Check List **5**(3): 673–691, 2009.
ISSN: 1809-127X

LISTS OF SPECIES

Fishes from the upper Yuruá river, Amazon basin, Peru

Tiago P. Carvalho [1]
S. June Tang [1]
Julia I. Fredieu [1]
Roberto Quispe [2]
Isabel Corahua [2]
Hernan Ortega [2]
James S. Albert [1]

[1] University of Louisiana at Lafayette, Department of Biology.
Lafayette, LA 70504, USA. E-mail: jalbert@louisiana.edu

[2] Museo de Historia Natural de la Universidad Nacional Mayor de San Marcos.
Av. Arenales 1256, Lima 11, Peru.

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.

Check List **5**(3): 673–691, 2009.
ISSN: 1809-127X

LISTS OF SPECIES

Here we report the result of an expedition to the Rio 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 Rio 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.

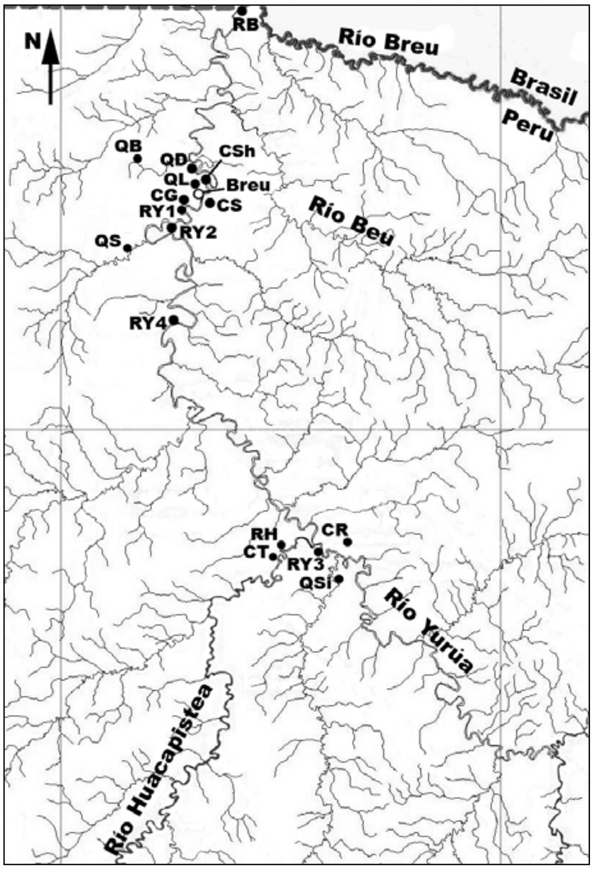


Figure 1. Map of study site showing the collecting sites in the upper Yuruá river basin close to the city of Breu (9°32' S 72°45' W) in the department of Ucayali, Peru. Locality abbreviatures are available in Table 1.

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 Shayenpiriarini	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 Rio Yurua
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
Rio Yuruá above Breu	RY1	09° 32'36"S, 72° 39'57"W	261	Sandy beach, river 30 m wide
Rio Yuruá above Breu	RY2	09° 33'21"S, 72° 46'00"W	268	Muddy and sand Bank
Rio Yuruá above Huacapishtea	RY3	09° 45'56"S, 72° 40'36"W	272	Sandy Beach
Rio Huacapishtea	RH	09° 46'07"S, 72° 42'07"W	282	Small rapids
Mouth of Rio Breu	RB	09° 24'45"S, 72° 43'04"W	258	Confluence with Rio Yurua
Rio Yuruá between Nueva Victoria and Breu	RY4	09° 36'11"S, 72° 46'24"W	271	Outcrop in the river

LISTS OF SPECIES

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.

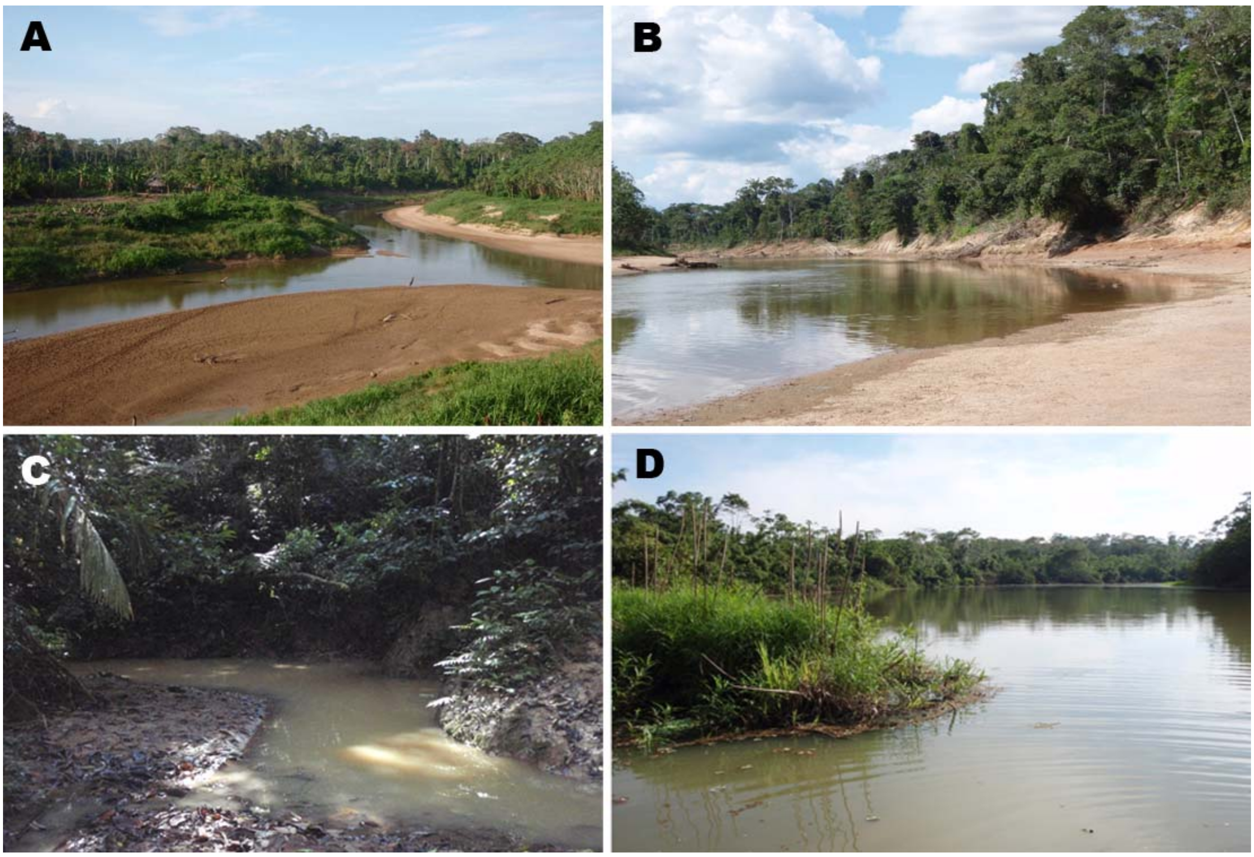


Figure 2. Examples of sampled localities in the upper Yuruá river basin; **A**. Huacapistea river close to confluence with Yuruá river **B**. Yuruá river upstream Breu. **C**. *Quebrada* Dos y Medio. **D**. *Cocha* Shayenpiriarini.

LISTS OF SPECIES

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 tributaries of the Amazon basin (4.7% in Anjos et al. 2008; 4.4 % in Silvano et al. 2000). Perhaps the low diversity could be explained by the preference of cichlids to occupy lentic habitats within rivers and streams (Kullander 2003).

These results are part of a four-year project to survey and document the aquatic fauna of the upper Purus National Park, a poorly known, species rich and vulnerable region of tropical moist forests and flooded savannas in the Peruvian Amazon. From a biogeographic perspective, the upper Purus is located on the Fitzcarrald Arch, an upland associated with the Miocene-Pliocene rise of the Peruvian Andes (Campbell et al. 2001). The Fitzcarrald Arch contains the headwaters of four of the largest 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*, cetopsids, auchenipterids, *Eigenmannia*, *Rhamphichthys*, and *Colomesus*. Much of the upper Yuruá traverses a relatively narrow and water-scourged 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

LISTS OF SPECIES

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	*Río*	*Quebrada*	*Cocha*
OSTEOGLOSSIFORMES			
Arapaimatidae			
Arapaima gigas (Schinz,1822)			x
CLUPEIFORMES			
Engraulididae			
Lycengraulis cf. *batesii* (Günther, 1868)	x		
CHARACIFORMES			
Parodontidae			
Parodon pongoensis (Allen, 1942)	x		
Curimatidae			
Curimatella meyeri (Steindachner, 1882)		x	
Cyphocharax cf. *festivus* Vari, 1992			x
Cyphocharax spiluropsis (Eigenmann & Eigenmann, 1889)			x
Potamorhina altamazonica (Cope, 1878)		x	
Steindachnerina cf. *dobula* (Günther, 1868)		x	
Steindachnerina guentheri (Eigenmann & Eigenmann, 1889)			x
Steindachnerina hypostoma (Boulenger, 1887)	x		
Steindachnerina aff. *insculpta* (Fernández-Yépez, 1948)	x		
Prochilodontidae			
Prochilodus nigricans Agassiz, 1829		x	
Anostomidae			
Leporellus vittatus (Valenciennes, 1850)	x		
Leporinus cf. *friderici* (Bloch, 1794)			x
Leporinus pearsoni Fowler, 1940	x		
Leporinus striatus Kner, 1858	x		
Schizodon fasciatus Spix & Agassiz, 1829			x
Crenuchidae			
Characidium cf. *fasciatum* Reinhardt, 1866	x	x	
Gasteropelecidae			
Carnegiella myersi Férnandez-Yépez, 1950		x	

LISTS OF SPECIES

Order/Family/Species	***Río***	***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.			x
Creagrutus barrigai Vari & Harold, 2001	x	x	
Ctenobrycon hauxwellianus (Cope, 1870)		x	x
Engraulisoma taeniatum Castro, 1981	x		
Galeocharax gulo (Cope, 1870)	x	x	
Gephyrocharax sp.		x	
Gymnocorymbus 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 dichroura (Kner, 1858)		x	
Moenkhausia oligolepis (Günther, 1864)	x		
Mylossoma duriventre (Cuvier, 1818)	x		
Odontostilbe fugitiva Cope, 1870		x	x
Odontostilbe sp.	x	x	
Phenacogaster cf. *pectinatus* (Cope, 1870)		x	
Prionobrama filigera (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 argenteus Cuvier, 1816			x
Triportheus albus Cope, 1872	x		
Triportheus angulatus (Spix & Agassiz, 1829)	x	x	
Erythrinidae			
Erythrinus erythrinus (Bloch & Schneider, 1801)		x	
Hoplerythrinus unitaeniatus (Agassiz, 1829)		x	
Hoplias malabaricus (Bloch, 1794)		x	
Lebiasinidae			
Copeina guttata (Steindachner, 1876)		x	
SILURIFORMES			
Aspredinidae			
Pseudobunocephalus bifidus (Eigenmann, 1942)			x
Trichomycteridae			
Acanthopoma annectens Lütken, 1892	x		
Henonemus punctatus (Boulenger, 1887)	x		
Plectrochilus sp.	x		
Pseudostegophilus nemurus (Günther, 1869)	x	x	
Callichthyidae			
Callichthys callichthys (Linnaeus, 1758)		x	

Check List **5**(3): 673–691, 2009.
ISSN: 1809-127X

LISTS OF SPECIES

Order/Family/Species	***Río***	***Quebrada***	***Cocha***
Corydoras cf. *aeneus* (Gill, 1858)		x	
Corydoras cf. *septentrionalis* Gosline, 1940		x	
Lepthoplosternum altamazonicum Reis, 1997		x	
Lepthoplosternum 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
Hypoptopoma 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		x
Lasiancistrus schomburgki (Günther, 1864)		x	
Limatulichthys griseus (Eigenmann, 1909)	x		
Loricaria sp.	x	x	
Loricarichthys sp.			x
Panaque changae Chockley & Armbruster, 2002	x		
Pterygoplichthys lituratus (Kner, 1854)		x	
Pterygoplichthys punctatus (Kner, 1854)		x	
Spatuloricaria puganensis (Pearson, 1937)	x		
Heptapteridae			
Imparfinis stictonotus (Fowler, 1940)	x		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. *goeldii* (Steindachner, 1908)	x		
Pimelodus cf. *altissimus* Eigenmann & Pearson, 1942	x		
Pimelodus sp.		x	
Pinirampus pirinampu (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	x	
Trachydoras steindachneri (Perugia, 1897)	x		
GYMNOTIFORMES			
Gymnotidae			
Electrophorus electricus (Linnaeus, 1766)		x	x
Gymnotus carapo Linnaeus, 1758		x	x
Gymnotus cf. *curupira* Crampton, Thorsen & Albert, 2005			x
Sternopygidae			
Sternopygus macrurus (Bloch & Schneider, 1801)		x	x

LISTS OF SPECIES

Order/Family/Species	***Río***	***Quebrada***	***Cocha***
Apteronotidae			
Sternarchorhynchus sp.	x		
CYPRINODONTIFORMES			
Rivulidae			
Rivulus sp.			x
BELONIFORMES			
Belonidae			
Pseudotylosurus angusticeps (Günther, 1866)	x		
SYMBRANCHIFORMES			
Synbranchidae			
Synbranchus madeirae 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 semicincta Steindachner, 1892			x
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.

Literature cited

Albert, J. S., N. R. Lovejoy, and W. G. R. Crampton. 2006. Miocene tectonism and the separation of cis- and trans-Andean river basins: Evidence from Neotropical fishes. Journal of South American Earth Sciences 21(1-2): 14-27.

Anjos, H. D. B, J. Zuanon, T. M. P. Braga, and K. N. S. Souza. 2008. Fish, upper Purus River, state of Acre, Brazil. Check List 4: 198-213.

Campbell, K. E., C. D. Frailey, and L. Romero-Pittman. 2006. The Pan-Amazonian Ucayali Peneplain, late Neogene sedimentation in Amazonia, and the birth of the modern Amazon River system. Palaeogeography, Palaeoclimatology Palaeoecology 239(1-2): 166-219.

Campbell, K. E., M. Heizler, C. D. Frailey, L. Romero-Pittman, and D. R. Prothero. 2001. Upper Cenozoic chronostratigraphy of the southwestern Amazon Basin. Geology 29(7): 595-598.

Cascon, S. C., W. B. Mors, B. M. Tursch, R. T. Aplin, and L. J. Durham. 1965. Ichthyothereol and its acetate, the active polyacetylene constituents of *Ichthyothere terminalis* (Spreng.) Malme, a fish poison from the Lower Amazon. Journal American Chemical Society 87: 5237-41.

Correa, S. B., W. G. R. Crampton, L. J. Chapman, and J. S. Albert. 2008. A comparison of flooded forest and floating meadow fish assemblages in an upper Amazon floodplain. Journal Fish Biology 72(3): 629-644.

LISTS OF SPECIES

Crampton, W. G. R. 1999. Os peixes da Reserva Mamirauá: diversidade e história natural na planície alagável da Amazônia; p. 10-36 *In* Crampton, H. G. Queiroz, and W. G. R. Crampton (ed.). Estratégias para Manejo de Recursos Pesqueiros em Mamirauá. Brasília: Sociedade Civil Mamirauá/CNPq.

Czerson, H., F. Bohlmann, T. F. Stuessy, and N. H. Fischer. 1979. Sesquiterpenoid and acetylenic constituents of seven *Clibadium* species. Phytochemistry 18: 257.

Espurt, N., P. Baby, S. Brusset, M. Roddaz, W. Hermoza, V. Regard, P.-O. Antoine, R. Salas-Gismondi, and R. Bolaños. 2007. How does the Nazca Ridge subduction influence the modern Amazon foreland basin? Geology 35: 515-518.

Goulding, M., R. Barthem, and E. Ferreira. 2003. The Smithsonian Atlas of the Amazon. Washington: Smithsonian. 251 p.

Harris, S. E. and A. C. Mix. 2002. Climate and tectonic influences on continental erosion of tropical South America, 0-13 Ma. Geology 30(5): 447-450.

Hrbek, T. S., J. Seckinger, and A. Meyer. 2006. A phylogenetic and biogeograpical perspective on the evolution of poeciliid fishes. Molecular Phylogenetics and Evolution 43(3): 986-998.

Hrbek, T., F. Kucuk, T. Frickey, K. N. Stolting, R. H. Wildekamp, and A. Meyer. 2002. Molecular phylogeny and historical biogeography of the *Aphanius* (Pisces, Cyprinodontiformes) species complex of central Anatolia, Turkey. Molecular Phylogenetics and Evolution 25(1): 125-137.

Kullander, S. O. 2003. Family Cichlidae; p. 1-9 *In* Reis, R. E., S. O. Kullander, and C. J. Ferraris (ed.). Checklist of the Freshwater Fishes of South and Central America. Porto Alegre: Edipucrs.

La Monte, F. R. 1935. Fishes from rio Juruá and rio Purus, Brazilian Amazonas. American Museum Novitates 784: 1-8.

Lovejoy, N. R., J. S. Albert, and W. G. R Crampton. 2006. Miocene marine incursions and marine/freshwater transitions: Evidence from Neotropical fishes. Journal of South American Earth Sciences 21(1-2): 5-13.

Lowe-McConnell, R. H. 1987. Ecological studies in tropical fish communities. Cambridge: Cambridge University Press. 382 p.

Montoya-Burgos, J. I. 2003. Historical biogeography of the catfish genus *Hypostomus* (Siluriformes : Loricariidae), with implications on the diversification of Neotropical ichthyofauna. Molecular Ecology 12(7): 1855-1867.

Petry, P., P. B. Bayley, and D. F. Markle. 2003. Relationships between fish assemblages, macrophytes and environmental gradients in the Amazon River floodplain. Journal of Fish Biology 63(3): 547-579.

Potter, P. E. 1997. The Mesozoic and Cenozoic paleodrainage of South America: a natural history. Journal of South American Earth Sciences 10(5-6): 331-344.

Reis, R. E., S. O. Kullander, and C. J. Ferraris. 2003. Introduction; p. 1-9 *In* Reis, R. E., S. O. Kullander, and C. J. Ferraris (ed.). Checklist of the Freshwater Fishes of South and Central America. Porto Alegre: Edipucrs.

Rengifo, B. 2007. Diversidad de peces en la cuenca del Alto Yuruá (Ucayali, Perú). Revista Perúana de Biologia 13(3):195-202.

Roberts, T. R. 1972. Ecology of fishes in the Amazon and Congo Basins. Bulletin of the Museum of Comparative Zoology 143(2): 117-147.

Silvano, R. A. M., B. D. do Amaral, and O. T. Oyakawa. 2000. Spatial and temporal patterns of diversity and distribution of the Upper Juruá River fish community. Environmental Biology of Fishes 57: 25-35.

Silvano, R. A. M., O. T. Oyakawa, B. D. do Amaral, and A. Begossi. 2001. Peixes do Alto Rio Juruá (Amazônia, Brasil). São Paulo: Editora da Universidade de São Paulo. 301 p.

Sivasundar, A., E. Bermingham, and G. Ortí. 2001. Population structure and biogeography of migratory freshwater fishes (Prochilodus : Characiformes) in major South American rivers. Molecular Ecology 10(2): 407-417.

Vari, R. P. and L. R. Malabarba. 1998. Neotropical ichthyology: An overview; p. 1-12 *In* L. Malabarba, R. E. Reis, R. P. Vari, C. A. S. de Lucena, and Z. M. S. de Lucena (ed). Phylogeny and Classification of Neotropical Fishes. Porto Alegre: Edipucrs.

Weir, J. T. 2006. Divergent timing and patterns of species accumulation in lowland and highland neotropical birds. Evolution 60(4): 842-855.

Wells, J. K. and W. G. R. Crampton. 2006. A portable bio-amplifier for eletric fish research: design and construction. Neotropical Ichthyology 4(2): 295-299.

Westaway, R. 2006. Late Cenozoic sedimentary sequences in Acre state, southwestern Amazonia: Fluvial or tidal? Deductions from the IGCP 449 fieldtrip. Journal of South American Earth Sciences 21(1-2): 120-134.

Received April 2009
Accepted August 2009
Published online September 2009

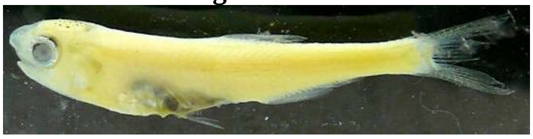
Check List **5**(3): 673–691, 2009.
ISSN: 1809-127X

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)

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

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

Steindachnerina guentheri 43 mm (MUSM 33742)

Cyphocharax spiluropsis 109 mm (MUSM33737)

Steindachnerina hypostoma 95 mm (MUSM 33806)

Potamorhina altamazonica 128 (MUSM 33737)

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

Prochilodontidae

Prochilodus nigricans 135 mm (MUSM 33744)

LISTS OF SPECIES

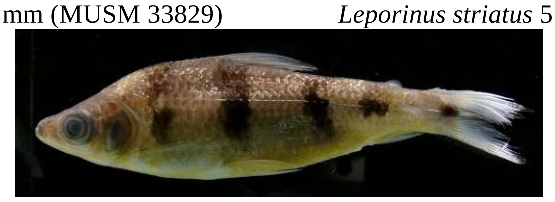
Anostomidae


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)

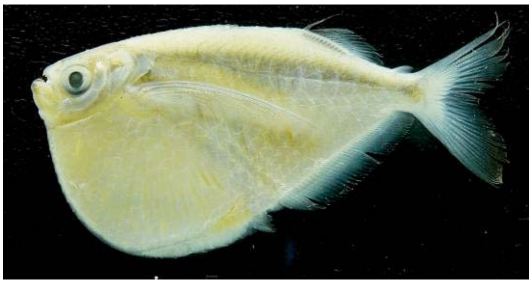

Schizodon fasciatus 86.3 mm (MUSM 33738)

Crenuchidae


Characidium fasciatum 32 mm (MUSM 33769)

Gasteropelecidae


Carnegiella myersi 24.8 mm (MUSM 33809)

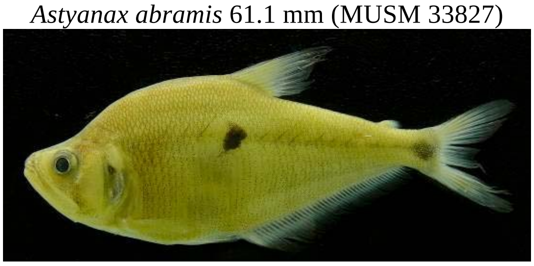

Thoracocharax stellatus 55.1 (MUSM 33754)

Characidae


Aphyocharax pusillus 46.9 mm (MUSM 33788)


Astyanax abramis 61.1 mm (MUSM 33827)

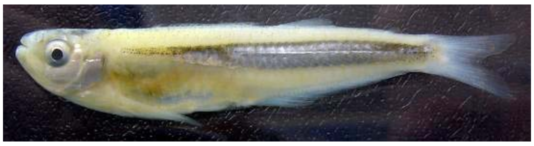

Charax sp. 41 mm (MUSM 33878)


Charax tectifer 85.4 mm (MUSM 33862)

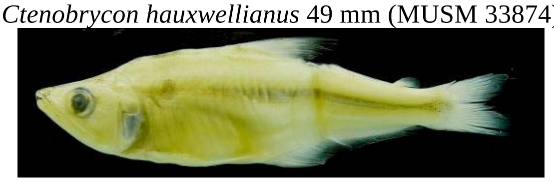
LISTS OF SPECIES

Creagrutus barrigai 36.3 mm (MUSM 33815)

Ctenobrycon hauxwellianus 49 mm (MUSM 33874)



Engraulisoma taeniatum 54 mm (MUSM 33831)

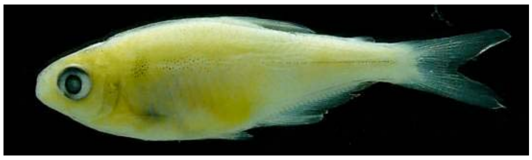


Galeocharax gulo 81.6 mm (MUSM 33888)

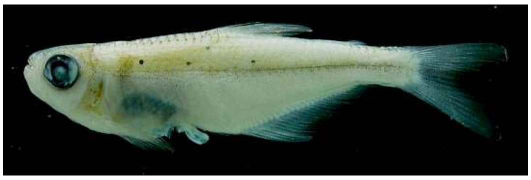
Gephyrocharax sp. 38.3 mm (MUSM 33860)

Gymnocorymbus thayeri 38 mm (MUSM 33745)

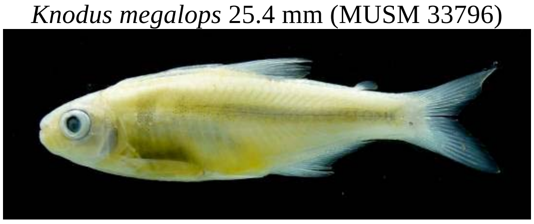
Knodus breviceps 40.3 mm (MUSM 33830)



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.)

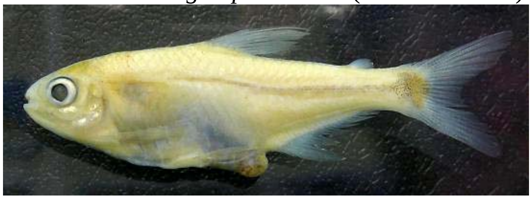
Moenkhausia cf. *comma* 39 mm (MUSM 33716)

Moenkhausia dichroura 47.9 (MUSM 33814)

LISTS OF SPECIES

Moenkhausia oligolepis 39 mm (MUSM 33884)

Mylossoma duriventre 127 mm (MUSM 33841)

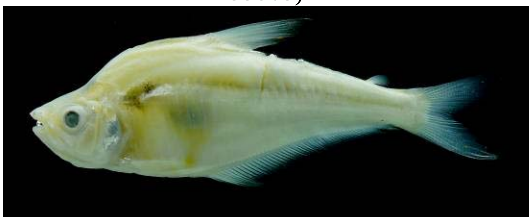


Odontostilbe fugitiva 45 mm (MUSM 33760)

Odontostilbe sp. 45 mm (MUSM 33772)

Phenacogaster cf. *pectinatus* 34 mm (MUSM 33863)

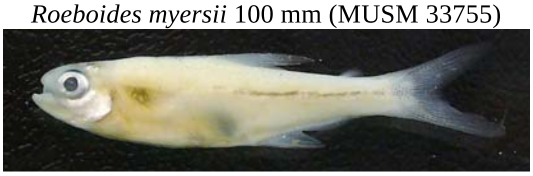
Prionobrama filigera 51.9 mm (MUSM 33787)



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

Triportheus albus 103 mm (MUSM 33866)

Triportheus angulatus 133 mm (MUSM 33828)

Erythrinidae

Erythrinus erythrinus 63 mm (MUSM 33720)

Hoplerythrynus unitaeniatus 126 mm (MUSM 33730)

Hoplias malabaricus 61.3 mm (MUSM 33741)

Lebiasinidae

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)

Check List **5**(3): 673–691, 2009.
ISSN: 1809-127X

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)

Lepthoplosternum altamazonicum 48.7 (MUSM33723)

Lepthoplosternum 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)

Check List **5**(3): 673–691, 2009.
ISSN: 1809-127X

LISTS OF SPECIES

Hypostomus emarginatus 155 mm (MUSM 33824)

Hypostomus cf. *pyrineusi* 38.8 m (MUSM 33856)

Hypostomus unicolor 115 mm (MUSM 33781)

Lamontichthys filamentosus 170 mm (MUSM 33818)

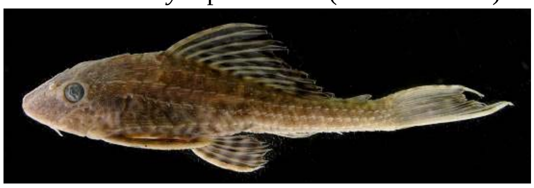
Lasiancistrus schomburgki 30.6 mm (MUSM 33857)

Limatulichthys griseus 141 mm (MUSM 33783)

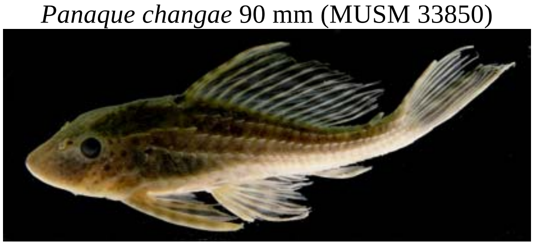
Loricaria sp. 187 mm (MUSM 33845)

Loricarichthys sp. 260 mm (MUSM 33750)

Panaque changae 90 mm (MUSM 33850)



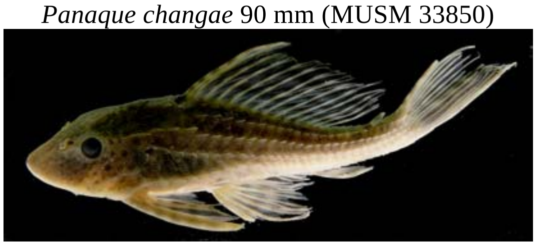
Pterygoplichthys lituratus 71 mm (MUSM 33727)



Pterygoplichthys punctatus 70 mm

Panaque changae 90 mm (MUSM 33850)

Pterygoplichthys lituratus 71 mm (MUSM 33727)



Pterygoplichthys punctatus 70 mm

Check List **5**(3): 673–691, 2009.
ISSN: 1809-127X

LISTS OF SPECIES

Spatuloricaria puganensis 90 mm (MUSM 33775)

Heptapteridae

Imparfinis stictonotus 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

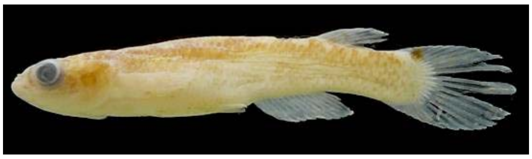
Sternopygus macrurus 270 mm (MUSM 33752)

Apteronotidae

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 madeirae 250 mm (MUSM 33808)

Check List **5**(3): 673–691, 2009.
ISSN: 1809-127X

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)