"EVALUATION OF FISH FAUNA IN LESS EXPLORED AQUATIC SYSTEMS OF SOUTHERN BAHIA- BIOBAHIA PROJECT – PART II"

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ACSI funding proposal 06-45 (regarding fieldwork)

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Introduction:

The southern Bahia region is composed by several hydrological basins that give shelter to a rich and diverse fish fauna with endemic species. The hydrological richness contrasts with the less explored fish fauna, with species still unknown to the scientists.

The extreme southern Bahia is in an accelerated process of degradation, due to expansion of disoriented agriculture and cut of natural vegetation (ARAÚJO *et al.,* 1998; MMA, 2000). The impact of removal of natural vegetation may represent a danger to aquatic fish fauna. Some species inhabit only forested environments, with shadow and dense vegetation. These species are in risk of extinction, as is the case of *Mimagoniates sylvicola* and *Rachoviscus graciliceps,* actually in the official list of endangered fauna in Brazil (MMA, 2003). During the field activities of the Biobahia project, both these endangered species were found in the coastal river basins at Cumuruxatiba. *Mimagoniates sylvicola* was found in the Rio Imbassuaba, a short river basin protected by the Parque Nacional do Descobrimento (Sarmento-Soares & Martins-Pinheiro, 2006a). *Rachoviscus graciliceps* were found in vulnerable environments, such as small creeks (Sarmento-Soares & Martins-Pinheiro, 2006b). It is possible that along more than 500 years of colonization, many fish species become extinct, not leaving us a chance to discover about their existence.

Available April 27, 2007

The southern Bahia hydrographic region is formed, from north to south, by the following eleven river basins: Rio Santo Antônio, Rio João de Tiba, Rio Buranhém, Rio Frade, Rio Caraíva, Rio Corumbau, Rio Cahy, small coastal rivers at Cumuruxatiba, Rio Jucuruçu, Rio Itanhém, and Rio Peruípe. Those basins are bordered by two large river basins: the Rio Mucuri, on south, and Rio Jequitinhonha, on north. The whole area covers part of southern Bahia state and western Minas Gerais state. This region is situated between coordinates $15^0$50' to $18^0$30' latitude south and $38^0$50' to $40^0$40' longitude west. In a first trip, funded by the ACSI during year 2004, the fish fauna of southern Bahia river basins were sampled, between the Rio Mucuri and Rio Cahy (Sarmento-Soares et al., 2005a). This first trip rendered the description of three new catfish species (Sarmento-Soares et al. 2005b; Sarmento-Soares et al. 2006 a and 2006b). During this second trip we sampled the river basins between Cumuruxatiba and the Rio Jequitinhonha, covering an area of about 10.000 Km^2, in 12 days of collecting efforts.

Metodology:

Study area. The field work was carried out in the river drainages of Rio Jequitinhonha, Rio Santo Antônio, Rio João de Tiba, Rio Buranhém, Rio Frade, Rio Caraíva, Rio Corumbau, Rio Cahy, along small coastal river basins at Cumuruxatiba, and on lower Rio Jucuruçu, in order to inventory the ichthyofauna (see fig. 1- map). The fish samples were obtained through trawl nets in freshwater environments. There were sampled the upper and lower portions of the river basins in the study area.

The river systems at southern Bahia cross a plain to ondulate relief with sediments from Tertiary to Quaternary, responsible to the formation of "Tabuleiros", regional name due to long plain surfaces left on landscape. Geologically those coastal "tabuleiros" from the area of the study belongs to the "Formação Barreiras", dated from the Pliocene, extending form the coast up to 110 Km inland since Ilhéus, at Bahia, on north until the mouth of Rio Doce, at Espírito Santo, on south (Superintendência de Recursos Hídricos, 1996). The original vegetal covering was the Atlantic forest, now with remaining patches seen only at Cumuruxatiba, Cahy and Corumbau regions.

Collecting techniques. Sampling was done along the day until crepuscule. The choice of collecting upstream or middle/down stream was previously planned, taking into account accessibility, even through small unpaved roads. The fieldwork stations were located through a GPS, photographed, the sampled time and fishing gear annotated. Each station was

described regarding environmental (abiotic and physiographic) parameters, as: size of stream, current velocity, abundance of marginal, floating and/or submerged vegetation, botton type and structure, water coloration, water depth and weather conditions. The fishes were captured through different fishing nets and fixed in 10% formalin. Most species were photographed alive, in a field aquarium.

Collecting licenses and sample deposit procedures. The collecting licenses for the present trip were obtained at the IBAMA (process number 02006.002926/06-17).
All samples, after identification and catalogue, were registered under the MNRJ ichthyological collections. The taxonomic classification of species follows Reis et al. (2003), Buckup et al. (2007) and Menezes et al. (2003). The requested deposit in US institutional collections is taken into account, but the legal way to do this is thorough donation. Direct shipping of native fauna to foreign institutions with no formal passage at a local museum is prohibited under brazilian laws. Representative fish species captured under this trip will be formally sent to US institutions through our colleague, Dr. Paulo A. Buckup, one of the curators of the ichthyological collections at the Museu Nacional.

Morphometric and meristic procedures. In order to provide the identification of the catfishes in the study area, morphological aspects were observed, and some measurements and counts made necessary in most cases. The proportional measurements are expressed in percentuals of standard length (SL) or head length (HL); or whatever stated in the text, and the metodology for measurements or counts follow the pertinent litterature for the different groups, and are mentined together with the species report.

Results:

There were sampled 43 fieldwork stations along six river drainages (fig. 1). The cumulative species richness in each river drainage is seen on table 1. In analyzing separately the stations sampled, localities at river drainages of Cahy and Frades were the most speciose in the number of fishes, with at least more than 12 different fish species sampled in each point (see fig. 1). A considerable part of the ciliary vegetation is still present along river banks in both Cahy and Frades river basins. Along the Frades river valley we observed cacao agriculture in some points, and the rivers were vegetated along its margin. On the other hand, the Rio Caraíva basin was one of the most heaviest impacted regarding fish diversity, as the river bank vegetation was in most part removed, and fish diversity was reduced.

We collected 2.994 fish specimens, belonging to 21 families, 32 genera and 42 species (table 2). The Ostariophysi was the dominant fish group, with 83,3 % of the collected species, corresponding to 45,2 % of all fishes caught. Among the Ostariophysi caught, 42,8 % were Characiformes, 2,8% Gymnotiformes, and 54,3% Siluriformes. The catfish families Trichomycteridae, Loricariidae and Heptapteridae were the most abundant within the group. Among the Siluriformes, we were able to find six potentially new species, and some catfish deserving comments.

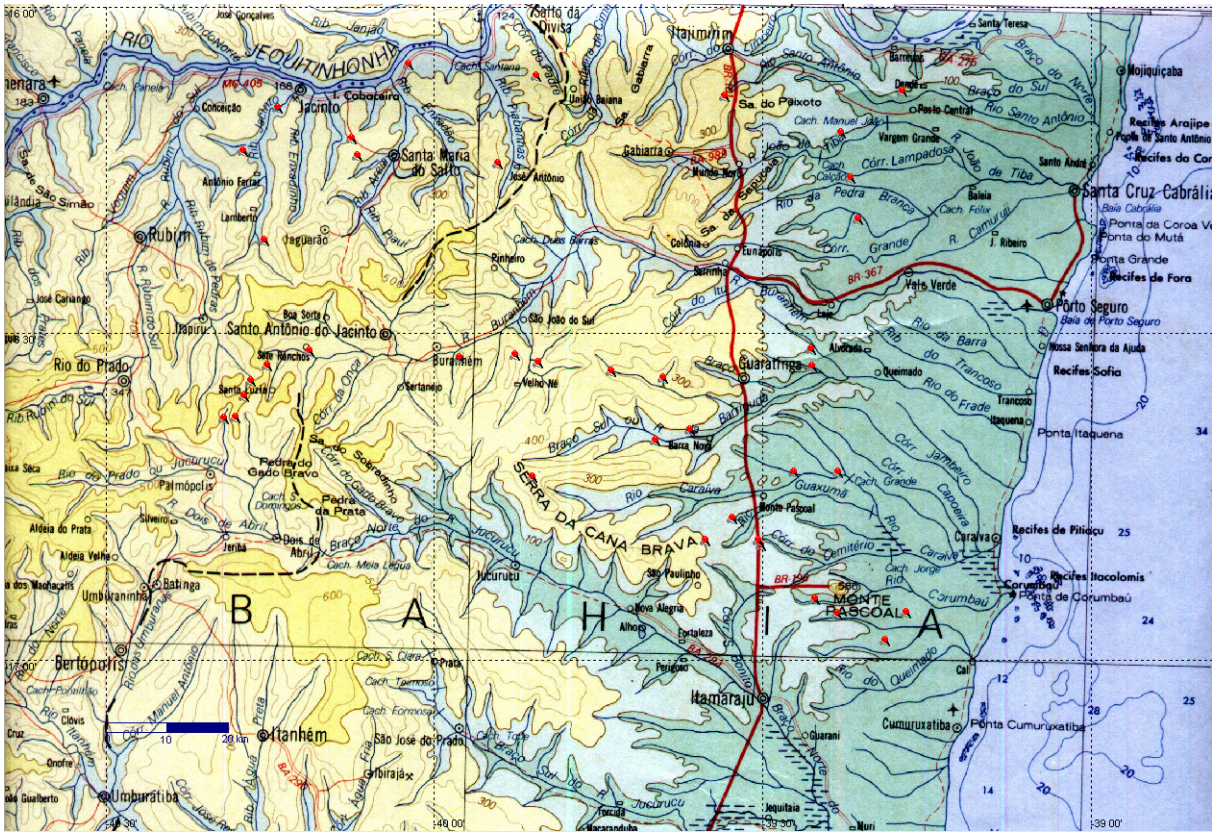

Fig. 1- Map of the 43 collecting localities and records of GPS information.

Potentially new species:

Parotocinchlus sp. n.

Fig. 2- new *Parotocinclus*

The revision of genus *Parotocinclus* was provided about thirty years ago, by Garavello (1976), and since that eleven new species have been described. Nowadays the genus is composed by 24 species, and is in need of a revisionary study.

The genus *Parotocinclus* was being recognized through a combination of characters, such as the presence of an adipose fin, head not strongly depressed, eyes not visible in ventral view, pectoral arrector fossae opened, at least partially, region of snout surrounding anterior portion of nostrils plated and slightly depressed, head without crests Schaefer & Provenzano (1993); and on the presence of a caudal fenestrum anterior to notch between hypurals 2 and 3 (Reis & Schaefer, 1998). These features are not necessarily derived, but all of them are present in the *Parotocinclus* from southern Bahia.

Parotocinclus sp.n. has an abdomen with extensive naked areas, an almost rectangular caudal peduncle in cross section, and also an uncommon anal fin ray. Among the *Parotocinclus* species with a rectangular caudal peduncle, the new species is morphologically similar to *P. jumbo*, *P. cearensis* and *P. spilosoma*, due to the extensive naked abdomen, and the pectoral girdle partially exposed.

The southern Bahia *Parotocinchlus* is a different one, due to a unique combination of morphological characters. Morphometric measurements and meristic data, regarding plates, were also taken and compared to available comparative specimens and species descriptions.

Hypostomus sp.n. 1

Fig. 3- *Hypostomus* sp. 1

The *Hypostomus* from the coastal river drainages of brazilian east obviously need a revisionary study. There are 8 hypostomus names cited for the Brazilian east river drainages between Rio de Janeiro and Bahia (based on Carvalho & Bockmann, 2007): *Hypostomus brevicauda, H. niger*; *H. punctatus*, *H. scabriceps*, *H. subcarinatus, H. unae*; *H. vermicularis* and *H. wuchereri*.

According to the comparisons we made between the nominal species for the area, the form that is most close to our southern Bahia population is *Hypostomus affinis*, restricted by Mazzoni et al (1994) to the Rio Paraíba do Sul. Among the Steindachner´s (1876) syntipes of *H. affinis*, there were specimens from the Rio Mucuri, but now those specimens have no formal name, and consequently the southern bahian population is unnamed.

We have provided morphometric and meristic data for the *Hypostomus* of the southern Bahia river basins in order to make comparisons with the nominal species at the brazilian east river basins. The measurements taken were based on Armbruster (2003) and Mazzoni et al. (1994). The proportional measurements are comparatively different, as for an example, a large head (predorsal length 40% in SL; head length 34% in SL; versus 37 and 29 in *H. affinis*), a smaller adipose spine (adipose spine length 6% in SL versus 7% in *H. affinis*) and less number of predorsal scutes (2 versus 3 to 4). The *Hypostomus* sp. 1 has a flattened body depth and a naked abdomen.

A detailed comparative study is necessary to be done, in order to proceed an elucidative species description.

Hypostomus sp.n. 2

Fig. 4- *Hypostomus* sp. 2

The genus *Hypostomus* is composed by 80 species (sensu Carvalho & Bockmann, 2007), and is by far the most speciose genus in the family Loricariidae. It is recognized by the snout covered with plates, with a small naked area; and by the interopercle less movable, bearing short spines. Hypostomus is a paraphyletic assemblage, although smaller monophyletic entities are recognized within the group.

A preliminary direct comparison between our *Hypostomus* sp.2 and the *H. francisci* from the Rio São Francisco was provided, and we observed that both species have a keel behind each eye and a keel on supraoccipital. The Hypostomus sp. 2 has a tall body depth and an abdomen with small platelets.

Trichomycterus sp. n. 1

Fig. 5- *Trichomycterus* sp. 1

Trichomycterus is the largest trichomycterid catfish genus, with 22 species recorded for the rivers between Rio de Janeiro and Bahia (Wosiacki & de Pinna, 2007). Five different *Trichomycterus* were found in southern Bahia freshwaters.

A single specimen of 59 mm SL was found at the upper portion of Rio Caraíva basin. The potentialy new *Trichomycterus* species has a unique reticulated color pattern with dorsal and caudal fins completely dark. At a first comparison, this fish has a unique color pattern, as its geographically closest congener, *T. pradensis*, has all fins hyaline and a spotted pattern. The

possibly new *Trichomycterus* species has 8 branched rays on pectoral fin, and differs from *T.mimonha* and *T.trefauti*, species with 6 branched rays on pectoral fin.

Trichomycterus sp n. 2

Fig. 6- *Trichomycterus* sp. 2

The coloration pattern is unique, with stripes over sides of body, extended until caudal fin. It is similar to *T.alternatus* and *T.itatiayae* due to the position of anal and urogenital openings at vertical through the origin of dorsal fin base. Nasal barbels short, not reaching interopercular odontodes, which is similar to the condition found in *T.aurogutatus, T.florensis* and *T. pradensis* and different from *T. longibarbatus* (almost reaching caudal fin). The six branched dorsal fin rays in *Trichomycterus sp n. 2* is also found in *T. pradensis,* from southern Bahia, and *T. immaculatus,* from the Rio Paraíba do Sul.

Rhamdia sp.

Fig. 7- *Rhamdia* sp.

There are only two *Rhamdia* species known to occur in the brazilian east river drainages, according to Bockmann & Guazzelli (2003): *R. jequitinhonha* Silvergrip, 1996, from a single specimen from the Rio Araçuai, at Rio Jequitinhonha drainage in Minas Gerais, and the wide ranged *R. quellen* (Quoy e Gaimardi, 1824) known from the Americas.

In *R. jequitinhonha* the following differences were found (in comparison to Silvergrip, 1996:85): caudal peduncle length larger 19,4 a 24,9% in SL (versus 16,3% in *R. jequitinhonha*) and caudal peduncle depth 38,1 to 55,9% in caudal peduncle length (versus 61,1%); eye diameter shorter 13,0 to 17,4% in HL (versus 20,4%) and interorbital distance larger 26,8 to 38,3% in HL (versus 24,2%).

In *R. quelen* (Quoy e Gaimardi, 1824) the following differences were found (in comparison to Silvergrip, 1996:95): caudal peduncle depth average almost lower 46,6% in caudal peduncle length (versus 60,7% in *R. quelen*); eye diameter average shorter 15,5% in HL (versus 22,3%). Silvergrip (1996) measured 821 specimens of *R. quelen* and found only two catfishes having anal fin with 9 to 10 rays. In the 15 specimens we analysed from Bahia river drainages, we were able to find 11 fishes with 9 to 10 rays on anal fin.

Rhamdia quelen is a very complicate, still unsolved, complex of species, but we are aware that those southern bahian catfishes do not fit in its description.

Some catfish deserving comments:

Trichomycterus pradensis

Fig. 8- *Trichomycterus pradensis*

This species was described as new as part of the results of the first Biobahia expedition, funded by the ACSI. *Trichomycterus pradensis* is recognized by its spotted color pattern,

much similar to the coloration of *T. alternatus*, from the Rio Doce. *Trichomycterus pradensis* differs from *T. alternatus* due to a short nasal barbel, not reaching opercular odontode plate (vs. long and reaching); and by the pectoral fin filament shorter than head length (vs. longer). During this expedition *T. pradensis* is found to occur at the Rio Santo Antônio, Rio Buranhém, Rio dos Frades and Rio Cahy basins.

Trichomycterus jequitinhonhae

Fig. 9- ***Trichomycterus jequitinhonhae***

Color pattern with grey dark spots on latero- dorsal parts of body, becoming more scattered towards ventral parts. The opercular patch of odontodes is unpigmented. Fins hyaline. The anal opening is placed at vertical anterior to the origin of dorsal fin base. Dorsal fin ray with seven branched rays; pectoral fin ray with seven branched rays and 5 branched rays on anal fin. This species was known only from the type series, and was captured by us in some localities at the Rio Jequitinhonha basin.

Trichomycterus itacambirussu

Fig. 10- ***Trichomycterus itacambirussu***

Trichomycterus itacambirussu has roundish dark brown spots over the body not arranged into series (Triques & Vono, 2004). The opercular odontode plate is partially dark. The body is robust. The pelvics are separated. Pectoral fin rays vary between seven to eight branched rays. The dorsal fin ray counts correspond to the same number observed for *T. bahianus*, although this last species is distinctive regarding pectoral fin ray counts, seven branched (vs. eight

branched in *T. itacambirussu*). This species was known only by the types, and a lot of three specimens was identified by us from the Rio Jequitinhonha basin.

Rhamdia jequitinhonhae

Fig. 11- *Rhamdia jequitinhonhae*

Silvergrip (1996) described *Rhamdia jequitinhonhae* from a single specimen from middle Jequitinhonha basin. This species has multiple cephalic pores in the head and an elongate body. The color pattern is darker, with no spots or bands. The adipose fin is shorter than that observed for *Rhamdia quelen*.

Rhamdia jequitinhonhae was reported by us for several localities at the Rio Jequitinhonha basin, and this will make possible a better knowledge about this species.

Neoplecostominae new genus and new species

Fig. 12- Neoplecostominae

The Neoplecostominae sensu Armbruster (2004) was defined to include most species currently assigned to *Hemipsilichthys, Isbrueckerichthys, Kronichthys, Neoplecostomus,* and *Pareiorhina*. The Neoplecostominae is being studied by Edson H. L. Pereira and Roberto E.

Reis, who will examine the relationships of the genera to each other and to the Hypoptopomatinae (Reis el al., 2006).

The Neoplecostominae is almost exclusively found in south-eastern Brazil, and, together with the Hypoptopomatinae, is supposed to be a clade basal to all other loricariid clades (Reis et al., 2006).

The Neoplecostominae is identified by the dorsal-fin spinelet rectangular or absent and by dorsal-fin spine lock not functional (Reis et al., 2006). The new taxon from southern Bahia is being studied by Pereira and Reis, and specimens were sent to them. It has 24-25 plates on lateral line; 4 predorsal plates and 5-6 plates on dorsal fin base. Dorsal fin with seven to eight branched rays and pectoral fin with six branched rays. During this trip, we captured specimens at upper Rio Buranhém basin.

Exotic species:

Fig. 13- ***Clarias gareipinnus***

During the collecting of fish samples we found three exotic species: *Clarias gareipinnus* (Burchell, 1822), *Oreochromis niloticus* (Linnaeus, 1758) and *Poecilia reticulata* Peters, 1859. Those fishes were found in the river basins showing intense human occupation, as was the case of Rio Jequitinhonha (see table 1), and also the Rio dos Frades.

Table 1- River drainages captures and fish sampled:

River drainages	fieldwork stations	fish diversity in each drainage	fish species
Jucuruçu	2	*Astyanax rivularis.; Hyphessobrycon sp. ; Mimagoniates microlepis; Hoplias malabaricus; Hoplerythrynus unitaeniatus; Otothyris travassosi; Rhamdia sp.; Gymnotus carapo; Poecilia vivipara; Geophagus brasiliensis*.	10
Cumuruxatiba coastal rivers	2	*Acentronichthys leptos; Astyanax rivularis; Rachoviscus graciliceps; Mimagoniates microlepis; Eleotris pisonis; Hoplerythrinus unitaeniatus; Aspidoras virgulatus; Otothyris travassosi; Gymnotus carapo; Phalloceros caudimaculatus, Poecilia vivipara, Oreochromis niloticus; Geophagus brasiliensis*.	13
Cahy	5	*Astyanax lacustris; Astyanax rivularis.; Characidium sp. 1; Hyphessobrycon sp. ; Hoplias malabaricus; Oligosarcus acutirostris; Otothyris travassosi; Hypostomus sp..; Microglanis pataxo; Pimellodella sp.; Imparfinis. minutus; Aspidoras virgulatus; Scleromystax prionotos; Parauchenipterus striatulus; Trichomycterus pradensis; Phalloceros caudimaculatus; Poecilia vivipara; Geophagus brasiliensis; Synbranchus marmoratus*.	21
Corumbau	2	*Astyanax rivularis.; Characidium sp. 1; Mimagoniates microleps; Otothyris travassosi; Hypostomus sp..; Pimellodella sp.; Aspidoras virgulatus; Scleromystax prionotos; Phalloceros caudimaculatus; Geophagus brasiliensis*.	10
Caraíva	5	*Astyanax lacustris; Astyanax rivularis.; Characidium*	13

		sp. 1; Hoplias malabaricus; Oligosarcus acutirostris; Otothyris travassosi; Pimellodella sp.; Rhamdia sp.; Scleromystax prionotos; Trichomycterus sp. 1; Gymnotus carapo; Poecilia vivipara; Geophagus brasiliensis.	
Frades	7	*Astyanax lacustris; Astyanax rivularis.; Characidium sp. 1; Hemigrammus sp. ; Hoplias malabaricus; Oligosarcus acutirostris; Cyphocharax gilbert; Leporinus coppelandi; Leporinus sp.; Otothyris travassosi; Hypostomus sp..; Pimellodella sp.; Rhamdia sp.; Scleromystax prionotos; Parauchenipterus striatulus; Trichomycterus pradensis; Clarias gariepinus; Gymnotus carapo; Poecilia vivipara; Geophagus brasiliensis; Synbranchus marmoratus.*	21
Buranhém	7	*Astyanax lacustris; Astyanax rivularis.; Characidium sp. 1; Hemigrammus sp. ; Hoplias malabaricus; Parotocinclus sp. ; Hypostomus sp..; Neoplecostominae; Pimellodella sp.; Rhamdia sp.; Trichomycterus sp. 1; Oreochromis niloticus; Geophagus brasiliensis.*	12
João de Tiba	4	*Astyanax lacustris; Astyanax rivularis.; Characidium sp. 1; Hoplias malabaricus; Oligosarcus acutirostris; Hypostomus sp..; Rhamdia sp.; Scleromystax prionotos; Trichomycterus pradensis; Gymnotus carapo; Geophagus brasiliensis.*	14
Santo Antônio	2	*Astyanax lacustris; Astyanax rivularis.; Characidium sp. 1; Hypostomus sp..; Scleromystax prionotos; Pimellodella sp.; Trichomycterus pradensis; Gymnotus carapo; Poecilia vivipara; Geophagus brasiliensis.*	10
Jequitinhonha	7	*Astyanax lacustris; Astyanax rivularis.; Characidium*	19

		sp. 1; Hyphessobrycon sp.; Hemigrammus sp. ; Hoplias malabaricus; Parotocinclus sp.; Otothyris travassosi; Hypostomus sp..; Hypostominae; Pimellodella sp.; Rhamdia jequitinhonhae.; Trichomycterus jequitinhonhae; Trichomycterus itacambirussu; Trichomycterus sp.n. 2; Poecilia reticulata; Geophagus brasiliensis; Oreochromis niloticus; Synbranchus marmoratus.	
Total stations	43	**Total species diversity**	58

Table 2- Fish species collected during the Biobahia II expedition:

Characiformes

Curimatidae

Cyphocharax gilberti (Quoy & Gaimard, 1824)

Anostomidae

Leporinus copelandii Steindachner, 1875

Leporinus sp.

Characidae

Incertae sedis

Astyanax lacustris

Astyanax rivularis

Astyanax sp. 1

Hemigrammus sp.

Hyphessobrycon bifasciatus Ellis, 1911

Oligosarcus acutirostris

Glandulocaudinae

Mimagoniates microlepis (Steindachner, 1876)

Mimagoniates sylvicola Menezes & Weitzman, 1990

Chenuchidae

Characidiinae

Characidium sp. 1

Characidium sp. 2

Erythrinidae

Hoplerythrinus unitaeniatus (Agassiz, 1829)

Hoplias malabaricus (Bloch, 1794)

Siluriformes

Callichthyidae

Aspidoradini

Aspidoras virgulatus Nijssen & Isbrüecker, 1980

Scleromystax prionotos (Nijssen & Isbrüecker, 1980)

Clariidae

Clarias gariepinus (Burchell, 1822)

Heptapteridae

Acentronichthys leptos Eigenmann & Eigenmann

Imparfinis minutus

Microglanis pataxo.

Pimellodella sp.

Rhamdia jequitinhonhae

Rhamdia sp.

Loricariidae

Hypoptopomatinae

Otothyris travassosi

Parotocinchlus sp.n.

Hypostominae

Hypostomus sp. 1

Hypostomus sp. 2

Neoplecostominae

Gen. & sp. n.

Trichomycteridae

Trichomycterus pradensis

Trichomycterus jequitinhonhae

Trichomycterus itacambirussu

Trichomycterus sp. 1

Trichomycterus sp. 2

Auchenipteridae

Trachelyopterus striatulus (Steindachner, 1877)

Gymnotiformes

Gymnotidae

Gymnotus carapo Linnaeus, 1758

Atheriniformes

Poeciliidae

Phalloceros caudimaculatus (Hensel, 1848)

Poecilia reticulata Peters, 1859

Poecilia vivipara Bloch & Schneider, 1801

Symbranchiformes

Symbranchidae

Synbranchus marmoratus Bloch, 1795

Perciformes

Cichlidae

Geophagus brasiliensis (Quoy & Gaimard, 1824)

Oreochromis niloticus (Linnaeus, 1758)

Eleotridae

Eleotris pisonis (Gmelin, 1789)

Acknowledgments:

We wish to thank our colleagues at the setor de Ictiologia of the Museu Nacional, and in special to (in alphabetical order): Gustavo W. Nunan; Marcelo R. Britto; Paulo A. Buckup and Priscila Motta. We acknowledge the students of the "Projeto Peixes Meninos" at Cumuruxatiba, Bahia, for their help during the separation of fish specimens.

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