Helminths of freshwater fishes in the reservoir of the Hydroelectric Power Station of Itaipu, Paraná, Brazil

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ABSTRACT: This study presents results from several expeditions in 1985, 1991-1995 and 2003 to the Medium Paraná River in the section that begins below the Itaipu Dam and ends at the trinational border of Brazil, Argentina and Paraguay, in the lotic and lentic zones of the reservoir of the Hydroelectric Power Station of “Itaipu Binacional” (localities Foz do Iguaçu, Santa Helena and Guaira). Ninety-eight species of freshwater fishes belonging to 22 families were examined for helminths. A host-parasite list based on Acanthocephala, Cestoda, Digenea, Monogenea and Nematoda collected from the region in question is provided. New host records are presented for Digenea and Nematoda. The Monogenea and Acanthocephala are being studied and will be published in a later paper, but are referred in the host-parasite list, in order to demonstrate the parasitism in the fishes of the reservoir. The results are compared with those presented by other authors from the Upper Paraná River.

INTRODUCTION

The Paraná River, the tenth longest river in the world, is a river in south-central South America, running through Brazil, Paraguay and Argentina. Together with its tributaries, it forms the larger of the two river systems that drain into the La Plata River, making it the second largest river system in South America, outranked only by the Amazon River. Along the course of the Paraná is the Itaipu Dam, the largest hydroelectric power station in the world, which creates a massive, deep reservoir behind it. Itaipu Binacional is a binational company undertaking run by Brazil and Paraguay at the Paraná River on the border section between the two countries.

Fish parasites in the Medium Paraná River basin have remained little known to date. This study reports results from several expeditions in 1985, 1991-1995 and 2003 to the Medium Paraná River in the section that begins below the Itaipu Dam and ends at the trinational border of Brazil, Argentina and Paraguay, and in the reservoir of the Hydroelectric Power Station of Itaipu Binacional, in the localities of Foz do Iguaçu (lentic zone, next to the dam at the end of the reservoir), Santa Helena (transition zone in the middle of the reservoir) and Guaira (lotic zone at the beginning of the reservoir) (Figure 1). A host-parasite list is presented in Table 1. The results were compared with those obtained by other authors in the floodplain of the Upper Paraná River and recently published in a checklist by Takemoto et al. (2009).

MATERIALS AND METHODS

A total of 1,142 freshwater fish specimens belonging to 98 species and 22 families were examined for helminths. These were caught using gill nets in the Medium Paraná River in the localities of Foz do Iguaçu (25°32'52"S, 54°32'48"W) and...
of the 98 fish species examined from the Medium Paraná River, lotic and lentic zones of the reservoir of the Hydroelectric Power Station of Itaipu, parasitism by helminths was verified in 78 species. Nematoda was the most prevalent group, identified in 63% of the fishes examined, followed by Digenea (47.4%), Monogenea (45.4%), Cestoda (19.5%) and Acanthocephala (14.4%).

Forty-eight species of Nematoda were recorded and nine of them were found in new hosts (Table 1): Cucullanus sp. (if), Goezia sp., Ichthyoyouris laterifilamenta Moravec, Kohn and Fernandes, 1992, Paracamarallanus amazonensis Ferraz and Thatcher, 1992, Procamallanus (Procamallanus) annipertaeae Kohn and Fernandes, 1988, Procamallanus (Spirocamallanus) inopinatus Travassos, Artigas and Pereira, 1928, Procamallanus (Spirocamallanus) sp., Raphidascaris (Spretascaris) mahmerti (Petter and Cassone, 1984) and Rondonia rondoni Travassos, 1920 (if).

Thirty four species of Digenea were recorded, 11 of them in new hosts (Table 1): Crassicuticichlalosoma Manter, 1936, Dadaytrema oxycyphala (Diesing, 1836), Dendorchis sp., Genarchella astyanactis (Watson, 1976), Genarchella tropica (Manter, 1936), Magnivitellinum simplex Kloss, 1906, Paralecithobothrys brasiliensis Freitas, 1947, Prosthenothrya obesa (Diesing, 1850), Saccocoeloides godoyi Kohn and Frös, 1986, Saccocoeloides magnus Szidat, 1954 and Saccocoeloides nani Szidat, 1954.

Eighteen species of Cestoda and ten of Acanthocephala were found in hosts already reported. Forty-four of the 98 species of fishes examined were parasitized with Monogenea and will be published in a later paper. The species of Acanthocephala referred herein were subject of a master thesis and are referred in another paper (Lopes et al. 2011).

Some morphological and taxonomical data based on these materials have already been published by Baptista-Farias et al. (2001), Cohen and Kohn (2008a, b), Cohen and Kohn (2009) Cohen et al. (2001), Fernandes and Kohn (2001), Kohn and Fernandes (1994; 2006), Kohn et al. (1995; 1999; 2000; 2003), Lopes et al. (2011) and Moravec et al. (1990; 1992a, b, c; 1993 a, b, c; 1994 a, b; 1997).

The Medium Paraná River underwent a great impact when changing from a lotic to a lentic environment. In addition, the natural barrier known as Sete Quedas was eliminated, because it was submerged in the reservoir when the Itaipu Dam was built. Thus, fish species that had only lived in Sete Quedas (Guaira) below were able to climb and explore a new environment.

The floodplain of the Upper Paraná River was considered the last free stretch of the Paraná River. However, it has undergone severe changes in its system of flood and drought, since hydroelectric plants were built upstream and now control the water level of the river. Considering these changes, all the fauna, including the parasites of fishes, may be affected. Oscillations in the hydrologic flow, such as occur in floodplains, may influence the occurrence and size of fish parasite infrapopulations (Dogiel 1970). All these observed impacts on the floodplain can directly and indirectly affect the parasitic fauna of fish. Endoparasites, which typically have a complex life cycle, can be affected by changes in environments where the intermediate hosts live. Some species of the organisms that can serve as intermediate hosts may be favored and others may even be eliminated from the environment. Ectoparasites, those which are in direct contact with the environment, suffer directly from the changes caused by these impacts.

In the Medium Paraná River, 78 fish species out of 98 examined were parasitized by helminths. Nematoda was the most prevalent group, present in 63% of the fishes examined, followed by Digenea (47.4%), Monogenea (45.4%), Cestoda (19.5%) and Acanthocephala (14.4%). Since 1986, in the floodplain of the Upper Paraná River, 72 fish species have been examined and 278 species of helminths were recorded as parasitizing these. Monogeneans were identified with the largest number of species (95), followed by Digenea (73), Nematoda (71), Cestoda (47) and Acanthocephala (18). A checklist of fish hosts and their parasites was published recently by Takemoto et al. (2009).

In general, nematodes exhibit a low degree of host specificity. According to Eiras et al. (2010), the nematode Procamallanus (Spirocamallanus) inopinatus has already been identified in 51 fish species in Brazil. In the Medium Paraná River, P. (S.) inopinatus confirmed a low degree of host specificity and was identified in 15 species of fish (Astyanax bicolor, Astyanax fasciatus, A. b. lacustris, B. sp., Brycon orbignyanus, Catathyridium jenynsii, Crenichila haroldoi, Leporellus striatus, Leporinus copelandii, L. friderici, Pterodoras granulosus, Serrasalmus marginatus, S. spilopleura, Trachyderas paraguayensis, Tracheliopterus galeatus, Pimelodus sp. and Potamotrygon motoro). In the floodplain of the Upper Paraná River, this species was recorded in 10 host species (Hoplias aff. malabaricus, L. elongatus, L. obtusidens, L. lacustris, Metynnis lippincottianus, Pseudoplatystoma corruscans, Serrasalmus marginatus, S. maculatus, Schizodon borelli and Trachyderas paraguayensis). Among all these species, only S. marginatus and T. paraguayensis were common in both environments studied.

Immature forms of nematodes of the family Anisakidae (Contracaecum sp., Hysterothylacium sp. and Anisakidae gen. sp.) were found in 24 fish species examined in the localities studied on the Medium Paraná River. In the floodplain of the Upper Paraná River, 17 hosts were reported to be parasitized by Contracaecum and/or Hysterothylacium larvae. Species of the Anisakidae deserve special attention; they parasitize fish as larvae, using them as intermediate or paratenic hosts and are
known to be agents of parasitoses in humans. However, to date, no reports of such zoonotic diseases have been made in the region. This is probably because the parasites are large and mainly parasitize the mesentery, which is not used as food by people.

Some species of Digenea also exhibit a low degree of host specificity. The metacercariae of Austrodiplostomum compactum, parasitic in the eyes of fish, were recorded for the first time in Plagioscion squamosissimus from the reservoir of the Hydroelectric Power Station of Itaipu by Kohn et al. (1995). In the floodplain, this larva was reported in the same host species by Pavanelli et al. (1997), as well as in some other host species: Hoplias aff. malabaricus, Satanoperca pappaterra, Crenicichla britskii, Cichla kelberi (= Cichla monoculus), Cichlasoma paraense (Machado et al. 2005). Yamada et al. (2008) also reported it as parasitising Hypostomus regani, Schizodon borelli, Serrasalmus marginatus and Auchenipterus osteomystax. This parasite is very common in the "corvina" P. squamosissimus. Machado et al. (2005) reported a prevalence of 95% and recorded 397 parasites in one fish. Due to this high prevalence, this trematode species was probably introduced together with its definitive host.

The prevalence was also relatively high in S. pappaterra (71.9%) and in C. kelberi (65%). This parasite is ecologically important since it lives in the eyes of fish, damaging their vision and making them susceptible to predators. Thus, the parasite can complete its life cycle.

Among the hosts examined, 47 helminth species were common in both sampling sites. However, fishes from the Upper Paraná River floodplain showed a greater species diversity of helminth parasites. This difference probably occurred because, despite all the above-mentioned changes that are occurring in the floodplain, all animals necessary for completing the life cycles of the respective helminths are present in this environment. In the Itaipu reservoir, the impact was greater following the impoundment and many organisms may have disappeared. Some of them may act as intermediate hosts of helminth parasites.

The differences in the taxonomic diversification of the parasite assemblages of different fish species were mainly related to the environment, trophic level and temperature (Luque and Poulin 2008). Therefore, the Upper Paraná River floodplain, characterized by the presence of a wide variety of habitats and species, favors the occurrence of a greater diversity of fish parasites.

The Table 1. List of helminths of freshwater fishes recorded in reservoir of the Hydroelectric Power Station of Itaipu, Parana, Brazil. E/P = number of examined / parasitized hosts, I = number of infected hosts by each species, A = Acanthocephala, C = Cestoda, D = Digenea, M = Monogenea, N = Nematoda, if = immature form, mc = metacercariae.

| HOSTS           | COMMON NAME     | E/P | I   | HELMINTHS                                                                 |
|-----------------|-----------------|-----|-----|---------------------------------------------------------------------------|
| Acestrorhynchidae |                 |     |     |                                                                           |
| Acestrorhynchus lacustris | peixe-cachorro | 11/6 | 1   | N Contracaecum sp. (if)                                                    |
| Leporellus vittatus | solteira     | 11/4 | 2   | N Procamallanus (Spirocamallanus) inopinatus Travassos, Artigas and Pereira, 1928 |
| Leporinus copelandii | piav          | 9/5  | 4   | N Procamallanus (S.) inopinatus Travassos, Artigas and Pereira, 1928      |
| Leporinus elongatus | piapara     | 3/2  | 1   | D Anisakidae gen. sp.                                                     |
| Leporinus friderici | piava        | 15/12| 2   | N Procamallanus (S.) inopinatus Travassos, Artigas and Pereira, 1928      |
| Leporinus obtusidens | piapara    | 5/5  | 1   | D Procamallanus gen. sp.                                                  |
| Schizodon borelli | piava         | 9/2  | 1   | D Austrodiplostomum gen. sp.                                              |
| Schizodon fasciatus | Piava       | 5/5  | 1   | D Austrodiplostomum gen. sp.                                              |
| Schizodon knerri | piava         | 7/3  | 2   | D Austrodiplostomum gen. sp.                                              |

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**Table 1. Continued.**

| HOSTS | COMMON NAME        | E/P | 1 HELMINTHS |
|-------|---------------------|-----|-------------|
| *Schizodon knerii* | piava               | 7/3 | 1 D *Paralecithobothrys brasilienis* Freitas, 1947 (new host record) |
|        |                     |     | 2 D *Saccocoelaoides magnus* Szidat, 1954 (new host record) |
|        |                     |     | 2 A Acanthocephala gen. sp. |
|        |                     |     | 1 M Monogenea gen. sp. |

**Auchenipteridae**

| *Ageneiosus militaris* | manduvê, bagre       | 10/4 | 2 N *Cucullanus (Cucullanus) pinnai pinnai* Travassos, Artigas and Pereira, 1928 |
|                       |                     |     | 1 N *Goezia sp. (f)* of Moravec, Kohn and Fernandes, 1993 |
|                       |                     |     | 1 D Gönostomidae (mc) |

**Auchenipterus osteonystax**

(referred as *Auchenipterus nuchalis* by Moravec, Kohn and Fernandes, 1993)

| surumana       | 68/16 | 4 D *Microrchis olgovitellum* Lunachi, 1987 |
|                |       | 9 M Monogenea gen.sp. |

**Trachelyopterus galeatus**

 [= *Parauchenipterus galeatus*]

| cangati       | 24/12 | 1 N *Contracaecum sp. 2 (f)* of Moravec, Kohn and Fernandes, 1993 |
|               |       | 1 N *Goezia sp. (f)* |
|               |       | 1 N *Procamallanus (S.) inopinatus* Travassos, Artigas and Pereira, 1928 (new host record) |
|               |       | 8 D *Microrchis olgovitellum* Lunachi, 1987 |
|               |       | 1 C *Cangatiella arandasi* Pavanelli and Machado, 1991 |
|               |       | 5 M Monogenea gen.sp. |

**Characidae**

| *Astyanax bimaculatus bimaculatus* | tambiú       | 31/12 | 1 N *Procamallanus (S.) inopinatus* Travassos, Artigas and Pereira, 1928 |
|                                     |              |     | 4 D Magnivitellinum simplex Kloss, 1966 |
|                                     |              |     | 8 M Monogenea gen.sp. |
|                                     |              |     | 1 N Cosmoxynemoides aguirrei Travassos, 1949 |
|                                     |              |     | 1 N *Procamallanus (S.) inopinatus* Travassos, Artigas and Pereira, 1928 |

| *Astyanax bimaculatus lacustris* | tambiú       | 19/4 | 1 N *Travnema travnema* Pereira, 1938 |
|                                  |              |     | 3 M Monogenea gen.sp. |

| *Astyanax eigenmanniorum* | tambiú, lambari | 11/3 | 3 N *Travnema* sp. |
|                         |                 |     | 1 N Anisakidae gen.sp. |
|                         |                 |     | 1 N *Goezia brasilienis* Moravec, Kohn and Fernandes, 1994 |
|                         |                 |     | 1 N *Goezia brevicecea* Moravec, Kohn and Fernandes, 1994 |

| *Brycon hilarii* | piracanjuba     | 7/2 | 2 N *Goezia sp. (new host record)* |
|                  |                 |     | 2 N *Procamallanus (S.) inopinatus* Travassos, Artigas and Pereira, 1928 (new host record) |
|                  |                 |     | 1 M Monogenea gen.sp. |
|                  |                 |     | 4 N Anisakidae gen. sp. (if) |
|                  |                 |     | 1 N *Procamallanus (S.) inopinatus* Travassos, Artigas and Pereira, 1928 (new host record) |

| *Cynopotamus knicaii* | peixe-cachorro, saicanga | 8/6 | 1 D *Prosthenhystera obesa* (Diesing, 1850) (new host record) |
|                       |                         |     | 2 M Monogenea gen.sp. |

| *Galeocharax humeralis* | cigarra | 5/2 | 1 N *Contracaecum sp. 1 (f)* of Moravec, Kohn and Fernandes, 1993 |
|                       |         |     | 2 N *Contracaecum sp. 1 (f)* of Moravec, Kohn and Fernandes, 1993 |

| *Galeocharax knerii* | Cigarrão, cadela | 24/4 | 1 N *Hysterothylacium sp. (f)* of Moravec, Kohn and Fernandes, 1993 |
|                     |                 |     | 2 C Cestoda gen. sp. (f) |

| *Piaractus mesopotamicus* | pacu | 29/26 | 2 N *Goezia sp. (f)* |
|                         |      |      | 1 N Rondonia rondoni Travassos, 1920 |
|                         |      |      | 1 N Spectatus sp. (juvenile female) of Moravec, Kohn and Fernandes, 1997 |
|                         |      |      | 2 D *Curumai curumai* Travassos, 1961 |
|                         |      |      | 3 D *Dadaytrema oxycephalo* (Diesing, 1836) |
|                         |      |      | 1 C Cestoda gen. sp. |
|                         |      |      | 23 M Monogenea gen.sp. |

| *Roeboides paranensis* | dentudo | 36/21 | 12 D Magnivitellinum simplex Kloss, 1966 (new host record) |
|                       |         |      | 7 M Monogenea gen.sp. |

| *Salminus brasiliensis* [= *Salminus maxillosus*] | dourado | 26/21 | 1 N Acuariniae gen. sp. (f) of Moravec, Kohn and Fernandes, 1993 |
|                                                        |         |      | 9 N *Hysterothylacium sp. (f)* of Moravec, Kohn and Fernandes, 1993 |
|                                                        |         |      | 1 N *Paracapillaria piscicola* (Travassos, Artigas and Pereira, 1928) |
| HOSTS                        | COMMON NAME | E/P | I | HELMINTHS                                                                 |
|-----------------------------|-------------|-----|---|---------------------------------------------------------------------------|
| Salminus brasiliensis       | dourado     | 26/21 | 13 D | Neocladocystis intestinalis (Vaz, 1932)                                   |
| [=Salminus maxillosus]      |             |     | 2 D | Prosthynystera obesa (Diesing, 1850)                                     |
|                             |             |     | 9 D | Rhipidocotyle jeffersoni (Kohn, 1970)                                    |
|                             |             |     | 1 D | Thometrema overstreeti (Brooks, Mayes and Thorson, 1979)                 |
|                             |             |     | 6 C | Cestoda gen. sp. (if)                                                    |
|                             |             |     | 12 M | Monogenea gen. sp.                                                       |
| Serrasalmus marginatus      | piranha     | 58/17 | 1 N | Contracaecum sp. (if)                                                    |
|                             |             |     | 1 N | Cucullan sp. 3 of Moravec, Kohn and Fernandes, 1993                     |
|                             |             |     | 4 N | Goezia sp. (if) of Moravec, Kohn and Fernandes, 1993                    |
|                             |             |     | 3 N | Procamallanus (S.) inopinatus Trassavos, Artigas and Pereira, 1928      |
|                             |             |     | 7 M | Monogenea gen. sp.                                                       |
| Serrasalmus spilopleura     | piranha     | 12/6 | 3 N | Procamallanus (S.) inopinatus Trassavos, Artigas and Pereira, 1928      |
|                             |             |     | 3 M | Monogenea gen. sp.                                                       |
| Tripotherus angulatus       | sardinha    | 6/4  | 2 N | Anisakidae gen. sp. (if)                                                 |
|                             |             |     | 1 N | Procamallanus (S.) sp.                                                  |
|                             |             |     | 3 M | Monogenea gen. sp.                                                       |
| Cichla monoculus            | tucunare    | 7/6  | 1 N | Anisakidae gen. sp. (if)                                                 |
|                             |             |     | 2 N | Procamallanus (Procamallanus) peraccuratus Pinto, Fábio, Noronha and Rolas, 1976 |
|                             |             |     | 1 D | Diplostomidae gen. sp. (mc)                                              |
|                             |             |     | 3 C | Proteocephalus macrophallus (Diesing, 1850)                              |
|                             |             |     | 4 C | Proteocephalus microscopics (Woodland, 1935)                             |
| Crenicichla haroldoi        | joaninha    | 1/1  | 1 N | Procamallanus (S.) inopinatus Trassavos, Artigas and Pereira, 1928      |
|                             |             |     | 1 C | Cestoda gen. sp. (if)                                                    |
| Crenicichla niederleini     | joaninha    | 47/44 | 1 N | Contraacem sp. 1 (if) of Moravec, Kohn and Fernandes, 1993              |
| [referred as C. lepidota by Moravec, Kohn and Fernandes, 1993] | | | 2 N | Hysterothylacium sp. (if) of Moravec, Kohn and Fernandes, 1993          |
|                             |             |     | 34 N | Procamallanus (P.) peraccuratus Pinto, Fábio, Noronha and Rolas, 1976   |
|                             |             |     | 3 D | Crassicutis cichlasomae Manter, 1936 (new host record)                   |
|                             |             |     | 18 D | Diplostomidae gen. sp. (mc)                                              |
|                             |             |     | 8 D | Neascus sp. (mc)                                                         |
|                             |             |     | 9 M | Monogenea gen. sp.                                                       |
|                             |             |     | 2 N | Hysterothylacium gen. sp. (if)                                           |
|                             |             |     | 2 N | Procamallanus (P.) peraccuratus Pinto, Fábio, Noronha and Rolas, 1976   |
| Geophagus brasiliensis      | cará        | 18/11 | 1 N | Procamallanus (S.) sp.                                                  |
|                             |             |     | 1 N | Raphidascaris (Sprentascaris) sp. (if) of Moravec, Kohn and Fernandes, 1993 |
|                             |             |     | 5 D | Crassicutis cichlasomae Manter, 1936 (new host record)                   |
|                             |             |     | 2 D | Diplostomidae gen. sp. (mc)                                              |
|                             |             |     | 2 M | Monogenea gen. sp.                                                       |
| Curimatidae                 |             |     | 2 N | Cosmoxyneum vianai Trassavos, 1949                                      |
| Cyphocharax gilbert         | saguiru     | 5/5  | 1 N | Cosmoxyneumoides aguiirei Trassavos, 1949                                |
| [=Pseudocurimata gilberti]  |             |     | 1 N | Cosmoxyneumoides aguiirei Trassavos, 1949                                |
|                             |             |     | 1 N | Guyanema sp. of Moravec, Kohn and Fernandes, 1993                        |
|                             |             |     | 2 N | Travnema araujoi Fernandes, Campos and Artigas, 1983                    |
|                             |             |     | 1 D | Zonocotyle bicaecata Trassavos, 1948                                    |
|                             |             |     | 1 M | Monogenea gen. sp.                                                       |
|                             |             |     | 2 N | Cosmoxyneumoides sp.                                                     |
| Cyphocharax nagelii         | saguiru     | 3/3  | 2 N | Diplostomidae gen. sp. (mc)                                              |
|                             |             |     | 2 D | Saccocoelioides godoyi Kohn and Frôes, 1986 (new host record)            |
| Potamorhina squamoralevis   | saguiru, papa-terra | 5/4 | 1 N | Ichthyorynchus laterifilamenta Moravec, Kohn and Fernandes, 1992 (new host record) |
|                             |             |     | 3 M | Monogenea gen. sp.                                                       |
| Satanoperca pappaterra      | cará        | 9/3  | 1 C | Cyclophilidae gen. sp.                                                   |
|                             |             |     | 2 M | Monogenea gen. sp.                                                       |
| Steindacherina elegans      | saguiru     | 5/2  | 1 N | Cosmoxyneumoides aguiirei Trassavos, 1949                                |
| [=Pseudocurimata elegans]   |             |     | 1 N | Travnema travnema Pereira, 1938                                         |
### Table 1. Continued.

| HOSTS | COMMON NAME | E/P | I | HELMINTHS |
|-------|-------------|-----|---|-----------|
| Steindachnerina elegans [=Pseudocurimata elegans] | saguiru | 5/2 | 1 | Acanthocephala gen. sp. |
| Steindachnerina insculpta | saguiru | 3/2 | 2 | Diplostomidade gen.sp (mc) |

#### Cynodontidae

| Rhaphiodon vulpinus | peixe-cadela, dourado cachorro | 48/31 | 3 | Contracaeum sp. 1 (if) of Moravec, Kohn and Fernandes, 1993 |
|---------------------|--------------------------------|--------|---|----------------------|
|                      |                                |        | 1 | Contracaeum sp. 2 (if) of Moravec, Kohn and Fernandes, 1993 |
|                      |                                |        | 1 | Cucullanus sp. (if) (new host record) |
|                      |                                |        | 1 | Goezia sp. (if) of Moravec, Kohn and Fernandes, 1993 |
|                      |                                |        | 2 | Guyanema raphidondi Moravec, Kohn and Fernandes, 1993 |
|                      |                                |        | 16 | Hysterothylacium sp. (if) of Moravec, Kohn and Fernandes, 1993 |
|                      |                                |        | 1 | Rondonia rondoni Travassos, 1920 (if) (new host record) |
|                      |                                |        | 16 | Monogenea gen.sp. |

#### Doradidae

| Oxydoras knerii | armado, abotoado | 3/1 | 1 | Paracavisoma impudica (Diesing, 1851) |
|----------------|------------------|-----|---|-------------------------------------|
|                |                  |     | 2 | Cucullanus pinnai pterodorasi Moravec, Kohn and Fernandes, 1992 |
|                |                  |     | 1 | Goezia sp. |
|                |                  |     | 1 | Hysterothylacium sp. (if) |
|                |                  |     | 2 | Neoparaseuratum travassosi Moravec, Kohn and Fernandes, 1992 |
|                |                  |     | 2 | Paracamallanus amazonensis Ferraz and Thatcher, 1992 |
|                |                  |     | 3 | Procamentallus (S.) inopinatus Travassos, Artigas and Pereira, 1928 |
|                |                  |     | 14 | Rondonia rondoni Travassos, 1920 |
|                |                  |     | 6 | Dadaytrema oxycephala (Diesing, 1836) |
|                |                  |     | 3 | Monticellia belavistensis Pavanelli, Machado, Takemoto, Massado and Santos, 1994 |
|                |                  |     | 12 | Monogenea gen.sp. |

| Trachydoras paraguayanus | armadinho | 21/19 | 12 | Ichthyuris laterifilamenta Moravec, Kohn and Fernandes, 1992 |
|-------------------------|-----------|--------|---|---------------------|
|                         |           |        | 10 | Neoparaseuratum travassosi Moravec, Kohn and Fernandes, 1992 |
|                         |           |        | 1 | Parasyndontidias petterae Moravec, Kohn and Fernandes, 1992 |
|                         |           |        | 15 | Procamentallus (S.) inopinatus Travassos, Artigas and Pereira, 1928 |
|                         |           |        | 3 | Rondonia rondoni Travassos, 1920 |
|                         |           |        | 1 | Monogenea gen.sp. |

#### Erythrinidae

| Hoplias malabaricus | traíra | 20/10 | 1 | Contracaeum sp. 1 (if) |
|---------------------|--------|--------|---|----------------------|
|                     |        |        | 1 | Guyanema raphidondi Moravec, Kohn and Fernandes, 1993 |
|                     |        |        | 3 | Diplostomidae gen. sp. (mc) |
|                     |        |        | 1 | Pseudosceloctyla lutzii (Freitas, 1941) |
|                     |        |        | 1 | Monogenea gen.sp. |

#### Heptapteridae

| Pimelodella gracilis | mandi, roncador | 5/3 | 1 | Hysterothylacium sp. (if) |
|---------------------|-----------------|-----|---|--------------------------|
|                     |                 |     | 1 | Cucullanus (C) pinnai Travassos, Artigas and Pereira, 1928 |
|                     |                 |     | 2 | Rondonia rondoni Travassos, 1920 (new host record) |
|                     |                 |     | 1 | Cestoda gen. sp. |
|                     |                 |     | 1 | Monogenea gen.sp. |

| Pimelodella lateristriga | mandi-chorão, mandi roncador | 2/2 | 2 | Procamallanus (Spirocamallanus) pimelodus Pinto, Fábio, Noronha and Rolas, 1974 |
|--------------------------|-------------------------------|-----|---|--------------------------|
|                          |                               |     | 1 | Parspina argentinensis (Szidat, 1954) |
|                          |                               |     | 1 | Cestoda gen. sp. |

#### Loricariidae

| Rhamdia quelen | bagre | 1/1 | 1 | Acanthostomum gnerii Szidat, 1954 |
|----------------|--------|-----|---|-------------------------------|
|                |        |     | 1 | Monogenea gen.sp. |

#### Hyphostomus aë. albopunctatus

| cascido-viola, cascudo-ferro | 1/1 | 1 | Monogenea gen.sp. |

| Hyphostomus cochliodon | cascudo | 2/2 | 2 | Acanthocephala gen.sp. |
| HOSTS | COMMON NAME | E/P | I | HELMINTHS |
|-------|-------------|-----|---|-----------|
| Hypostomus regani | cascudo | 11/9 | 1 | Nematoda gen. sp. |
|          |               |     | 2 | Procamallanus (Procamallanus) annipitterae Kohn and Fernandes, 1988 |
|          |               |     | 3 | Crassicuts intermedius (Szidat, 1954) |
|          |               |     | 2 | Acanthocephala gen. sp. |
|          |               |     | 6 | Monogenea gen.sp. |
| Hypostomus ternetzi | cascudo | 4/1 | 1 | Monogenea gen.sp. |
| Hypostomus sp. 1 | cascudo-pintado | 7/1 | 1 | Monogenea gen.sp. |
| Hypostomus sp. 2 | cascudo | 30/11 | 2 | N | Procamallanus (P.) annipitterae Kohn and Fernandes, 1988 |
|          |               |     | 1 | Raphidascaris (Sprentascaris) hypostomi (Petter and Cassone, 1984) |
|          |               |     | 3 | Crassicuts intermedius (Szidat, 1954) |
|          |               |     | 1 | Diplostomidae gen. sp. (mc) |
|          |               |     | 2 | Gorytocephalus sp. |
| Loricaria sp. | cascudo | 4/3 | 1 | Anisakidae gen. sp. (if) |
|          |               |     | 1 | Cucullanus (C.) pinnai (Travassos, Artigas and Pereira, 1928) |
|          |               |     | 2 | Diplostomidae gen. sp. (mc) |
|          |               |     | 1 | Acanthocephala gen. sp. |
|          |               |     | 2 | Monogenea gen.sp. |
| Loricariichthys platymetopon | cascudo-chinelo | 8/8 | 2 | Diplostomidae gen. sp. (mc) |
|          |               |     | 1 | Monogenea gen.sp. |
| Loricariichthys rostratus | cascudo-chinelo | 7/6 | 4 | Diplostomidae gen. sp. (mc) |
|          |               |     | 1 | Raphidascaris (S.) mahnerti (Petter and Cassone, 1984) (new host record) |
|          |               |     | 22 | Raphidascaris (S.) mahnerti (Petter and Cassone, 1984) |
| Loricariichthys sp. | cascudo | 25/21 | 7 | Diplostomidae gen. sp. (mc) |
|          |               |     | 2 | Cestoda gen. sp. (if) |
| Megalancistrus parananus | cascudo-abacaxi | 11/8 | 7 | Icthyouris brasiliensis Moravec, Kohn and Fernandes, 1992 |
|          |               |     | 3 | Procamallanus (P.) annipitterae Kohn and Fernandes, 1988 (new host record) |
|          |               |     | 1 | Diplostomidae gen. sp. (mc) |
|          |               |     | 1 | Genarchella tropica (Manter, 1936) (new host record and first report in South America) |
|          |               |     | 4 | Saccocoelioides magnus Szidat, 1954 (new host record) |
| Pseudohemiodon laticeps | cascudo-chicote | 2/2 | 2 | Diplostomidae gen. sp. (mc) |
|          |               |     | 1 | Raphidascaris (S.) mahnerti (Petter and Cassone, 1984) |
| Pterygoplichthys sp. | cascudo-pintado | 1/1 | 1 | Diplostomidae gen. sp. (mc) |
|          |               |     | 1 | Dendrorchis sp. (new host record) |
| Rhinelepis strigosa | cascudo-pintado | 6/3 | 1 | Paracanthurus serratus Petter, moravec, 1992 |
|          |               |     | 1 | Monogenea gen.sp. |
| Parodontidae | | | | |
| Apareiodon affinis | canivete | 18/1 | 1 | Monogenea gen.sp. |
| Pimelediidae | | | | |
| Bergiaria westermannii | mandi-beijudo | 5/3 | 2 | Acanthocephala gen. sp. |
|          |               |     | 1 | Diplostomidae gen. sp. (mc) |
|          |               |     | 3 | Cestoda gen. sp. |
|          |               |     | 1 | Monogenea gen.sp. |
|          |               |     | 8 | Hysterothylacium sp. (if) |
| Hemisorubim platyrhynchos | jurupoca, jeripoca | 5/4 | 2 | Sanguinicola sp. |
|          |               |     | 1 | Diplostomidae gen. sp. (mc) |
|          |               |     | 1 | Acanthocephala gen. sp. |
|          |               |     | 5 | Monogenea gen.sp. |
| Hypophthalmus edentatus | mapará | 19/13 | 9 | Paracanthurus serratus Petter, moravec, 1992 |
|          |               |     | 1 | Monogenea gen.sp. |
| Iheringichthys labrosus | mandi | 19/11 | 1 | Goezia sp. |
|          |               |     | 5 | Procamallanus (S.) pimelodus Pinto, Fábio, Noronha and Rolas, 1974 |
|          |               |     | 2 | Auriculostoma platense (Szidat, 1954) |
|          |               |     | 2 | Pseudopolydactylus sp. |
|          |               |     | 4 | Monogenea gen.sp. |
| HOSTS                  | COMMON NAME   | E/P   | I   | HELMINTHS                                      |
|-----------------------|---------------|-------|-----|-----------------------------------------------|
| Megalobothriopsis     | ranarum      | 4/2   | 1 N | *Hysterothylacium* sp. (if)                    |
|                       |               |       | 1 D | Genarchella sp.                               |
| *Pimelodus maculatus* | mandi         | 29/18 | 7 N | *Cucullanus* (C) *pinnai* *pinnai* Travassos, Artigas and Pereira, 1928 |
|                       |               |       | 1 N | *Dichelyne* *pimelodi* Moravek, Kohn and Fernandes, 1997 |
|                       |               |       | 2 N | *Procamallanus* (S) *pimelodus* Pinto, Fábio, Nornha and Relas, 1974 |
|                       |               |       | 3 D | *Auriculostoma* *platense* (Szidat, 1954)     |
|                       |               |       | 1 C | *Monticellia* *magna* (Rego, Santos and Silva, 1974) |
|                       |               |       | 5 A | *Neocochinorhynchus* sp.                      |
|                       |               |       | 6 M | Monogenea gen.sp.                             |
| *Pimelodus ornatus*   | mandi         | 2/2   | 2 N | *Cucullanus* (C) *pinnai* *pinnai* Travassos, Artigas and Pereira, 1928 |
|                       |               |       | 1 D | *Genarchella* *genarchella* Travassos, Artigas and Pereira, 1928 |
|                       |               |       | 1 N | *Raphidascaris* (S) sp.                      |
| *Pimelodus sp.*       | mandi         | 40/23 | 1 N | *Raphidascaris* (S) sp. (if)                  |
|                       |               |       | 1 N | *Rondonia* *rondoni* Travassos, 1920         |
|                       |               |       | 2 D | *Auriculostoma* *platense* (Szidat, 1954)     |
|                       |               |       | 4 D | Diplostomidae gen. sp.                       |
|                       |               |       | 1 A | Acanthocephala gen. sp.                      |
|                       |               |       | 10 M| Monogenea gen.sp.                            |
| *Pinirampus pirinampu*| barbado       | 17/10 | 1 N | *Oxyuroidea* gen.sp.                          |
|                       |               |       | 9 C | *Rudophiella* *piranabu* (Woodland, 1934)    |
| *Pseudopimelodus*     | mangurus      | 2/1   | 1 D | *Iheringtrema* *iheringi* Travassos, 1948    |
|                       | [*Pseudopimelodus* *roosevelti*] |       | 1 N | Capilaridae gen. sp. 2 of Moravek, Kohn and Fernandes, 1993 |
|                       |               |       | 2 N | *Contracaeum* sp. 2 (if) Moravek, Kohn and Fernandes, 1993 |
|                       |               |       | 4 N | *Cucullanus* pseudoplatisystem Moravek, Kohn and Fernandes, 1993 |
|                       |               |       | 1 N | *Goezia* *brasiliensis* Moravek, Kohn and Fernandes, 1994 |
|                       |               |       | 1 D | *Clinostomum* *marginatum* (Rudophi, 1819) (if) |
|                       |               |       | 1 D | *Dadaytrema* *oxycephala* (Diesing, 1836)     |
|                       |               |       | 1 C | *Choanoscolex* *abscessus* (Riggenbach, 1895) |
|                       |               |       | 1 C | *Harrisocole* *kaparari* (Woodland, 1935)     |
|                       |               |       | 1 C | *Spasskyelina* *spumilifera* (Woodland, 1935) |
|                       |               |       | 1 M | Monogenea gen.sp.                            |
| *Sorubim lima*        | mandi-chinelo, chinelo, jurupoca | 5/4 | 1 D | *Sanguinicola* sp.                           |
|                       |               |       | 1 C | *Gozeella* *nupelensis* Pananelli and Rego, 1991 |
|                       |               |       | 1 C | *Manoastra* *brocchomoco* Woodland, 1935      |
|                       |               |       | 3 C | *Paramonticellia* *italpuensis* Pananelli and Rego, 1991 |
|                       |               |       | 2 N | *Cucullanus* (C) *pinnai* *pinnai* Travassos, Artigas and Pereira, 1928 |
|                       |               |       | 1 N | *Cucullanus* (*Cucullanus*) *zungaro* Vaz and Pereira, 1934 |
|                       |               |       | 1 N | Seuratoidea gen.sp. (if)                      |
| *Zungaro zungaro*     | [*Zungaro* *zungaro*; *Paulicea* *luetkenii*] | 6/4 | 1 D | *Iheringtrema* *iheringi* Travassos, 1948 |
|                       |               |       | 2 C | *Gozeella* *argostinioi* Pananelli and Santos, 1992 |
|                       |               |       | 1 C | *Megathylacus* *brooksi* Rego and Pananelli, 1985 |
|                       |               |       | 1 C | *Peltidocotyle* *rugosa* Diesing, 1850        |
|                       |               |       | 1 C | *Travassiella* *avetellina* Rego and Pananelli, 1987 |

**Potamotrygonidae**

| Potamotrygon motoro | raia          | 5/3  | 1 N | *Prociamallanus* (P) *peraccuratuis* Pinto, Fábio, Nornha and Relas, 1976 |
|                     |               |       | 1 N | *Prociamallanus* (S) *inopinatus* Travassos, Artigas and Pereira, 1928 |
|                     |               |       | 1 D | *Generchella* *tropicalis* (Manter, 1936) (new host record and first report in South America) |
|                     |               |       | 3 C | Cestoda gen. sp.                   |
|                     |               |       | 1 M | Monogenea gen.sp.                             |

**Prochilodontidae**

| Prochilodus lineatus | curimbatá    | 45/22 | 1 N | *Contracaeum* sp. 2 (if) Moravek, Kohn and Fernandes, 1993 |
|                     |              |       | 1 N | *Spinicterus* *asperus* Travassos, Artigas and Pereira, 1928 |
### Table 1. Continued.

| HOSTS | COMMON NAME | E/P | I | HELMINTHS |
|-------|-------------|-----|---|-----------|
| Prochilodus lineatus [=Prochilodus scrofa] | curimbá | 45/22 | 10 D | Saccococlioides nanii Szidat, 1954 |
| | | | 10 D | Saccococlioides elongatus Szidat, 1954 |
| | | | 10 A | Neoechinorhynchus (Neoechinorhynchus) curemai Noronha, 1973 |
| | | | 1 M | Monogenea gen. sp. |
| Rhamphichthys rostratus | peixe-espada | 1/1 | 1 N | Cucullanus rhamphichthys Moravec, Kohn and Fernandes, 1997 |
| Sciaenidae | | | | |
| Plagioscion squamosissimus | corvina | 61/53 | 1 N | Contraeacuem sp. 1 (if) of Moravec, Kohn and Fernandes, 1993 |
| | | | 14 N | Hysterorythylacium sp. (if) of Moravec, Kohn and Fernandes, 1993 |
| | | | 1 N | Ichthyocaris brasiliensis Moravec, Kohn and Fernandes, 1992 |
| | | | 5 N | Paracamallanus amazonensis Ferraz and Thatcher, 1992 (new host record) |
| | | | 22 D | Austrodiplostenos compactum Lutz, 1928 (nc) |
| | | | 1 D | Genarchella astranatis (Watson, 1976) (new host record and first report in South America) |
| | | | 1 C | Cestoda gen. sp. (if) |
| | | | 9 M | Monogenea gen. sp. |
| Sternopygidae | | | | |
| Eigenmania virescens | tuína | 5/1 | 1 M | Monogenea gen. sp. |
| | | | 1 C | Cestoda gen. sp. |
| Sternopygus macrurus | sarapó, tuína | 1/1 | 1 C | Cestoda gen. sp. |

### Table 2. List of freshwater fishes not parasitized recorded in reservoir of the Hydroelectric Power Station of Itaipu, Paraná, Brazil.

| FISHERS | COMMON NAME | N |
|---------|-------------|---|
| Anostomidae | | |
| Leporinus sp. | piau, piava | 10 |
| Schizodon altiparanensis | piau | 4 |
| Schizodon nasutus | piau, timbôrê | 1 |
| Auchenipiteridae | | |
| Ageneiosus inermis [=A. brevisflorus] | perna de moça | 1 |
| Ageneiosus ucyalensis | mandubé, mani-leiteiro | 1 |
| Callichthyidae | | |
| Callichthys callichthys | cascudinha, tamoata | 1 |
| Characidae | | |
| Moenkhausia intermedia | viuvinha | 2 |
| Cichlidae | | |
| Oreochromis niloticus niloticus | tília | 1 |
| Tilapia rendalli | tília | 1 |
| Curimatidae | | |
| Curimata sp. | papa-terra | 1 |
| Doradidae | | |
| Rhinodoras dorbignyi | armado | 1 |
| Gymnotidae | | |
| Gymnotus carapo | sarapó, morenita | 1 |
| Loricaridae | | |
|Ancistrus cirrhosus | cascudo-mreta | 2 |
| Hypostomus lateomaculatus | cascudo-amarelo | 2 |
| Hypostomus margaritifer | cascudo | 1 |
| Hypostomus sp. 3 | cascudo-tarzã | 5 |
| Parodontidae | | |
| Parodon tortuosa | canivete | 6 |
| Pimelodidae | | |
| Pimelodus fur | mandi-prata | 1 |
| Rivulidae | | |
| Rivulus sp. | charuto | 1 |
| Sternopygidae | | |
| Eigenmannia trilineata | tuína | 1 |

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