LISTS OF SPECIES

Fishes from the upper Yuruá river, Amazon basin, Peru

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Abstract
We report results of an ichthyological survey of the upper Rio Yuruá in southeastern Peru. Collections were made at low water (July-August, 2008) near the headwaters of the Brazilian Rio Juruá. This is the first of four expeditions to the Fitzcarrald Arch - an upland associated with the Miocene-Pliocene rise of the Peruvian Andes - with the goal of comparing the ichthyofauna across the headwaters of the largest tributary basins in the western Amazon (Ucayali, Juruá, Purús and Madeira). We recorded a total of 117 species in 28 families and 10 orders, with all species accompanied by tissue samples preserved in 100% ethanol for subsequent DNA analysis, and high-resolution digital images of voucher specimens with live color to facilitate accurate identification. From interviews with local fishers and comparisons with other ichthyological surveys of the region we estimate the actual diversity of fishes in the upper Juruá to exceed 200 species.

Introduction
The freshwater fish fauna of tropical South America is among the richest vertebrate faunas on Earth, with more than 6,000 species representing about 46% of the world’s 13,000 freshwater fish species, and perhaps 10% of all known vertebrate species (Vari and Malabarba 1998; Reis et al. 2003). At the core of this region lies the Amazon basin, the greatest interconnected freshwater fluvial system on the planet, discharging approximately 16% of the world’s flowing freshwater into the Atlantic Ocean (Goulding et al. 2003). The diversity of South American freshwater fishes is centered on the Amazon basin. The alpha diversity of Amazonian ichthyofaunas is very high, with many floodplain faunas represented by more than 100 locally abundant resident species (e.g., Crampton 1999; Petry et al. 2003; Correa et al. 2008).

The Yuruá river rises in the department of Ucayali in Peru and runs into Brazilian territory, where it is known as Juruá river. The Juruá river is a tributary to the Solimões river (Brazil) in the Amazon basin with more than 90% of its length flowing through Brazilian territory. The river has an extensive number of meanders, a huge floodplain, and is studded with thousands of oxbow lakes. The Juruá contributes about 4% of the total Amazon discharge (Goulding et al., 2003). One of the earliest fish studies in the Rio Yuruá basin was made by La Monte (1935), who presented a fish list with 37 species from the Envira river, an upper tributary to the Juruá in Brazil. Other studies in the upper portions of Juruá river basin include Silvano et al. (2000; 2001) presenting respectively 90 and 111 species from the Brazilian portion of this drainage, and Rengifo (2007), identifying a high diversity of 185 species from the Peruvian portion.
Here we report the result of an expedition to the Río Yuruá, as part of a four-year survey project funded by NSF called "Proyecto Alto Purus". The goals of this project are to sample the headwaters of four major basins in Peru: Ucayali, Yuruá, Purus and Madre de Dios. These basins have a radial pattern rising in the Fitzcarrald arch, a major structural high of the Andes in the Amazon foreland basin (Espurt et al. 2007).

Materials and methods
Sixteen localities where sampled in the upper portions of the Río Yuruá, department of Ucayali in Peru (Table 1, Figure 1). Field work was conducted from July 20 to August 11, 2008, for a period of 20 days during the dry season, in the area of the town of Breu (09°31' S, 72° 45' W, 271 m) on the upper Yuruá river in southeastern Peru, by James Albert (University of Louisiana at Lafayette), Roberto Quispe and Isabel Corahua (University of San Marcos, Lima). Three major types of environments where sampled: river channels and beaches (rios), stream runs and pools (quebradas), and oxbow lakes (cochas) (Figure 2). Rios are major rivers (i.e., Yuruá, Breu, Huacapistea), quebradas are small tributary streams, and cochas are oxbow lakes located on the floodplain. All collecting stations were georeferenced using GPS, and habitats were documented with high resolution digital photographs and written descriptions.

Table 1. Sampled sites in the upper Río Yuruá basin, Ucayali, Peru. MA = Map; alt = meters above sea level.

| Locality                      | MA    | Coordinates       | alt      | Description                             |
|-------------------------------|-------|-------------------|----------|-----------------------------------------|
| Cocha Segundo                 | CS    | 09° 32'14"S, 72° 45'04"W | 265      | Floodplain oxbow lake                    |
| Cocha Galpon                  | CG    | 09° 32'22"S, 72° 46'00"W | 272      | Oxbow lake, muddy anoxic bottom          |
| Cocha Renacal                 | CR    | 09° 45'48"S, 72° 39'57"W | 283      | Small Lake in tierra firme              |
| Cocha Trozadera               | CT    | 09° 46'23"S, 72° 42'17"W | 282      | Lake, Muddy anoxic bottom                |
| Cocha Shayanpiariini          | CSh   | 09° 31'44"S, 72° 45'19"W | 260      | Large ox bow, thin layer mud             |
| Quebrada Dos y Medio          | QD    | 09° 31'10"S, 72° 45'45"W | 271      | Tierra firme stream, muddy bottom        |
| Quebrada Sabotari             | QS    | 09° 34'22"S, 72° 48'08"W | 272      | Bridge on logging road to Victoria      |
| Quebrada Shonohuachi          | QSi   | 09° 46'25"S, 72° 40'04"W | 281      | Flowing water near Río Yuruá             |
| Quebrada Boca Piedra          | QB    | 09° 30'59"S, 72° 47'53"W | 272      | Small tierra firme stream                |
| Quebrada Lupuna               | QL    | 09° 31'32"S, 72° 45'31"W | 260      | Small stream at Breu                      |
| Río Yuruá above Breu          | RY1   | 09° 32'36"S, 72° 39'57"W | 261      | Sandy beach, river 30 m wide             |
| Río Yuruá above Breu          | RY2   | 09° 33'21"S, 72° 46'00"W | 268      | Muddy and sand Bank                      |
| Río Yuruá above Huacapishtea  | RY3   | 09° 45'56"S, 72° 40'36"W | 272      | Sandy Beach                              |
| Río Huacapishtea              | RH    | 09° 46'07"S, 72° 42'07"W | 282      | Small rapids                             |
| Mouth of Río Breu             | RB    | 09° 24'45"S, 72° 43'04"W | 258      | Confluence with Río Yuruá                |
| Río Yuruá between Nueva Victoria and Breu | RY4 | 09° 36'11"S, 72° 46'24"W | 271      | Outcrop in the river                     |
Collections were made using standard ichthyological gear, including seine nets (5, 10 and 20 m, 5 mm between knots), dip nets, cast nets, traps, and hook and line. Electric fishes were located with the aid of a portable amplifier (Wells and Crampton 2006). A local fish-toxin called *huaca* (pronounced 'waka') was used in log jams of larger streams. In the upper Rio Yuruá leaves of the shrubby *Clibadium remotiflorum* (Asteraceae) are crushed and molded into a paste, and then washed through the water where a polyacetylenic compound, ichthyothereol, depletes the oxygen (Cascon et al. 1965; Czerson et al. 1979). After application most fishes float to the surface, except for certain loricariid taxa which tend to burrow deeper into the substrate. Fish mortality using the *huaca* of the upper Yuruá is very low and most specimens recover in minutes (JSA, pers. obs.). The fishes collected in upper Rio Yuruá were not poisoned; indeed *huaca* is biodegradable and commonly used by the local Ashininka communities for collecting fish for consumption.

A synoptic reference collection was accumulated in Breu, including one or more representative of all morphospecies encountered. Each lot in this reference collection was assigned a unique field number that was attached to each tissue sample, and accompanying digital photo(s) and unique voucher specimen. Tissue samples were excised using a sterilized scalpel and preserved in 100% ethanol in 1.8 ml vials, and then stored in a cool location at the base camp before transport to the laboratory. All voucher specimens were measured for standard length, individually labeled with plastic tags, fixed in 10% formalin for at least 48 hours in a closed Nalgene container or covered flat plastic tray (for larger specimens), and later transferred to 70% ethanol in the laboratory.

**Figure 2.** Examples of sampled localities in the upper Yuruá river basin; A. Huacapistea river close to confluence with Yuruá river B. Yuruá river upstream Breu. C. Quebrada Dos y Medio. D. Cocha Shayenpiriarini.
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Fishes were identified to the lowest taxonomic level possible, using available literature and help of specialists’ photo identifications. The classification presented here is based on Reis et al., (2003); within orders families are listed alphabetically. Voucher specimens were deposited in the fish collection of the Museo de Historia Natural da Universidad Mayor de San Marcos (MUSM), Lima, Peru. The fishes were collected under permit from the Peruvian Ministry of the Environment (INRENA); Carta #1312-2007-INRENA.

Results and Discussion

A total of 117 species (Table 2) belonging to 28 families and 10 orders were captured and identified. The list of species and their respective occurrence environment are presented in Table 2. The families with highest species richness were Characidae (33 spp.); Loricariidae (18 spp.); Pimelodidae and Curimatidae (8 spp.). Half of the families (14) were represented by only one species. The most abundant orders were Characiformes (54 spp.) and Siluriformes (44 spp.), representing 46% and 37%, respectively, of the total fishes captured. Less abundant representatives, however, were the orders Perciformes (7 spp., 6%) and Gymnotiformes (5 spp., 4 %). In our study, except for Perciformes, the composition of ostariophysan orders is approximately the same as found throughout the Amazon basin, 43% Characiformes, 39% Siluriformes, 12% Perciformes, and 3% Gymnotiformes (Roberts 1972; Lowe-McConnell 1987). A relatively low diversity of Perciformes is also found in other studies in the upper portions of tributary basins in the western Amazon-Ucayali, Juruá, Purús and Madeira. Importantly, the upper reaches of these rivers are hydrologically isolated from one another. Analyses of radiometric and biostratigraphic data indicate that the Fitzcarrald Arch changed from a depositional to an erosional setting during the Late Miocene to Pliocene (c. 9-3 Ma.) (Potter 1997; Campbell et al. 2001; Harris and Mix 2002; Campbell et al. 2006; Westaway 2006) providing minimum age estimates for the genetic divergence of populations/species inhabiting these isolated basins (Sivasundar et al. 2001; Hrbek et al., 2002; Montoya-Burgos 2003; Albert et al. 2006; Hrbek et al., 2006; Lovejoy et al. 2006; Weir 2006). The Fitzcarrald Arch therefore represents an exceptional biogeographic setting: it is the only geological region contained entirely within the Amazon Basin for which we have reliable estimates of the timing of headwater basin separation.

Given the goals of the Alto Purus project to compare patterns of diversity and taxa across the Fitzcarrald Arch, the Alto Yuruá expedition was scheduled for the period of maximum low water. During this time fishes and other aquatic animals are concentrated in lakes and channels, and not dispersed onto the floodplain. Also the lack of rain and mud greatly facilitates transportation, by air, water and foot. In other words it would not have been possible to sample as many localities during the rainy season in the same number of field days, and each station sampled would have produced fewer specimens and species (Silvano et al. 2000). However, interviews with local fishermen suggest that several fish taxa are present or even abundant in the Alto Yuruá during the rainy season, that were not collected in our survey: e.g., potamotrygonids, Lepidosiren, Pellona, Semaprochilodus, Myleus, Brycon, Hydrolicus, cetopontids, auchenipterids, Eigenmannia, Rhamphichthys, and Colomesus. Much of the upper Yuruá traverses a relatively narrow and water-scoured channel (about 30 - 50 m wide and 1- 2 m deep at low water), with steep high banks (10 - 20 m), sandy or muddy beaches, and little aquatic vegetation. These conditions are not favorable to many fish groups specialized
to inhabit lowland Amazonian floodplains and deep river channels.

The diversity reported here compares with 111 species reported by Silvano et al. (2001) on two MacArthur Foundation supported expeditions (1993 and 1994) to adjacent areas of the upper Juruá in Brazil, and 133 species reported by Rengifo (2007) for two expeditions to the Peruvian region of the upper Yuruá in 2005 and 2006. In the ecologically similar upper Purus basin, Anjos et al. (2008) reported 86 species of fishes with just 22 of them being identified in our survey, indicating a very different fauna between these two Amazon tributaries. However, the main peril in comparing species list is the accuracy of the taxonomic identification between different studies. Most of the problems occur in groups widely distributed and those without recent taxonomic reviews in the Amazon basin (e.g. in Loricariidae: Ancistrus, Loricariichthys, Loricaria, Hypostomus, Hypoptopoma, and others), which make the diversity and distribution within these groups almost incomparable. In an effort to reduce this problem, we provided a complete album of the fish species in this paper (Appendix 1). By comparing our species list (with photos) with those presented in Silvano et al. (2001), we identify at least 50 morphospecies that were not captured in our survey. This brings to 167 the total number of fish species known from the upper rio Juruá basin. Taking into account the species presented by Rengifo (2007), we estimate that the ichthyofauna in the upper portions of Rio Juruá should surpass 200 species.

Table 2. List of 117 fish species collected in the upper Yuruá river and their respective capture environment.

| Order/Family/Species | Rio Quebrada Cocha |
|----------------------|---------------------|
| **OSTEOGLOSSIFORMES** |                     |
| Arapaimatidae        |                     |
| Arapaima gigas (Schinz,1822) |                   |
| **CLUPEIFORMES**     |                     |
| Engraulididae        |                     |
| Lycengraulis cf. batesii (Günther, 1868) |     |
| **CHARACIFORMES**    |                     |
| Parodontidae         |                     |
| Parodon pongoensis (Allen, 1942) | x |
| Curimatidae          |                     |
| Curimatella meyeri (Steindachner, 1882) | x |
| Cyphocharax cf. festivus Vari, 1992 |   |
| Cyphocharax spiluropsis (Eigenmann & Eigenmann, 1889) | x |
| Potamorhina allamazonica (Cope, 1878) |   |
| Steindachnerina cf. dobula (Günther, 1868) | x |
| Steindachnerina guentheri (Eigenmann & Eigenmann, 1889) | x |
| Steindachnerina hypostoma (Boulenger, 1887) |   |
| Steindachnerina aff. insculpta (Fernández-Yépez, 1948) | x |
| **Prochilodontidae** |                     |
| Prochilodus nigricans Agassiz, 1829 | x |
| Anostomidae          |                     |
| Leporellus vitatus (Valenciennes, 1850) | x |
| Leporinus cf. friderici (Bloch, 1794) | x |
| Leporinus pearsoni Fowler, 1940 |   |
| Leporinus striatus Kner, 1858 |   |
| Schizodon fasciatus Spix & Agassiz, 1829 | x |
| **Crenuchidae**      |                     |
| Characidium cf. fasciatum Reinhardt, 1866 | x |
| **Gasteropelecidae** |                     |
| Carnegiella myersi Féndez-Yépez, 1950 | x |
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| Order/Family/Species | Rio | Quebrada | Cocha |
|----------------------|-----|----------|-------|
| **Thoracocharax stellatus** (Kner, 1858) | | x | |
| **Characidae** |
| Aphyocharax pusillus Günther, 1868 | x | x | |
| Astyanax abramis (Jenyns, 1842) | x | x | x |
| Charax tectifer (Cope, 1870) | | | x |
| Charax sp. | | | |
| Ctenobrycon hauwellianus (Cope, 1870) | | x | x |
| Engraulisoma taeniatum Castro, 1981 | | x | |
| Galeocara gulo (Cope, 1870) | x | x | |
| Gephyrocharax sp. | | | |
| Gymnocyrtus thayeri Eigenmann, 1908 | | x | |
| Knodus breviceps (Eigenmann, 1908) | x | x | |
| Knodus megalops Myers, 1929 | | | x |
| Knodus aff. moenkhausii (Eigenmann & Kennedy, 1903) | x | x | |
| Knodus sp. 1 | | | x |
| Knodus sp. 2 | | | x |
| Leptagoniates steindachneri Boulenger, 1887 | x | | |
| Moenkhausia cf. comma Eigenmann, 1908 | | | x |
| Moenkhausia dichrous (Kner, 1858) | | | x |
| Moenkhausia oligolepis ( Günther, 1864) | | x | |
| Mylossoma dariventre (Cuvier, 1818) | x | | |
| Odontostilbe fugitiva Cope, 1870 | x | x | |
| Odontostilbe sp. | x | x | |
| Phenacogaster cf. pectinatus (Cope, 1870) | | x | |
| Prionobrama filiger (Cope, 1870) | | x | |
| Roeboides affinis (Günther, 1868) | | x | |
| Roeboides myersi Gill, 1870 | | x | |
| Serrapinnus sp.1 | | | x |
| Serrapinnus sp. 2 | | | x |
| Serrasalmus rhombeus (Linnaeus, 1766) | x | x | |
| Tetragonopterus argentus Cuvier, 1816 | | | x |
| Triportheus albus Cope, 1872 | | x | |
| Triportheus angulatus (Spix & Agassiz, 1829) | x | x | |
| **Erythrinidae** |
| Erythrinus erythrinus (Bloch & Schneider, 1801) | | | x |
| Hoplophyrinus unitaeniatus (Agassiz, 1829) | | | x |
| Hoplias malabaricus (Bloch, 1794) | | | x |
| **Lebiasinidae** |
| Copeina guttata (Steindachner, 1876) | | x | |
| **SILURIIFORMES** |
| **Aspredinidae** |
| Pseudobunocephalus bifidus (Eigenmann, 1942) | | x | |
| **Trichomycteridae** |
| Acanthopoma annectens Lütken, 1892 | | x | |
| Henomonema punctatus (Boulenger, 1887) | | x | |
| Plectrochilus sp. | | | x |
| Pseudostegophilus nemurus (Günther, 1869) | x | | x |
| **Callichthyidae** |
| Callichthys callisthus (Linnaeus, 1758) | | x | |
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| Order/Family/Species | Rio | Quebrada | Cocha |
|----------------------|-----|----------|-------|
| Corydoras cf. aeneus (Gill, 1858) |     | x        |       |
| Corydoras cf. septentrionalis Gosline, 1940 |     | x        |       |
| Leptoplosternum altamazonicum Reis, 1997 |     | x        |       |
| Leptoplosternum cf. stellatum Reis & Kaefer, 2005 |     | x        |       |
| **Loricariidae** |     |          |       |
| Ancistrus sp. 1 |     | x        |       |
| Ancistrus sp. 2 |     | x        |       |
| Ancistrus sp. 3 |     |          | x     |
| Crossoloricaria rhami Isbrücker & Nijssen, 1983 |     |          | x     |
| Furcodontichthys cf. novaesi Rapp Py-Daniel, 1981 |     |          | x     |
| Hypooptopoma cf. thoracatum Günther, 1868 |     |          | x     |
| Hypostomus emarginatus Valenciennes, 1840 |     |          | x     |
| Hypostomus cf. pyrineusi (Miranda Ribeiro, 1920) |     |          | x     |
| Hypostomus unicolor (Steindachner, 1908) |     |          | x     |
| Lamontichthys filamentosus (La Monte, 1935) |     |          | x     |
| Lasiancistrus schomburgki (Günther, 1864) |     |          | x     |
| Limatulichthys griseus (Eigenmann, 1909) |     |          | x     |
| Loricaria sp. |     |          | x     |
| Panaque changae Chockley & Armbruster, 2002 |     |          |       |
| Pterygoplichthys lituratus (Kner, 1854) |     |          | x     |
| Pterygoplichthys punctatus (Kner, 1854) |     |          |       |
| Spatuloricaria puganensis (Pearson, 1937) |     |          | x     |
| **Heptapteridae** |     |          |       |
| Imparfinis stictonotus (Fowler, 1940) |     |          | x     |
| Pimelodella cf. gracilis (Valenciennes, 1835) |     |          | x     |
| Pimelodella sp. 1 |     |          | x     |
| Pimelodella sp. 2 |     |          | x     |
| Rhamdia quelen (Quoy & Gaimard, 1824) |     |          | x     |
| **Pimelodidae** |     |          |       |
| Brachyplatystoma juruense (Boulenger, 1898) |     |          | x     |
| Calophysus macropterus (Lichtenstein, 1819) |     |          | x     |
| Cheirocerus cf. goldi (Steindachner, 1908) |     |          | x     |
| Pimelodus cf. altissimus Eigenmann & Pearson, 1942 |     |          | x     |
| Pimelodus sp. |     |          | x     |
| Pinirampus pirinampa (Spix & Agassiz, 1829) |     |          | x     |
| Platystomatichthys sturio (Kner, 1858) |     |          | x     |
| Sorubim lima (Bloch & Schneider, 1801) |     |          | x     |
| **Pseudopimelodidae** |     |          |       |
| Batrochoglanis raninus (Valenciennes, 1840) |     |          | x     |
| **Doradidae** |     |          |       |
| Nemadoras sp. |     |          | x     |
| Trachydoras steindachneri (Perugia, 1897) |     |          | x     |
| **Gymnotiformes** |     |          |       |
| Gymnotidae |     |          |       |
| Electrophorus electricus (Linnaeus, 1766) |     |          | x     |
| Gymnotus carapo Linnaeus, 1758 |     |          | x     |
| Gymnotus cf. curupira Crampton, Thorsen & Albert, 2005 |     |          | x     |
| **Sternopygidae** |     |          |       |
| Sternopygus macrurus (Bloch & Schneider, 1801) |     |          | x     |
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|----------------------------|-----|----------|-------|
| **Apteronotidae**          |     |          |       |
| *Sternarchorhynchus* sp.   |     | x        |       |
| **CYPRINODONTIFORMES**     |     |          |       |
| **Rivulidae**              |     |          |       |
| *Rivulus* sp.              |     |          | x     |
| **BELONIFORMES**           |     |          |       |
| **Belonidae**              |     |          |       |
| *Pseudotylosurus angusticeps* (Günther, 1866) | x | | |
| **SYMBRANCHIFORMES**       |     |          | x     |
| **Synbranchidae**          |     |          |       |
| *Synbranchus madeirensis* Rosen & Rumney, 1972 | | | x |
| **PERCIFORMES**            |     |          |       |
| **Sciaenidae**             |     |          |       |
| *Pachyurus schomburgkii* Günther, 1860 | | | x |
| **Cichlidae**              |     |          |       |
| *Bujurquina* cf. robusta Kullander, 1986 | | x | x |
| *Crenicichla* cf. sedentaria Kullander, 1986 | | x | x |
| *Crenicichla* semincincta Steindachner, 1892 | | | |
| *Cichlasoma* cf. amazonarum Kullander, 1983 | | | x |
| *Cichlasoma* sp. 1         | | | x |
| *Cichlasoma* sp. 2         | | | x |
| **PLEURONECTIFORMES**      |     |          |       |
| **Achiridae**              |     |          |       |
| *Apionichthys finis* (Eigenmann, 1912) | | x | |
| *Hypoclinemus mentalis* Günther,1862 | | x | |

**Acknowledgments**
For collaboration in the field and intellectual camaraderie we thank: L. Anderson, I. Almagro, F. Brusa, C. Damborenea, and C. Noreña. We also thank B. Rengifo for logistical support and P. Petry for geographic information. For help with species identification we thank: M. Arce, J. Birindelli, C. Bührnheim, A. Cardoso, M. Hidalgo, C. Lucena, M. Lucena, R. Reis, T. Roberts, M. Rodriguez, A. Takako, and R. Tamar da Costa. This research was supported by NSF-DEB 0741450.

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Received April 2009
Accepted August 2009
Published online September 2009
LISTS OF SPECIES

Appendix I. Pictures of most of the voucher specimens from the upper Río Yuruá basin, Ucayali, Peru. Measurements are presented as standard length (SL).

CLUPEIFORMES
Engraulididae

*Lycengraulis cf. batesii* 23.3 mm (MUSM 33822)

CHARACIFORMES
Parodontidae

*Parodon pongoensis* 30.3 mm (MUSM 33789)

Curimatidae

*Curimatella meyeri* 123 mm (MUSM 33757)

*Cyphocharax cf. festivus* 41 mm (MUSM 33743)

*Cyphocharax spiluropsis* 109 mm (MUSM 33737)

*Potamorhina altamazonica* 128 mm (MUSM 33737)

Steindachnerina* cf. dobula* 98 mm (MUSM 33758)

*Steindachnerina guentheri* 43 mm (MUSM 33742)

*Steindachnerina hypostoma* 95 mm (MUSM 33806)

*Steindachnerina aff. insculpta* 51 mm (MUSM 33838)

Prochilodontidae

*Prochilodus nigricans* 135 mm (MUSM 33744)
LISTS OF SPECIES

Anostomidae

Leporellus vittatus 72 mm (MUSM 33834)
Leporinus friderici 70.3 mm (MUSM 33735)
Leporinus pearsoni 118 mm (MUSM 33829)
Leporinus striatus 57.3 mm (MUSM 33777)
Schizodon fasciatus 86.3 mm (MUSM 33738)

Crenuchidae

Characidium fasciatum 32 mm (MUSM 33769)

Gasteropelecidae

Carnegiella myersi 24.8 mm (MUSM 33809)
Thoracocharax stellatus 55.1 (MUSM 33754)

Characidae

Aphyocharax pusillus 46.9 mm (MUSM 33788)
Astyanax abramis 61.1 mm (MUSM 33827)
Charax sp. 41 mm (MUSM 33878)
Charax tectifer 85.4 mm (MUSM 33862)
LISTS OF SPECIES

- Creagrutus barrigai 36.3 mm (MUSM 33815)
- Ctenobrycon hauxwellianus 49 mm (MUSM 33874)
- Engraulisoma taeniatum 54 mm (MUSM 33831)
- Galeocharax gulo 81.6 mm (MUSM 33888)
- Gephyrocharax sp. 38.3 mm (MUSM 33860)
- Gymnocorymbus thayeri 38 mm (MUSM 33745)
- Knodus breviceps 40.3 mm (MUSM 33830)
- Knodus megalops 25.4 mm (MUSM 33796)
- Knodus aff. moenkhausii 35 mm (MUSM 33771)
- Knodus sp. 1 42.6 mm (MUSM 33803)
- Knodus sp. 2 30.5 (MUSM 33816)
- Leptagoniates steindachneri (MUSM uncat.)
- Moenkhausia cf. comma 39 mm (MUSM 33716)
- Moenkhausia dichroura 47.9 (MUSM 33814)
LISTS OF SPECIES

Moenkhausia oligolepis 39 mm (MUSM 33884)

Mylossoma duriventre 127 mm (MUSM 33841)

Odontostilbe fugitiva 45 mm (MUSM 33760)

Odontostilbe sp. 45 mm (MUSM 33772)

Phenacogaster cf. pectinatus 34 mm (MUSM 33863)

Prionobrama filigera 51.9 mm (MUSM 33787)

Roeboides affinis 69.9 mm (MUSM 33867)

Roeboides myersii 100 mm (MUSM 33755)

Serrapinnus sp. 1 24.9 mm (MUSM 33736)

Serrapinnus sp. 2 32 mm (MUSM 33791)

Serrasalmus rhombeus 35.9 mm (MUSM 33812)

Tetragonopterus argenteus 78 (MUSM 33782)
LISTS OF SPECIES

**Erythrinidae**

*Triportheus albus* 103 mm (MUSM 33866)

*Triportheus angulatus* 133 mm (MUSM 33828)

*Erythrinus erythrinus* 63 mm (MUSM 33720)

*Hoploerythynus unitaeniatus* 126 mm (MUSM 33730)

**Lebiasinidae**

*Hoplias malabaricus* 61.3 mm (MUSM 33741)

*Copeina guttata* 47.3 mm (MUSM 33718)

**Siluriformes**

**Aspredinidae**

*Pseudobunocephalus bifidus* 40 mm (MUSM 33855)

**Trichomycteridae**

*Acanthopoma annectens* 30.6 mm (MUSM 33849)

*Henonemus punctatus* 70 mm (MUSM 33784)

*Plectrochilus sp.* 70 mm (MUSM 33813)

*Pseudostegophilus nemurus* 64 mm (MUSM 33774)
LISTS OF SPECIES

Callichthyidae

*Callichthys callichthys* 59.2 mm (MUSM 33722)

*Corydoras* cf. *aeneus* 20.3 mm (MUSM 33719)

*Corydoras* cf. *septentrionalis* 54 mm (MUSM 33865)

*Leptoplo stomernum altamazonicum* 48.7 (MUSM33723)

*Leptoplosternum* cf. *stellatum* 25.5 mm (MUSM 33717)

Loricariidae

*Ancistrus* sp. 1 100 mm (MUSM 33766)

*Ancistrus* sp. 2 51.2 mm (MUSM 33767)

*Ancistrus* sp. 3 110 mm (MUSM 33879)

*Crossoloricaria* *rhami* 112 mm (MUSM 33886)

cf. *Furcodontichthys novaesi* 60.3 mm (MUSM 33746)

*Hypoptopoma* cf. *thoracatum* 36 mm (MUSM 33851)
LISTS OF SPECIES

*Hypostomus emarginatus* 155 mm (MUSM 33824)

*Hypostomus unicolor* 115 mm (MUSM 33781)

*Loricaria* sp. 187 mm (MUSM 33845)

*Loricarichthys* sp. 260 mm (MUSM 33750)

*Lamontichthys filamentosus* 170 mm (MUSM 33818)

*Loricaria* sp. 187 mm (MUSM 33845)

*Loricarichthys* sp. 260 mm (MUSM 33750)

*Lasiancistrus schomburgki* 30.6 mm (MUSM 33857)

*Limatulichthys griseus* 141 mm (MUSM 33783)

*Lasiancistrus schomburgki* 30.6 mm (MUSM 33857)

*Limatulichthys griseus* 141 mm (MUSM 33783)

*Panaque changae* 90 mm (MUSM 33850)

*Panaque changae* 90 mm (MUSM 33850)

*Pterygoplichthys punctatus* 70 mm

*Pterygoplichthys punctatus* 70 mm

*Pterygoplichthys lituratus* 71 mm (MUSM 33727)

*Pterygoplichthys lituratus* 71 mm (MUSM 33727)
LISTS OF SPECIES

Spatuloricaria puganensis 90 mm (MUSM 33775)

Heptapteridae

Imparfinis sticonotus 28.7 mm (MUSM 33790)

Pimelodella cf. gracilis 108 mm (MUSM 33764)

Pimelodella sp. 1 108 (MUSM 33835)

Pimelodella sp. 2 98.8 (MUSM 33882)

Rhamdia quelen 102.8 mm (MUSM 33882)

Pimelodidae

Calophysus macropterus 205 mm (MUSM 33799)

Cheirocerus cf. goeldii 124 mm (MUSM 33780)

Pimelodus cf. altissimus 87 mm (MUSM 33820)

Pimelodus sp. 104 mm (MUSM 33762)

Pinirampus pirinampu 225 mm (MUSM 33817)

Platystomatichthys sturio 240 mm (MUSM 33800)

Sorubim lima 230 mm (MUSM 33881)

Pseudopimelodidae

Batrochoglanys raninus 31 mm (MUSM 33854)
LISTS OF SPECIES

Doradidae

Nemadoras sp. 96 mm (MUSM 33826)

Trachydoras steindachneri 74 mm (MUSM 33868)

GYMNOTIFORMES

Gymnotidae

Gymnotus carapo 285 mm (MUSM 33807)

Gymnotus cf. curupira 140 mm (MUSM 33714)

Sternopygidae

Sternopygus macrurus 270 mm (MUSM 33752)

Apterontidae

Sternarchorhyncus sp. 200 mm (MUSM 33844)

CYPRINODONTIFORMES

Rivulidae

Rivulus sp. 26.6 mm (MUSM 33877)

BELONIFORMES

Belonidae

Pseudotylosurus angusticeps 270 mm (MUSM33843)

SYMBRANCHIFORMES

Symbranchidae

Symbranchus madeira 250 mm (MUSM 33808)
LISTS OF SPECIES

PERCIFORMES

Scianidae

*Pachyurus schomburgkii* 83.9 mm (MUSM 33801)

Cichlidae

*Bujurquina* cf. *robusta* 78.3 mm (MUSM 33886)

*Crenicichla* cf. *sedentaria* 102 mm (MUSM33876)

*Crenicichla semicincta* 67.1 mm (MUSM 33798)

*Cichlasoma* cf. *amazonarum* 56.8 mm (MUSM33749)

*Cichlasoma* sp. 1 30.6 mm (MUSM 33749)

*Cichlasoma* sp. 2 43.1 mm (MUSM 33793)

PLEURONECTIFORMES

Achiridae

*Apionichthys finis* 23 mm (MUSM 33785)

*Hypoclinemus mentalis* 240 mm (MUSM 33836)