



Review

Inventory of Metazoan Parasites Associated with Anostomids in South America

Wallas Benevides Barbosa de Sousa ^{1,2} , Maria Fernanda Barros Gouveia Diniz ^{2,*} and Fabio Hideki Yamada ²

¹ Programa de Pós-Graduação em Ciências Biológicas (PPGCB), Universidade Federal da Paraíba (UFPB), João Pessoa CEP 58059-900, PB, Brazil; wallas.benevides@urca.br

² Laboratório de Ecologia Parasitária (LABEP), Programa de Pós-Graduação em Diversidade Biológica e Recursos Naturais (PPGDR), Universidade Regional do Cariri (URCA), Crato CEP 63105-000, CE, Brazil; fabio.yamada@urca.br

* Correspondence: fernanda.gouveia@urca.br

Abstract

Anostomidae is one of the most diverse families within the order Characiformes and is widely distributed across the river basins of the Neotropical region. Anostomids are known to host a rich diversity of metazoan parasites, including ectoparasites, such as monopisthocotylans, and endoparasites, such as nematodes, cestodes, and digeneans. The present study aims to develop an inventory of metazoan parasites recorded in fish of the Anostomidae family. A bibliographic review of metazoan parasite species in anostomids was conducted, using searches in different databases. This bibliographic review was complemented with information from books and book chapters on ictioparasitology. The data were compiled until January 2025. Based on the review, 191 taxa (126 are described at the species level and 65 were identified only to the genus level or higher taxonomic categories) of metazoan parasites associated with anostomid fishes were found. Monopisthocotyla and Nematoda were the taxonomic groups with the most parasitic associations at the species level, with 31 and 30 species, respectively. This study presents a comprehensive and updated inventory of metazoan parasites associated with fish from the family Anostomidae, covering over 170 years of research (1850–2025). This survey highlights the importance of anostomids as hosts for a rich parasitic fauna.

Keywords: Anostomidae; checklist of species; Digenea; fish; *Leporinus*; Monopisthocotyla; Nematoda

1. Introduction

Anostomidae is one of the most diverse families within the order Characiformes and is widely distributed across the river basins of the Neotropical region [1–3]. These fish play important ecological roles, such as nutrient cycling and the control of aquatic vegetation, due to their predominantly detritivorous and herbivorous feeding habits [1,4,5]. In addition to their ecological relevance, anostomids are known to host a rich diversity of metazoan parasites, including ectoparasites, such as monopisthocotylans, and endoparasites, such as nematodes, cestodes, and digeneans [6,7]. The relationship between these hosts and their parasites reflects the complexity of ecological interactions in aquatic ecosystems and can provide valuable insights into the biogeography and evolution of these organisms [8–12].

The diversity of parasites found in species of the Anostomidae family reflects both the wide distribution of these fish and their exposure to various habitats and environmental



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interactions, which facilitates colonization by specific parasites [13]. This phenomenon has been extensively documented in studies of the parasitofauna of Neotropical fish, where monopisthocotylans, digeneans, and nematodes emerge as the most frequently encountered parasitic groups [6,7,14,15].

Despite the wealth of data accumulated over the past few decades on parasites of fish in the Anostomidae family, much of the information remains fragmented and scattered in the scientific literature [6,7,13]. Although several studies have described new parasites and recorded their associations with different host species [14–20], the lack of a comprehensive and systematic compilation hinders a complete understanding of the diversity and parasitic interactions within this fish family [13]. In light of this knowledge gap and the growing relevance of studies on parasites and their interactions with hosts, the present study aims to develop an inventory of metazoan parasites recorded in fish of the Anostomidae family.

2. Materials and Methods

A bibliographic review of metazoan parasite species in anostomids was conducted, using searches in different databases (SciELO, Scopus, Science Direct, Lilacs, Periódico Capes, and ResearchGate) through Google Scholar. The following keywords were used: Anostomidae, helminth parasite, *Hypomastix*, ictioparasitology, *Leporellus*, *Leporinus*, *Megaleporinus*. Metazoan parasites, *Rhytiodus*, and *Schizodon*. Among the various genera of Anostomidae occurring in Brazil, only the five mentioned above have available data regarding their parasitic fauna. This bibliographic review was complemented with information from books and book chapters on ictioparasitology. The data were compiled until January 2025. The systematic classification used for metazoan parasite species was based on WoRMS [21], and the classification of anostomid fishes was based on Froese & Pauly [2].

The distribution of parasitic associations was mapped using metadata from studies on anostomid parasites in South America. For the map's creation, all studies containing precise geographic coordinates were selected. The map was generated using QGIS Desktop 3.28.2 [22], based on data from the metadata catalog of the Agência Nacional de Águas [23].

3. Results

This study presents a comprehensive and updated inventory of metazoan parasites associated with fish from the family Anostomidae, covering over 170 years of research (1850–2025). Based on the review, 191 taxa (126 are described at the species level; and 65 were identified only to the genus level or higher taxonomic categories) of metazoan parasites associated with anostomid fishes were found, belonging to the following taxonomic groups: Myxozoa, Monopisthocotyla, Digenea, Aspidogastriidae, Cestoda, Nematoda, Acanthocephala, Branchiura, Copepoda, Isopoda, and Mollusca.

Monopisthocotyla and Nematoda were the taxonomic groups with the most parasitic associations, with 45 (31 are described at the species level) and 48 (30 are described at the species level), respectively. Together, they represent more than 48% of the total number of species recorded for the Anostomidae family. The species *Procamallanus* (*Spirocamallanus*) *inopinatus* Travassos, Artigas & Pereira, 1929 stood out as the parasite species with the highest number of records in hosts from the Anostomidae family, being found in 20 different fish species from this family (Table 1).

Table 1. List of metazoan parasites associated with anostomids in South America (1850–2025).

Parasite	Host	Localities	Reference
Myxozoa			
<i>Ceratomyxa affinis</i> Reis, Carvalho, Ferreira, Morais, Souza, Araujo & Videira, 2025	<i>Leporinus affinis</i>	Amazon River Basin, Brazil	[24]
<i>Ceratomyxa anomala</i> Müller, Atkinson, Bartholomew & Adriano, 2025	<i>Schizodon fasciatus</i>	Amazon River Basin, Brazil	[25]
<i>Ceratomyxa deformis</i> Müller, Atkinson, Bartholomew & Adriano, 2025	<i>Schizodon fasciatus</i>	Amazon River Basin, Brazil	[25]
<i>Myxidium ceccarelli</i> Adriano, Silva, Atkinson, Bartholomew & Maia, 2014	<i>Megaleporinus elongatus</i>	São Francisco River Basin, Brazil	[26]
<i>Henneguya azevedoi</i> Barassa, Adriano, Cordeiro, Arana & Ceccarelli, 2012	<i>Megaleporinus obtusidens</i>	Paraná River Basin, Brazil	[27]
<i>Henneguya caudicula</i> Eiras, Takemoto & Pavanelli, 2008	<i>Leporinus lacustris</i>	Paraná River Basin, Brazil	[14,28]
<i>Henneguya friderici</i> Casal, Matos & Azevedo, 2003	<i>Leporinus friderici</i>	Western Northeast Atlantic Basin; Paraná River Basin, Brazil	[29,30]
<i>Henneguya leporini</i> Nemeček, 1926	<i>Hypomasticus mormyrops</i>	Amazon River Basin, Brazil	[31,32]
<i>Henneguya leporinicola</i> Martins, Souza, Moraes & Moraes, 1999	<i>Megaleporinus macrocephalus</i>	Paraná River Basin, Brazil	[33,34]
<i>Henneguya paranaensis</i> Eiras, Pavanelli & Takemoto, 2004	<i>Schizodon borellii</i>	Paraná River Basin, Brazil	[35]
<i>Henneguya schizodon</i> Eiras, Malta, Varela & Pavanelli, 2004	<i>Schizodon corti</i>	Amazon River Basin, Brazil	[36]
<i>Henneguya visibilis</i> Moreira, Adriano, Silva, Ceccarelli & Maia, 2014	<i>Megaleporinus obtusidens</i>	Paraná River Basin, Brazil	[37]
<i>Henneguya</i> sp.	<i>Hypomasticus copelandii</i> ; <i>Leporinus fasciatus</i> ; <i>Leporinus piau</i> ; <i>Megaleporinus conirostris</i> ; <i>Leporinus friderici</i> ; <i>Megaleporinus obtusidens</i> ; <i>Schizodon borellii</i>	Eastern Northeast Atlantic Basin, Brazil; Paraná River Basin, Brazil; Parnaíba River, Brazil; Southeast Atlantic Basin, Brazil	[15,17,38–40]
<i>Myxobolus associatus</i> Nemeček, 1926	<i>Hypomasticus mormyrops</i>	Amazon River Basin, Brazil	[31,32]

Table 1. Cont.

Parasite	Host	Localities	Reference
Monogenea			
Monogenea fam. gen. sp.	<i>Leporellus vittatus</i> ; <i>Megaleporinus macrocephalus</i> ; <i>Schizodon borellii</i> ; <i>Schizodon knerii</i> ; <i>Schizodon nasutus</i>	Paraná River Basin, Brazil	[14,41–43]
Dactylogyridae fam. gen. sp.	<i>Hypomasticus copelandii</i> ; <i>Leporinus friderici</i> ; <i>Leporinus octofasciatus</i> ; <i>Leporinus piau</i> ; <i>Megaleporinus macrocephalus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Schizodon borellii</i> ; <i>Schizodon borellii</i>	Amazon River Basin, Brazil; Eastern Northeast Atlantic Basin, Brazil; Paraná River Basin, Brazil; South Atlantic Basin, Brazil	[15,17,19,44–48]
<i>Amphithecium</i> sp.	<i>Schizodon borellii</i>	Paraná River Basin, Brazil	[14]
<i>Anacanthorus penilabiatus</i> Boeger, Husak & Martins, 1995	<i>Megaleporinus macrocephalus</i>	Paraná River Basin, Brazil	[49]
Ancyrocephalinae gen. sp.	<i>Leporinus friderici</i> ; <i>Schizodon borellii</i> ; <i>Leporinus lacustris</i>	Paraná River Basin, Brazil	[14,50]
<i>Annulotrematoides</i> sp.	<i>Schizodon borellii</i>	Paraná River Basin, Brazil	[14]
<i>Apedunculata</i> sp.	<i>Schizodon borellii</i>	Paraná River Basin, Brazil	[14]
<i>Cleidodiscus</i> sp.	<i>Leporinus friderici</i> ; <i>Leporinus lacustris</i> ; <i>Megaleporinus obtusidens</i> ; <i>Megaleporinus piavussu</i>	Paraná River Basin, Brazil	[14,42,51]
<i>Demidospermus paravalenciennesi</i> Gutiérrez & Suriano, 1992	<i>Leporinus friderici</i>	Paraná River Basin, Brazil	[52]
<i>Jainus Amazon Riverensis</i> Kritsky, Thatcher & Kayton, 1980	<i>Leporinus friderici</i>	Paraná River Basin, Brazil	[52]
<i>Jainus beccus</i> Yamada, Müller, Zago, Yamada, Ebert, Franceschini & Silva, 2023	<i>Leporinus friderici</i> ; <i>Leporinus octofasciatus</i> ; <i>Leporinus piau</i> ; <i>Leporinus striatus</i> ; <i>Megaleporinus elongatus</i>	Eastern Northeast Atlantic Basin, Brazil; Paraná River Basin, Brazil	[15,17,20]
<i>Jainus leporini</i> Abdallah, Azevedo & Luque, 2012	<i>Hypomasticus copelandii</i> ; <i>Leporinus friderici</i> ; <i>Megaleporinus macrocephalus</i>	Amazon River Basin, Brazil; Paraná River Basin, Brazil; Southeast Atlantic Basin, Brazil	[52–55]
<i>Jainus ornatus</i> Yamada, Müller, Zago, Yamada, Ebert, Franceschini & Silva, 2023	<i>Leporinus friderici</i>	Paraná River Basin, Brazil	[20]
<i>Jainus piava</i> Karling, Bellay, Takemoto & Pavanelli, 2011	<i>Leporinus friderici</i> ; <i>Megaleporinus obtusidens</i> ; <i>Schizodon borellii</i> ; <i>Schizodon nasutus</i>	Paraná River Basin, Brazil; South Atlantic Basin, Brazil	[14,19,20,47,48,56,57]
<i>Jainus radixelongatus</i> Yamada, Müller, Zago, Yamada, Ebert, Franceschini & Silva, 2023	<i>Leporinus friderici</i> ; <i>Leporinus octofasciatus</i> ; <i>Leporinus piau</i> ; <i>Leporinus striatus</i> ; <i>Megaleporinus elongatus</i>	Eastern Northeast Atlantic Basin, Brazil; Paraná River Basin, Brazil	[15,20]

Table 1. Cont.

Parasite	Host	Localities	Reference
<i>Jainus</i> sp.	<i>Hypomasticus copelandii</i> ; <i>Leporellus vittatus</i> ; <i>Leporinus friderici</i> ; <i>Leporinus lacustris</i> ; <i>Megaleporinus elongatus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Megaleporinus piavussu</i> <i>Schizodon borellii</i>	Paraná River Basin, Brazil; Southeast Atlantic Basin, Brazil	[14,39,42,47,50,51,57,58]
<i>Kritskyia eirasi</i> Guidelli, Takemoto & Pavanelli, 2003	<i>Leporinus friderici</i> ; <i>Leporinus lacustris</i> ; <i>Megaleporinus macrocephalus</i> ; <i>Megaleporinus obtusidens</i> <i>Megaleporinus elongatus</i> ; <i>Megaleporinus obtusidens</i> ;	Amazon River Basin, Brazil; Paraná River Basin, Brazil South Atlantic Basin, Brazil	[14,32,35,42,46,48,50,51]
<i>Kritskyia</i> sp.	<i>Megaleporinus piavussu</i> <i>Schizodon borellii</i>	Paraná River Basin, Brazil	[14,42,51]
<i>Mymarothecioides</i> sp.	<i>Leporinus agassizii</i> ; <i>Leporinus friderici</i> ; <i>Leporinus lacustris</i> ; <i>Megaleporinus elongatus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Megaleporinus piavussu</i> ; <i>Rhytidus argenteofuscus</i> ; <i>Schizodon altoparanae</i> ; <i>Schizodon borellii</i> ; <i>Schizodon corti</i> ; <i>Schizodon</i> sp.	Paraná River Basin, Brazil	[19]
<i>Rhinoxenus arietinus</i> Kritsky, Boeger & Thatcher, 1988	<i>Leporinus agassizii</i>	Amazon River Basin, Brazil; Paraná River Basin, Brazil; South Atlantic Basin, Brazil	[14,19,32,42,48,50–52,59,60]
<i>Rhinoxenus euryxenus</i> Domingues & Boeger, 2005	<i>Leporinus agassizii</i> ; <i>Schizodon corti</i> ; <i>Schizodon</i> sp.	Amazon River Basin, Brazil; Paraná River Basin, Brazil	[32,60]
<i>Rhinoxenus nyttus</i> Kritsky, Boeger & Thatcher, 1988	<i>Megaleporinus macrocephalus</i>	Amazon River Basin, Brazil; Paraná River Basin, Brazil	[32,59,60]
<i>Rhinoxenus</i> sp.	<i>Leporinus amblyrhynchus</i> ; <i>Leporinus friderici</i> ; <i>Leporinus piau</i> ; <i>Megaleporinus elongatus</i>	Paraná River Basin, Brazil	[14,42]
<i>Tereancistrum flabellum</i> Zago, Yamada, Franceschini, Bongiovani, Yamada & Da Silva, 2017	<i>Leporinus piau</i> ; <i>Megaleporinus macrocephalus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Schizodon borellii</i> ; <i>Schizodon intermedius</i>	Eastern Northeast Atlantic Basin, Brazil; Paraná River Basin, Brazil	[15,61]
<i>Tereancistrum paranaensis</i> Karling, Lopes, Takemoto & Pavanelli, 2014	<i>Leporinus fasciatus</i> ; <i>Leporinus friderici</i> ; <i>Leporinus lacustris</i> ; <i>Leporinus piau</i> ; <i>Megaleporinus elongatus</i> ; <i>Megaleporinus macrocephalus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Megaleporinus piavussu</i> ; <i>Schizodon borellii</i> ; <i>Schizodon nasutus</i>	Amazon River Basin, Brazil; Eastern Northeast Atlantic Basin, Brazil; Paraná River Basin, Brazil; South Atlantic Basin, Brazil	[14,15,17,19,35,46,48,62–64]
<i>Tereancistrum parvus</i> Kritsky, Thatcher & Kayton, 1980	<i>Leporinus friderici</i> ; <i>Leporinus lacustris</i> ; <i>Megaleporinus elongatus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Megaleporinus piavussu</i> ; <i>Schizodon borellii</i>	Amazon River Basin, Brazil; Eastern Northeast Atlantic Basin, Brazil; Paraná River Basin, Brazil; South Atlantic Basin, Brazil	[14,15,17,19,32,42,46,48,50,51,54,55,57,61–63,65]
<i>Tereancistrum</i> sp.	<i>Leporinus friderici</i> ; <i>Leporinus lacustris</i> ; <i>Megaleporinus elongatus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Megaleporinus piavussu</i> ; <i>Schizodon borellii</i>	Amazon River Basin, Brazil; Paraná River Basin, Brazil; South Atlantic Basin, Brazil	[14,42,47,50,51,54,57,58]

Table 1. Cont.

Parasite	Host	Localities	Reference
<i>Trinibaculum rotundus</i> Karling, Lopes, Takemoto & Pavanelli, 2011	<i>Schizodon borellii</i>	Paraná River Basin, Brazil	[14,35,66]
<i>Trinibaculum</i> sp.	<i>Schizodon borellii</i>	Paraná River Basin, Brazil	[14]
<i>Urocleidoides aimarai</i> Moreira, Scholz & Luque, 2015	<i>Leporinus friderici</i>	Paraná River Basin, Brazil	[52]
<i>Urocleidoides amapaensis</i> Santos Neto, Domingues, Oliveira & Soares, 2025	<i>Schizodon fasciatus</i>	Amazon River Basin, Brazil	[67]
<i>Urocleidoides cuiabai</i> Rosim, Mendoza-Franco & Luque, 2011	<i>Leporinus friderici</i>	Paraná River Basin, Brazil	[52]
<i>Urocleidoides digitabulum</i> Zago, Yamada, De Oliveira Fadel Yamada, Franceschini, Bongiovani & da Silva, 2020	<i>Leporinus friderici</i> ; <i>Leporinus octofasciatus</i> ; <i>Leporinus piau</i> ; <i>Megaleporinus elongatus</i>	Eastern Northeast Atlantic Basin, Brazil; Paraná River Basin, Brazil	[15,18]
<i>Urocleidoides eremitus</i> Kritsky, Thatcher & Boeger, 1986	<i>Leporinus friderici</i> ; <i>Megaleporinus macrocephalus</i>	Amazon River Basin, Brazil; Paraná River Basin, Brazil	[46,52,55]
<i>Urocleidoides falxus</i> Zago, Yamada, De Oliveira Fadel Yamada, Franceschini, Bongiovani & da Silva, 2020	<i>Megaleporinus elongatus</i>	Paraná River Basin, Brazil	[18]
<i>Urocleidoides itabocaensis</i> Santos-Neto & Domingues, 2024	<i>Pseudanos trimaculatus</i>	Tocantins-Araguaia Basin, Brazil	[68]
<i>Urocleidoides jariensis</i> Oliveira, Santos-Neto, Tavares-Dias & Domingues, 2020	<i>Schizodon corti</i>	Amazon River Basin, Brazil	[69]
<i>Urocleidoides omphalocleithrum</i> Santos-Neto & Domingues, 2024	<i>Pseudanos trimaculatus</i>	Tocantins-Araguaia Basin, Brazil	[68]
<i>Urocleidoides paradoxus</i> Kritsky, Thatcher & Boeger, 1986	<i>Leporinus friderici</i> ; <i>Leporinus lacustris</i> ; <i>Leporinus piau</i> ; <i>Megaleporinus elongatus</i> ; <i>Megaleporinus macrocephalus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Megaleporinus piavoussu</i> ; <i>Rhytiodus microlepis</i> ; <i>Schizodon borellii</i>	Amazon River Basin, Brazil; Eastern Northeast Atlantic Basin, Brazil; Paraná River Basin, Brazil; South Atlantic Basin, Brazil	[14,15,17,19,32,42,46,48,50–52,54,55,69–71]

Table 1. Cont.

Parasite	Host	Localities	Reference
<i>Urocleidoides ramentacuminatus</i> Oliveira, Santos-Neto, Tavares-Dias & Domingues, 2020	<i>Laemolyta proxima</i> ; <i>Schizodon corti</i> ; <i>Schizodon borellii</i>	Amazon River Basin, Brazil; Paraná River Basin, Brazil	[19,69]
<i>Urocleidoides sapucaiensis</i> Zago, Yamada, De Oliveira Fadel Yamada, Franceschini, Bongiovani & da Silva, 2020	<i>Megaleporinus elongatus</i>	Paraná River Basin, Brazil	[18]
<i>Urocleidoides sinus</i> Zago, Yamada, De Oliveira Fadel Yamada, Franceschini, Bongiovani & da Silva, 2020	<i>Leporinus striatus</i> ; <i>Schizodon intermedius</i> ; <i>Schizodon nasutus</i>	Paraná River Basin, Brazil	[18]
<i>Urocleidoides solarivaginatus</i> Zago, Yamada, De Oliveira Fadel Yamada, Franceschini, Bongiovani & da Silva, 2020	<i>Leporinus friderici</i> ; <i>Leporinus octofasciatus</i> ; <i>Leporinus striatus</i>	Paraná River Basin, Brazil	[18]
<i>Urocleidoides</i> sp.	<i>Leporinus friderici</i> ; <i>Leporinus lacustris</i> ; <i>Leporinus piau</i> ; <i>Megaleporinus elongatus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Megaleporinus piavussu</i> ; <i>Schizodon borellii</i> ;	Amazon River Basin, Brazil; Eastern Northeast Atlantic Basin, Brazil; Paraná River Basin, Brazil; South Atlantic Basin, Brazil	[14,15,17,42,47,48,50–52,54,57,58]
<i>Scleroductus yuncensi</i> Jara & Cone, 1989	<i>Hypomasticus copelandii</i>	Southeast Atlantic Basin	[39]
<i>Microcotyle</i> sp.	<i>Megaleporinus macrocephalus</i>	Amazon River Basin, Brazil	[46]
Digenea			
Digenea fam. gen. sp.	<i>Leporinus friderici</i> ; <i>Megaleporinus macrocephalus</i>	Amazon River Basin, Brazil; Paraná River Basin, Brazil	[17,42,47,57]
<i>Sanguinicola</i> sp.	<i>Megaleporinus obtusidens</i> ; <i>Megaleporinus piavussu</i>	Paraná River Basin, Brazil	[17,43]
<i>Clinostomum complanatum</i> (Rudolphi, 1814; Braun, 1899)	<i>Leporinus lacustris</i>	Paraná River Basin, Brazil	[42,50,51]
<i>Clinostomum marginatum</i> (Rudolphi, 1819; Braun, 1899)	<i>Leporinus friderici</i>	Amazon River Basin, Brazil	[54]
<i>Clinostomum</i> sp.	<i>Schizodon borellii</i>	Paraná River Basin, Brazil	[42,58,72,73]
<i>Ithyoclinostomum dimorphum</i> (Diesing, 1850; Witenberg, 1925)	<i>Schizodon borellii</i> ; <i>Schizodon corti</i>	Paraná River Basin, Brazil	[42,58,72–74]
<i>Austrodiplostomum compactum</i> (Lutz, 1928; Dubois, 1970)	<i>Leporinus amblyrhynchus</i> ; <i>Leporinus piau</i> ; <i>Schizodon borellii</i> ; <i>Schizodon intermedius</i> ; <i>Schizodon nasutus</i>	Eastern Northeast Atlantic Basin, Brazil; Paraná River Basin, Brazil	[14,15,17,19,42,75–77]
<i>Diplostomum lunaschiae</i> Locke, Drago, Núñez, Rangel e Souza & Takemoto, 2020	<i>Leporinus piau</i>	Eastern Northeast Atlantic Basin, Brazil	[15,16,78]

Table 1. Cont.

Parasite	Host	Localities	Reference
<i>Diplostomum</i> sp.	<i>Leporinus friderici</i> ; <i>Schizodon borellii</i>	Paraná River Basin, Brazil	[14,42,50,51,58,72,73]
<i>Neodiplostomum</i> sp.	<i>Megaleporinus obtusidens</i> ; <i>Megaleporinus piavussu</i>	Paraná River Basin, Brazil	[14,42,51]
<i>Tylodelphys</i> sp.	<i>Leporinus lacustris</i>	Paraná River Basin, Brazil	[14,42,50,51]
Diplostomidae gen. sp.	<i>Leporinus friderici</i> ; <i>Megaleporinus obtusidens</i> ; <i>Megaleporinus piavussu</i>	Paraná River Basin, Brazil	[14,43,57]
<i>Cystodiplostomum</i> sp.	<i>Leporinus lacustris</i>	Paraná River Basin, Brazil	[14,42,50,51]
<i>Herpetodiplostomum</i> sp.	<i>Leporinus friderici</i> ; <i>Leporinus lacustris</i> ; <i>Megaleporinus elongatus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Megaleporinus piavussu</i>	Paraná River Basin, Brazil	[14,42,50,51]
Strigeidae gen. sp.	<i>Hypomasticus copelandii</i> ; <i>Leporinus octofasciatus</i>	Paraná River Basin, Brazil	[44,79]
<i>Creptotrema creptotrema</i> Travassos, Artigas & Pereira, 1928	<i>Leporellus vittatus</i> ; <i>Leporinus friderici</i> ; <i>Leporinus</i> sp.; <i>Megaleporinus conirostris</i> ; <i>Megaleporinus elongatus</i> ; <i>Megaleporinus obtusidens</i>	Paraná River Basin, Argentina; Amazon River Basin, Brazil; Paraná River Basin, Brazil; Southeast Atlantic Basin	[14,32,39,42,50,51,79–83]
<i>Creptotrema lynchi</i> Brooks, 1976	<i>Hypomasticus copelandii</i> ; <i>Leporinus octofasciatus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Megaleporinus piavussu</i>	Paraná River Basin, Argentina; Amazon River Basin, Brazil; Paraná River Basin, Brazil; South Atlantic Basin, Brazil	[14,32,42,44,48,51,79,83,84]
<i>Creptotrema</i> sp.	<i>Hypomasticus copelandii</i> ; <i>Leporinus lacustris</i>	Paraná River Basin, Brazil	[14,42,50,51,79]
<i>Prosthenthystera obesa</i> (Diesing, 1850)	<i>Hypomasticus copelandii</i> ; <i>Laemolyta taeniata</i> ; <i>Leporellus vittatus</i> ; <i>Leporinus friderici</i> ; <i>Leporinus</i> sp.; <i>Megaleporinus macrocephalus</i> ; <i>Megaleporinus reinhardti</i> ; <i>Pseudanos trimaculatus</i>	Amazon River Basin, Brazil; Paraná River Basin, Brazil; São Francisco River Basin, Brazil; Tocantins-Araguaia Basin, Brazil	[32,46,74,79–81,85–89]
<i>Pseudocladorchis nephrodorchis</i> Daday, 1907	<i>Laemolyta taeniata</i>	Amazon River Basin, Brazil	[74]
<i>Dadaytrema oxycephalum</i> (Diesing, 1850; Vaz, 1932)	<i>Leporinus</i> sp.	Amazon River Basin, Brazil	[74]
<i>Genarchella astyanactis</i> (Watson, 1976; Scholz, Vargas-Vazquez & Salgado-Maldonado, 1995)	<i>Megaleporinus elongatus</i> ; <i>Megaleporinus obtusidens</i>	Paraná River Basin, Brazil	[14,43]
<i>Genarchella genarchella</i> Travassos, Artigas & Pereira, 1928	<i>Leporinus friderici</i> ; <i>Megaleporinus obtusidens</i>	Paraná River Basin, Argentina; Paraná River Basin, Brazil; Tocantins-Araguaia Basin, Brazil	[48,89,90]
<i>Genarchella parva</i> Travassos, Artigas & Pereira, 1928	<i>Megaleporinus obtusidens</i>	Paraná River Basin, Argentina	[90]

Table 1. Cont.

Parasite	Host	Localities	Reference
Echinostomatidae gen. sp.	<i>Leporinus friderici</i>	Paraná River Basin, Brazil	[14,42,50,51]
<i>Phyllodistomum</i> sp.	<i>Laemolyta taeniata</i>	Amazon River Basin, Brazil	[74]
<i>Chalcinotrema lucieni</i> Brooks, 1977	<i>Megaleporinus muyscorum</i>	Amazon River Basin, Brazil; Magdalena River Basin, Colombia	[32,91]
<i>Chalcinotrema platense</i> (Lunaschi, 1984; Overstreet & Curran, 2005)	<i>Schizodon borellii</i>	Paraná River Basin, Brazil	[14,42,58,72,73]
<i>Chalcinotrema thatcheri</i> Kohn, Fernandes & Gibson, 1999	<i>Leporinus lacustris</i> ; <i>Schizodon knerii</i> ; <i>Schizodon nasutus</i>	Paraná River Basin, Brazil	[14,42,50,51,92]
<i>Megacoelium plecostomi</i> Szidat, 1954	<i>Schizodon borelli</i>	Paraná River Basin, Brazil	[93]
<i>Megacoelium</i> sp.	<i>Megaleporinus piavussu</i> ; <i>Megaleporinus obtusidens</i>	Paraná River Basin, Brazil	[14,42,51]
<i>Paralecithobothrys brasiliensis</i> Freitas, 1947	<i>Leporinus friderici</i> ; <i>Leporinus</i> sp.; <i>Megaleporinus elongatus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Megaleporinus piavussu</i> ; <i>Schizodon borellii</i> ; <i>Schizodon knerii</i> ; <i>Schizodon nasutus</i>	Amazon River Basin, Brazil; Paraná River Basin, Brazil	[14,32,42,50,51,58,72,73,79,81,93,94]
<i>Saccocoeloides magniovatatus</i> Szidat, 1954	<i>Megaleporinus elongatus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Schizodon borelli</i>	Amazon River Basin, Brazil; Paraná River Basin, Brazil	[14,42,50,51,93]
<i>Saccocoeloides magnus</i> Szidat, 1954	<i>Leporinus lacustris</i> ; <i>Megaleporinus elongatus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Schizodon knerii</i> ; <i>Schizodon nasutus</i>	Paraná River Basin, Brazil	[14,42,50,51]
<i>Saccocoeloides nanii</i> Szidat, 1954	<i>Megaleporinus obtusidens</i>	South Atlantic Basin, Brazil	[48]
<i>Saccocoeloides saccodontis</i> Thatcher, 1978	<i>Leporellus vittatus</i> ; <i>Leporinus friderici</i> ; <i>Megaleporinus elongatus</i>	Magdalena Basin, Colombia; Amazon River Basin, Brazil; Paraná River Basin, Brazil	[17,32,42,50,51,95]
<i>Saccocoeloides szidati</i> Travassos, Freitas & Kohn, 1969	<i>Leporinus friderici</i> ; <i>Megaleporinus elongatus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Schizodon corti</i>	Paraná River Basin, Argentina; Amazon River Basin, Brazil; Paraná River Basin, Brazil; South Atlantic Basin, Brazil	[14,32,43,48,96–99]
<i>Saccocoeloides</i> sp.	<i>Schizodon nasutus</i>	Paraná River Basin, Brazil	[79]
<i>Crassicutis intermedia</i> (Szidat, 1954; Bray, de Chambrier & Vaucher, 1996)	<i>Hypomasticus copelandii</i>	South Atlantic Basin, Brazil	[100]

Table 1. Cont.

Parasite	Host	Localities	Reference
Aspidogastridae			
Aspidogastridae gen. sp.	<i>Megaleporinus obtusidens</i>	South Atlantic Basin, Brazil	[48]
Cestoda			
Cestoda fam. gen. sp.	<i>Leporinus friderici</i> ; <i>Leporinus lacustris</i> ; <i>Megaleporinus elongatus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Schizodon borellii</i>	Paraná River Basin, Brazil	[14,43,58]
Onchoproteocephalidea fam. gen. sp.	<i>Leporellus vittatus</i> ; <i>Schizodon corti</i>	Amazon River Basin, Brazil	[14,74]
<i>Gibsoniella</i> sp.	<i>Leporinus jamesi</i>	Amazon River Basin, Brazil	[74]
<i>Monticellia</i> sp.	<i>Leporinus</i> sp.	Amazon River Basin, Brazil	[74]
Proteocephalidea gen. sp.	<i>Leporellus vittatus</i>	Paraná River Basin, Brazil	[42]
<i>Proteocephalus vazzoleræ</i> Pavanelli & Takemoto, 1995	<i>Leporinus friderici</i> ; <i>Leporinus lacustris</i>	Paraná River Basin, Brazil	[14,35,42,50,51,93]
Nematoda			
Nematoda fam. gen. sp.	<i>Hypomasticus copelandii</i> ; <i>Leporellus vittatus</i> ; <i>Leporinus friderici</i> ; <i>Leporinus lacustris</i> ; <i>Leporinus octofasciatus</i> ; <i>Megaleporinus elongatus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Pseudanos trimaculatus</i> ; <i>Rhytidodus microlepis</i> ; <i>Schizodon corti</i>	Amazon River Basin, Brazil; Paraná River Basin, Brazil	[44,58,74,79]
<i>Eustrongylides</i> sp.	<i>Hypomasticus copelandii</i> ; <i>Megaleporinus obtusidens</i> ; <i>Megaleporinus piavussu</i>	Paraná River Basin, Brazil	[14,42,51,79]
Anisakidae gen. sp.	<i>Hypomasticus copelandii</i> ; <i>Leporellus vittatus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Schizodon borellii</i>	Paraná River Basin, Brazil	[14,43,51,79]
<i>Contracaecum</i> sp.	<i>Leporellus vittatus</i> ; <i>Leporinus friderici</i> ; <i>Leporinus jamesi</i> ; <i>Leporinus lacustris</i> ; <i>Megaleporinus elongatus</i> ; <i>Megaleporinus piavussu</i> ; <i>Pseudanos trimaculatus</i> ; <i>Schizodon borellii</i> ; <i>Schizodon corti</i>	Amazon River Basin, Brazil; Paraná River Basin, Brazil; South Atlantic Basin, Brazil	[14,42,47,48,50,51,54,57,74,93,101]
<i>Cosmoxynema</i> sp.	<i>Schizodon corti</i>	Amazon River Basin, Brazil	[74]
<i>Hysterothylacium</i> sp.	<i>Leporinus friderici</i> ; <i>Leporinus lacustris</i>	Paraná River Basin, Brazil	[14,42,50,51,93]
<i>Goezia breviceca</i> Moravec, Kohn & Fernandes, 1994	<i>Leporinus friderici</i> ; <i>Leporinus lacustris</i>	Paraná River Basin, Brazil	[14,42,50,51]
<i>Goezia leporini</i> Martins & Yoshitoshi, 2003	<i>Megaleporinus macrocephalus</i>	Amazon River Basin, Brazil; Paraná River Basin, Brazil	[46,102,103]

Table 1. Cont.

Parasite	Host	Localities	Reference
<i>Goezia spinulosa</i> (Diesing, 1839)	<i>Leporinus friderici</i> ; <i>Leporinus lacustris</i> ; <i>Megaleporinus elongatus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Megaleporinus piauussu</i>	Paraná River Basin, Brazil	[14,42,50,51]
<i>Goezia</i> sp.	<i>Leporinus friderici</i>	Paraná River Basin, Brazil	[43]
<i>Amplicaeum</i> sp.	<i>Hypomasticus copelandii</i>	Paraná River Basin, Brazil	[79,81]
<i>Porrocaecum</i> sp.	<i>Megaleporinus elongatus</i> ; <i>Megaleporinus obtusidens</i>	Paraná River Basin, Brazil	[17,42,51]
<i>Klossinemella iheringi</i> (Travassos, Artigas & Pereira, 1928)	<i>Leporinus fasciatus</i>	Amazon River Basin, Brazil	[32]
<i>Paracapillaria</i> (<i>Paracapillaria</i>) <i>piscicola</i> (Travassos, Artigas & Pereria, 1928; Mendonça, 1963)	<i>Hypomasticus copelandii</i> ; <i>Leporellus vittatus</i>	Amazon River Basin, Brazil	[32]
<i>Procamallanus</i> (<i>Procamallanus</i>) <i>peraccuratus</i> Pinto, Fabio, Noronha & Rolas, 1976	<i>Leporinus jamesi</i>	Amazon River Basin, Brazil	[74]
<i>Procamallanus</i> (<i>Spirocamallanus</i>) <i>amarali</i> Vaz & Pereira, 1934	<i>Leporinus friderici</i> ; <i>Leporinus lacustris</i> ; <i>Leporinus</i> sp.; <i>Megaleporinus elongatus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Megaleporinus piauussu</i>	Amazon River Basin, Brazil	[14,42,47,50,51,57,79,104,105]
<i>Procamallanus</i> (<i>Spirocamallanus</i>) <i>iheringi</i> Travassos, Artigas & Pereira, 1928	<i>Hypomasticus copelandii</i> ; <i>Leporinus fasciatus</i> ; <i>Leporinus friderici</i> ; <i>Leporinus lacustris</i> ; <i>Leporinus octofasciatus</i> ; <i>Leporinus</i> sp.; <i>Megaleporinus elongatus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Megaleporinus piauussu</i> ; <i>Schizodon borellii</i> ; <i>Schizodon corti</i> ; <i>Schizodon nasutus</i> <i>Hypomasticus copelandii</i> ; <i>Leporellus vittatus</i> ; <i>Leporinus fasciatus</i> ; <i>Leporinus jamesi</i> ; <i>Leporinus lacustris</i> ; <i>Leporinus moralesi</i> ; <i>Leporinus octofasciatus</i> ; <i>Leporinus piau</i> ;	Amazon River Basin, Brazil; Paraná River Basin, Brazil	[14,32,42,47,50,51,57,58,72,73,79,81,105–107]
<i>Procamallanus</i> (<i>Spirocamallanus</i>) <i>inopinatus</i> Travassos, Artigas & Pereira, 1928	<i>Leporinus striatus</i> ; <i>Leporinus taeniatus</i> ; <i>Leporinus</i> sp.; <i>Megaleporinus elongatus</i> ; <i>Megaleporinus macrocephalus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Megaleporinus piauussu</i> ; <i>Megaleporinus reinhardtii</i> ; <i>Schizodon borellii</i> ; <i>Schizodon knerii</i> ; <i>Schizodon nasutus</i> ; <i>Anostomoides passionis</i> ; <i>Hypomasticus copelandii</i>	Amazon River Basin, Brazil; Eastern Northeast Atlantic Basin, Brazil; Paraná River Basin, Brazil; São Francisco River Basin, Brazil	[14,15,17,32,39,43,44,46,50,54,55,58,72–74,79–81,93,101,105–111]
<i>Procamallanus</i> (<i>Spirocamallanus</i>) <i>saofranciscensis</i> (Moreira, Oliveira & Costa, 1994)	<i>Leporinus piau</i>	Eastern Northeast Atlantic Basin, Brazil	[11,109]

Table 1. Cont.

Parasite	Host	Localities	Reference
<i>Procamallanus (Spirocamallanus) wrighti</i> (Pereira, 1935)	<i>Leporinus</i> sp.	Amazon River Basin, Brazil	[32]
<i>Procamallanus (Spirocamallanus)</i> sp.	<i>Leporinus lacustris</i>	Paraná River Basin, Brazil	[58]
<i>Procamallanus</i> sp.	<i>Hypomastiscus copelandii</i> ; <i>Leporinus octofasciatus</i> ; <i>Leporinus striatus</i> ; <i>Leporinus</i> sp.; <i>Schizodon altoparanae</i>	Paraná River Basin, Brazil	[14,42,58,105]
<i>Serpinema trispinosum</i> (Leidy, 1852)	<i>Leporinus taeniatus</i>	Eastern Northeast Atlantic Basin, Brazil	[11]
<i>Cucullanus (Cucullanus) brevispiculus</i> Moravec, Kohn & Fernandes, 1993	<i>Hypomastiscus copelandii</i>	Southeast Atlantic Basin, Brazil	[39]
<i>Cucullanus (Cucullanus) mogi</i> Travassos, 1947	<i>Hypomastiscus copelandii</i> ; <i>Leporinus</i> sp.	Amazon River Basin, Brazil; Paraná River Basin, Brazil	[32,79,81,112]
<i>Cucullanus (Cucullanus) pinnai pinnai</i> Travassos, Artigas & Pereira, 1928	<i>Hypomastiscus copelandii</i> ; <i>Leporinus jamesii</i> ; <i>Megaleporinus obtusidens</i> ; <i>Schizodon borellii</i>	Amazon River Basin, Brazil; Paraná River Basin, Brazil	[14,32,42,44,45,58,72–74,79,93,113]
<i>Cucullanus</i> sp.	<i>Megaleporinus obtusidens</i>	South Atlantic Basin, Brazil	[48]
<i>Dichelyne leporini</i> Petter, 1989	<i>Leporinus friderici</i> ; <i>Leporinus lacustris</i> ; <i>Schizodon corti</i>	Amazon River Basin, Brazil; Paraná River Basin, Brazil; Paraguay River Basin, Paraguay	[14,32,42,43,50,51,114]
<i>Cystidicoloides</i> sp.	<i>Leporinus lacustris</i> ; <i>Leporinus friderici</i>	Paraná River Basin, Brazil	[14,42,50,51]
<i>Spinitectus asperus</i> Travassos, Artigas & Pereira, 1928	<i>Leporinus friderici</i>	Paraná River Basin, Brazil	[47]
<i>Spinitectus jamundensis</i> Thatcher & Padilha, 1977	<i>Leporinus striatus</i> ; <i>Megaleporinus obtusidens</i>	Paraná River Basin, Argentina; Paraguay River Basin, Paraguay	[113,115]
<i>Ancyracanthus schubarti</i> (Kohn, Gomes & Motta, 1968)	<i>Leporinus octofasciatus</i> ; <i>Schizodon borellii</i>	Paraná River Basin, Brazil	[58,72,73,79]
<i>Brevimulticaecum</i> sp.	<i>Leporinus friderici</i> ; <i>Leporinus lacustris</i> ; <i>Megaleporinus elongatus</i> ; <i>Megaleporinus macrocephalus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Megaleporinus piavussu</i>	Paraná River Basin, Brazil	[14,42,46,50,51]
<i>Cosmoxynema vianai</i> Travassos, 1949	<i>Schizodon borellii</i>	Amazon River Basin, Brazil	[74]
<i>Cosmoxynemoides aguirrei</i> Travassos, 1949	<i>Leporinus moralesi</i> ; <i>Schizodon corti</i>	Amazon River Basin, Brazil	[74]
<i>Cosmoxynemoides</i> sp.	<i>Schizodon corti</i>	Amazon River Basin, Brazil	[74]
<i>Ichthyouris brasiliensis</i> Moravec, Kohn & Fernandes, 1992	<i>Laemolyta taeniata</i>	Amazon River Basin, Brazil	[74]

Table 1. Cont.

Parasite	Host	Localities	Reference
<i>Ichthyouris laterifilamenta</i> Moravec, Kohn & Fernandes, 1992	<i>Schizodon borellii</i>	Amazon River Basin, Brazil	[74]
<i>Ichthyouris nunani</i> Cárdenas, Fernandes, Justo & Cohen, 2019	<i>Laemolyta taeniata</i>	Tocantins-Araguaia Basin, Brazil	[116]
<i>Neoparaseuratum travassosi</i> Moravec, Kohn & Fernandes, 1992	<i>Schizodon borellii</i>	Amazon River Basin, Brazil	[74]
<i>Rhabdochona acuminata</i> (Molin, 1860)	<i>Leporellus vittatus</i> ; <i>Megaleporinus macrocephalus</i>	Amazon River Basin, Brazil; Paraná River Basin, Brazil	[32,46,47,55,57,79]
<i>Rondonia rondoni</i> Travassos, 1920	<i>Leporinus fasciatus</i> ; <i>Leporinus</i> sp.	Tocantins-Araguaia Basin, Brazil	[89]
<i>Ancyracanthus schubarti</i> (Kohn, Gomes & Motta, 1968)	<i>Hypomasticus copelandii</i> ; <i>Leporellus vittatus</i> ; <i>Leporinus lacustris</i> ; <i>Leporinus octofasciatus</i> ; <i>Schizodon borellii</i>	Amazon River Basin, Brazil; Paraná River Basin, Brazil	[17,32,42,50,51,117,118]
<i>Capillariidae</i> gen. sp.	<i>Megaleporinus obtusidens</i> ; <i>Schizodon corti</i>	Paraná River Basin, Brazil	[14,43]
<i>Capillostrongyloides minima</i> (Travassos, Artigas & Pereira, 1928)	<i>Leporinus</i> sp.; <i>Megaleporinus elongatus</i> ; <i>Schizodon nasutus</i>	Amazon River Basin, Brazil; Paraná River Basin, Brazil	[32,79–81]
<i>Capillostrongyloides sentinosa</i> (Travassos, 1927)	<i>Leporinus</i> sp.; <i>Megaleporinus elongatus</i> ; <i>Schizodon nasutus</i>	Amazon River Basin, Brazil; Paraná River Basin, Brazil	[32,42,51]
<i>Capillostrongyloides</i> sp.	<i>Leporellus vittatus</i>	Paraná River Basin, Brazil	[79]
<i>Trichuridae</i> sp.	<i>Schizodon corti</i>	Paraná River Basin, Brazil	[119]
Acanthocephala			
<i>Acanthocephala</i> fam. gen. sp.	<i>Hypomasticus copelandii</i> ; <i>Leporinus piau</i> ; <i>Megaleporinus obtusidens</i> ; <i>Schizodon altoparanae</i> ; <i>Schizodon knerii</i> ; <i>Schizodon nasutus</i> ; <i>Schizodon altoparanae</i>	Eastern Northeast Atlantic Basin, Brazil; Paraná River Basin, Brazil	[11,14,42,43,58,79]
<i>Echinorhynchida</i> fam. gen. sp.	<i>Laemolyta taeniata</i> ; <i>Schizodon corti</i>	Amazon River Basin, Brazil	[74]
<i>Echinorhynchus salobrensis</i> Machado Filho, 1948	<i>Schizodon borellii</i>	Paraná River Basin, Brazil	[93]
<i>Echinorhynchus</i> sp.	<i>Megaleporinus obtusidens</i> ; <i>Schizodon borellii</i> ; <i>Schizodon corti</i>	Amazon River Basin, Brazil; South Atlantic Basin; Paraná River Basin, Brazil	[14,42,48,58,72–74]
<i>Quadrigyus torquatus</i> Van Cleave, 1920	<i>Laemolyta taeniata</i> ; <i>Leporinus friderici</i> ; <i>Leporinus lacustris</i>	Amazon River Basin, Brazil; Paraná River Basin, Brazil	[14,42,50,51,74]

Table 1. Cont.

Parasite	Host	Localities	Reference
<i>Neoechinorhynchus</i> (<i>Neoechinorhynchus</i>) <i>curemai</i> Noronha, 1973	<i>Laemolyta taeniata</i>	Amazon River Basin, Brazil	[74]
<i>Neoechinorhynchus</i> (<i>Neoechinorhynchus</i>) <i>veropesoi</i> Melo, Costa, Giese, Gardner & Santos, 2015	<i>Laemolyta taeniata</i>	Amazon River Basin, Brazil	[74]
<i>Neoechinorhynchus</i> sp.	<i>Leporinus friderici</i>	Amazon River Basin, Brazil	[101]
<i>Octospiniferoides incognita</i> Schmidt & Huggins, 1973	<i>Laemolyta taeniata</i> ; <i>Leporinus friderici</i> ; <i>Leporinus lacustris</i> ; <i>Rhytiodus microlepis</i> ; <i>Schizodon borellii</i> ; <i>Schizodon corti</i>	Amazon River Basin, Brazil; Paraná River Basin, Brazil	[14,32,41,42,48,49,52,56,69–72,91]
<i>Octospiniferoides</i> sp.	<i>Leporinus</i> sp.; <i>Schizodon corti</i>	Amazon River Basin, Brazil	[74]
Branchiura			
<i>Argulus chicomendesi</i> Malta & Varella, 2000	<i>Leporinus affinis</i> ; <i>Rhytiodus microlepis</i> ; <i>Schizodon corti</i>	Amazon River Basin, Brazil	[32,71,120]
<i>Argulus elongatus</i> Heller, 1857	<i>Leporinus fasciatus</i>	Amazon River Basin, Brazil	[121]
<i>Argulus</i> sp.	<i>Leporinus friderici</i> ; <i>Leporinus lacustris</i> ; <i>Megaleporinus macrocephalus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Megaleporinus piavussu</i> ; <i>Rhytiodus microlepis</i>	Amazon River Basin, Brazil; Paraná River Basin, Brazil	[14,32,42,49–51]
<i>Dolops bidentata</i> (Bouvier, 1899)	<i>Rhytiodus microlepis</i>	Amazon River Basin, Brazil	[32,71]
<i>Dolops discoidalis</i> Bouvier, 1899	<i>Megaleporinus macrocephalus</i> ; <i>Rhytiodus argenteofuscus</i> ; <i>Rhytiodus microlepis</i>	Amazon River Basin, Brazil	[55,71,121]
<i>Dolops nana</i> Lemos de Castro, 1950	<i>Leporinus friderici</i> ; <i>Leporinus lacustris</i> ; <i>Megaleporinus elongatus</i> ; <i>Megaleporinus piavussu</i>	Paraná River Basin, Brazil	[14,42,50,51]
<i>Dolops striata</i> (Bouvier, 1899)	<i>Leporinus fasciatus</i> ; <i>Leporinus</i> sp.; <i>Rhytiodus microlepis</i> ; <i>Schizodon corti</i>	Amazon River Basin, Brazil	[32,71,122]
<i>Dolops</i> sp.	<i>Megaleporinus elongatus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Schizodon borellii</i>	Paraná River Basin, Brazil	[42]
Copepoda			
<i>Ergasilidae</i> gen. sp.	<i>Leporinus friderici</i> ; <i>Leporinus lacustris</i> ; <i>Megaleporinus obtusidens</i> ; <i>Megaleporinus piavussu</i>	Paraná River Basin, Brazil	[14,47]
<i>Amplexibranchius</i> sp.	<i>Megaleporinus obtusidens</i> ; <i>Megaleporinus piavussu</i>	Paraná River Basin, Brazil	[14,42,51]
<i>Brasergasilus guaporensis</i> Malta, 1995	<i>Leporinus fasciatus</i>	Amazon River Basin, Brazil	[32,123]
<i>Brasergasilus</i> sp.	<i>Schizodon borellii</i>	Paraná River Basin, Brazil	[19]

Table 1. Cont.

Parasite	Host	Localities	Reference
<i>Ergasilus bryconis</i> Thatcher, 1981	<i>Leporinus friderici</i> ; <i>Leporinus lacustris</i> ; <i>Megaleporinus elongatus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Megaleporinus piavussu</i> ; <i>Schizodon borellii</i>	Paraná River Basin, Brazil	[14,19,42,51]
<i>Ergasilus leporinidis</i> Thatcher, 1981	<i>Leporinus fasciatus</i> ; <i>Rhytioidus microlepis</i>	Amazon River Basin, Brazil	[32,71,124]
<i>Ergasilus triangularis</i> Malta, 1996	<i>Laemolyta taeniata</i>	Amazon River Basin, Brazil	[32,125]
<i>Ergasilus turucuyus</i> Malta & Varella, 1996	<i>Leporinus affinis</i>	Amazon River Basin, Brazil	[120]
<i>Ergasilus</i> sp.	<i>Leporinus fasciatus</i> ; <i>Leporinus piau</i> ; <i>Megaleporinus macrocephalus</i>	Amazon River Basin, Brazil; Eastern Northeast Atlantic Basin, Brazil	[17,54,55,126]
<i>Gamispatulus ferrilongus</i> Narciso & Silva, 2020	<i>Schizodon intermedius</i>	Paraná River Basin, Brazil	[127]
<i>Gamispatulus schizodontis</i> Thatcher & Boeger, 1984	<i>Leporinus friderici</i> ; <i>Leporinus lacustris</i> ; <i>Leporinus piau</i> ; <i>Megaleporinus elongatus</i> ; <i>Megaleporinus obtusidens</i> ; <i>Megaleporinus piavussu</i> ; <i>Schizodon borellii</i> ; <i>Schizodon corti</i> ; <i>Schizodon intermedius</i>	Amazon River Basin, Brazil; Eastern Northeast Atlantic Basin, Brazil; Paraná River Basin, Brazil	[15,17,19,42,50,51,127–129]
<i>Therodamas longicollum</i> Oliveira, Correa, Adriano & Tavares-Dias, 2021	<i>Leporinus fasciatus</i>	Amazon River Basin, Brazil	[126,130]
<i>Lernaea cyprinacea</i> Linnaeus, 1758	<i>Leporinus friderici</i> ; <i>Megaleporinus elongatus</i> ; <i>Megaleporinus macrocephalus</i>	Paraná River Basin, Brazil	[41,49,131]
<i>Lernaea devastatrix</i> Boxshall, Montú & Schwarzbald, 1997	<i>Schizodon borellii</i>	Paraná River Basin, Brazil	[19]
Vaigamidae gen. sp.	<i>Leporinus friderici</i> ; <i>Leporinus lacustris</i> ; <i>Megaleporinus elongatus</i> ; <i>Megaleporinus obtusidens</i>	Paraná River Basin, Brazil	[14,42,50,51]
Isopoda			
<i>Excorallana berbicensis</i> Boone, 1918	<i>Leporinus affinis</i>	Amazon River Basin, Brazil	[120]
<i>Braga patagonica</i> Schioedte & Meinert, 1884	<i>Leporinus fasciatus</i>	Amazon River Basin, Brazil	[121]
<i>Livoneca guianensis</i> Van Name, 1925	<i>Leporinus fasciatus</i>	Amazon River Basin, Brazil; Amazon River Basin, Guiana	[13,32,132]
<i>Nerocila armata</i> Dana, 1853	<i>Leporinus fasciatus</i>	Amazon River Basin, Brazil	[32]
<i>Riggia brasiliensis</i> Szidat & Schubart, 1960	<i>Hypomasticus copelandii</i> ; <i>Leporinus octofasciatus</i> ; <i>Schizodon nasutus</i>	Amazon River Basin, Brazil	[32]
<i>Riggia nana</i> Szidat & Schubart, 1960	<i>Leporinus striatus</i>	Amazon River Basin, Brazil	[32]
Mollusca			
<i>Diplodon delodontus</i> (Lamarck, 1819)	<i>Schizodon corti</i>	Amazon River Basin, Guiana	[133]

The genus *Leporinus* had the highest number of recorded parasite species, with 79 identified species (out of 81 taxa), followed by the genera *Megaleporinus*, with 47 species (out of 81 taxa), and *Schizodon*, with 43 species. The host species with the highest number of parasitic associations at the species level were: *Leporinus friderici* (Bloch, 1794) with 38 associations, *Megaleporinus obtusidens* (Valenciennes, 1837) and *Megaleporinus elongatus* (Valenciennes, 1850), with 28 each, and *Schizodon borellii* (Boulenger, 1900) with 25 (Table 1).

Regarding the geographical distribution of metazoan parasites in anostomids, records were found in nine South American river basins (Figure 1). The majority of species were recorded in hosts from the Paraná River basin, with 75 identified species (out of 127 taxa), followed by the Amazon River basin, with 69 species (out of 86 taxa). The other basins had fewer than 20 taxa.



Figure 1. Geographic distribution of parasitic associations with fish of the Anostomidae family in South American river basins.

4. Discussion

In the present study, 126 species of parasites were recorded associated with 34 species of anostomids, resulting in an average of 3.7 parasites per host fish species. To date, the family Anostomidae has approximately 162 described species [2]. If we assume that each fish species may harbor about 3 to 4 different species of metazoan parasites, its actual parasitofauna could range from 486 to 648. However, this number could be much higher, considering that, in some hosts, such as *L. friderici*, *M. obtusidens*, *M. elongatus*, and *S. borellii*, more than 20 species of parasites have been reported.

Monopisthocotyla and Nematoda were the taxonomic groups with the highest number of species associated with anostomids, which aligns with expectations, as these groups are frequently the most encountered in neotropical freshwater fish [6,14,39,42]. This predominance can be explained by the fact that most Monopisthocotyla species, associated with fish, parasitize the gills, a highly exposed location, which facilitates direct transmission between hosts [6,8,134–136]. Nematodes, in turn, have more complex life cycles and generally depend on intermediate hosts, such as crustaceans and small fish, which are abundant in freshwater ecosystems, potentially increasing their diversity between definitive and paratenic hosts [7,137,138].

Procamallanus (S.) *inopinatus* was the species recorded in the highest number of anostomid fish. According to Neves et al. [138], this nematode has been recorded in over 80 host species, belonging to 19 families and five different orders in Brazil. *Procamallanus* (S.) *inopinatus* has low host specificity and high adaptability to different freshwater habitats in Brazil, which enables it to have a wide geographic distribution [137,138]. Parasites like *P.* (S.) *inopinatus*, which infect a broad range of hosts, are highly resistant to environmental changes, increasing their chances of expanding their geographic distribution and resource use [138–140].

The genus *Leporinus* stands out as the group with the highest number of parasitic associations, totaling 79 parasite species and approximately 35 unidentified taxa at the species level, recorded to date. This result can be attributed to two main factors: first, *Leporinus* is the most diverse genus within the family Anostomidae, representing more than half of the described species in this family [2]. Second, the broad geographic distribution of these fish, which occur in a variety of aquatic habitats across South America, from fast-flowing rivers to lakes and flooded areas [1,138], increases the likelihood of exposure to a diverse parasitic fauna [6,7]. This combination of high host diversity and wide geographic distribution creates a favorable scenario for parasite speciation and colonization, resulting in a rich network of ecological interactions. Additionally, the ecological plasticity of many *Leporinus* species, which occupy different trophic niches and habitats throughout their life cycle, may facilitate infection by a variety of metazoan parasites [2,7,141].

Leporinus friderici stands out as the species with the highest number of parasitic associations among anostomids, a result that can be attributed to both its ecological characteristics and its broad geographic distribution. The opportunistic feeding behavior of *L. friderici* is a key factor influencing its susceptibility to parasitism. This species alters its diet in response to environmental changes, consuming detritus, algae, and small invertebrates, which exposes it to a wide variety of parasites at different life stages [47,142]. Additionally, *L. friderici* has an extensive geographic distribution, occurring in various aquatic environments across South America, such as fast-flowing rivers, lakes, flooded areas, and floodplains [1,2,141,143]. This ecological plasticity increases the chances of contact with a diversity of parasites, which may be associated with different habitats and intermediate hosts, such as mollusks, crustaceans, and other aquatic invertebrates [14,32,47,52,54].

The results of this review highlight Brazil as the country with the highest number of parasite records in fish of the family Anostomidae, with 120 species and approximately 67 unidentified taxa at the species level. This finding reflects not only the high diversity of anostomids in the country but also the intensity of parasitological studies conducted in Brazilian territory [6,14,15]. Additionally, parasites of anostomids have been recorded in nine South American river basins, with emphasis on the Paraná and Amazon River basins. This predominance may be related to the greater richness of anostomid species in these basins, as well as the greater availability of habitats and ecological conditions favorable to the diversification of both hosts and their parasites [1,2,144]. The correlation between parasite diversity and host richness in large river basins reinforces the importance of these ecosystems as hotspots of parasitic biodiversity [14,32,61,136].

5. Conclusions

This survey highlights the importance of anostomids as hosts for a rich parasitic fauna. These results indicate that, although knowledge of the parasitofauna of anostomids has significantly advanced, there are still important gaps, particularly in under-sampled regions of South America. Therefore, future studies should focus on expanding parasitological knowledge to other areas of the anostomid distribution, aiming to improve

the understanding of the biogeography and ecology of the parasites associated with this fish family.

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