


Article

Diversity of Rotifera in Freshwaters of Bolivia: An Updated Checklist

Carla E. Fernández ^{1,†} , Melina Campero ^{1,†} , Francisca Acosta ¹, Pablo E. Prado ^{1,2} , Mabel Maldonado ¹, Edgar Goitia ¹, Georgia Stamou ³, Evangelia Michaloudi ³  and Carlos López ^{4,*} 

¹ Unidad de Limnología y Recursos Acuáticos, Universidad Mayor de San Simón, Sucre Street in Front of La Torre Park, Cochabamba 00591, Bolivia; carla.fernandez@fcyt.umss.edu.bo (C.E.F.); melinacampero.p@fcyt.umss.edu.bo (M.C.); facosta23@gmail.com (F.A.); p.prado@umss.edu or pablo_edmundo.prado_velasco@tvr1.lth.se (P.E.P.); mabelmaldonado.m@fcyt.umss.edu.bo (M.M.); limnoed@fcyt.umss.edu.bo (E.G.)

² Division of Water Resources Engineering, Lund University, John Ericssons Väg 1, V-Hus, 221 00 Lund, Sweden

³ Department of Zoology, School of Biology, Aristotle University of Thessaloniki, 54124 Thessaloniki, Greece; gstmouc@bio.auth.gr (G.S.); tholi@bio.auth.gr (E.M.)

⁴ Escuela Superior Politécnica del Litoral, ESPOL, Centro de Agua y Desarrollo Sustentable, Campus Gustavo Galindo, Av. Perimetral, Guayaquil 2019, Ecuador

* Correspondence: cllopez@espol.edu.ec; Tel.: +593-960052363

† These authors contributed equally to this work.

Abstract: Biodiversity records are of great importance, especially in light of the biodiversity crisis. Here, we present a study on the diversity of rotifers in Bolivia based on an extensive investigation of the literature published so far. Through this approach and an analysis of samples from 207 water bodies of the country, we updated the checklist of reported species. This study revealed a total of 195 species of rotifers previously reported; we identified 153 species in our samples, with 84 of them being reported for the first time in Bolivia. Thus, a total of 279 species are known at present in this country. Our findings suggest that Bolivia has a rich and diverse rotifer community, with many species likely to be unique to the region.

Keywords: South America; zooplankton; rotifers; neotropics



Citation: Fernández, C.E.; Campero, M.; Acosta, F.; Prado, P.E.; Maldonado, M.; Goitia, E.; Stamou, G.; Michaloudi, E.; López, C. Diversity of Rotifera in Freshwaters of Bolivia: An Updated Checklist. *Diversity* **2024**, *16*, 589. <https://doi.org/10.3390/d16090589>

Academic Editor: Ulrike Obertegger

Received: 10 July 2024

Revised: 23 August 2024

Accepted: 12 September 2024

Published: 18 September 2024



Copyright: © 2024 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Rotifers are a group of microscopic aquatic invertebrates that are known for their unique morphology and their role in freshwater ecosystems. They play an important role in aquatic food webs as primary consumers of algae and bacteria, contributing to nutrient recirculation through the microbial loop [1,2], and as a food source for many aquatic invertebrates and fish [3]. Rotifers are found in a wide range of aquatic environments, including lakes, rivers, ponds, and wetlands, and they are known for their ability to tolerate a wide range of environmental conditions, including high levels of pollution and low oxygen levels [4,5].

Despite their ecological significance, the diversity and distribution of rotifers in many regions of the world, including South America, remain poorly understood. It is known that South America has a rotifer fauna with over 500 species recorded in the region [6]; these species probably have a high level of endemism [7], and there is a predominance of the Bdelloidea and Monogononta classes. Bolivia has a high geomorphological diversity and an extreme altitudinal gradient (varying from 300 to 6000 m a.s.l.), including the Amazonian rainforest, Chacoan dry forest, and Andean mountains. This is mostly reflected by the three biggest basins of the country: the Amazon basin, the La Plata basin, and the Altiplano basin. The latter of which exhibits a high biodiversity and hosts numerous endemic species, both in terrestrial and aquatic systems [8,9]. Given all these considerations, Bolivia is also expected to harbor a high diversity of rotifers.

The morphospecies richness of rotifers in Bolivia reported to date is relatively low compared to neighboring countries such as Brazil and Argentina, which have been reported to host over 400 [6] and over 300 [6,10,11] rotifer species, respectively. However, the low Bolivian diversity may be due to the limited research that has been carried out so far on rotifers in Bolivia rather than an actual lack of species diversity. For invertebrates, which constitute most of the Earth's biodiversity yet remain underrepresented in conservation efforts, checklists provide the foundational data necessary for assessing ecosystem health and guiding preservation strategies. By systematically cataloging species, it is possible to identify trends, detect declines, and prioritize conservation actions, ultimately helping to mitigate the biodiversity crisis and preserve often overlooked but important invertebrates such as rotifers.

This study reports the results of over two decades of unpublished limnological studies conducted in Bolivian territory and a comprehensive review of existing references on rotifer diversity in Bolivia. With this checklist, we are significantly increasing the number of reported rotifer species for Bolivia and contributing to this research area in South America.

2. Materials and Methods

To update the checklist of rotifer species in Bolivia, we conducted a comprehensive study of research published in English, French, and Spanish on rotifers in the country. The literature was searched by using keywords (rotifer AND Bolivia OR rotatoria AND Bolivia, zooplankton AND Bolivia) on multiple databases, including Web of Science, Google Scholar, and Scopus, as well as local libraries, and we gathered data from such sources and other online databases, such as the Global Biodiversity Information Facility (GBIF). A hand search, an intensive search of tables book contents, and a search of the reference lists of articles complemented our initial search. We included all studies that reported rotifers from freshwater habitats in Bolivia and compiled a list of all reported species to date.

Additionally, herein, we provide results from an analysis of samples from 207 water bodies in Bolivia (S1; Figure 1). These samples were collected during the last two decades (2005 to date). Zooplankton samples were collected and curated by the Unit of Limnology and Aquatic Resources (ULRA) at the Universidad Mayor de San Simón. The samples were collected in the limnetic zone of lakes and ponds, filtrated through a 50 µm mesh plankton net, and preserved in a 4% aqueous formalin solution. Taxonomic identification was carried out for both the two major groups of rotifers—Subclass Monogononta and Subclass Bdelloidea—using an Olympus CX30 optical microscope, following proper identification keys [12–18]. For identification, trophi of representative organisms of each sample were extracted by adding a sodium hypochlorite solution to dissolve the mastax's soft tissues. To ensure the accuracy of our species identifications, we reassessed our specimens by comparing their photographs (when available) with the most recent taxonomic resources [19–22]. From the resulting list of our observations, we excluded organisms that could not be identified at least to the genus level (except for Bdelloids), but we maintained all aff. and cf. species. Identification challenges arose due to a lack of appropriate keys and preservation issues (mostly with soft-lorica rotifers such as Bdelloidea). Valid species names, authorship, and spelling were verified and updated using the Rotifer World Catalog [23,24] according to the recent List of Available Names (LAN) of the International Commission on Zoological Nomenclature for rotifer species [23–26].

To present an overview of the sampling effort within Bolivia, a hydrological map of Bolivia, including all sampling points (both our own and those from the existing literature when geographical coordinates were provided) was made using ArcGIS 10.8.2, and it is shown below.

Finally, as the map suggested that the sampling effort was representative enough in the Altiplano basin, we constructed a species accumulation curve and extracted a Chao2 index [27] to determine if the samples captured a representative proportion of the total number of rotifer species present in the basin above using R-Project v4.3.1.

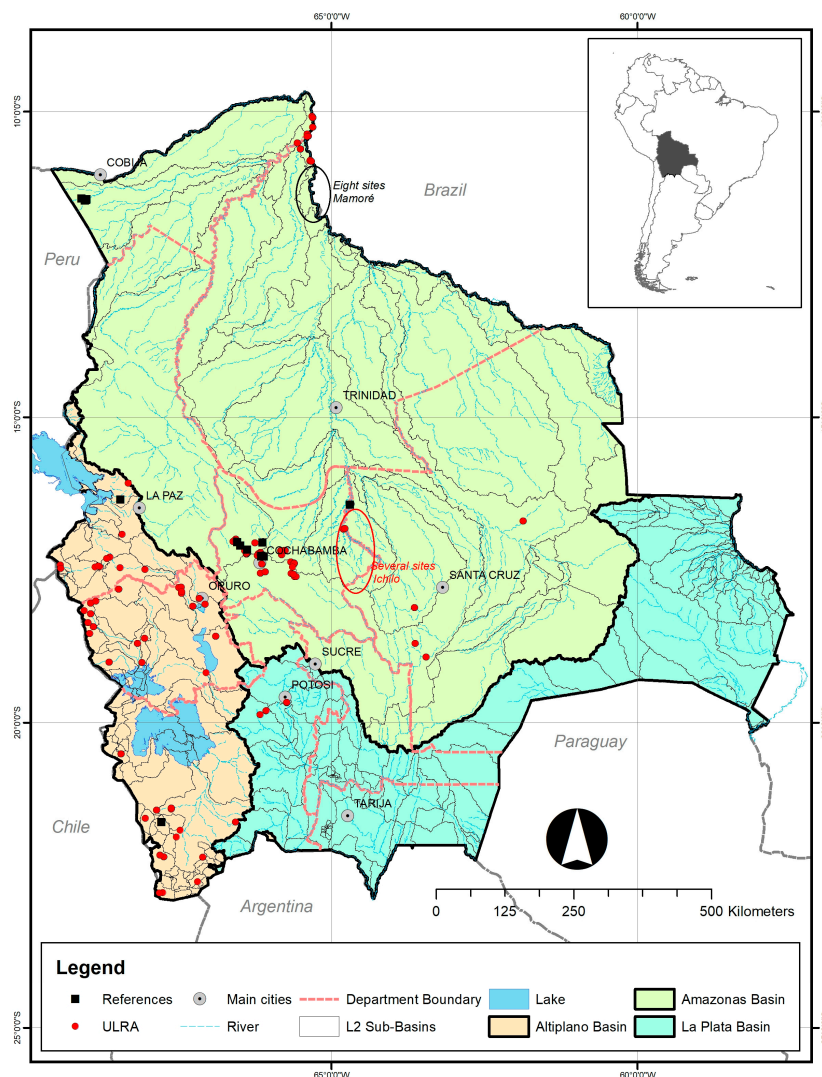


Figure 1. Hydrological map of Bolivia including the sampling points from the present study (red dots) and those from the existent literature (black dots).

3. Results

3.1. Literature Review

The literature search resulted in us retrieving eight journal articles [28–35] and three book chapters [18,36,37] that included a list of rotifer species or mentioned one or a few in their contents. Based on them, we compiled a list of 194 species belonging to 53 genera and 23 families of rotifers (Table 1, S1). The most frequently reported genera were Lecane (28 spp.), Lepadella (21 spp.), and Brachionus (12 spp.).

Table 1. Number of rotifer species in the families recorded in Bolivia according to the literature and the observations of the present study.

Subclass	Family	References 1965–2009	Own Observations	Total Spp.	Not Identified/Not Included Morphospecies	New Additions
Bdelloidea	Habrotrochidae	1	0	1	0	0
	NI *	1	1	1	9	0

Table 1. Cont.

Subclass	Family	References 1965–2009	Own Observations	Total Spp.	Not Identified/Not Included Morphospecies	New Additions
Monogononta	Asplanchnidae	3	2	3	6	0
	Brachionidae	21	38	51	8	30
	Collothecidae	1	0	1	0	0
	Conochilidae	2	1	2	1	0
	Dicranophoridae	8	1	9	0	1
	Epiphanidae	2	5	7	0	5
	Euchlanidae	6	0	6	0	0
	Flosculariidae	6	1	7	0	1
	Gastropodidae	4	1	4	6	0
	Hexarthriidae	3	3	3	12	0
	Lecanidae	28	28	43	13	15
	Lepadellidae	27	20	28	19	1
	Mytilinidae	7	6	12	1	5
	Notommatidae	19	6	19	12	0
	Philodinidae	7	0	7	0	0
	Proalidae	1	0	1	0	0
	Scardiidae	1	1	2	0	1
	Synchaetidae	10	4	10	5	0
	Testudinellidae	7	5	11	1	4
	Trichocercidae	19	18	36	1	17
Trichotriidae	3	4	5	2	2	
Trochosphaeridae	8	8	10	6	2	
TOTAL		192	153	279	102	84

* not identified.

3.2. Sample Analysis

The analyses of the ULRA collection samples resulted in the identification of 153 species (Table 1, S2) from 33 genera and 19 families of rotifers, with 84 species being reported for the first time in Bolivia. Our results increased the reported rotifer species richness of the country by 44%. The rotifer families with the highest number of new additions were Brachionidae (30 new additions), Trichocercidae (17 new additions), and Lecanidae (15 new additions; see Table 1). Many taxa were excluded from the list (102) as they were identified only at the genus level and were compiled in one entry per genus (Table 1).

The map of all sampling points (Figure 1) shows that two of Bolivia's three principal basins (the Amazon and La Plata basins) are severely undersampled, indicating that there are potentially more rotifer species in this basin that have yet to be documented. On the other hand, the species accumulation curve for the Altiplano basin started to level off, although no clear plateau was observed (Figure 2). To evaluate the adequacy of our sampling effort, for the Altiplano basin, we conducted a Chao2 analysis that provided an estimate of the total species richness, including both the observed species and those that are likely present but not detected in the samples. In our study, the Chao2 value (estimated total number of rotifer species in the Altiplano) was 116, while the observed number of species in this region was 106. This suggests that our sampling effort has captured a substantial and representative portion of the rotifer diversity of the Altiplano basin.

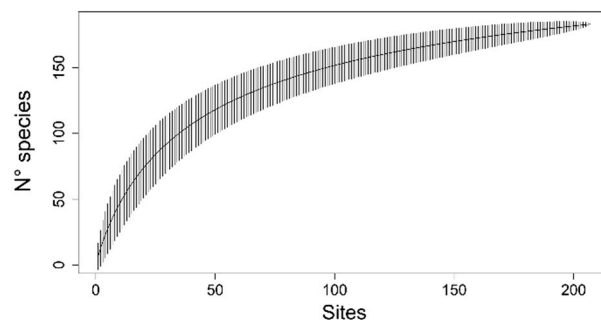


Figure 2. Accumulation curve of species from Altiplano basin.

4. Discussion

At present, Bolivian rotifer fauna remain poorly studied. Our compilation of previous studies reports over 200 rotifer species, and with the species added due to the ULRA collection samples, we are now at almost 300 recorded species for Bolivia. Still, as observed in Figure 1, the sampling areas in Bolivia are patchy, and the Amazon and La Plata basins are severely undersampled. Although published records have mainly focused on the lowland rivers and streams of the Amazon basin [29,30,32,36,37], this basin remains less known in terms of rotifer fauna, especially when considering the number of sampling points per area ratio. Lowland Amazonian rivers are known for their associated floodplain ecosystem, increasing their available habitat and rotifer niches. As such, it is plausible that rotifer diversity in this area is underestimated, as suggested by other authors [10], considering that 102 morphospecies (almost a third of the total species of Bolivia) were reported in only one Amazonian lake by Segers, Ferrufino, and de Meester [29].

Also, we should note that we only considered records made on Bolivian territory; therefore, any references from neighboring countries, such as Brazil (Amazonian basin) or Argentina (La Plata basin), where we share aquatic systems as geographical boundaries, were not included here. Several rotifer species may have been reported for these natural boundaries, which is also valid for Bolivia.

On the other hand, while few species were previously reported for the high-altitude Andes [31,33–35], our collection samples were focused on this region. Given that the area of the Altiplano basin is the smallest, the sampling effort is greater than that of the other two basins (see Figure 2), and the species record is expected to be more conclusive here, which is partially shown by the species accumulation curve made for this basin. Additionally, due to the natural low precipitation in this area [31,32], most of the scarce waterbodies to the south are saline-based, and rotifer diversity is either low or non-existent under high-salinity conditions [38]. Again, this makes us hypothesize that the sampling effort is sufficient for the Altiplano basin, and research efforts regarding rotifer diversity should be focused on the Amazon basin and, especially, the La Plata basin.

In our study, only 69 species that were mentioned earlier by other authors were found in the ULRA sample collection. The discrepancy between the number of rotifer species identified in our study and those reported in the existing literature can be attributed to several factors. Our research primarily focused on sampling sites in the Altiplano and Andean regions, whereas much of the existing literature focuses on the Amazonian region of Bolivia, known for its higher biodiversity. The absence of sampling in the Amazonian region likely contributed to the lower number of species recorded in our study. Additionally, differences in sampling effort and methodology may have played a role. Some earlier studies conducted long-term monitoring across different seasons, increasing the likelihood of detecting a wider range of species. Environmental changes over time may have also influenced species distributions, potentially leading to the absence of some species previously recorded. Lastly, taxonomic revisions and careful verification of species identifications against the latest literature may have resulted in some species being synonymized or reclassified, contributing to the observed discrepancies in species counts.

With this study, the total reported rotifer species for Bolivia increases to 279. This is similar to the records for nearby countries with more extensive territorial areas, such as Argentina (approximately 300 species [6,11,39]), and is close to the numbers of Brazil (467 species [6,11,40]), suggesting that Bolivia harbors a rich and diverse rotifer community, with many species yet to be recorded for the country. Due to limitations regarding access to proper taxonomic keys for Bolivia/South America, 68 registries from our own collections are reported as *affinis* (aff) or *confer* (cf). If we consider all those entries as misidentifications from the original species, several of those entries may be new species or at least sub-species not previously reported for Bolivia. Similar issues could apply to the 102 entries recorded as morphospecies (sp1, sp2, etc.). Still, such species were not included in our final count to focus on reporting new additions, with numbers being on the conservative side. At present, we have no means to prove either notion; however, given the considerable altitudinal gradient (more than 4500 m) and the lack of accessibility and geographical isolation of many of the sampled places, we are inclined to believe that the number of species is closer to the upper limits than the lower ones and that there is a high probability of the existence of new, endemic species not yet reported, as has happened before, for example, in the Andean aquatic systems (e.g., Segers, Meneses, and Del Castillo [28]).

The taxonomy of rotifers in South America is complex and constantly evolving. Numerous species in the region have not been thoroughly described, and debates persist regarding the taxonomic status of several common species. Recent advancements in molecular techniques, such as DNA barcoding and metabarcoding, have provided valuable in-sights into these taxonomic ambiguities, facilitating more precise species identification and diversity assessments [41]. Although the application of molecular and metabarcoding analyses in Bolivia has been limited, the potential for generating extensive datasets that are currently underrepresented in global databases is significant. This situation highlights the pressing need for taxonomic research within the country, which holds profound eco-logical, evolutionary, and societal implications. Enhanced taxonomic efforts are essential not only for understanding the ecological roles of rotifer species and informing conservation strategies but also for the effective ecological management of natural and recreational areas.

The diverse ecological landscapes of Bolivia, including the high-altitude Andean lakes and the rich Amazon basin, offer exceptional opportunities to study not only rotifer diversity but also rotifers' adaptation and evolution under varied environmental pressures. To achieve a comprehensive understanding of rotifer ecology and distribution in Bolivia, further extensive sampling, particularly in the undersampled Amazon and La Plata basins, is imperative. The integration of contemporary taxonomic and molecular methodologies is expected to uncover numerous additional species. Establishing standardized sampling protocols and developing a national database for rotifer records would greatly facilitate future research efforts.

South America hosts some of the world's most varied water resources, featuring the largest river (the Amazon), the longest mountain range (the Andes), and the driest region (the Atacama Desert) on the planet. But the conservation status of rotifers in South America is largely unknown. Many freshwater ecosystems in this region are increasingly threatened by various forms of pollution, habitat destruction, and climate change, along with other pressures [42], which could have severe implications for the region's rotifer fauna. Future studies will be crucial for informing conservation and management efforts in freshwater ecosystems, as rotifers play essential roles in nutrient cycling [1,2] and are important prey for other aquatic organisms [3]. The destruction of inland water habitats due to deforestation, mining, and agricultural activities may significantly impact the biodiversity of rotifers and other organisms. Therefore, the conservation of these ecosystems and their biodiversity should be a priority for the sustainable development of Bolivia and the broader region of South America.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/d16090589/s1>, S1: List of species of rotifers reported in Bolivia. Numbers in the column of occurrence correspond to the name cited in the original publication. S2:

List of species of Rotifers observed in samples of the Unit of Limnology and Aquatic Resources from Bolivia territory.

Author Contributions: Conceptualization, C.E.F. and M.C.; methodology, F.A., M.M. and E.G.; data analysis, C.E.F., M.C. and P.E.P.; validation and formal analysis, C.L. and P.E.P.; investigation, F.A.; data curation, G.S. and E.M.; writing—original draft preparation, C.E.F. and M.C.; writing—review and editing, P.E.P., G.S., E.M. and C.L. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Data Availability Statement: The original contributions presented in this study are included in the article/Supplementary Materials; further inquiries can be directed to the corresponding author.

Acknowledgments: The authors would like to express their sincere gratitude to Wendy Buhezo and Neshmi Salawes for their invaluable assistance with the dissection and identification of rotifers of the ULRA collection.

Conflicts of Interest: The authors declare no conflicts of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

References

- Arndt, H. Rotifers as predators on components of the microbial web (bacteria, heterotrophic flagellates, ciliates)—A review. In Proceedings of the Rotifer Symposium VI: Proceedings of the Sixth International Rotifer Symposium, Banyoles, Spain, 3–8 June 1991; pp. 231–246.
- Rejas, D.; Muylaert, K.; De Meester, L. Trophic interactions within the microbial food web in a tropical floodplain lake (Laguna Bufeos, Bolivia). *Rev. Biol. Trop.* **2005**, *53*, 85–96. [[PubMed](#)]
- Park, G.; Marshall, H. The trophic contributions of rotifers in tidal freshwater and estuarine habitats. *Estuar. Coast. Shelf Sci.* **2000**, *51*, 729–742. [[CrossRef](#)]
- Saksena, D.N. Rotifers as Indicators of Water Quality. *Acta Hydrochim. Hydrobiol.* **1987**, *15*, 481–485. [[CrossRef](#)]
- Marneffe, Y.; Comblin, S.; Thomé, J.-P. Ecological water quality assessment of the Bütgenbach lake (Belgium) and its impact on the River Warche using rotifers as bioindicators. In Proceedings of the Rotifera VIII: A Comparative Approach: Proceedings of the VIIIth International Rotifer Symposium, Collegeville, MN, USA, 22–27 June 1997; pp. 459–467.
- Aoyagui, A.S.; Bonecker, C.C. Rotifers in different environments of the Upper Paraná River floodplain (Brazil): Richness, abundance and the relationship with connectivity. *Hydrobiologia* **2004**, *522*, 281–290. [[CrossRef](#)]
- Segers, H. Global diversity of rotifers (Rotifera) in freshwater. In *Freshwater Animal Diversity Assessment*; Balian, E.V., Lévêque, C., Segers, H., Martens, K., Eds.; Springer: Dordrecht, The Netherlands, 2008; pp. 49–59.
- Jézéquel, C.; Tedesco, P.A.; Darwall, W.; Dias, M.S.; Frederico, R.G.; Hidalgo, M.; Hugueny, B.; Maldonado-Ocampo, J.; Martens, K.; Ortega, H.; et al. Freshwater fish diversity hotspots for conservation priorities in the Amazon Basin. *Conserv. Biol.* **2020**, *34*, 956–965. [[CrossRef](#)]
- Mariac, C.; Duponchelle, F.; Miranda, G.; Ramallo, C.; Wallace, R.; Tarifa, G.; Garcia-Davila, C.; Ortega, H.; Pinto, J.; Renno, J.-F. Unveiling biogeographical patterns of the ichthyofauna in the Tuichi basin, a biodiversity hotspot in the Bolivian Amazon, using environmental DNA. *PLoS ONE* **2022**, *17*, e0262357. [[CrossRef](#)]
- De Paggi, J.S.; Paggi, J.C. El zooplancton de los grandes ríos sudamericanos con planicie de inundación. *Fabriz* **2015**, *18*, 166–194. [[CrossRef](#)]
- Ferrando, N.S.; Claps, M.C. A Revised and Updated Checklist of Monogononta Rotifers from Argentina. 2016. Available online: <https://ri.conicet.gov.ar/handle/11336/23554> (accessed on 11 September 2024).
- García-Morales, A.E.; Gutiérrez, M.E. The Rotifer fauna of Guatemala and Belize: Survey and biogeographical affinities. *Rev. De Biol. Trop.* **2007**, *55*, 569–584.
- Koste, W.; De Paggi, S.J. Rotifera of the Superorder Monogononta recorded from Neotropis. *Gewässer Abwässer* **1982**, *68*, 71–102.
- Nogrady, T.; Pourriot, R.; Segers, H. Rotifera 3. Notommatidae and Scariidae. In *Guides to the Identification of the Microinvertebrates of the Continental Waters of the World 8*; Dumont, H., Nogrady, T., Eds.; SPB Academic Publishing BV: Amsterdam, The Netherlands, 1995; 248p.
- Nogrady, T.; Segers, H. Asplanchnidae, Gastropodidae, Lindiidae, Microcodidae, Synchaetidae, Trochosphaeridae and Filinia. In *Guides to the Identification of the Microinvertebrates of the Continental Waters of the World*; HJF Dumont. Kingston Ont. Canada Gent University, Belgium Backhuys Publisher: Leiden, The Netherlands, 2002; Volume 6, 264p.
- Segers, H.; Dumont, H. 102+ rotifer species (Rotifera: Monogononta) in Broa reservoir (SP, Brazil) on 26 August 1994, with the description of three new species. *Hydrobiologia* **1995**, *316*, 183–197. [[CrossRef](#)]

17. Shiel, R.; Koste, W. Rotifera from Australian inland waters. VIII: Trichocercidae (Monogononta). *Trans. R. Soc. South Aust.* **1992**, *116*, 1–27.
18. De Paggi, S.B.J.; Wallace, R.; Fontaneto, D.; Marinone, M.C. Phylum rotifera. In *Thorp and Covich's Freshwater Invertebrates*; Elsevier: Amsterdam, The Netherlands, 2020; pp. 145–200.
19. Kriska, G. Rotifers: Rotifera. In *Freshwater Invertebrates in Central Europe: A Field Guide*; Springer: Berlin/Heidelberg, Germany, 2023; pp. 55–81.
20. Sarma, S.; Jiménez-Santos, M.A.; Nandini, S. Rotifer species diversity in Mexico: An updated checklist. *Diversity* **2021**, *13*, 291. [[CrossRef](#)]
21. Segers, H. Annotated checklist of the rotifers (Phylum Rotifera), with notes on nomenclature, taxonomy and distribution. *Zootaxa* **2007**, *1564*, 1–104. [[CrossRef](#)]
22. Wilke, T.; Ahlrichs, W.H.; Bininda-Emonds, O.R. A weighted taxonomic matrix key for species of the rotifer genus Synchaeta (Rotifera, Monogononta, Synchaetidae). *ZooKeys* **2019**, *871*, 1–40. [[CrossRef](#)]
23. Jersabek, C.D.; De Smet, W.H.; Hinz, C.; Fontaneto, D.; Hussey, C.G.; Michaloudi, E.; Wallace, R.L.; Segers, H. List of Available Names in Zoology, Candidate Part Phylum Rotifera, Genus-Group Names Established before 1 January 2000. Available online: <https://archive.org/details/LANCandidatePartGeneraRotifera> (accessed on 11 September 2024).
24. Jersabek, C.D.; De Smet, W.H.; Hinz, C.; Fontaneto, D.; Hussey, C.G.; Michaloudi, E.; Wallace, R.L.; Segers, H. List of Available Names in Zoology, Candidate Part Phylum Rotifera, Species-Group Names Established before 1 January 2000. 2018. Available online: <https://archive.org/details/LANCandidatePartSpeciesRotifera> (accessed on 11 September 2024).
25. Segers, H.; De Smet, W.H.; Fischer, C.; Fontaneto, D.; Michaloudi, E.; Wallace, R.L.; Jersabek, C.D. Towards a list of available names in zoology, partim Phylum Rotifera. *Zootaxa* **2012**, *3179*, 61–68. [[CrossRef](#)]
26. International Commission on Zoological Nomenclature, I.C.Z.N. Opinion 2430—Parts of the List of Available Names in Zoology for phylum Rotifera: Accepted. *Bull. Zool. Nomencl.* **2019**, *76*, 74–76.
27. Chiu, C.-H.; Wang, Y.-T.; Walther, B.A.; Chao, A. An improved nonparametric lower bound of species richness via a modified good–turing frequency formula. *Biometrics* **2014**, *70*, 671–682. [[CrossRef](#)]
28. Segers, H.; Meneses, L.; Del Castillo, M. Rotifera (Monogononta) from Lake Kothia, a high-altitude lake in the Bolivian Andes. *Arch. Für Hydrobiol.* **1994**, *132*, 227–236.
29. Segers, H.; Ferrufino, N.L.; de Meester, L. Diversity and Zoogeography of Rotifera (Monogononta) in a Flood Plain Lake of the Ichilo River, Bolivia, with Notes on Little-Known Species. *Int. Rev. Hydrobiol.* **1998**, *83*, 439–448. [[CrossRef](#)]
30. Rejas, D.; de Meester, L.; Ferrufino, L.; Maldonado, M.; Ollevier, F. Diel vertical migration of zooplankton in an Amazonian várzea lake (Laguna Bufeos, Bolivia). *Stud. Neotrop. Fauna Environ.* **2007**, *42*, 71–81. [[CrossRef](#)]
31. Iltis, A.; Risacher, F.; Servant Vildary, S. Contribution à l'étude hydrobiologique des lacs salés du sud de l'Altiplano bolivien. 1984. Available online: <https://agris.fao.org/search/en/providers/122415/records/647368cc2c1d629bc980712f> (accessed on 11 September 2024).
32. Acosta, F. Caracterización del zooplancton de lagunas en la llanura inundable del río Ichilo (Cochabamba-Bolivia). *Rev. Bolív. De Ecol.* **2005**, *17*, 1–14.
33. Aguilera, X.; Crespo, G.; Declerck, S.; De Meester, L. Diel vertical migration of zooplankton in tropical high mountain lakes (Andes, Bolivia). *Pol. J. Ecol.* **2006**, *3*, 453–464.
34. Pinto, J. Distribución del zooplancton en la parte boliviana del lago. In *El Lago Titicaca: Síntesis Del Conoc. Limnológico Actual*; Hisbol-ORSTOM: La Paz, Bolivia, 1991; pp. 277–283.
35. Uéno, M. Zooplankton of Lake Titicaca on the Bolivian side. *Hydrobiologia* **1967**, *29*, 547–568. [[CrossRef](#)]
36. Barbosa, F.V.V. *A Biological Assessment of the Aquatic Ecosystems of the Upper Río Orthon Basin, Pando, Bolivia*; Conservation International: Washington, DC, USA, 1999.
37. Ibañez, C.; Paggi, J.C.; Molina, C.; Pinto, J.; Koste, W. Zooplankton de las lagunas. In *Diversidad Biológica en la Llanura de Inundación del Río Mamoré. Importancia Ecológica de la Dinámica Fluvial*; Pouilly, M., Beek, S.G., Moraes, M., Ibañez, C., Eds.; Centro de Ecología Simón I. Patiño: Santa Cruz, Bolivia, 2004.
38. Williams, W.D.; Carrick, T.R.; Bayly, I.A.E.; Green, J.; Herbst, D.B. Invertebrates in salt lakes of the Bolivian Altiplano. *Int. J. Salt Lake Res.* **1995**, *4*, 65–77. [[CrossRef](#)]
39. De Paggi, J. Ecological and biogeographical remarks on the rotifer fauna of Argentina. *Rev. Hydrobiol. Trop* **1990**, *23*, 297–311.
40. Martínez, J.C.C.; Canesin, A.; Bonecker, C.C. Species composition of rotifers in different habitats of an artificial lake, Mato Grosso do Sul State, Brazil. *Acta Sci.* **2000**, *22*, 343–346.
41. Sørensen, M.V.; Giribet, G. A modern approach to rotiferan phylogeny: Combining morphological and molecular data. *Mol. Phylogenetics Evol.* **2006**, *40*, 585–608. [[CrossRef](#)]
42. Oyedotun, T.D.T.; Ally, N. Environmental issues and challenges confronting surface waters in South America: A review. *Environ. Chall.* **2021**, *3*, 100049. [[CrossRef](#)]

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.