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ZOOPLANKTON COMPOSITION AND ABUNDANCE OF THE XHIMOJAY RESERVOIR, STATE OF MEXICO, MEXICO

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Abstract: The Xhimojay reservoir, currently subject to overexploitation for various human activities, is a freshwater ecosystem whose biota remains poorly documented. The present study aimed to characterize the taxonomic composition of zooplankton at the genus level and to analyze its temporal variations throughout the 2013 annual cycle. Monthly sampling was carried out from February to December, using a 115 μm mesh conical net. During the study period, relevant physicochemical variations were recorded: the greatest depth (92 cm) and transparency (62 cm) occurred in February; the maximum temperature (25.53 °C) in October; the highest dissolved oxygen concentration (9.85 mg/L) in April; the highest conductivity (234.85 μS/cm) in May and the maximum pH (13.78) in December. Forty-one species and three additional zooplanktonic groups (nauplii, cyclopoid copepodites and diaptomids) were identified, belonging to 21 families distributed in three classes: Cladocera, Copepoda and Rotifera. The most abundant species were *Bosmina longirostris var. cornuta* (22.92 %), *Asplanchna brightwelli* (18.12 %) and diaptomid copepodites (11.02 %), while those with the lowest abundance were *Eurycercus lamellatus*, *Leptodiaptomus novamexicanus* and *Rotaria neptunia* (0.02 % each). This study is the first detailed analysis of the composition and abundance of zooplankton in the Xhimojay reservoir. The presence of *Dunhevedia setigera*, previously documented only in the Yucatan Peninsula, represents a new record for the reservoirs of the State of Mexico, highlighting the need to continue limnological research in this region.

Keywords: Xhimojay Reservoir, Zooplankton, Taxonomic composition, Temporal variation.

INTRODUCTION

The various human activities exert considerable pressure, both directly and indirectly, on the hydrological cycle. These pressures have had negative consequences in many regions, affecting not only the quality of life of the population, but also natural ecosystems and their biodiversity. As a result of pollution, many freshwater ecosystems show evident signs of degradation, which has reduced both the quantity and quality of the environmental services they offer and, in some cases, has led to the loss of biodiversity (SEMARNAT, 2021).

Climate change may aggravate this situation since, according to various projections, the risk of floods and droughts is expected to increase due to changes in the intensity and geographic distribution of precipitation. A decrease in water reserves stored in glaciers and snow is also expected, as well as an increase in water-stressed land surface, among other effects. Given this scenario, water management represents one of the most important environmental challenges, both globally and in Mexico (SEMARNAT, 2021).

Dams are key instruments for the efficient use of surface water, especially in regions where the rainy season is concentrated in a few months. In addition, they help mitigate the occurrence of floods caused by floods (Arreguín-Cortés et al., 2013). These freshwater systems have great ecological relevance and harbor a high potential for resources and biodiversity (Margalef, 1983; Namihira-Santillán et al., 2002; Aguilar, 2003).

There are more than five thousand dams, reservoirs and embankments in Mexico, some of which are classified as large dams according to the definition of the International Commission on Large Dams (Arreguín-Cortés et al., 2013; CONAGUA, 2018). The highest concentration of lentic systems is found in the Central-West zone of the country, which includes the states of Jalisco and Michoacán. A smaller number are distributed in the Central-South and Northern regions (Arreguín-Cortés et al., 2013; Gómez-Márquez et al., 2013).

Dams and their associated reservoirs allow the storage of water for later use and offer various services such as flow regulation, navigation, electricity generation, consumptive and non-consumptive water uses, and flood protection, among others (FAO, 2021). These bodies of water represent a fundamental resource for the development of fisheries and aquaculture in Mexico (Moreno-Hernández et al., 1993).

Despite their ecological, economic and cultural relevance (Aguilar, 2003), studies on freshwater zooplankton are scarce. Most limnological work has focused mainly on hydrological aspects of these systems (Suárez-Morales et al., 1993), and smaller reservoirs have been less studied and exploited, so the information available is limited (Moreno-Hernández et al., 1993).

Zooplankton play a crucial role in the transmission of energy within epicontinental systems. Its temporal variability responds to changes in biotic and abiotic factors, so its composition and abundance fluctuate according to the diversity and abundance of phytoplankton (Armengol, 1982; Folt and Burns, 1999; Wetzel, 2001). Therefore, the study of zooplankton provides valuable information on the trophic state and general productivity processes of lakes and reservoirs (Suárez-Morales et al., 1991; 1993).

The State of Mexico has 259 dams (Arreguín-Cortés et al., 2013), among which the Xhimojay dam and reservoir, located in the municipality of Jilotepec, stands out (INEGI, 2001). However, like many other dams, it has not received the necessary attention from the scientific community. To date, only the formal works of Rodríguez-Varela et al. (2015a, b) on ichthyofauna and zoobenthos are available, as well as Rodríguez-Varela et al. (2018), who investigated the water quality in that reservoir. In this context, the objective of the present research was to provide information on the taxonomic composition of zooplankton species collected in Xhimojay Dam and to determine the magnitude of temporal changes occurred during the 2013 annual cycle.

METHOD

STUDY AREA

The Xhimojay dam is located in the municipality of Jilotepec, northwest of the State of Mexico, between coordinates 19° 52’ 02” and 20° 12’ 43” north latitude, and 99° 26’ 37” and 99° 44’ 02” west longitude, at an altitude of 2,440 meters above sea level (masl). It belongs to the Alto Pánuco hydrological region and has a temperate sub-humid climate with summer rains. Its climatic regime is divided into two seasons: dry season (November-April) and rainy season (May-October). The system has an average depth of 57.01 cm, with a minimum of 25.5 cm in August and a maximum of 92 cm in February (Rodríguez-Varela et al., 2018) (Figure 1).

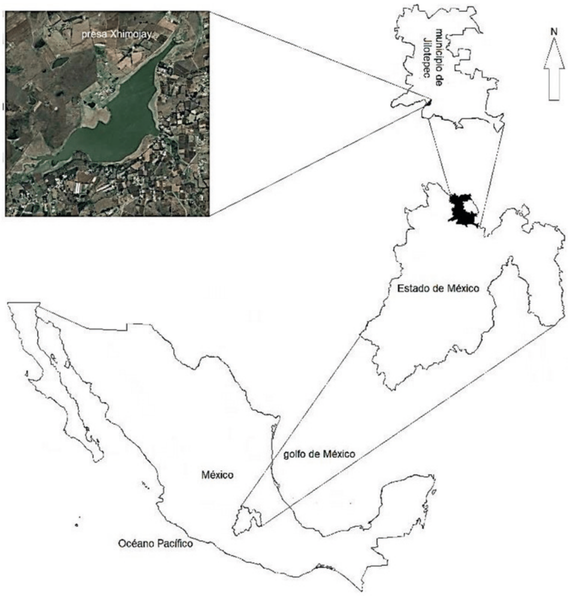

Figure 1. Study area. Xhimojay Dam, municipality of Jilotepec, State of Mexico, Mexico.

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Monthly sampling was conducted from February to December 2013. Zooplankton samples were obtained using a conical net with a 115 micron mesh size, 12.7 cm diameter and 29 cm length. Horizontal trawls of 15 meters were conducted at each sampling site. Samples were stored in 500 ml plastic containers and preserved in 4% formalin. Subsequently, the material was transferred to the Coastal Oceanography Laboratory at the Facultad de Estudios Superiores Iztacala, Universidad Nacional Autónoma de México.

In the laboratory, the volume of each sample was standardized to 100 ml, from which 5 ml aliquots were taken for separation and identification of zooplankton. The organisms were identified using an optical microscope and following the taxonomic criteria of Frey (1993), Hebert and Finston (1996), Sarma and Elías-Gutiérrez (1998), Thorp and Covich (2001), Dumont et al. (2002), Barón-Rodríguez and Gavilán (2007), Elías-Gutiérrez et al. (2008), Aliberti et al. (2013), Athibai et al. (2013), Mercado-Salas and Suárez-Morales (2014), Silva-Briano et al. (2015), Plewka (2019), and CMU (2021).

The following environmental variables were recorded at the collection sites: depth and transparency (using a Secchi WaterMark disk), water temperature and conductivity (using a YSI 30 conductivity meter), dissolved oxygen (OAKTON DO 300 oximeter) and pH (ORION 290 WD-35624-74 digital potentiometer).

Zooplankton abundance was expressed as individuals per liter (ind/L) and the data were organized in matrices of species (p) by months (n). The following ecological indices were calculated: species richness (number of species per month), Shannon-Weiner alpha diversity using the natural logarithm (H'), Pielou's evenness (J') and dominance (D) (Brower et al., 1998; Krebs, 1998).

To explore dominance patterns, a shadow plot was developed, from which it was decided to apply a fourth-root transformation to abundances. This transformation allowed the weight of dominant species to be reduced and the contribution of less abundant species to be highlighted (Clarke et al., 2014).

The similarity in species composition and abundance was calculated using the Bray--Curtis coefficient. For this purpose, a dummy variable with an abundance of 1 in all months was incorporated into the matrix M (Clarke et al., 2006). Variation in the similarity matrix was analyzed by non-metric multidimensional scaling (nMDS), using two-dimensional representations (Clarke, 1993).

Additionally, in order to identify spatio--temporal distribution patterns, a principal coordinates analysis (PCO) (Gower, 1966; Clarke and Warwick, 2001; Anderson and Willis, 2003) and a hierarchical classification analysis (Cluster) using the average linkage method were applied. To validate the groupings obtained, the SIMPROF (Similarity Profile) test was used (Clarke et al., 2008; Legendre and Legendre, 2012). A shadow plot was also generated to identify the variables responsible for the clustering (Clarke et al., 2014).

The environmental information was organized in a matrix of ecological variables (p) by months (n). No transformation was necessary, according to the results of the correlation matrix analysis (Draftsman plot), although the data were normalized. The dissimilarity between variables in each pair of sites was calculated using the Euclidean distance coefficient (Legendre and Legendre, 2012).

To explore correlation patterns between variables, principal component analysis (PCA) was applied in two or three dimensions, as well as classification analysis using the average linkage method and the SIMPROF test to determine significant groupings (Clarke et al., 2008; Legendre and Legendre, 2012).

All statistical analyses were performed using PRIMER v.7 software with the PERMANOVA add-on (Anderson et al., 2008).

RESULTS

The greatest depth was recorded in February (92 cm) and the least in August (25.25 cm), with an overall average of 57.01 cm. Transparency reached its maximum value in February (62 cm) and the minimum in June (8.5 cm), with an average of 30.37 cm. The highest water temperature was in October (25.53 °C) and the lowest in March (17.1 °C), with an average of 20.86 °C. The highest dissolved oxygen concentration was recorded in November and December (11.22 mg/L) and the lowest in September (6.33 mg/L), with an average of 8.78 mg/L. Conductivity was highest in May (234.85 μS/cm) and lowest in August (80.83 μS/cm), with an average of 144.28 μS/cm. The highest pH value was recorded in December (13.78) and the lowest in March (7.8), with an average of 9.4 (Figure 2).

The principal component analysis of the hydrological variables showed that the first three components explained 88.8% of the total variance, with being depth, transparency, pH and conductivity the most influential variables. Depth was determinant in the behavior of the rest of the hydrological factors, due to its relationship with the seasonality of low water and rainfall. The months with a "normal" water level (January to May) were grouped according to depth and transparency. April, as the beginning of reservoir emptying, and the months from June to September, with the lowest water levels, were related to conductivity. The months from October to December were associated with high pH and dissolved oxygen levels (Figure 3). Although the dendrogram showed three clusters at 60 % similarity, the SIMPROF test indicated that these are not statistically significant.

Forty-one species and three groups (nauplii, cyclopoid copepodites and diaptomids) were identified, belonging to 21 families and three classes: Cladocera, Copepoda and Rotifera. The relative abundances were: Cladocera 53 %, Copepoda 5 % and Rotifera 42 %. On a monthly basis, cladocerans and copepods dominated in February, June and November; while no rotifers were collected in December.

Bosmina longirostris var. *cornuta* was the most abundant species, with 22.92 % of the total relative abundance, followed by *Asplachna brightwelli* with 18.12 % and diaptomid copepodites with 11.02 %. The least abundant species were *Eurycercus lamellatus, Leptodiaoptomus novamexicanus* and *Rotaria neptunia* (0.02 % each) (Table 1).

The highest richness was recorded in November (22 species) and the lowest in December (6 species). Ecological diversity reached its maximum in November (2.43 nits/ind) and the minimum in December (1.38 nits/ind). The equitability ranged from 0.59 (June) to 0.88 (September). The lowest dominance index occurred in September (0.12) and the highest in June (0.41) (Table 2).

The nMDS ordination of the species showed a pattern related to the low water and rainfall seasons, which determine the water level in the reservoir (Figure 4). April, as a transition month, was located in the center of the diagram, indicating the beginning of the draining. May to August (with low water levels) were grouped towards the left of the diagram. From September onwards, with the beginning of reservoir filling, the months were arranged to the right. November was distinguished by its composition, abundance and ecological characteristics, separating it from the rest of the months.

Clustering analysis by species (Figure 5), validated by the SIMPROF test, identified four actual clusters:

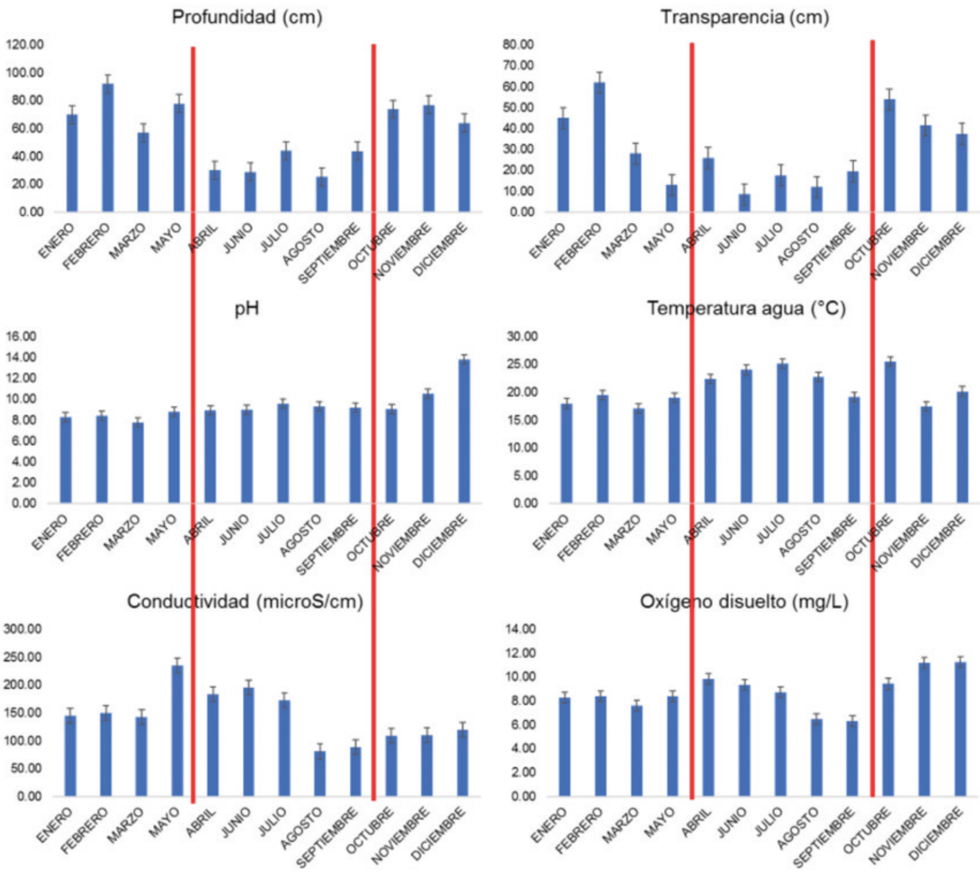

Figure 2. Temporal variation of the physicochemical characteristics of the water recorded in the Xhimojay reservoir. The red lines represent the water level of the reservoir and water use for human activities.

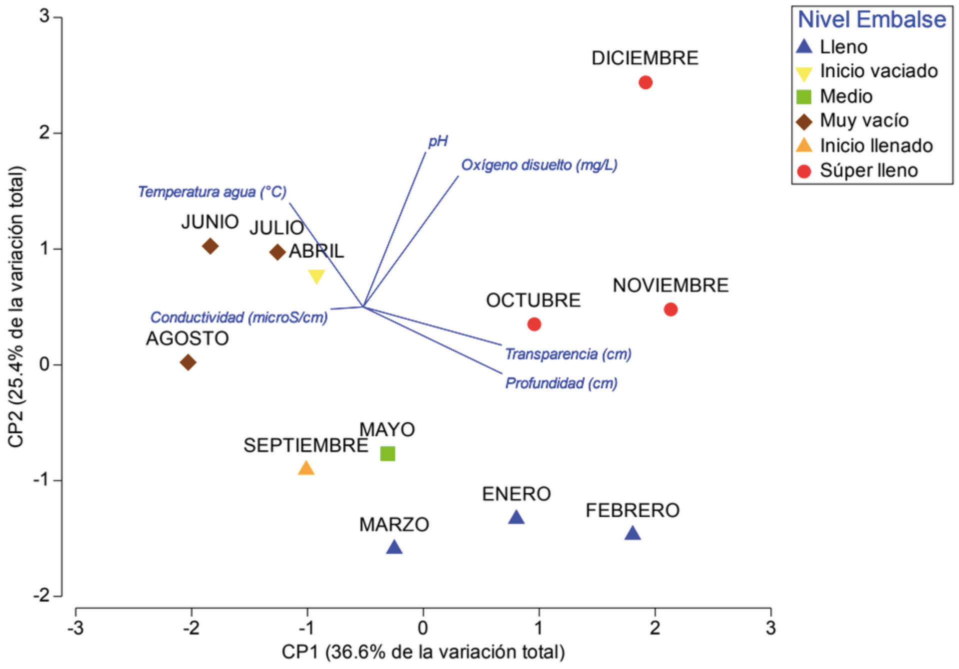

Figure 3. Two-dimensional principal component ordination plot (PCA) of the physicochemical variables for each sampling month.

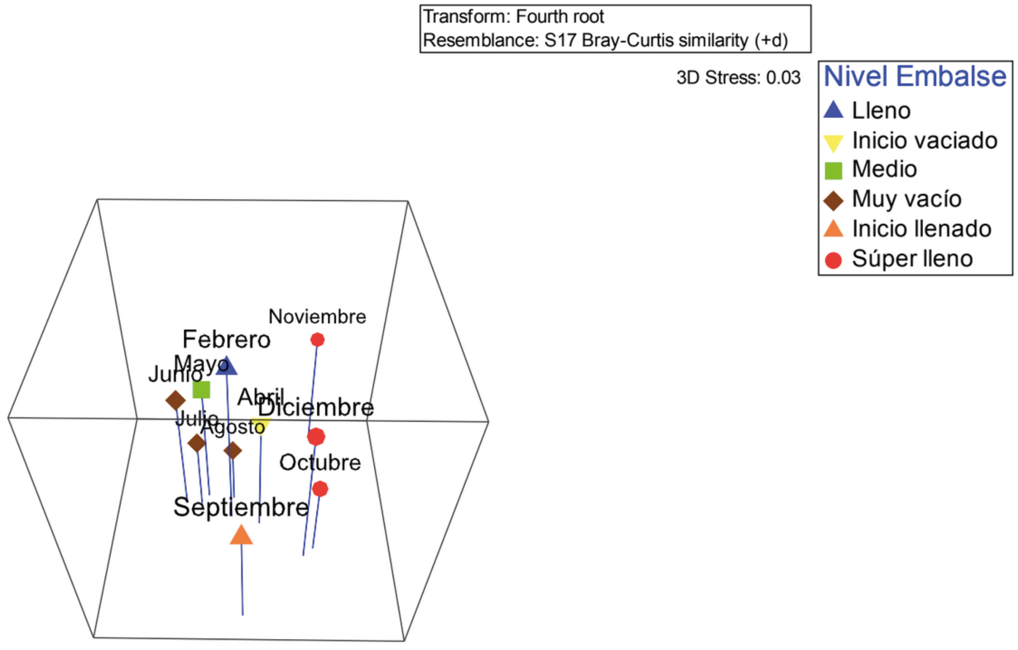

Figure 4. Non-metric multidimensional scaling ordination diagram (NMSD) in three dimensions reflects the relative similarity of species composition by month and reservoir water level.

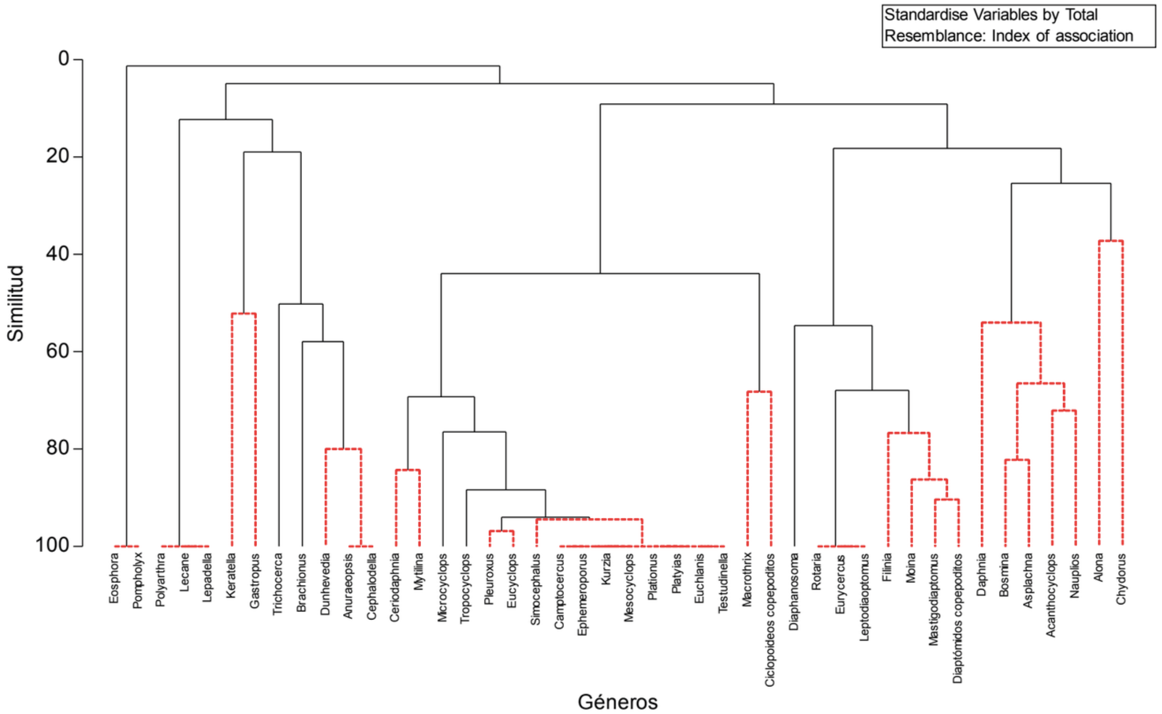

Figure 5. Hierarchical clustering dendrogram (R mode). Red lines indicate non-real clusters according to the SIMPROF test (Note. Only genus name is indicated).

Group A: *Eosphora najas, Pompholyx complanata, Polyarthra vulgaris, Lecane luna, Lepadella patella, Keratella cochlearis, Gastropus stylifer, Trichocerca longiseta, Brachionus quadridentatus, Dunhevedia setigera, Anuraeopsis fissa,* and *Cephalodella gibba.*

Group B: *Ceriodaphnia reticulata, Mytilina mucronata, Microcyclops rubellus, Tropocyclops prasinus mexicanus, Pleuroxus cf. varidentatus, Eucyclops conrowae, Simocephalus vetulus, Camptocercus dadayi, Ephemeroporus acanthodes, Kurzia polyspina, Mesocyclops longisetus, Plationus patulus, Platyias quadricornis, Euchlanis dilatata, Testudinella patina intermedia, Macrothrix cf. spinosa* and cyclopoid copepodites.

Group C: *Diaphanosoma birgei, Rotaria neptuni, Eurycercus lamellatus, Leptodiaoptomus novamexicanus, Filinia longiseta, Moina micrura, Mastigodiaptomus albuquerquensis* and diaptomid copepodites.

Group D: *Daphnia mendotae, Bosmina longirostris var. cornuta, Asplachna brightwelli, Acanthocyclops robustus, Alona cf. setulosa, Chydorus brevilabris* and nauplii.

The classification by months (Figure 6) revealed similarities in the composition of species collected. According to SIMPROF, three real groups were observed: November, September and the rest of the months.

The OCP analysis (Figure 7) showed a clustering pattern that reflects the temporal variation of the species and their hydrological conditions. This pattern was determined by the water level, with April to the left (beginning of the draining) and the months with the highest water level (September onwards) to the right. November was again presented as a distinct entity. The variables that most influenced zooplankton composition were conductivity, pH and temperature.

Figure 8 shows the shade plots and dendrograms by month and species. The monthly dendrogram identified three clusters: November; low water level months (including February and May) and high water level months (such as September). In terms of species, the main responsible for the clusters were: *Bosmina longirostris var. cornuta, Asplachna brightwelli*, nauplii, diaptomid and cyclopoid copepodites, *Brachionus quadridentatus and Daphnia mendotae*. The richness, abundance and absence of certain species in November explain their distinctiveness within the sampling cycle.

DISCUSSION

The physicochemical parameters in reservoirs, such as Xhimojay, show marked temporal fluctuations, especially between the rainy and dry seasons , reflecting changes in precipitation, temperature and hydrological dynamics (Díaz-Vargas et al., 2005; Gómez-Márquez et al., 2013). These variations are influenced by geological and climatic factors, incoming water quality, biotic processes and human activity (Montes et al., 1978).

The Xhimojay reservoir has been described as shallow, transparent, hyperoxygenated, soft and alkaline (Rodríguez-Varela et al., 2018), conditions consistent with high mountain lentic bodies (Fernández et al., 2010). Water surface temperature showed seasonality, with maximum values during the dry season, in agreement with what has been reported for other reservoirs in central Mexico, and although a slight thermal stratification was identified, its influence seems limited by the shallow depth and morphometry of the system (Cuna et al., 2015; López-Martínez, et al., 2017).

The depth of the reservoir was positively correlated with transparency (R=0.75), which is consistent with studies indicating that this relationship may be due to the lower amount of suspended matter and greater light penetration

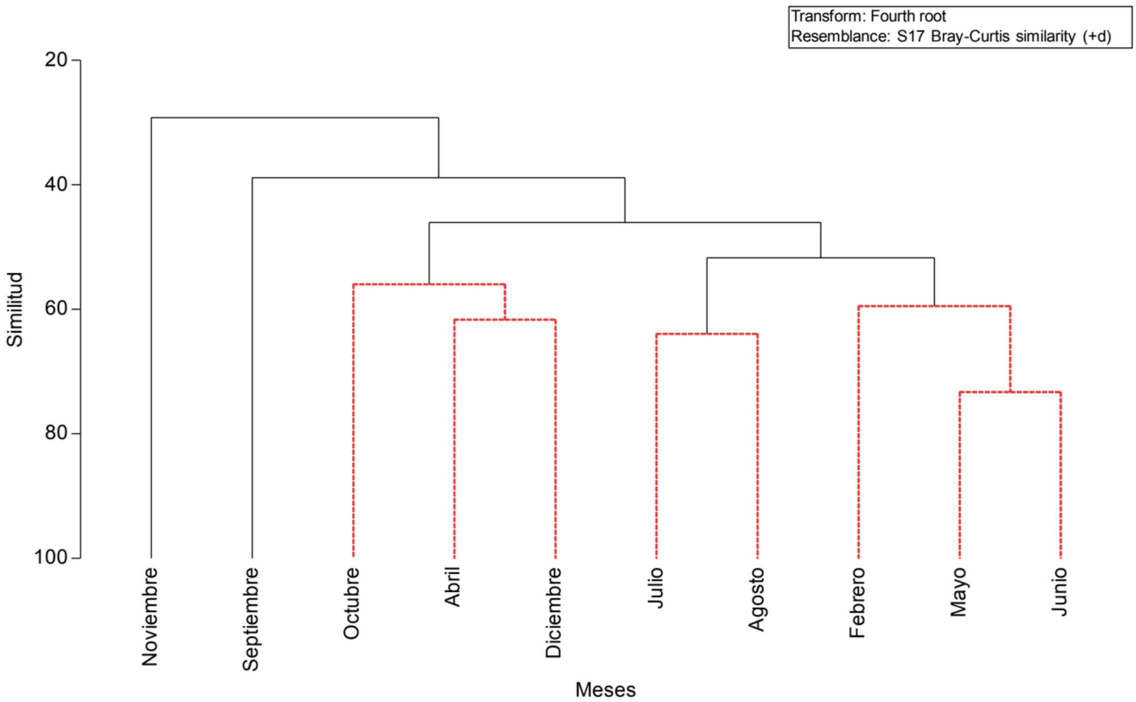

Figure 6. Hierarchical clustering dendrogram (Q mode) of the sampling months. Red lines indicate non--real clusters according to the SIMPROF test.

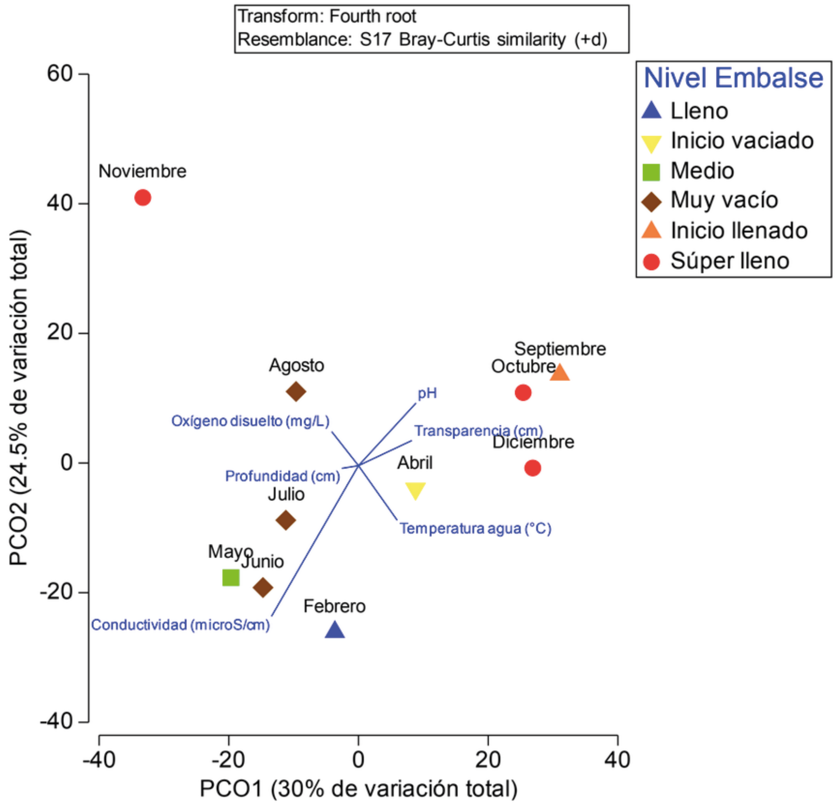

Figure 7. Principal coordinate ordination plot (PCO) reflecting temporal variation in species composition between sampling months. The length and direction of each vector indicates the strength of the relationship between variables.

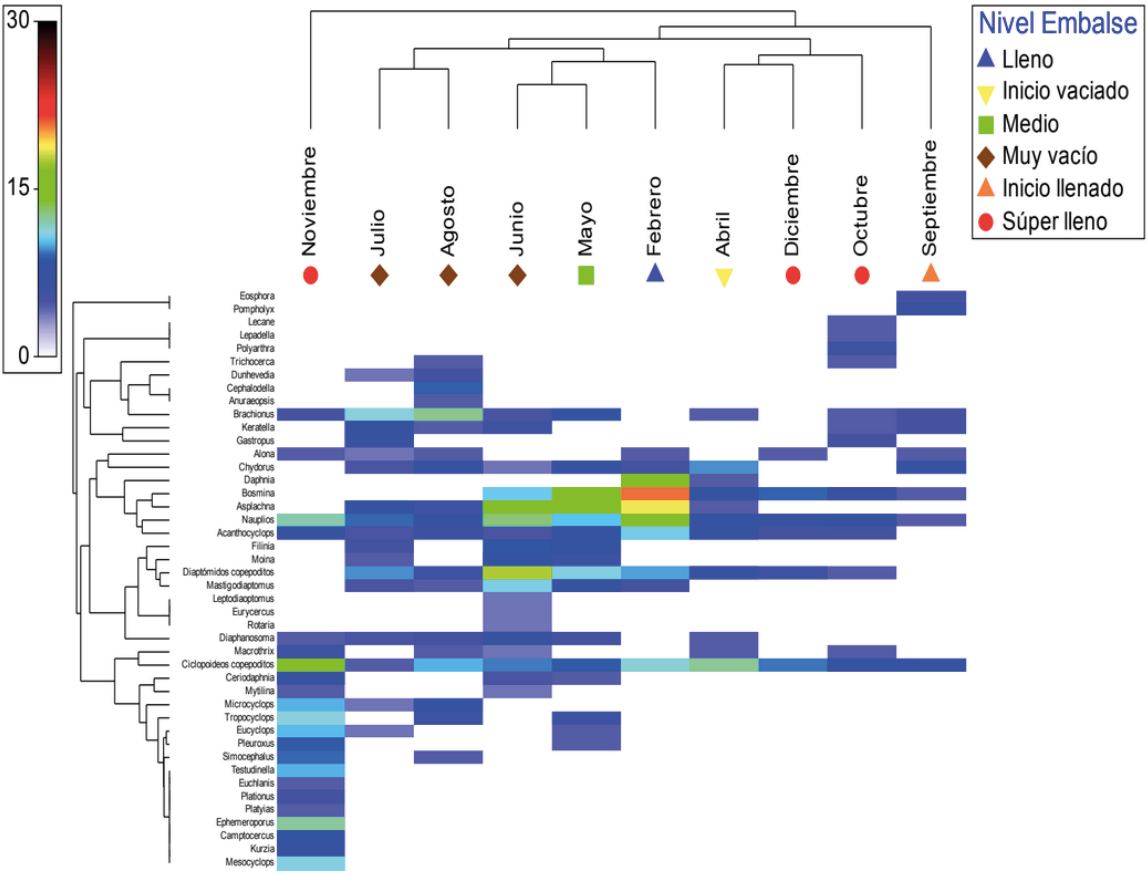

Figure 8. Shade plot for sampling months. Months are grouped by water level and species (only the genus name is presented) according to their presence and abundance. The shading or color towards red determines the dominance of the species by month of collection.

in conditions of higher water level (Montoya--Moreno et al., 2011). In contrast, no significant correlations were detected between depth and other variables such as temperature, pH, dissolved oxygen or conductivity.

Dissolved oxygen showed high values throughout the year, even in the rainy season, possibly due to the constant mixing of the water column in a shallow system and the intense photosynthesis of macrophytes in the margins (Bonilla-Buitrago et al., 2021). These conditions, associated with well-oxygenated waters, indicate good environmental quality in certain periods (Fernández et al., 2010), although in some months such as March, August and September, decreases were observed that could be related to organic loads of anthropogenic origin (Alonso and Camargo, 2005).

Conductivity remained low during the annual cycle, within favorable ranges for aquatic life (Baltazar, 2007). Its variability is mainly attributed to physical factors such as precipitation, hydrology, and local human activities such as agriculture and livestock (Pedrosa and Rezende, 1999; Rodríguez et al., 2010). This situation is similar to that observed in small aquifers such as the Motril-Salobreña aquifer, where conductivity is influenced by rainfall recharge and land use.

The pH showed consistently high values, above 9, which is indicative of intense photosynthetic activity but also represents an ecological risk due to the increase of non-ionized ammonia (NH_3), potentially toxic to aquatic organisms (Fernández et al., 2010). Although pH in shallow systems varies with time of day and proximity to shores due to decomposition processes, the extreme values observed in this study exceed the natural fluctuations reported in lentic systems (Ramirez et al., 1999). The inverse relationship of pH with dissolved CO_2 confirms a dynamic controlled by photosynthesis and respiration (Margalef, 1983; Montes et al., 1978).

Variations in the water level of the reservoir were related to the rainfall regime, although they did not always coincide due to factors such as the time of sampling, local precipitation and groundwater recharge, especially noticeable between October and January (Montes et al., 1978). These dynamics directly influence the morphometry of the reservoir, affecting variables such as transparency and the distribution of aquatic organisms (Montoya-Moreno et al., 2011).

Regarding water quality, Rodríguez-Varela et al. (2018) reported indices that indicate conditions between regular and severe contamination, both in the dry and rainy seasons, although with a slight improvement in the latter. This diagnosis is consistent with the influence of diffuse sources of agricultural and livestock pollution noted in previous work (Rodríguez et al., 2010; Alonso and Camargo, 2005).

Finally, it is important to emphasize that aquatic organisms not only respond to physicochemical conditions, but also modify them. Therefore, the integrated study of these parameters together with biodiversity is fundamental to understand the dynamics of lentic ecosystems (Montes et al., 1978). The Xhimojay reservoir, like other shallow systems in the country, represents an environment sensitive to natural and anthropogenic disturbances, whose proper management requires an integrated ecosystem approach.

The composition of zooplankton in the Xhimojay reservoir was dominated by cladocerans (53%), followed by rotifers (42%) and, to a lesser extent, by copepods (5%). Similar results have been reported by Arroyo-Bustos et al. (2007, 2008), who identified cladocerans as the dominant group in three reservoirs located in the upper Lerma River basin, Mexico. In contrast, Gómez-Márquez et al. (2013) identified copepods as the dominant group both quantitatively and qualitatively, representing up to 80% of the total zooplankton density in their studies. For their part, Conde-Porcuna et al. (2004) state that the predominant zooplanktonic groups in continental systems are rotifers, cladocerans and copepods, highlighting the functional importance of rotifers in pelagic food chains due to their ability to transfer energy from bacterial particles and detritus that are not taken advantage of by other planktonic organisms.

In studies conducted in karst lakes in southeastern Chiapas, Fernandez et al. (2020) found that of a total of 59 zooplanktonic species, 42.4% corresponded to copepods, 22% to cladocerans and 35.6% to rotifers. Among the copepods, they identified seven species of Calanoidea (Diaptomidae) and 18 of Cyclopoida (Cyclopidae). In addition, they reported 13 species of cladocerans distributed in four families (Sididae, Daphniidae, Moinidae and Bosminidae), and 21 species of rotifers belonging to the subclass Monogononta and eight families. In the present study, the species with the highest relative abundance were *Bosmina longirostris var. cornuta* (22.92%), *Asplanchna brightwellii* (18.12%) and diaptomid copepodites (11.02%).

In terms of monthly variation, November presented the highest specific richness (22 species) and the highest ecological diversity (2.43 nits/ind). During this month, the cladocerans *Ephemeroporus acanthodes and Kurzia polyspina*, the copepod *Mesocyclops longisetus*, and the rotifers *Plationus patulus*, *Platyias quadricornis, Euchlanis dilatata* and *Testudinella patina intermedia* were identified as key species. On the contrary, September registered the lowest total abundance, highlighting the presence of *Eosphora najas* and *Pompholyx complanata*. In the other months, an average of 13.88 genera, a mean abundance and an ecological diversity of 1.78 nits/ind was observed. Fernandez et al. (2020) reported a richness between 4 (6.8%) and 24 (40.7%) species, with an average of 10.2 ± 6.0 species per lake, which is comparable to what was observed in this study (Table 2).

Elías-Gutiérrez et al. (1999) point out that Cladocera is a widely distributed group in Mexico, common in reservoirs and temporary ponds with low water supply and low predation pressure from vertebrates. They are also frequent in lowland tropical wetlands in the southeast of the country (Oaxaca, Chiapas, Quintana Roo, Tabasco and Campeche), although these ecosystems have not yet been sufficiently studied. The authors also point out the importance of exploring desert and semi-arid environments in the north of the country to better understand the distribution and biogeography of this group, with the central region of Mexico being the best documented to date.

The present work identified the presence of *Dunhevedia setigera*, a species whose identity requires taxonomic revision. Elías-Gutiérrez et al. (1997) indicate that its status is uncertain, as its record is limited to two old publications, and it is currently considered synonymous with *D. crassa* King, 1853. Cervantes-Martínez et al. (2018) recently reported *D. odontoplax* Sars, 1901 in cenotes of the Yucatán Peninsula. Villalobos-Hiriart et al. (1993) noted the presence of *D. crassa* in Panama, Cuba, and Haiti, while *D. serrata* has been recorded in Louisiana, Texas, Cuba, and Haiti, and *D. odontoplax* in Cuba. These data reinforce the need for further studies in water bodies in central Mexico, such as the present one, which provide new records at the national level.

Authors such as Dumont (1983) and Segers (2003) point out that the optimal thermal interval for rotifers reproduction is between 15 and 20 °C. In the present study, the highest abundances were recorded in February (19.5 °C), May (19.05 °C) and December (20.18 °C), which coincides with what was described by those authors. In addition, Gómez-Márquez et al. (2013) note that some zooplanktonic species can function as environmental indicators. Granados-Ramírez and Álvarez-Del Ángel (2003) mention that the genus *Brachionus* is characteristic of alkaline and hard waters in tropical and temperate regions, dominating in mesotrophic or eutrophic environments, but avoiding hypertrophic conditions.

Sampaio et al. (2002) argue that certain species of this genus proliferate in the presence of high organic matter, especially during the rainy season. Fulton and Paerl (1988) observed that species such as *B. calyciflorus* and *B. longirostris* have a high capacity to consume cyanobacterial colonies, showing great tolerance to their blooms. Gannon and Stemberger (1978) also consider them as indicators of eutrophication.

In December, the highest abundance of rotifers was recorded, highlighting the presence of *B. quadridentatus*. This month was characterized by high productivity, evidenced by the greenish coloration of the water, average temperatures of 20.18 °C, sunny days and a reservoir with a high level of filling (see Figures 3, 6, 7 and 8). According to Fernando et al. (1990) and Gómez-Márquez et al. (2013), the genus *Asplanchna*, also recorded in this study, is a common rotifer, widely distributed and with predatory habits of zooplankton in temperate and tropical lentic systems.

Regarding copepods, no organisms of the genus *Arctodiaptomus* were detected, although *A. dorsalis* (Marsh, 1907) has a wide distribution from South America to northern Florida, USA, including records in Virginia in an introduced form (Álvarez and Campos, 2000, 2001; Parra et al., 2006; Reid, 2007; Gómez--Márquez et al., 2013). In Mexico, it has been recorded in Aguascalientes, Jalisco, Quintana Roo, Yucatán, Morelos and the municipality of Jilotepec, State of Mexico. It has also been reported from Lake Coatetelco and Alto Amacuzac systems (Parra et al., 2006; Gómez-Márquez et al., 2013).

The genus *Thermocyclops*, whose representatives have been observed in Aguascalientes, Estado de México, Michoacán, Morelos, San Luis Potosí, Quintana Roo and Yucatán, was also not recorded, being characteristic of neotropical regions (Suárez-Morales and Reid, 1998; Mercado-Salas and Suárez-Morales, 2011; Gómez-Márquez et al., 2013). Reid (1989) notes that this genus can reach high densities in eutrophic environments.

This study represents a significant contribution to the limnological knowledge of the Xhimojay reservoir, as it is the first detailed record of the composition, abundance and diversity of zooplankton in this system. The results highlight the dominance of cladocerans, followed by rotifers and copepods, which reflects particular trophic conditions and an ecological structure typical of temperate and mesotrophic water bodies. The high specific richness recorded, with remarkable seasonal variations, highlights the complex dynamics and biodiversity of the reservoir, suggesting its potential as a key habitat for the regional zooplankton fauna.

The identification of rarely reported species such as *D. setigera*, with very limited previous records in Mexico, underscores the need to continue exploring and documenting biodiversity in water bodies in the center of the country, which have been historically less studied. These data are relevant not only from a taxonomic and ecological point of view, but also as a basis for water quality monitoring, conservation and sustainable management of aquatic resources in the region.

In this context, the Xhimojay reservoir is positioned as a site of interest for future studies in aquatic ecology, zooplankton biogeography and environmental assessment, reaffirming the relevance of this type of research for the management of lentic ecosystems in Mexico.

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Family	Species	February	April	May	June	July	August	September	October	November	December	Ab. Rel. (%)
CLADOCERA												
Bosminidae	*Bosmina longirostris var. cornuta*	**1**	**1**	**1**	**1**	**0**	**0**	**1**	**1**	**0**	**1**	**22.92**
Chydoridae	*Alona cf. setulosa*	1	0	0	0	1	1	1	0	1	1	0.18
	Camptocercus dadayi	0	0	0	0	0	0	0	0	1	0	0.30
	Chydorus brevilabris	1	1	1	1	1	1	1	0	0	0	1.57
	Ephemeroporus acanthodes	0	0	0	0	0	0	0	0	1	0	1.90
	Eurycercus lamellatus	0	0	0	1	0	0	0	0	0	0	0.02
	Dunhevedia setigera	0	0	0	0	1	1	0	0	0	0	0.08
	Kurzia polyspina	0	0	0	0	0	0	0	0	1	0	0.17
	Pleuroxus cf. varidentatus	0	0	1	0	0	0	0	0	**1**	**0**	**0.50**
Daphniidae	*Ceriodaphnia reticulata*	0	0	1	1	0	0	0	0	1	0	0.28
	Daphnia mendotae	1	1	0	0	0	0	0	0	0	0	4.43
	Simocephalus vetulus	0	0	0	0	0	1	0	0	1	**0**	**0.60**
Macrothricidae	*Macrothrix cf. spinosa*	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**1**	**0**	**0.22**
Moinidae	*Moina micrura*	0	0	1	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0.43**
Sididae	*Diaphanosoma birgei*	0	1	1	1	1	1	0	0	1	0	**0.43**
COPEPODA												
Cyclopidae	*Acanthocyclops robustus*	1	1	1	1	1	1	0	1	1	1	2.07
	Eucyclops conrowae	0	0	1	0	1	0	0	0	1	0	0.95
	*Mesocyclops longisetus***	0	0	0	0	0	0	0	0	1	0	1.17
	Microcyclops rubellus	0	0	0	0	1	1	0	0	1	0	1.15
	Tropocyclops prasinus mexicanus	0	0	1	0	0	1	0	0	1	0	1.53
	Cyclopoidea copepodites	1	1	1	1	1	1	1	1	1	1	**9.97**
Diaptomidae	*Leptodiaoptomus novamexicanus*	0	0	0	1	0	0	0	0	0	0	0.02
	*Mastigodiaptomus albuquerquensis*** *Mastigodiaptomus albuquerquensis*	1	0	1	1	1	1	0	0	0	0	1.50
	Diaptomid copepodids	1	1	1	1	1	1	0	1	0	1	11.02
	Nauplios	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**11.00**
ROTIFERA												
Asplachnidae	*Asplachna brightwelli*	1	1	1	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**18.12**
Brachionidae	*Anuraeopsis fissa*	0	0	0	0	0	1	0	0	0	0	0.03
	*Brachionus quadridentatus***	0	1	1	1	1	1	1	1	1	0	3.97
	Keratella cochlearis	0	0	0	1	1	1	1	1	0	0	0.38
	Plationus patulus	0	0	0	0	0	0	0	0	1	0	0.07
	Platyias quadricornis	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0.03**

Euchlanidae	*Euchlanis dilatata*	0	0	0	0	0	0	0	0	1	0	0.03
Gastropodidae	*Gastropus stylifer*	0	0	0	0	1	0	0	1	0	0	0.25
Lecanidae	*Lecane luna*	0	0	0	0	0	0	0	1	0	0	0.03
Lepadellidae	*Lepadella patella*	0	0	0	0	0	0	0	1	0	0	0.03
Mytilinidae	*Mytilina mucronata*	0	0	0	1	0	0	0	0	1	0	0.05
Notommatidae	*Cephalodella gibba*	0	0	0	0	0	1	0	0	0	0	0.50
	Eosphora najas	0	0	0	0	0	0	1	0	0	0	0.07
Philodinidae	*Rotaria neptunia*	0	0	0	1	0	0	0	0	0	0	0.02
Synchaetidae	*Polyarthra vulgaris***	0	0	0	0	0	0	0	1	0	0	0.10
Testudinellidae	*Pompholyx complanata*	0	0	0	0	0	0	1	0	0	0	0.13
	Testudinella patina intermedia	0	0	0	0	0	0	0	0	1	0	0.87
Trichocercidae	*Trichocerca longiseta*	0	0	0	0	0	1	0	1	0	0	0.07
Trochosphae-ridae	*Filinia longiseta*	0	0	1	1	1	0	0	0	0	0	0.82

Table 1. Taxonomic composition and relative abundance (%) of the species collected in the Ximohay reservoir, State of Mexico, Mexico during the study period (1= presence 0= absence).

	Species richness (s)	Diversity H' (nits/ind)	Fairness (J')	Dominance
February	10	1.55	0.67	0.33
April	11	1.58	0.66	0.34
May	16	1.76	0.63	0.37
June	19	1.73	0.59	0.41
July	17	1.97	0.70	0.30
August	19	2.04	0.69	0.31
September	9	1.93	0.88	0.12
October	13	2.23	0.87	0.13
November	22	2.43	0.78	0.22
December	6	1.38	0.77	0.23

Species richness and estimates of diversity, evenness and dominance by month in the Xhimojay reservoir, State of Mexico, Mexico.