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Fishes from the Lower Urubamba river near Sepahua, Amazon Basin, Peru

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Abstract: We report results of an ichthyological survey of the Lower Urubamba river, a tributary of the Ucayali river located in the southwestern portion of the Amazon Basin in southeastern Peru. Collections were made at low water (July, 2009) from 280 - 310 m elevation, near the town of Sepahua within the Fitzcarrald Arch, an upland associated with Pliocene (c. 4 Ma) uplift of the Peruvian Andes. This is the second of four planned expeditions to the region with the goal of comparing ichthyofaunas across the headwaters of the largest tributary basins in the western Amazon (Juruá, Ucayali, Purús and Madre de Dios). Twenty-one sites were sampled using seine nets, hook lines, cast nets and dip nets. A total of 98 species in 22 families and eight orders were captured and identified. The most diverse families are Characidae (40 spp.) and Loricariidae (20 spp.), and 12 families are represented by a single species. These data suggest that the fish fauna of the Lower Urubamba river near Sepahua is distinct from, and less diverse than, adjacent areas of lowland Amazonia.

Introduction

Peru has one of the richest continental biotas on Earth, with exceptional levels of species richness and endemism in many groups of terrestrial vertebrates, insects, and flowering plants (Rodriguez and Young 2000). The aquatic fauna is also highly diverse, with about 1,000 fish species currently recorded in Peruvian freshwaters, the majority of which inhabit the Amazon Basin, and with many new species described every year (Ortega and Hidalgo 2008; Ortega *et al.* 2011). The Amazon Basin as a whole contains more than 2,600 fish species (currently about 2,200 valid species as of April 2010), a number that represents about one quarter of the freshwater fishes of the world, and about one in 20 of all known vertebrate species (Lundberg *et al.* 2000; Albert *et al.* 2011). How so many distinct evolutionary lineages have come to inhabit the Amazon Basin remains one of the great unanswered questions in tropical biology, and the reader is referred to the following references for an introduction to this literature (Albert *et al.* 2006; Albert and Crampton 2010; Albert *et al.* 2011).

The Lower Urubamba drainage is included within the Ucayali-Urubamba Piedmont ecoregion (Freshwater Ecoregion of the World; Abell *et al.* 2008), a transition zone between the lowlands and the Andean mountain ecoregions. The Urubamba is a white water (sediment rich) river that rises in the Andes southeast of Cuzco, Peru, where it is called Río Vilcanota. The river flows northwest for more than 700 kilometers before joining the Río Tambo to form the Ucayali river near the city of Atalaya. The Lower and Upper portions of the Urubamba are divided by the Pongo de Mainique, a deep canyon about 3 km long and as narrow as 45 meters wide, and with cliffs reaching to 900 meters. The Lower Urubamba also receives tributaries from the east, from rivers draining the Fitzcarrald Arch.

The fish fauna of the Urubamba basin remains poorly studied. Between 1996 and 1999, the Smithsonian Institution's Monitoring and Assessment of Biodiversity Program coordinated a large-scale, multi-taxa assessment of the flora and fauna of the Lower Urubamba Region (Ortega *et al.* 2001). In this study they collected in three sites in the lower Urubamba basin. They recorded 69 fish species at Atalaya, 116 species at Sepahua and 118 species at Camisea. In total 156 species, 121 genera, 25 families and nine orders were reported from the Lower Urubamba.

Here we report the result of an expedition to the Lower Urubamba as part of a four-year survey project funded by the U.S. National Science Foundation called "Proyecto Alto Purús". The goal of this project is to compare the ichthyofaunas of headwaters across four major basins of the Fitzcarrald Arch: the Ucayali, Yuruá, Purús and Madre de Dios Basins.

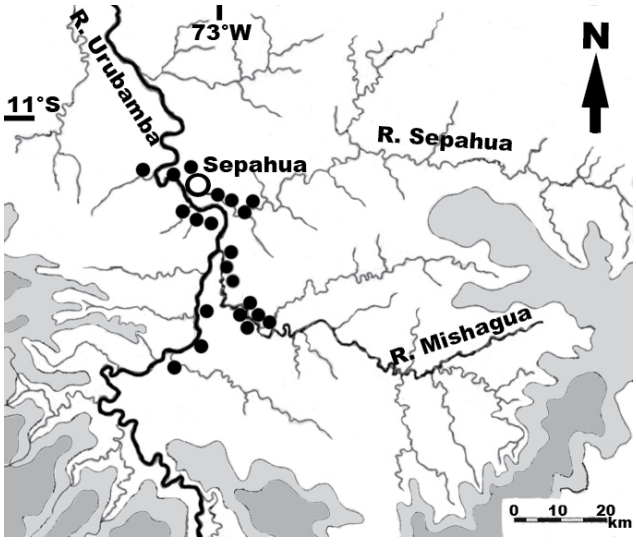

Figure 1. Map of study area showing the collecting sites (black dots) in the lower Río Urubamba, close to the city of Sepahua (9°32' S 72°45' W), Peru. Light gray represents 500 m.a.s.l. and dark gray represents 1000 m.a.s.l.

Materials and Methods

Twenty-one localities where sampled in the lower portion of Río Urubamba close to the town of Sepahua (11°08' S, 73°02' W) in Peru (Table 1, Figure 1). Collections were made on about 300 meters above sea level (m.a.s.l.), on three major types of environments: river channels ands beaches (*Ríos*), streams (*quebradas*), and oxbow lakes (*cochas*; Figure 2). Ríos are major rivers (*i.e.* Urubamba, Sepahua, Mishahua), quebradas are small tributary streams, and cochas are oxbow lakes located on the floodplain. All collecting stations were georeferenced (latitude, longitude, altitude) using GPS (specify map datum used), and habitats were documented with high resolution digital photographs and written descriptions. Abiotic attributes such as, water temperature, pH and electrical conductivity were measured using a HI 98129 tester (Hanna Instruments). Collections were made using standard ichthyological gear, including seine nets (5 and 10 m, 5 mm between knots), dip nets, cast nets, and hook and line. Electric fishes were located with the aid of a portable amplifier (Crampton *et al.* 2007).

A reference collection was accumulated in Sepahua, including one or more representative of all morphospecies encountered. 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 specimens 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°GL ethanol.

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), and Ferraris (2007) for Siluriformes. 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 PRODUCCION; Resolucion Directoral No. 546-2009-PRODUCE/DGPP.

Results and Discussion

A total of 98 species were collected and identified, representing 22 families and eight orders (Table 2). The families with highest species richness were Characidae (40 spp.), Loricariidae (22 spp.), and Pimelodidae and Crenuchidae (6 spp.). More than half of the families (12) were represented by a single nominal species. The most abundant orders were Characiformes (53 spp.) and Siluriformes (33 spp.), representing 54% and 33%, respectively, of the total fish species captured. Less diverse were the orders Gymnotiformes (5 spp.) and Perciformes (3 spp.). The species accumulation curve (Figure 3) shows that the actual total number of species on that region was

Figure 2. Examples of sampled localities in the lower Río Urubamba basin. A. Río Urubamba downstream mouth of Río Paquiria. B. Quebrada Gavilan. C. Quebrada Shimbillo. D. Cocha Ashacuya.

not sampled. A complete list of the fish species collected is provided in Appendix 1, and a photographic album of these species can be accessed online at: http://www.ucs.louisiana.edu/~jxa4003/Alto%20Purús.html.

Comparing our species list with those presented in Ortega *et al.* (2001), on the lower Urubamba, we identify at least 26 species that were not present in the previous study and were captured in our survey. With this, we estimate that the ichthyofauna in the lower Urubamba has a minimum of 180 species. The inventory presented by Ortega *et al.* (2001) from the same locality (Sepahua) shows 116 species. The difference of 18 species is due mostly to species recorded in local village market by Ortega *et al.* (2001). Therefore, species such as the big pimelodid genera *Pseudoplatystoma*, *Brachyplatystoma* (including), *Phractocephalus*, and *Hemisorubim* were present in the former list and were not recorded in our expedition. Because these large-bodied catfish species inhabit large

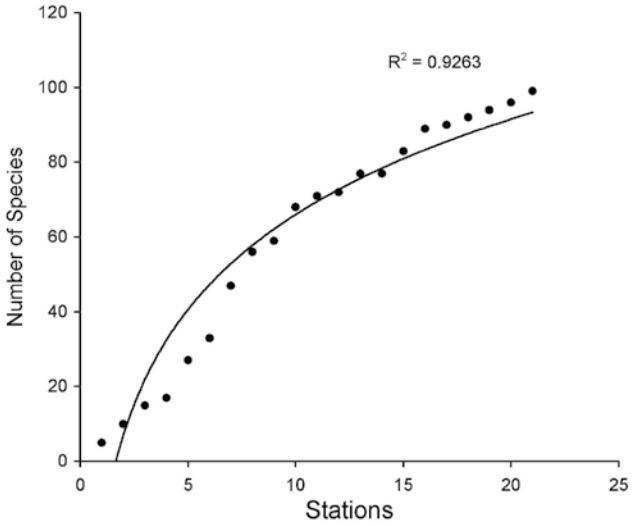

Figure 3. Species accumulation curve from lower Urubamba River.

Table 1. Descriptions of sites sampled in the lower Urubamba river, Ucayali, Peru.

LOCALITY	COORDINATES	ELEV.	DESCRIPTION
Quebrada Anandaya	11°09'10"S 72°57'42"W	305m	Small clear water stream (width 6 m), slow running waters over argillite bottom. Water temperature 25 °C.
Río Sepahua	11°09'10"S 72°57'42"W	292m	Sand beach at river curve on inner side, slow to medium flowing clear to white waters.
Quebrada Pona	11°08'59"S 72°59'05"W	290m	Small clear water stream (width 5 m), argillite and sand in the bottom.
Río Sepahua	11°09'10"S 72°59'29"W	289m	Sand beach in an island in the river (width 20 m), clear to white water, medium to fast flowing waters.
Cocha Ashacuya	11°11'39"S 72°59'54"W	286m	Ox bow lake (width 60 m), no flow, muddy bottom; water temp. 29.5 °C, pH 7.4, conductivity 497 µs.
Quebrada Ashacuya	11°11'09"S 73°01'08"W	284m	Stream (width 10) with white and slow flowing waters, muddy or sandy bottom. Water temp. 28.5 °C, pH 7.48, cond. 220 µs,
Quebrada Lazaro	11°14'22"S 72°58'19"W	298m	Small clear water stream, with medium flowing waters over a rocky, sandy bottom. Water temp. 24.9 °C, pH 8.3, cond. 216 µs.
Río Mishahua	11°14'06"S 72°58'26"W	296m	Sandy beach, (river width 40m) slow flowing white waters. Water temp. 28.3 °C, pH 8.04, cond. 176 µs.
Quebrada Ocote	11°13'09"S 72°58'02"W	294m	Slow flowing white water stream (width 4m), mud, sand and gravel in the bottom. Water temp. 28.0 °C, pH 7.1, cond. 305 µs.
Quebrada Kumarillo	11°11'09"S 73°02'06"W	286m	Stream (Width 15m), clear waters with slow to medium flowing speed over gravel. Water temp. 26.1, pH 8.1°C, cond. 153 µs.
Quebrada Gavilan	11°07'32"S 73°04'20"W	280m	Small white water stream (width 4m), no flow, with litter and mud in the bottom. Water temp. 26.8 °C, pH 7.59, cond 330 µs.
Quebrada Pulerja	11°07'33"S 73°06'51"W	280m	Wide (25 m) and shallow stream with clear waters over sand, gravel, and argillite. Water temp. 27.5 °C, pH 8.3, cond 298 µs.
Río Paquiria	11°26'33"S 73°00'25"W	310m	Wide stream (35 m), with white medium flowing waters over mud and gravel. Water temp. 25 °C, 8.2 pH, cond 147 µs.
Río Urubamba	11°25'00"S 72°58'29"W	303m	Sand beach in a river island, medium flowing waters over sand and gravel bottom. Water temp. 25.5 °C, pH 8.2, cond. 235 µs.
Quebrada Shimbillo	11°21'44"S 73°00'04"W	300m	Small stream (width 5m) with clear waters, sand and gravel on bottom. Water temp. 24.9 °C, 7.71 pH, cond. 135 µs.
Quebrada El Dorado	11°22'25"S 72°49'25"W	315m	Stream (width 20 m) with slow flowing white waters, sand and argilite bottom. Water temp. 20.4 °C, pH 8.26, cond. 264 µs.
Quebrada Capirona	11°21'38"S 72°53'11"W	305m	Stream (width 15 m), slow flowing clear to white waters sandy and muddy bottom. Water temp. 20.1 °C, 8.0 pH, cond. 165 µs.
Quebrada Raya	11°20'46"S 72°53'15"W	304m	Small stream (width 10m), with clear waters over sandy bottom. Water temp. 21.2 °C. pH 8.07, cond 227 µs.
Río Mishahua	11°19'37"S 72°57'08"W	305m	Sandy beach, (river width 30 m), white and medium flowing waters. Water temp. 22.5 °C., pH 8.08, cond. 180 µs.
Quebrada Las Piedras	11°16'06"S 72°57'06"W	307m	Small clear water stream (width 5), slow to fast flowing over sand and gravel. Water temp. 21.3 °C., 8.3 pH, cond. 214 µs.
Quebrada Huayashi	11°07'59"S 73°03'08"W	285m	Small stream (width 4 m) inside urban area of Sepahua, clear waters running over sand and gravel.

river channels in the lowlands, their presence in the local markets may be due to importation from locations further downstream. On the other hand, we caught more gymnotiform species (5 spp. *vs.* 2 spp.) than did Ortega *et al.* (2001). For the first time *Apteronotus albifrons*, *Gymnotus carapo*, *G. ucamara* and *Sternarchorhynchus* sp. are reported from this region. Probably the use of an electrical fish portable amplifier (Crampton *et al.* 2007) was the reason for collecting a larger number of electric fish in our expedition. In addition, some species of other groups are for the first time referred for the Lower Urubamba region; *Acestrocephalus boelkhei*, *Geryichthys sterbai*, *Leptagoniates steindachneri*, *Panaque changae*, *Farlowella kneri*, *Centromochlus perugiae*, and *Batrochoglanis raninus*.

Table 2. List of fish species collected in the lower Río Urubamba and their respective capture habitat S = stream, R = river, L = lake.

ORDER/FAMILY/SPECIES	S	R	L
CLUPEIFORMES			
Engraulididae			
Anchoviella carrikeri Fowler, 1940	X	X	
CHARACIFORMES			
Parodontidae			
Parodon pongoensis (Allen, 1942)	X	X	
Curimatidae			
Steindachnerina guenteri (Eigenmann & Eigenmann, 1889)			X
Steindachnerina hypostoma (Boulenger, 1887)	X	X	
Prochilodontidae			
Prochilodus nigricans Agassiz, 1829	X	X	
Anostomidae			
Leporinus friderici (Bloch, 1794)		X	
Leporinus trifasciatus Steindachner, 1876		X	
Characidium cf. *purpuratum* Steindachner, 1882	X		
Characidium cf. *steindachneri* Cope, 1878	X		
Characidium cf. *zebra* Eigenmann, 1909	X	X	
Characidium sp. 1		X	
Characidium sp. 2	X		
Geryichthys sterbai Zarske, 1997	X		
Characidae			
Acestrocephalus boehlkei Menezes, 1977	X	X	
Astyanacinus multidens Pearson, 1924	X	X	
Astyanax abramis (Jenyns, 1842)	X	X	
Astyanax bimaculatus (Linnaeus,1758)	X	X	X
Astyanax maximus (Steindachner, 1876)	X	X	
Astyanax sp.	X		
Attonitus ephimeros Vari & Ortega, 2000	X		
Bryconamericus pachacuti Eigenmann, 1927	X		
Bryconamericus sp. 1	X		
Bryconamericus sp. 2	X		
Ceratobranchia obtusirostris Eigenmann, 1914	X		
Charax sp.	X		
Clupeacharax anchoveiodes Pearson, 1924		X	
Creagrutus changae Vari & Harold, 2001	X	X	
Creagrutus pila Vari & Harold, 2001	X	X	

Table 2. *Continued.*

ORDER/FAMILY/SPECIES	S	R	L
Creagrutus sp.	X	X	
Ctenobrycon hauxwellianus (Cope, 1870)	X		X
Gephyrocharax sp.	X	X	
Hemibrycon jeltskii (Steindachner, 1877)	X		
Hemigrammus marginatus Ellis, 1911	X	X	
Knodus hypopterus (Fowler, 1943)	X	X	
Knodus orteguasae (Fowler, 1943)	X	X	
Knodus smithi (Fowler, 1913)	X	X	X
Knodus sp. 1	X		
Knodus sp. 2	X		
Leptagoniates steindachneri Boulenger, 1887	X	X	
Microgenys sp.	X		
Moenkhausia dichroura (Kner, 1858)	X	X	X
Moenkhausia oligolepis (Günther, 1864)	X		
Odontostilbe euspilura (Fowler, 1945)	X		
Odontostilbe fugitiva Cope, 1870		X	
Odontostilbe sp. 1	X	X	
Odontostilbe sp. 2	X		X
Paragoniates alburnus Steindachner, 1876	X	X	
Phenacogaster capitulatus (Malabarba & Malabarba, 2010)	X	X	
Prodontocharax melanotus Pearson, 1924		X	
Scopaeocharax cf. *rhinodus* (Bohlke, 1958)	X		
Serrasalmus rhombeus (Linnaeus, 1766)			X
Triportheus angulatus (Spix & Agassiz, 1829)		X	
Xenurobrycon heterodon Weitzmann & Fink, 1985	X	X	
Erythrinidae			
Hoplias malabaricus (Bloch, 1794)	X		X
SILURIFORMES			
Aspredinidae			
Bunocephalus coracoideus (Cope, 1874)	X		
Trichomycteridae			
Acanthopoma annectens Luetken, 1892	X	X	
Loricariidae			
Ancistrus sp. 1	X		
Ancistrus sp. 2	X		
Ancistrus sp. 3	X		
Ancistrus sp. 4	X	X	
Chaetostoma lineopunctatum Eigenmann & Allen, 1942	X		
Farlowella knerii (Steindachner, 1882)	X		
Farlowella nattereri Steindachner, 1910		X	
Farlowella smithi Fowler, 1913	X		
Hemiodontichthys acipenserinus (Kner, 1853)	X		X
Hypostomus aff. *emarginatus* Valenciennes, 1840	X	X	
Hypostomus pyrineusi (Miranda Ribeiro, 1920)	X	X	
Hypostomus unicolor (Steindachner, 1908)	X	X	
Hypostomus sp. 1	X	X	
Hypostomus sp. 2	X		
Lasiancistrus schomburgki (Günther, 1864)	X	X	
Loricaria sp.	X	X	

Table 2. ***Continued.***

ORDER/FAMILY/SPECIES	S	R	L
Panaque albomaculatus Kanazawa, 1958		X	
Panaque changae Chockley & Armbruster, 2002		X	
Rineloricaria lanceolata (Gunther, 1868)	X		
Sturisoma nigrirostrum Fowler, 1940	X	X	
Pseudopimelodidae			
Batrochoglanis raninus (Valenciennes, 1840)	X		
Heptapteridae			
Cetopsorhamdia phantasia Stewart, 1985	X		
Chasmocranus sp.	X		
Imparfinis stictonotus (Fowler, 1940)	X		
Pimelodidae			
Calophysus macropterus (Lichtenstein, 1819)		X	
Megalonema platycephalum Eigenmann, 1912		X	
Pimelodus blochii Valenciennes, 1840	X	X	X
Pimelodus pictus Steindachner, 1877		X	
Pimelodus sp. 1			X
Pimelodus sp. 2			X
Auchenipteridae			
Centromochlus perugiae Steindachner, 1882	X		
GYMNOTIFORMES			
Gymnotidae			
Gymnotus carapo Linnaeus, 1758	X		
Gymnotus ucamara Crampton, Lovejoy & Albert, 2003	X	X	
Sternopygidae			
Eigenmannia virescens (Valenciennes, 1842)	X	X	
Apteronotidae			
Apteronotus albifrons (Linnaeus, 1766)	X		
Sternarchorhynchus sp.	X	X	
CYPRINODONTIFORMES			
Rivulidae			
Rivulus sp.	X		
BELONIFORMES			
Cichlidae			
Bujurquina robusta Kullander, 1986			X
Crenicichla sedentaria Kullander, 1986	X	X	
Crenicichla proteus Cope, 1872	X		X
PLEURONECTIFORMES			
Achiridae			
Apionichthys finis (Eigenmann, 1912)		X	

The fish fauna of the Lower Urubamba Basin is similar in overall species richness to that of other major Amazonian drainages of the Fitzcarrald Arch (Jurua, Purús, and Madre de Dios), but is substantially different in terms of its species composition; i.e. the names of the actual species themselves (e.g. Maxime and Albert, 2009). The estimated total of 180 species now recorded for this region is slightly lower than the estimate of 200 species for the Upper Jurua (Carvalho *et al.* 2009), or the approximately 287 species referred to the Madre the Dios (Barthem *et al.* 2003). The Lower Urubamba is slightly more diverse than 86 species reported for the Upper Purús in Brazil (Anjos *et al*. 2008), although this later number is almost certainly an under estimate given the different methodologies employed.

To conclude, the results reported here are consistent with the conclusions of Ortega *et al*. (2001) that the fish fauna of the Lower Urubamba river near Sepahua is distinct from that of lowland Amazonia. Many conspicuous lowland floodplain species are not present, including all members of Osteoglossidae, Pristigasteridae, Hemiodontidae and Sciaenidae. Only two species of Curimatidae were found, whereas this family is represented by more than 40 species in the adjacent ecoregions of lowland Amazonia (Vari, 1988). Although absent from our collections, Potamotrygonidae is known from other reaches of the Urubamba Basin (Ortega *et al*. 2001), and is likely present near Sepahua. The absence of these species in collections to date may be a collection artifact, arising from the sampling methods employed, or may reflect the relative rarity of these taxa during the periods of low water when most of the sampling was conducted. Alternatively, these absences may reflect real differences in the ecological conditions of upland vs. lowland floodplain sites. Further investigations into the rich aquatic fauna of the Ucayali basin will be needed to resolve the actual geographic distributions of these taxa.

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Appendix 1. Pictures of fishes from the lower Río Urubamba basin, Sepahua, Ucayali, Peru. Measurements are presented as standard length.

CLUPEIFORMES

Engraulididae

Anchoviella carrikeri 28.6 mm MUSM 35661

CHARACIFORMES

Parodontidae

Parodon pongoensis 81.2 mm MUSM 35660

Curimatidae

Steindachnerina guentheri 56.5 mm MUSM 35626

Steindachnerina hypostoma 97.9 mm MUSM 35707

Prochilodontidae

Prochilodus nigricans 210 mm MUSM 35404

Anostomidae

Leporinus friderici 210 mm MUSM 35546

Leporinus trifasciatus 200 mm MUSM 35545

Crenuchidae

Characidium cf. *purpuratum* 43.8 mm MUSM 35486

Characidium cf. *steindachneri* 43.5 mm MUSM 35389

Characidium aff. *zebra* 40.3 mm MUSM 35602

Characidium sp. 1 38.4 mm MUSM 35503

Characidium sp. 2 33.9 mm MUSM 35525

Geryichthys sterbai 26.7 mm MUSM 35485

Characidae

Acestrocephalus boehlkei 79 mm MUSM 35741

Astyanacinus multidens 44.7 mm MUSM 35474

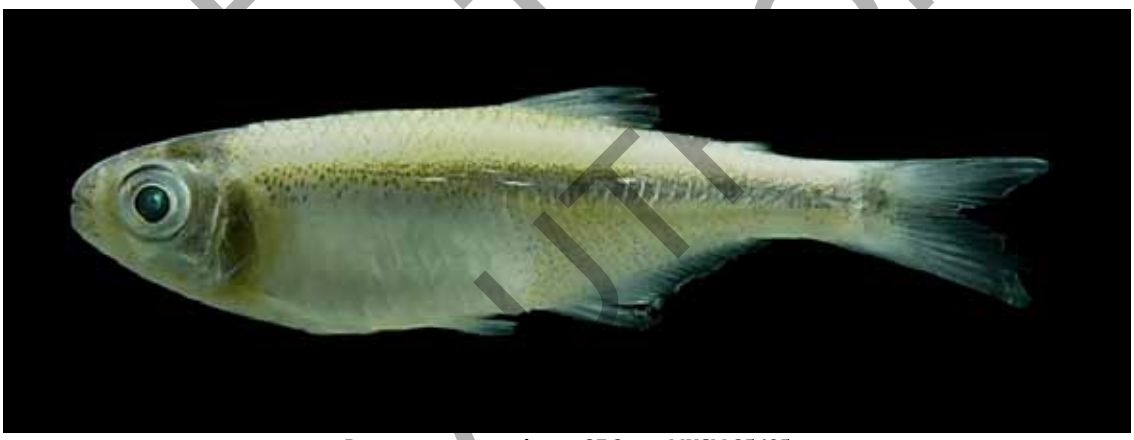
Astyanax abramis 77 mm MUSM 35556

Astyanax bimaculatus 79.2 mm MUSM 35557

Astyanax maximus 46.1 mm MUSM 35477

Astyanax sp. 75.7 mm MUSM 35475

Attonitus ephimeros 48.2 mm MUSM 35694



Bryconamericus pachacuti 27.2 mm MUSM 35695

Bryconamericus sp. 1 53.6 mm MUSM 35479

Bryconamericus sp. 2 42.2 mm MUSM 35478

Ceratobranchia obtusirostris 26.5 mm MUSM 35619

Charax sp. 54.6 mm MUSM 35481

Clupeacharax anchoveoides 67 mm MUSM 35727

Creagrutus changae 34.4 mm MUSM 35620

Creagrutus pila 37.9 mm MUSM 35649

Creagrutus sp. 26.5 mm MUSM 35725

Ctenobrycon hauxwellianus 36.4 mm MUSM 35428

Gephyrocharax sp. 40.3 mm MUSM35620

Hemibrycon jeltskii 54 mm MUSM 35492

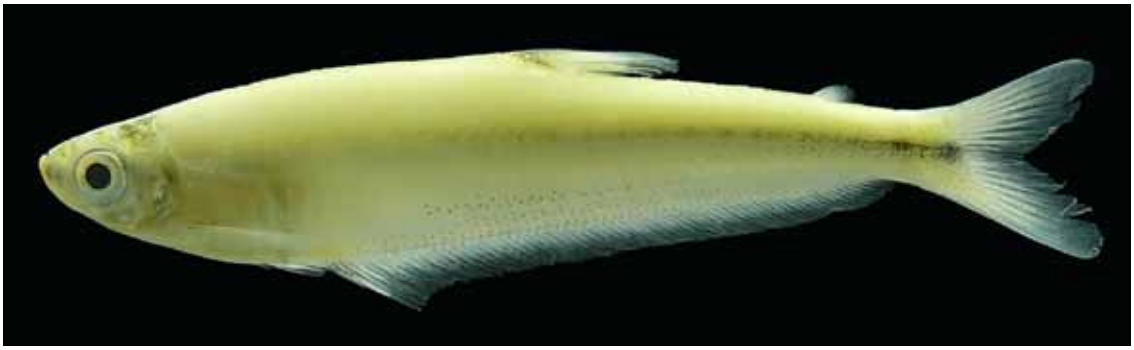
Knodus hypopterus 41.7 mm MUSM 35671

Knodus orteguasae 46.4 mm MUSM 35414

Knodus smithi 41.2 mm MUSM 35753

Knodus sp. 1 40.6 mm MUSM 35422

Knodus sp. 2 33.9 mm MUSM 35752



Leptagoniates steindachneri 60.3 mm MUSM35754

Microgenys sp. 17.5 mm MUSM 35775

Moenkhausia dichroura 36 mm MUSM 35755

Moenkhausia intermedia 62.9 mm MUSM E16?

Moenkhausia oligolepis 34.8 mm MUSM 35407

Odontostilbe euspilura 39.9 mm MUSM 35758

Odontostilbe fugitiva, 24.5 mm MUSM 35500

Odontostilbe sp.1 39.8 mm MUSM 35426

Odontostilbe sp.2 20.7 mm MUSM 35597

Paragoniates alburnus 76.2 mm MUSM 35656

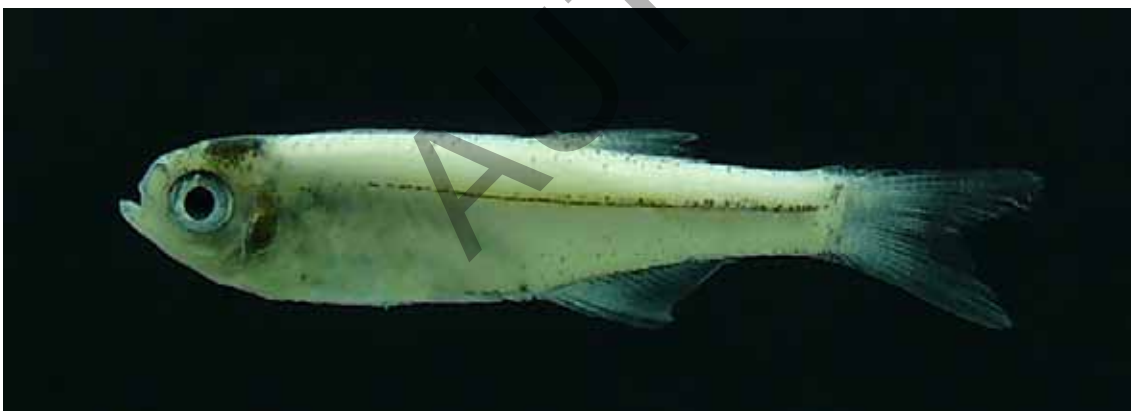
Phenacogaster pectinatus 27.9 mm MUSM 35581

Prodontocharax melanotus 20 mm MUSM 35434

Scopaecharax cf. *rhinodus* 12.5 mm MUSM 35638

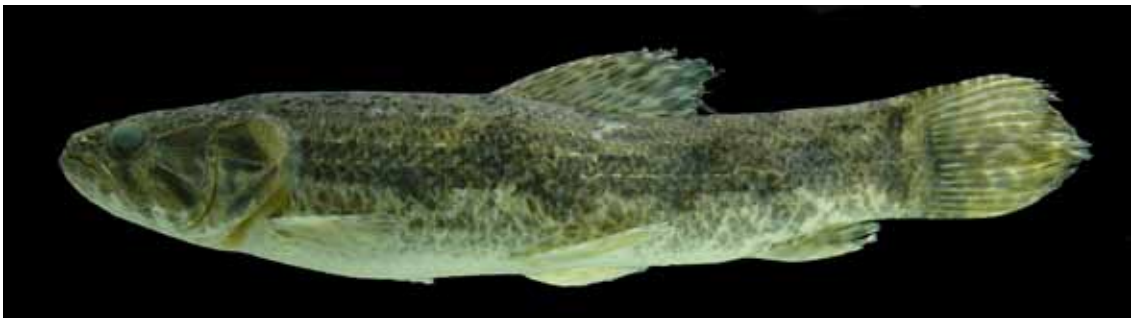
Serrasalmus rhombeus 23.8 mm MUSM 35437

Triportheus angulatus 132 mm MUSM 35659



Xenurobrycon heterodon 15.6 mm MUSM 35502

Erythrinidae



Hoplias malabaricus 141 mm MUSM 35759

SILURIFORMES

Aspredinidae

Bunocephalus coracoideus 48 mm MUSM 35556

Trichomycteridae

Acanthopoma annectens 24.7 mm MUSM 35722

Trichomycteridae

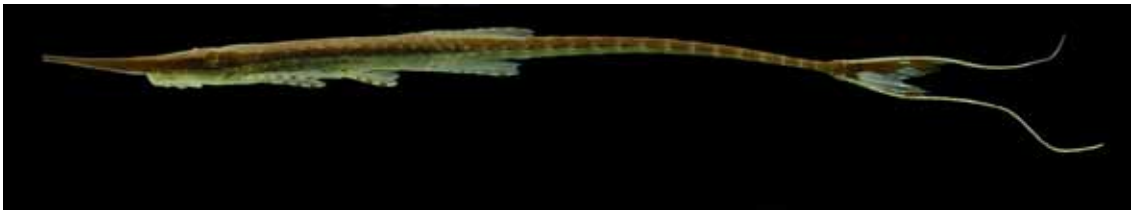
Ancistrus sp. 1 92.1 mm MUSM 35468

Ancistrus sp. 2 ?? mm MUSM 35469

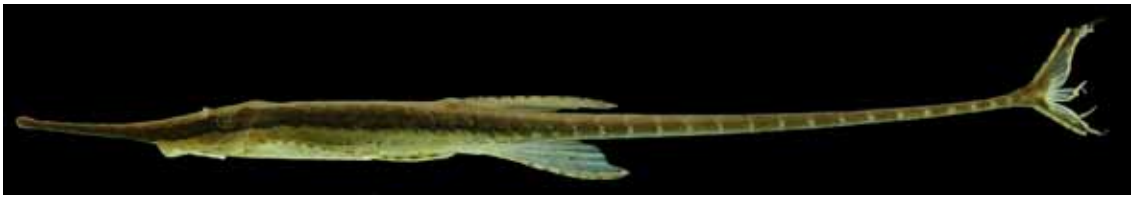
Ancistrus sp. 3 43.8 mm MUSM 35470

Ancistrus sp. 4 85.7 mm MUSM 35765

Chaetostoma lineopunctata 52 mm MUSM 35736



Farlowella knerii 87.9 mm MUSM 35530



Farlowella nattereri 133 mm MUSM 35396

Farlowella smithi 139 mm MUSM 35872

Hemiodontichthys acipenserinus 100 mm MUSM 35737

Hypostomus aff. *emarginatus* 92 mm MUSM 35721

Hypostomus pyrineusi 77.5 mm MUSM 35528

Hypostomus unicolor 90.7 mm MUSM 35718

Hypostomus sp. 1 72.2 mm MUSM 35397

Hypostomus sp. 2 43.5 mm MUSM 35739

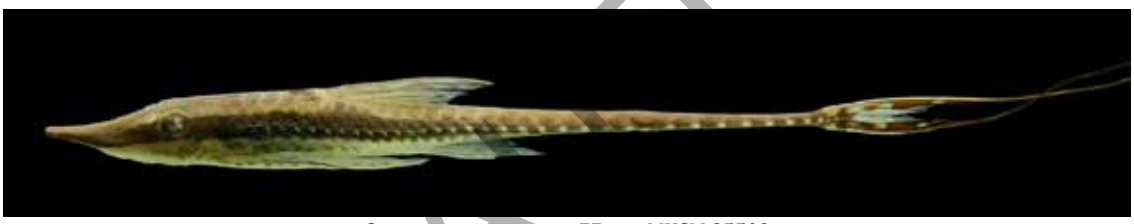
Lasiancistrus schomburgki 82 mm MUSM35643

Loricaria sp. 108 mm MUSM 35570

Panaque albomaculatus 43.8 mm MUSM 35400

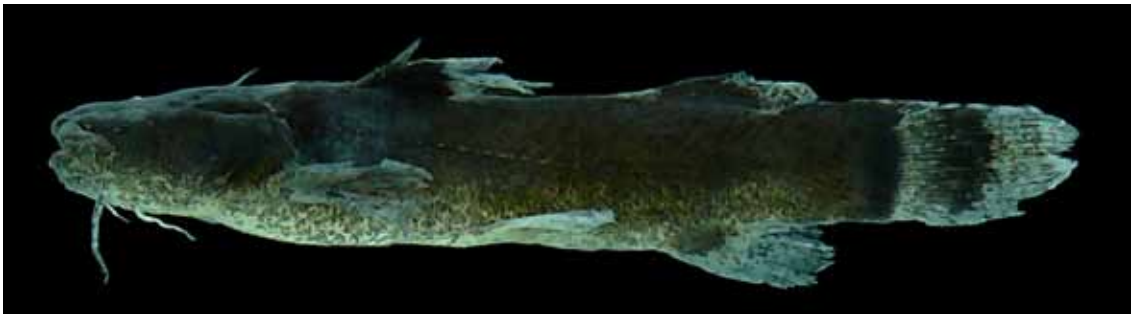
Panaque changae 45.7 mm MUSM 35401

Rineloricaria lanceolata 91 mm MUSM 35766



Sturisoma nigrirostrum 77 mm MUSM 35509

Pseudopimelodidae

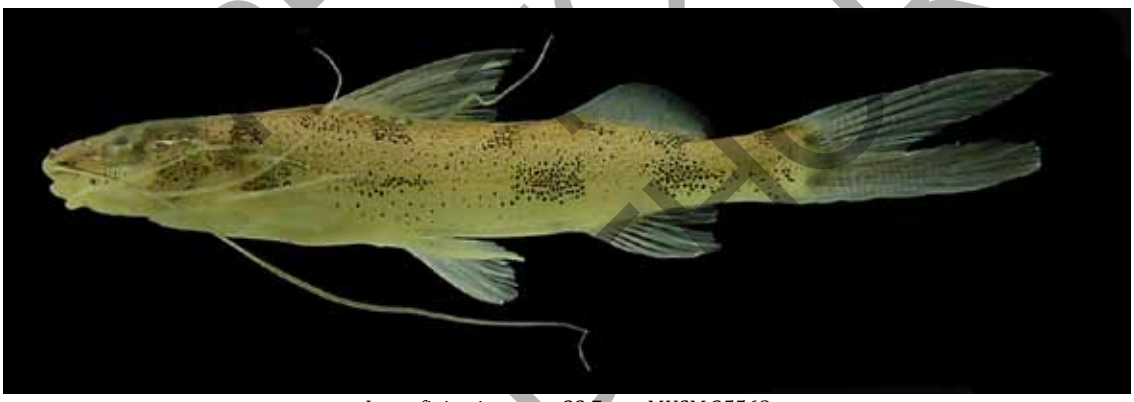


Batrochoglanys raninus 26 mm MUSM 35778

Heptapteridae

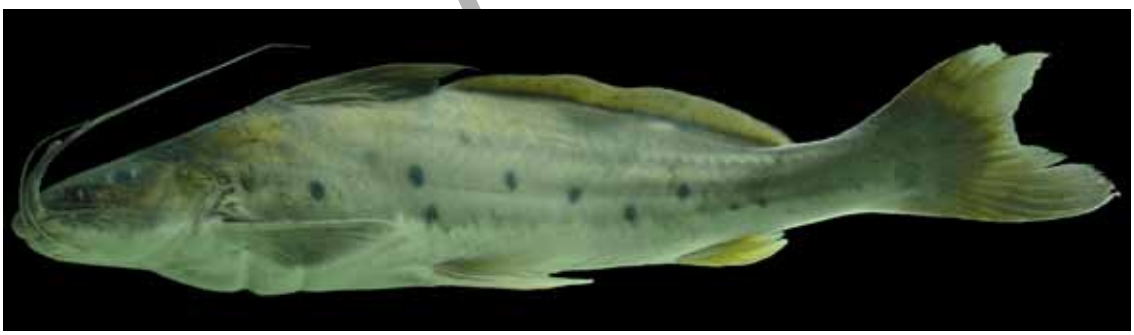
Cetopsorhamdia phantasia 23.5 mm MUSM 35639

Chasmocranus sp. 35.6 mm MUSM 35764



Imparfinis stictonotus 33.7 mm MUSM 35568

Pimelodidae



Calophysus macropterus 290 mm MUSM 35585

Megalonema platycephalum 61 mm MUSM 35410

Pimelodus blochii 112 mm MUSM 35442

Pimelodus pictus 78 mm MUSM? E19

Pimelodus sp.1, 103 mm MCP 35441

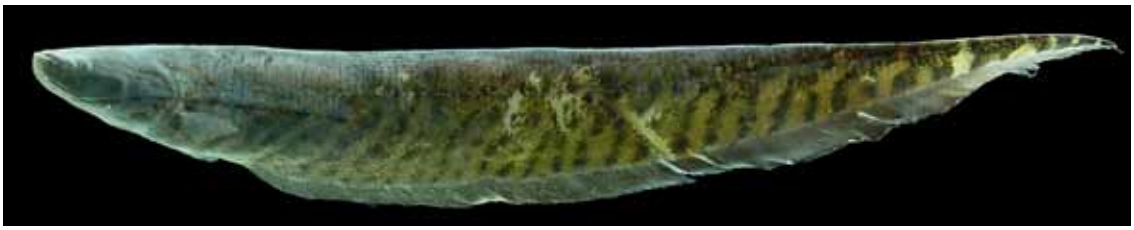
Pimelodus sp. 2, 117 mm MUSM? E5

Auchenipteridae

Centromochlus perugiae 20 mm MUSM 35633

GYMNOTIFORMES

Gymnotidae



Gymnotus carapo 180 mm MUSM 35859

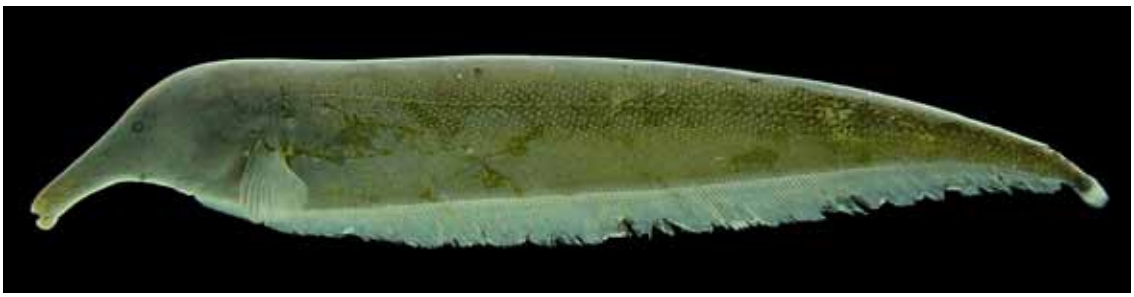
Gymnotus ucamara 170 mm MUSM 35860?

Sternopygidae

Eigenmannia virescens 126 mm MUSM 35761

Apteronotidae

Apteronotus albifrons 139 mm MUSM 35762



Sternarchorhyncus sp. 77 mm MUSM 35600

CYPRINODONTIFORMES

Rivulidae

Rivulus sp. 32.7 mm MUSM 35489

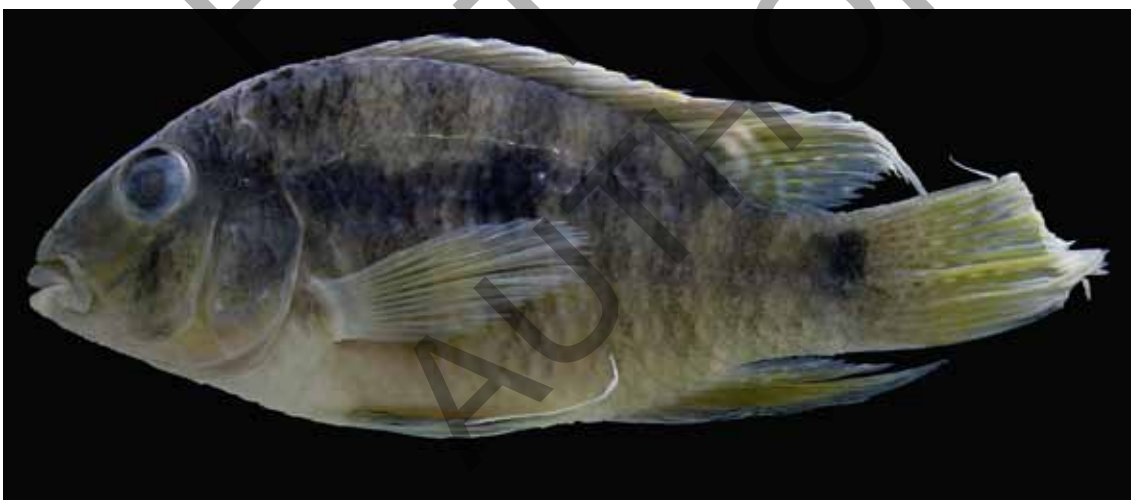
BELONIFORMES

Belonidae

Pseudotylosurus angusticeps 82 mm MUSM 35510

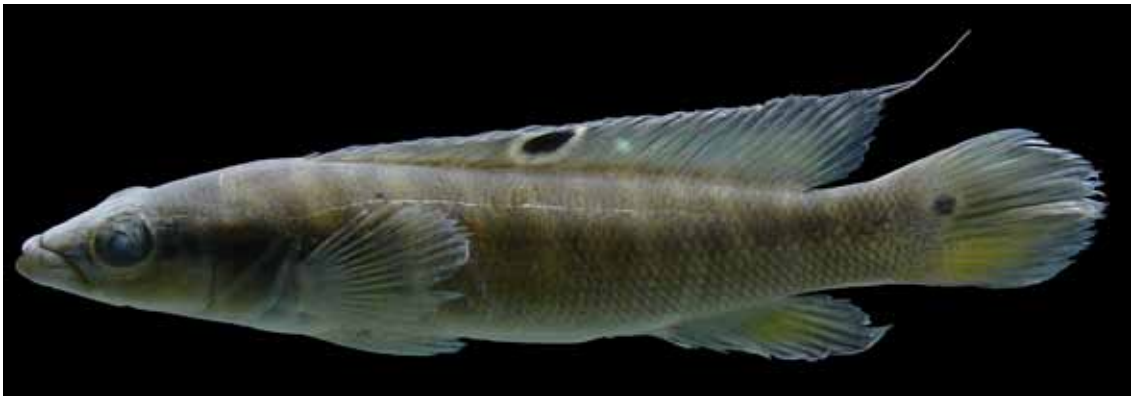
PERCIFORMES

Cichlidae



Bujurquina robusta 81.1 mm MUSM 35445

Crenicichla proteus 110 mm MUSM 35447



Crenicichla sedentaria 85.3 mm MUSM 35734

PLEURONECTIFORMES

Achiridae

Apionichthys finis 66.3 mm MUSM 35511