at a shallow tropical reservoir (Broa Reservoir, SP, Brazil) in a short scale time. **Revista Brasileira de Biologia**, v. 60, n. 1, p. 1–9, 2000. Disponível em: <http://dx.doi.org/10.1590/S0034-71082000000100002>. Acesso em: 20 jan. 2024.

SANT'ANNA, C. L.; AZEVEDO, M. T. P. Contribution to the knowledge of potencially toxic Cyanobacteria from Brazil. **Nova Hedwigia**, v. 71, n. 3-4, p. 359–385, 2000.

SEGERS, H. **Rotifera**: The Lecanidae (Monogononta). Guides to the identification of the microinvertebrates of the continental waters of the world. Hague: SPB Academic Productions, 1995. v. 2.

SEGERS, H. Global diversity of rotifers (Rotifera) in freshwater. **Hydrobiologia**, v. 595, p. 49–59, 2008. Disponível em: <http://dx.doi.org/10.1007/s10750-007-9003-7>. Acesso em: 20 jan. 2024.

SENDACZ, S.; CALEFFI, S.; SANTOS-SOARES, J. Zooplankton biomass of reservoirs in different trophic conditions in the state of São Paulo. **Brazilian Journal of Biology**, v. 66, n. 1B, p. 337-350, 2006. Disponível em: <http://dx.doi.org/10.1590/S1519-69842006000200016>. Acesso em: 20 jan. 2024.

SERAFIM-JÚNIOR, M.; PERBICHE-NEVES, G.; BRITO, L.; GHIDINI, A. R.; CASANOVA, SMC. Variação espaço-temporal de rotífera em um reservatório eutrofizado no Sul do Brasil. **Iheringia, Série Zoologia**, v. 100, n. 3, p. 233-241, 2010. Disponível em: <http://dx.doi.org/10.1590/S0073-47212010000300008>. Acesso em: 20 jan. 2024.

SMITH, H. A.; EJSMONT-KARABIN, J.; HESS, T. M.; WALLACE, R. L. Paradox of planktonic rotifers: similar structure but unique trajectories in communities of the Great Masurian Lakes (Poland). **Verhandlungen Internationale Vereinigung Limnologie**, v. 30, p. 951–956, 2009. Disponível em: <http://dx.doi.org/10.1080/03680770.2009.11902278>. Acesso em: 20 jan. 2024.

ŠPOLJAR, M. Microaquatic communites as indicators of environmental changes in lakes ecosystems. **Journal of Engineering Research**., v. 1, n. 1, p. 29-42. 2013.

ŠPOLJAR, M.; TOMLJANOVIĆ, T.; LALIĆ, I. Eutrophication impact on zooplankton community - a shallow lake approach. **The Holistic Approach to Environment**., v. 1, p. 131-151, 2011.

STARLING, F. L. R. M. Comparative study of the zooplankton composition of six lacustrine ecosystems in central Brazil during the dry season. **Rev. Brasil Biol.**, v. 60, n.1, p. 101–111, 2000. Disponível em: <http://dx.doi.org/10.1590/S0034-71082000000100013>. Acesso em: 20 jan. 2024.

TAKAHASHI, E. M.; LANSAC-TÔHA, F. A.; DIAS, D. J.; BONECKER, C. C.; VELHO, L. E. M. Spacial variations in the zooplankton community from the Corumbá Reservoirs, Goiás State, in distinct hydrological periods. **Acta Scientiarum, Biological Sciences**, v. 31, n. 3, p. 227–234, 2009. Disponível em: <http://dx.doi.org/10.4025/actascibiolsci.v31i3.41320>. Acesso em: 20 jan. 2024.

TASEVSKA, O.; JERSABEK, C. D.; KOSTOSKI, G.; GUŠESKA, D. Differences in rotifer communities in two freshwater bodies of different trophic degree (Lake Ohrid and Lake Dojran, Macedonia). **Biologia (Bratislava)**, v. 67, p. 656–572, 2012. Disponível em: <http://dx.doi.org/10.2478/s11756-012-0041-x>. Acesso em: 20 jan. 2024.

WALLACE, R. L.; SNELL, T. W.; RICCI. C.; NOGRADY, T. **Rotifera. Volume 1: biology, ecology and systematics**. Backhuys Publishers, Leiden. 2006.

ZEBAZE, T. S. H.; NJINE, T.; KEMKA, N.; NOLA, M.; FOTO, M. S.; MONKIEDJE, A.; NIYITEGEKA, D.; SIME-NGANDO, T.; JUGNIA, L. B. Variations spatiales et temporelles de la richesse et de l'abondance des rotifères (Brachionidae et Trichocercidae) et des cladocères dans un petit lac artificiel eutrophe situé en zone tropicale. **Rev. Sci. de l'eau**, v. 18, n. 4, p. 485–505, 2005. Disponível em: <http://dx.doi.org/10.7202/705569ar>. Acesso em: 20 jan. 2024.

Apêndice A

Suplement 1 – Species composition, trophic group, and frequency of occurrence of rotifers in the area of influence of the Estreito hydroelectric dam (upstream and downstream) on the Tocantins River in the Brazilian states of Maranhão and Tocantins, in the rainy (February) and dry seasons (August). RES: upstream (points 1–10); RIV: downstream (points 11–20); Microf: Microphage; Rapto: Raptorial; R: Rare; U: Uncommon; F: Frequent; V: Very frequent.

Taxonomic group	**Trophic group**	**Rainy**		**Dry**	
		RES	**RIV**	**RES**	**RIV**
Brachionidae					
Brachionus dolabratus (Harring, 1914)	*Microf*	U	U	V	V
Brachionus falcatus (Zacharias, 1898)	*Microf*	F	F	V	V
Brachionus forficula f. *reductus* (Greze, 1926)	*Microf*	-	-	-	R
Brachionus havanaensis (Rousselet, 1911)	*Microf*	-	R	-	-
Brachionus mirus (Daday, 1905)	*Microf*	F	V	R	R
Brachionus plicatilis (Müller, 1786)	*Microf*	R	-	-	-
Brachionus pterodinoides (Rousselet, 1913)	*Microf*	-	R	-	-
Brachionus quadridentatus (Hermann, 1783)	*Microf*	-	R	-	-
Brachionus Zahniseri (Ahlstrom, 1934)	*Microf*	F	V	V	V
Keratella americana (Carlin, 1943)	*Microf*	V	V	V	V
Keratella cochlearis (Gosse, 1851)	*Microf*	V	V	V	V
Keratella cochlearis angulifera (Lauterborn, 1900)	*Microf*	-	-	R	R
Keratella cochlearis cochearis (Gosse, 1851)	*Microf*	-	-	R	-
Keratella cochlearis connectens (Lauterborn, 1900)	*Microf*	-	-	R	-
Keratella hiemalis (Carlin, 1943)	*Microf*	-	R	-	-
Keratella javana (Hauer, 1937)	*Microf*	R	-	-	-
Keratella lenzi (Hauer, 1953)	*Microf*	-	U	R	R
Keratella quadrata (Müller, 1786)	*Microf*	R	-	-	-
Keratella serrulata (Ehrenberg, 1838)	*Microf*	-	-	-	R
Keratella tropica (Apstein, 1907)	*Microf*	U	U	F	R
Notholca spp (Gose, 1886)	*Microf*	U	F	R	R
Plationus patulus macracanthus (Daday, 1905)	*Microf*	V	V	R	
Plationus patulus (Müller, 1786)	*Microf*	V	V	F	U
Platyias leloupi (Gillard, 1957)	*Microf*	-	R	-	-
Platyias quadricornis (Ehrenberg, 1832)	*Microf*	R	-	-	-
Euchlanidae					
Euchlanis sp (Ehrenberg, 1830)	*Microf*	V	R	F	U
Euchlanis sp2 (Ehrenberg, 1830)	*Microf*	-	-	-	R
Conochilidae					
Conochilus dossuarius (Hudson, 1885)	*Microf*	-	-	R	R
Conochilus unicornis (Rousselet, 1892)	*Microf*	R	F	V	V
Dicranophoridae					
Wierzejskiella sp (Wiszniewski, 1934)	*Rapto*	-	-	R	-
Trochosphaeridae					
Filinia camasecla (Myers, 1938)	*Microf*	V	V	-	U

Filinia cornuta (Weisse, 1848)	*Microf*	-	-	R	-
Filinia longiseta (Ehrenberg, 1834)	*Microf*	U	R	-	R
Filinia minuta (Smirnov, 1928)	*Microf*	-	-	-	R
Filinia opoliensis (Zacharias, 1891)	*Microf*	U	R	-	U
Filinia sp (Bory de St. Vicent, 1824)	*Microf*	R	-	-	-
Collothecidae					
Collotheca balatonica (Varga, 1936)	*Rapto*	-	-	R	-
Collotheca coronetta (Cubitt, 1869)	*Rapto*	U	U	R	R
Collotheca mutabilis (Hudson, 1885)	*Rapto*	U	F	V	V
Collotheca rasmae (Bērziņš, 1951)	*Rapto*	-	-	R	-
Collotheca trilobata (Collins, 1872)	*Rapto*	U	R	F	U
Flosculariidae					
Ptygura libera (Myers, 1934)	*Microf*	-	R	V	V
Ptygura pedunculata (Edmondson, 1939)	*Microf*	-	-	R	-
Ptygura sp (Ehrenberg, 1832)	*Microf*	-	-	R	R
Gastropodidae					
Gastropus hyptopus (Ehrenberg, 1838)	*Rapto*	R	-	V	V
Gastropus sp (Imhof, 1898)	*Rapto*	-	-	V	F
Hexarthridae					
Hexarthra fennica (Lavander, 1892)	*Rapto*	R	R	U	-
Hexarthra intermedia brasiliensis (Hauer, 1953)	*Rapto*	-	-	-	R
Hexarthra mira (Hudson, 1871)	*Rapto*	-	-	U	-
Hexarthra sp (Schmarda, 1854)	*Rapto*	R	-	R	-
Lecanidae					
Lecane aculeata (Jakubski, 1912)	*Microf*	R	-	-	-
Lecane blachei (Berzinš, 1973)	*Microf*	R	-	R	-
Lecane bulla (Gosse, 1851)	*Microf*	F	R	R	R
Lecane clara (Bryce, 1892)	*Microf*	-	-	-	R
Lecane curvicornis (Murray, 1913)	*Microf*	-	-	-	U
Lecane elsa (Hauer, 1931)	*Microf*	R	-	-	-
Lecane flexilis (Gosse, 1886)	*Microf*	U	R	U	F
Lecane lunaris (Ehrenberg, 1832)	*Microf*	-	R	-	R
Lecane mira (Murray, 1913)	*Microf*	U	-	-	R
Lecane pertica (Harring & Myers, 1926)	*Microf*	R	-	-	-
Lecane sp1 (Nitzsch, 1827)	*Microf*	R	-	-	R
Lecane sp2 (Nitzsch, 1827)	*Microf*	R	-	-	-
Lecane sylviae (Segers, 1993)	*Microf*	R	-	-	-
Lecane tudicola (Harring & Myers 1926)	*Microf*	U	U	-	R
Lecane ungulata (Gosse, 1887)	*Microf*	-	-	-	R
Lepadellidae					
Colurella adriatica (Ehrenberg, 1831)	*Microf*	-	-	R	-
Lindiidae					
Lindia sp (Dujardin, 1841)	*Rapto*	R	-	R	-
Notommatidae					

Cephalodella gibba (Ehrenberg, 1830)	*Rapto*	R	-	-	R
Pleurotrocha sp (Ehrenberg, 1830)	*Rapto*	R	-	-	-
Proalidae					
Proales sp1 (Gosse, 1886)	*Microf*	U	R	R	R
Proales sp2 (Gosse, 1886)	*Microf*	-	-	R	-
Proales sp3 (Gosse, 1886)	*Microf*	-	R	-	-
Synchaetidae					
Ploesoma lenticulare (Herrick, 1885)	*Rapto*	R	R	-	-
Ploesoma peipsiense (Maëmets & Kutikova, 1979)	*Rapto*	R	R	-	-
Ploesoma triacantha (Bergendal, 1892)	*Rapto*	R	-	-	-
Polyarthra euryptera (Wierzejski, 1891)	*Rapto*	R	-	-	-
Polyarthra longiremis (Carlin, 1943)	*Rapto*	R	R	-	-
Polyarthra major (Burckhardt, 1900)	*Rapto*	R	-	-	-
Polyarthra minor (Voigt, 1904)	*Rapto*	U	-	-	-
Polyarthra remata (Skorikov, 1896)	*Rapto*	V	U	R	-
Polyarthra vulgaris (Carlin, 1943)	*Rapto*	F	U	-	-
Synchaeta sp (Ehrenberg, 1832)	*Rapto*	-	-	R	-
Trichocercidae					
Trichocerca chattoni (Beauchamp, 1907)	*Rapto*	U	-	R	U
Trichocerca cylindrica (Imhof, 1891)	*Rapto*	F	U	V	V
Trichocerca iernis (Gosse, 1887)	*Rapto*	R	-	-	-
Trichocerca ornata (Myers, 1934)	*Rapto*	R	-	-	-
Trichocerca similis (Wierzejski, 1893)	*Rapto*	-	U	R	-
Trichotriidae					
Macrochaetus altamirai (Arévalo, 1918)	*Microf*	R	-	R	-
Trichotria sp (Bory de St. Vincent, 1827)	*Microf*	R	R	-	-

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