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Do we know what we are conserving? Fishes from Parque Nacional Aconquija, Tucumán, Northwestern Argentina

¿Sabemos lo que estamos conservando? Peces del Parque Nacional Aconquija, Tucumán, Noroeste de Argentina

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ABSTRACT

Aconquija is the only National Park (NP) in the province of Tucumán and one of the most importants in northwestern Argentina. It is the NP with wider altitudinal gradient in the country (Administración de Parques Nacionales, 2023), ranging from 511 to 5450 m a.s.l. Given that this NP was recently created, most of its territory has yet to be investigated regarding its diversity of species. Water bodies in this area are represented by mountain rivers and streams draining to the Salí-Dulce River basin. The current study provides a species list of freshwater fishes inhabiting the Aconquija National Park. We examined 427 specimens, distributed in five orders, ten families and 20 species.

Keywords — Fish, species richness, protected areas, endemic species, introduced species.

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RESUMEN

Parque Nacional Aconquija es el único parque nacional de la provincia de Tucumán, Argentina, y uno de los más importantes del noroeste y de todo el país, debido a que es el parque con mayor gradiente altitudinal de Argentina (Administración de Parques Nacionales, 2023), que va desde los 511 hasta los 5450 m s.n.m. Dado que este parque nacional es de reciente creación, la mayor parte de su territorio aún no ha sido investigado en cuanto a su diversidad de especies. Los cuerpos de agua de esta zona están representados por ríos y arroyos de montaña pertenecientes a la cuenca del Salí-Dulce. El presente estudio proporciona una lista de especies de peces de agua dulce presentes en el Parque Nacional Aconquija. La investigación se llevó a cabo en cuatro áreas del parque nacional, es el primer abordaje para estudiar la ictiofauna del Parque, analizamos 427 individuos distribuidos en 5 órdenes, 10 familias y 20 especies. Cada una de las especies tiene ejemplares testigo depositados en la colección Ictiológica de la Fundación Miguel Lillo.

Palabras clave — Peces, riqueza de especies, áreas protegidas, especies endémicas, especies introducidas.

INTRODUCTION

The Sali-Dulce River basin is the largest endorheic basin in Argentina, and densely human-populated areas depend on this basin to cover basic needs such as water for consumption, recreation, irrigation, energy, and industrial purposes. The Río Salí-Dulce has a length of about 790 kilometers, and its basin occupies a surface of 57320 Km^2, 22000 of which are in the province of Tucumán (Jabif, 2019) where most of the tributaries are located. Headwaters of these tributaries are located in mountain ranges known as Cumbres Calchaquíes and Nevados del Aconquija, situated in western Tucumán, and flow through the Yungas rainforest to the southeast. Yungas are the sector where most of the intake and regulation of water occurs. Downstream, the basin is under anthropogenic influence: untreated sugarmills and urban effluents reaching the streams and rivers of the basin, together with a lack of policies regarding conservation and protection of the natural resources, threaten aquatic organisms. This is related to the high density of population in Tucumán, together with the lack of human and administrative resources to control the health of the basin (Buti and Cancino, 2005).

An effective way to enhance control and preservation is the creation of protected areas. Natural reserves and national parks are critical entities to protect biodiversity and ecosystem services (Andam, Ferraro and Hanauer, 2013), and are considered essential for accomplishing conservation objectives (Gray et al., 2016). Several studies have demonstrated the benefits of protected areas on the prevention of deforestation and fires, and to get a net gain of forest cover (Andam, Ferraro, Pfaff, Sanchez-Azofeifa and Robalino, 2008; Cropper, Puri and Griffiths, 2001; Deininger and Minten, 2002; Curran et al., 2004; Naughton-Treves, Holland and Brandon, 2005; Oliveira et al., 2007; Joppa, Loarie and Pimm, 2008; Sims, 2010; Joppa and Pfaff, 2010; Nelson

and Chomitz, 2011). Globally, the species richness is 10.6% higher and total abundance is 14.5% higher in samples taken within protected areas when compared to samples taken outside protected areas. These positive effects are mostly explained by the differences in the land use between protected and unprotected areas (Gray et al., 2016).

Aconquija is a national park located in the province of Tucumán, Argentina, created in 2018 by the addition of new lands to Campo los Alisos National Park and the inclusion of smaller conservation units such as Ayllú and Piedra Labrada (for details see Cano, 2022). Regarding its hydrography, it should be noted that one of the conservation objectives of the Aconquija National Park is to protect the basins of numerous streams, which have their headwaters in Nevados del Aconquija and Cumbre de Narváez, which are the main tributaries of important rivers of the Salí River basin, such as the Singuil, Chavarría, Marapa, Chico, Medinas, Las Pavas, Jaya, Gastona, Seco, Los Sosa and Balderrama rivers.

MATERIALS AND METHODS

Study Area.— The study area was Aconquija National Park (Parque Nacional Aconquija). Samples were taken in the sections Piedra Labrada (Pueblo Viejo River), Cochuna (Cochuna River), Laguna del Tesoro (Treasure Lagoon) and Jayas (Jayas River). Figure 1.

Sampling Methods.— Specimens were collected with frame nets, kicking nets, hand nets, trap nets, cast nets and fishing rods, in sampling stations which correspond to a river section of about 100 m. This variety of capture methods were chosen to cover the highest amount of microhabitats possible.

The sampling effort was defined as the capture by a time period of 40 minutes in the sampling station. In this period of time, three people were taking samples, with at least two different methods utilized for each sampling station.

Appropriate actions were taken to minimize pain or discomfort of fish. Specimens were euthanized by immersion in an anesthetic solution (0.1% 2-phenoxyethanol), and then fixed in a 4% formaldehyde for one week, washed in water for one day and transferred to a 70% ethanol solution for preservation. Individuals were taxonomically identified at species level by the use of original descriptions, and updated taxonomic and phylogenetic studies. After taxonomic identification, specimens were preserved in a solution of ethanol 70% and deposited in Ichthyological collection Fundación Miguel Lillo (CI-FML).

To have an estimation that the samples were representative of the studied communities, a rarefaction analysis (Heck, 1975) was performed using Rstudio, BiodiversityR package. Rarefaction analyses were performed for each one of the sections and for the 4 sections together.

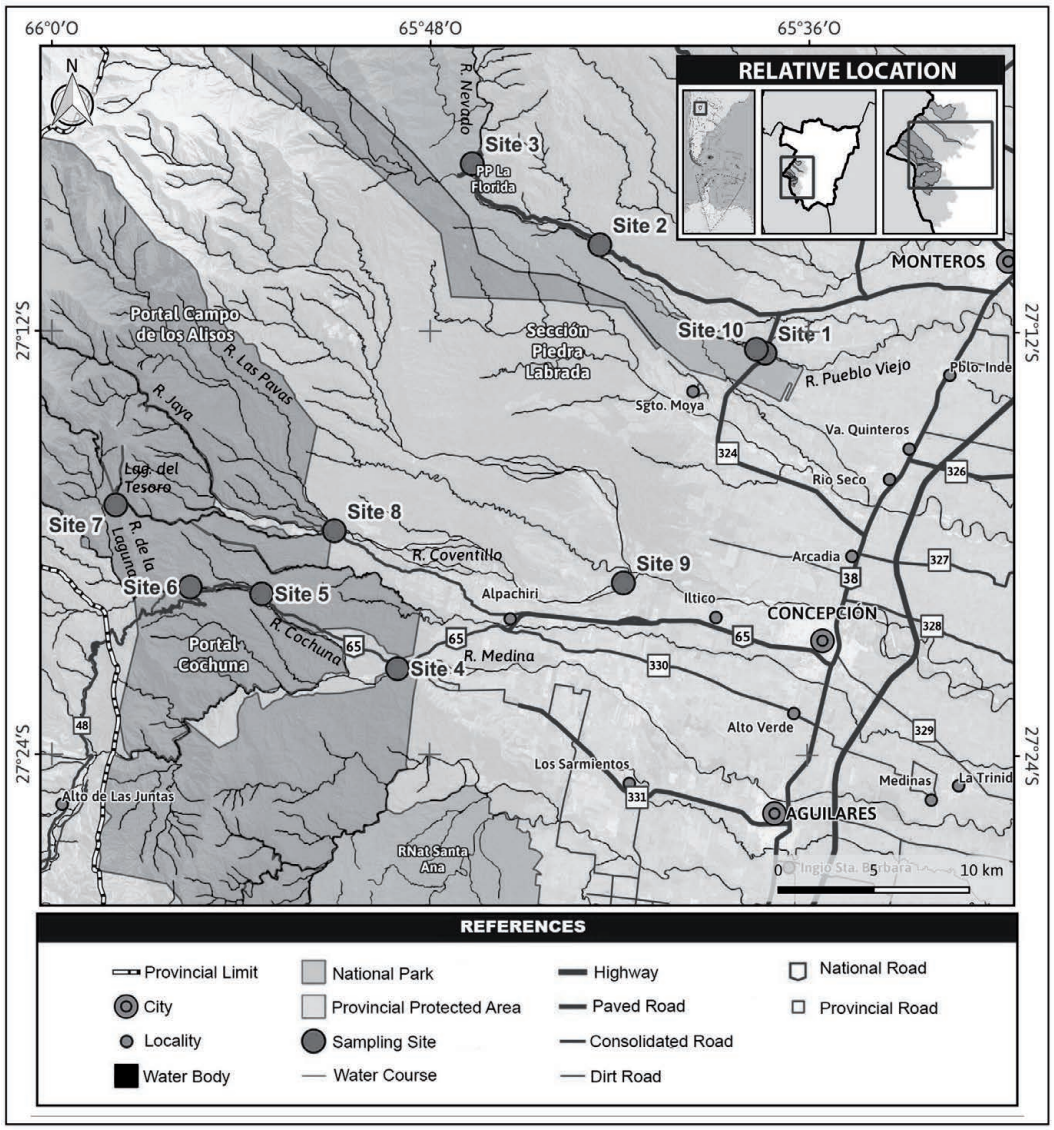

Figure 1. Map of Aconquija National Park, were the sampling stations are indicated by dots (Sites 1 to 10).

Figura 1. Mapa del Parque Nacional Aconquija, donde se indican las estaciones de muestreo con puntos (sitios 1 a 10).

RESULTS

The total number of specimens examined for this research was 427, from which 233 correspond to systematized samplings made between 2009 and 2010, and 194 were collected in samplings made in 2022.

Rarefaction analyses showed a statistically significant representation of the samples. For the park, the asymptotic behavior of the rarefaction curve is evident, meaning that almost all of the species present in the park were been captured during the sampling. For each individual section, the asymptotic behavior is less evident, although still present. In each individual section, some of the rare species are very likely to still be absent in the samplings. Laguna del Tesoro represents a special case, where only one species (*Odontesthes bonariensis*) was captured and historically record-

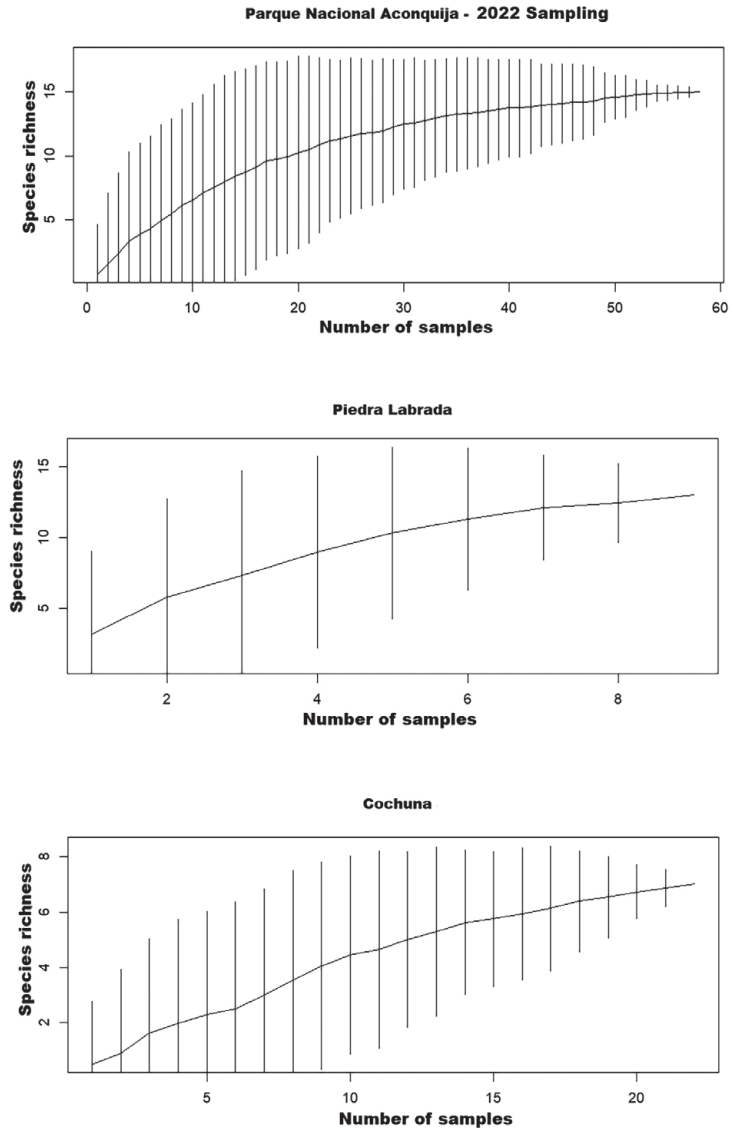

Figure 2. Rarefaction analyses of the samplings made in Aconquija National Park (2022), Piedra Labrada, Cochuna, and Treasure Lagoon.

Figura 2. Análisis de rarefacción de los muestreos realizados en el Parque Nacional Aconquija (2022), Piedra Labrada, Cochuna y Laguna del Tesoro.

ed (Administración de Parques Nacionales, 2023), reason why rarefaction analyses was not performed for this section (Figure 2).

The species list has a total of 20 species (Table 2). These species are classified in five orders and ten families (Atherinopsidae, Characidae, Crenuchidae, Prochilodontidae, Anablepidae, Salmonidae, Callichthyidae, Heptapteridae, Loricariidae, and Trichomycteridae). The best represented orders, for both total abundance and richness, were Characiformes and Siluriformes. The highest species richness was found in "Piedra Labrada" with 15 species, followed by "Jayas" with 13 species, "Cochuna" with 7 species, and finally "Laguna del Tesoro" with only one species. Two species found in the area (*Characidium borellii* and *Heptapterus qenqo*) are endemic to the Sali-Dulce basin, five species (*Acrobrycon tarijae*, *Astyanax lacustris*, *Corydoras*

Table 1. Location of sampling stations.

Tabla 1. Ubicación de las estaciones de muestreo.

Sampling points	Latitude	Longitude	Limnotope	Altitude (masl)	Section
1	27°12′ 36.21″S	65°37′ 22.80″W	Pueblo Viejo River	440	Piedra Labrada
2	27°09′ 32.65″S	65°42′ 37.61″W	Pueblo Viejo River	702	Piedra Labrada
3	27°07′ 15.30″S	65°46′ 40.67″W	Pueblo Viejo River	1049	Piedra Labrada
4	27°21′ 34.13″S	65°49′ 01.24″W	Cochuna River	648	Cochuna
5	27°19′ 27.29″S	65°53′ 20.28″W	Cochuna River	978	Cochuna
6	27°19′ 15.67″S	65°55′ 36.43″W	Cochuna River	1151	Cochuna
7	27°16′ 56.04″S	65°57′ 58.24″W	Laguna del Tesoro	1902	Laguna del Tesoro
8*	27°17′ 39,08″S	65°51′ 02,00″W	Jayas River	802	Jayas
9*	27°19′ 07,5″S	65°41′ 51,02″W	Jayas River	439	Jayas
10*	27°12′ 29,06″S	65°37′ 39,02″W	Pueblo Viejo River	436	Piedra Labrada

The sampling points marked with an asterisk (*) are the sections where the samplings of 2009 and 2010 were performed.

longipinnis, *Pimelodella laticeps* and *Psalidodon puka*,) were registered for the first time in Aconquija National Park, and two of the species found (*Odontesthes bonariensis* and *Oncorhynchus mykiss*) are exotic to the area.

The information regarding the lots of sampled material is detailed below. The information given for each species includes: Total of individuals collected; range of standard length, geolocalization, number of individuals of the lot.

ACONQUIJA NATIONAL PARK FISH IDENTIFICATION KEY

1a. Naked body or with presence of bony plates ..... Siluriformes
1b. Body covered in scales 2
2a. Presence of dorsal and anal fins with unsegmented spiny anterior rays; 2 dorsal fins; with horizontal silver stripe on body side .... Atheriniformes (*Odontesthes bonariensis*)
2b. Dorsal and anal fins composed entirely of segmented soft rays; branched or unbranched; single dorsal fin or with dorsal adipose fin 3
3a. Dorsal portion of head with scales; protractile mouth; absence of adipose fin ... . Cyprinodontiformes (*Jenynsia lineata*)
3b. Scaleless dorsal portion of head; not protractile mouth; usually with adipose fin 4
4a. Body covered by tiny scales, 100 or more scales in the longitudinal series; base of the anal fin less than half the length of head; body with black or dark spots (mainly on the dorsal region) on a greenish or copperish background .... Salmoniformes (*Oncorhynchus mykiss*)
4b. Body covered by bigger scales, usually less than 100 scales in the longitudinal series; base of the anal fin equal to or greater than half the head length; without a distinct pattern of spots ..... Characiformes

Table 2. Species list and presence of species per locality.

Tabla 2. Lista de especies y presencia de especies por localidad.

Species	Piedra Labrada	Cochuna	Laguna del Tesoro	Jayas
Characiformes				
Characidae				
Acrobrycon tarijae	●	●		●
Astyanax abramis	●			●
Astyanax lacustris	●			
Bryconamericus iheringii	●			●
Odontostilbe microcephala	●	●		●
Oligosarcus jenynsii				●
Psalidodon puka	●			
Crenuchidae				
Characidium borellii	●	●		●
Prochilodontidae				
Prochilodus lineatus		●		
Siluriformes				
Callichthyidae				
Corydoras longipinnis	●			
Heptapteridae				
Heptapterus qenqo	●	●		●
Pimelodella laticeps	●			
Loricariidae				
Hypostomus paranensis	●			●
Rineloricaria catamarcensis	●			●
Trichomycteridae				
Trichomycterus alterus	●			●
Trichomycterus barbouri				●
Trichomycterus corduvensis	●	●		●
Cyprinodontiformes				
Anablepidae				
Jenynsia lineata	●			●
Atheriniformes				
Atherinopsidae				
*Odontesthes bonariensis**			●	
Salmoniformes				
Salmonidae				
*Oncorhynchus mykiss**	●	●		

The species marked with an asterisk (*) are exotic species introduced in the study area.

Characiformes:

1a. Lips with tiny teeth on the edge ..... *Prochilodus lineatus*
1b. Developed teeth, not at the edge of the lips 2
2a. Anal fin with less than 8 branched rays; circular body section; 8-9 transverse bands on the flanks joined at the dorsal midline; sub-terminal mouth; highly developed pelvic and pectoral fins ..... *Characidium borellii*
2b. Anal fin with more than 15 branched rays; compressed body; no cross bands; terminal mouth; paired fins are not highly developed 3
3a. Presence of a tubular gland or glandular pocket at the base of the lower lobe of the caudal fin in males; orange adipose fin ..... *Acrobrycon tarijae*
3b. Absence of a caudal gland 4
4a. Conical teeth ..... *Oligosarcus jenynsii*

4b. Multicuspidate teeth 5
5a. Two series of premaxillary teeth, with non-pedunculated teeth 6
5b. One series of premaxillary teeth, with pedunculated teeth ..... *Odontostilbe microcephala*
6a. Dorsal fin with 8 branched rays, 4 teeth in the inner series of the premaxilla, maxilla with 6 to 9 teeth; anterior edge of dorsal, anal and pelvic fins whitish ... . *Bryconamericus iheringii*
6b. Dorsal fin with 9 branched rays, 5 teeth on the inner series of the premaxilla, maxilla with 1-3 teeth or no teeth; fins generally hyaline; no obvious whitish edges 7
7a. Teeth generally absent in maxilla; horizontal humeral spot 8
7b. One maxillary tooth with 7-9 cusps; vertical or diffuse humeral spot .... *Psalidodon puka*
8a. 30–39 perforated lateral line scales (rarely 40 or 41); 28-30 anal rays .... *Astyanax lacustris*
8b. 42-48 perforated lateral line scales; 23-27 anal rays ..... *Astyanax abramis*

Siluriformes:

1a. Armored body with bony plates on the flanks 2
1b. Naked body 4
2a. With 2 rows of bony plates on the flanks ..... *Corydoras longipinnis*
2b. With more than 2 rows of bony plates on flanks; sucker-shaped oral disc 3
3a. Strong pectoral spines, with large odontodes; rounded snout; deep caudal peduncle; subequal caudal fin; with adipose fin ..... *Hypostomus paranensis*
3b. Pectoral spines similar to the first pectoral ray, with small odontodes; pointed snout; depressed caudal peduncle; caudal fin with a small filament on the upper lobe; without adipose fin ..... *Rineloricaria catamarcensis*
4a. Operculum and interoperculum with odontodes directed towards the posterior region; absence of mentonian barbels 5
4b. Operculum and interoperculum without directed odontodes; with maxillary, outer, and inner mentonian barbels present 7
5a. First ray of pectoral fins is non-prolonged, similar in size to the rest of the fin rays. Large and blunt mucous glands that give the skin the appearance of goosebumps ..... *Trichomycterus corduvensis*
5b. First ray of the pectoral fins is prolonged 6
6a. Presence of 2 light spots in the middle-dorsal position, in front and behind dorsal-fin base ..... *Trichomycterus alterus*
6b. Absence of dorsal spots; with a longitudinal band on bodyside to the end of caudal-finrays; very elongated body ..... *Trichomycterus barbouri*
7a. Short adipose fin, with developed pectoral and dorsal spines .... *Pimelodella laticeps*
7b. Dorsal fin confluent with adipose fin, without pectoral spine .... *Heptapterus qenqo*

Order Characiformes (Figure 3)

Family Characidae

Acrobrycon tarijae Fowler 1940

Material examined. 83 exemplars; 49.2 - 74.2 mm SL. CI FML 7814, 2 ex, 27° 12' 29.6"S, 65° 37' 39.2"W Pueblo Viejo River. CI FML 7817, 5 ex, 27° 12' 29.6"S, 65° 37' 39.2"W Pueblo Viejo River. CI FML 7833, 10 ex, 27° 19' 07.5"S, 65° 41' 51.2"W, Jaya River. CI FML 7840, 5 ex, 27° 19' 07.5"S, 65° 41' 51.2"W Jaya River. CI FML 7845, 4 ex, 27° 19' 07.5"S, 65° 41' 51.2"W Jaya River. CI FML 7846, 8 ex, 27° 17' 39.8"S, 65° 51' 02.0"W Jaya River. CI FML 7858, 12 ex, 27° 19' 07.5"S, 65° 41' 51.2"W Jaya River. CI FML 7884, 2 ex, 27° 19' 07.5"S, 65° 41' 51.2"W Jaya River. CI FML 7914, 8 ex, 27° 21' 23.8" S, 65° 48' 33.3"W Cochuna River. CI FML 7917, 12 ex, 27°21'23.8" S, 65° 48'33.3"W Cochuna River. CI FML 7934, 15 ex, 27° 09'33.3" S 65°42' 37.6"W Pueblo Viejo River.

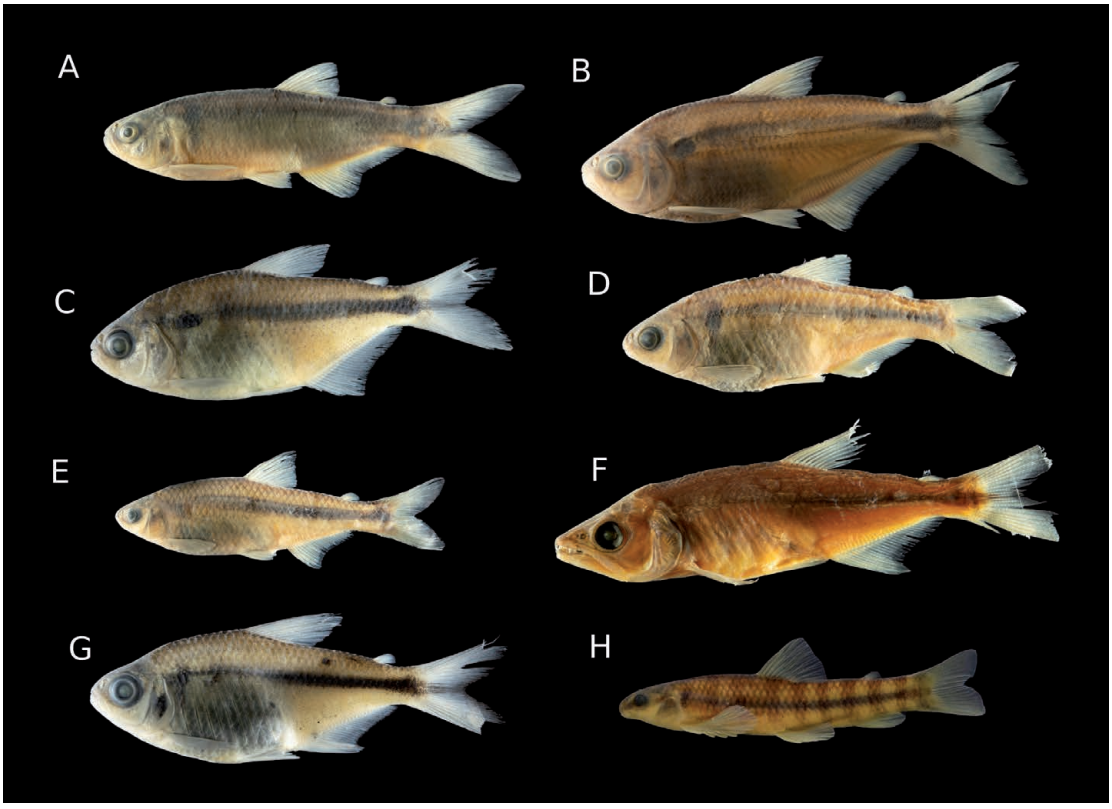

Figure 3. Characiformes: **A.** *Acrobrycon tarijae* CI FML 7917, 60.3 mm SL. **B.** *Astyanax abramis* CI FML 7887, 86.7 mm SL. **C.** *Astyanax lacustris* CI FML 7928, 53.5 mm SL. **D.** *Bryconamericus iheringii* CI FML7832, 52.7 mm SL. **E.** *Odontostilbe microcephala* CI FML 7885, 48.8 mm SL. **F.** *Oligosarcus jenynsii* CI-FML 7831, 53.7 mm SL. **G.** *Psalidodon puka* CI FML 7931, 51.2 mm SL. **H.** *Characidium borellii* CI FML 7924, 42.1 mm SL.

Figura 3. Characiformes: **A.** *Acrobrycon tarijae* CI FML 7917, 60,3 mm SL. **B.** *Astyanax abramis* CI FML 7887, 86,7 mm SL. **C.** *Astyanax lacustris* CI FML 7928, 53,5 mm SL. **D.** *Bryconamericus iheringii* CI FML7832, 52,7 mm SL. **E.** *Odontostilbe microcephala* CI FML 7885, 48,8 mm SL. **F.** *Oligosarcus jenynsii* CI-FML 7831, 53,7 mm SL. **G.** *Psalidodon puka* CI FML 7931, 51,2 mm SL. **H.** *Characidium borellii* CI FML 7924, 42,1 mm SL.

Identification. Number of perforated scales of the lateral line: 51-60; number of horizontal-scale rows around the caudal peduncle: 19-21; lower number of vertebrae (37-39); and pleural ribs: 12-13 pairs; number of branched anal-fin rays: 23-27; presence of a glandular pocket at the base of the lower lobe of the caudal fin in males; orange adipose fin (Briñoccoli et al., 2022).

Astyanax abramis (Jenyns 1842)

Material examined. 12 exemplars; 51.9 - 87.2 SL. CI FML 7816, 3 ex, 27° 12' 29.6"S, 65° 37' 39.2"W Pueblo Viejo River. CI FML 7837, 2 ex, 27° 19' 07.5"S, 65° 41' 51.2"W Jaya River. CI FML 7882, 1 ex, 27° 19' 07.5"S, 65° 41' 51.2"W Jaya River. CI FML 7887, 5 ex, 27° 19' 07.5"S, 65° 41' 51.2"W Jaya River. CI FML 7888, 1 ex, 27° 19' 07.5"S, 65° 41' 51.2"W Jaya River.

Identification. High and compressed body; complete lateral line with 42-48 perforated scales; naked caudal fin; presence of two series of teeth in the premaxilla with 5 teeth in the inner series; maxilla without maxillary teeth; dorsal fin with 9 branched rays; anal fin with 28-30 rays; dark horizontal humeral spot; fins mainly yellow color (Serra et al., 2014, Lucena and Soares, 2016)

Astyanax lacustris (Lütken 1875)

Material examined. 1 exemplar; 53.5 mm SL. CI FML 7928, 1 ex, 27°12' 36.21"S; 65°37' 22.80"W Pueblo Viejo River.

Identification. Complete lateral line; perforated scales on lateral lines 30–39 (rarely 40 or 41); naked caudal fin; presence of two series of teeth in the premaxilla with 5 teeth in the inner series; maxilla without maxillary teeth; dorsal fin with 9 branched rays; anal fin with 28-30 rays; dark horizontal humeral spot (Lucena and Soares, 2016).

Bryconamericus iheringii (Boulenger 1887)

Material examined. 6 exemplars; 51.1 - 53.8 mm SL. CI FML 7832, 2 ex, 27° 19' 07.5"S, 65° 41' 51.2"W Jaya River. CI FML 7855, 3 ex, 27° 19' 07.5"S, 65° 41' 51.2"W Jaya River. CI FML 7929, 1 ex, 27°12' 36.21"S; 65°37' 22.80" W Pueblo Viejo River.

Identification. Body elongated and compressed; deep-bodied; complete lateral line with 35-38 scales; premaxilla with two series of teeth, 4 teeth in the internal series and 3-5 teeth in the outer series, maxilla with 6-9 teeth; dentary with 5-9 multicuspid teeth; dorsal fin with 8 branched rays; anal fin with 18-23 rays; anterior edge of dorsal, anal and pelvic fins whitish; background color silvery and iridescent blue; with a dark elongated humeral spot vertically oriented; lateral band present (Serra et al., 2014; Almirón et al., 2015).

Odontostilbe microcephala Eigenmann 1907

Material examined. 110 exemplars; 34.9 - 52.4 mm SL. CI FML 7818, 2 ex, 27° 12' 29.6"S, 65° 37' 39.2"W Pueblo Viejo River. CI FML 7827, 6 ex, 27° 19' 07.5"S, 65° 41' 51.2" W Jaya River. CI FML 7853, 52 ex, 27° 19' 07.5"S, 65° 41' 51.2"W Jaya River. CI FML 7857, 29 ex, 27° 19' 07.5"S, 65° 41' 51.2"W Jaya River. CI FML 7885, 6 ex, 27° 19' 07.5"S, 65° 41' 51.2"W Jaya River. CI FML 7913, 10 ex, 27° 21'23.8" S, 65° 48'33.3"W Cochuna River. CI FML 7919, 8 ex, 27° 21'23.8" S, 65° 48'33.3" Cochuna River. CI FML 7927, 7 ex, 27°12' 36.21"S; 65°37' 22.80"O Pueblo Viejo River.

Identification. Lateral line with 35-37 pored scales; 6 scale rows between lateral line and dorsal-fin origin; horizontal orbit diameter of 24.6-32.8 % HL, mean 28.7%; one series of premaxillary teeth, all of them pedunculated; subterminal mouth; branched anal-fin rays 16-19 (Chuctaya et al., 2018).

Oligosarcus jenynsii (Günther 1864)

Material examined. 1 exemplar; 53.7 mm SL. CI FML 7831, 1 ex, 27° 19' 07.5"S, 65° 41' 51.2"W Jaya River.

Identification. Presence of 54-62 perforated scales in lateral series; 8-11 longitudinal series of scales between the lateral line and the origin of the dorsal fin; 21-23 horizontal series of scales around the caudal peduncle; short snout, the same length as the diameter of the eye; jaws are identical, although in some specimens the upper jaw slightly longer; jaws with conical and caniniform teeth, maxilla with 19-28 teeth; anal fin with 26-30 rays (Serra et al., 2014; Almirón et al., 2015).

Psalidodon puka (Mirande, Aguilera & Azpelicueta 2007)

Material examined. 68 exemplars; 38.3 - 56.3 mm SL. CI FML 7931, 68 ex, 27° 12' 36.21"S; 65° 37' 22.80"W Pueblo Viejo River.

Identification. Shallow body (33.5-39.8% of SL); short distance between pelvic and anal-fin origins (17.1-20.6 % SL); long caudal peduncle (13.3-16.5 % SL); 36-38 perforated scales in lateral line; 6-5 transverse scales; presence of two series of teeth in the premaxilla with 5 teeth in the inner series; 9-10 gradually decreasing dentary teeth; distally expanded premaxillary teeth; one distally expanded maxillary tooth with 7–9 cusps; short upper jaw length (34.5-37.8 % HL), short maxilla (20.7-23.3 % HL) expanded abruptly under maxillary tooth position; short postorbital distance (36.6–46.9 % HL); dorsal fin with 9 branched rays; 22–27 branched anal-fin rays; vertical or diffuse humeral spot (Mirande et al., 2007).

Family Crenuchidae

Characidium borellii (Boulenger 1895)

Material examined. 42 exemplars; 33.4 - 59.8 mm SL. CI FML 7812, 3 ex, 27° 12' 29,6"S, 65° 37' 39,2"W Pueblo Viejo River. CI FML 7815, 1 ex, 27° 12' 29,6"S, 65° 37' 39,2"W Pueblo Viejo River. CI FML 7835, 4 ex, 27° 19' 07.5"S, 65° 41' 51.2"W Jaya River. CI FML 7842, 1 ex, 27° 19' 07.5"S, 65° 41' 51.2"W Jaya River. CI FML 7844, 2 ex, 27° 17' 39.8"S, 65° 51' 02.0"W Jaya River. CI FML 7850, 10 ex, 27° 19' 07.5"S, 65° 41' 51.2"W Jaya River. CI FML 7852, 2 ex, 27° 17' 39.8"S, 65° 51' 02.0"W, Jaya River. CI FML 7915, 1 ex, 27° 21' 23.8" S, 65° 48' 33.3"W Cochuna River. CI FML 7918, 12 ex, 27° 21'23.8" S, 65° 48'33.3" W Cochuna River. CI FML 7924, 6 ex, 27°12' 36.21"S; 65°37' 22.80"W Pueblo Viejo River.

Identification. Caudal peduncle relatively compressed and not very narrow; circulary body section; complete lateral line with 36-39 scales, 14 scales around caudal peduncle, 5 scales from pelvic fin to anus isthmus covered by scales; scales 4-3 in transverse series from dorsal to pelvic fins; 10 scales from dorsal fin to adipose fin; subterminal mouth; teeth uniserial; 5-8 premaxillary and dentary teeth; adipose fin moderately developed; dorsal fin with 10 rays; anal fin normally with 9 rays; pectoral and pelvic fins well developed; a black longitudinal band extends from the snout to base of caudal fin; normally with 9 transverse bars (Ringuelet et al., 1961; Gery et al., 2001).

Family Prochilodontidae

Prochilodus lineatus (Valenciennes 1837)

Material examined. 1 exemplar; 360.9 mm SL. CI FML 7916, 1 ex, 27° 21'23.8" S, 65° 48'33.3"W Cochuna River.

Identification. Body robust and relative deep; scales on the flank are large and cycloid, with 44-46 scales in the lateral line; a small protractile mouth, with thick lips; teeth diminute and located on lips, not the jaws; 11 dorsal-fin rays; 10-11 anal-fin rays; forked caudal fin; a bifid spine anteriorly directed in front of dorsal fin; silverish coloration, with thin longitudinal lines along the body; pectoral and pelvic fins orange (Serra et al., 2014; Almirón et al., 2015).

Order Siluriformes (Figure 4)

Family Callichthyidae

Corydoras longipinnis Knaack 2007

Material examined. 2 exemplars; 40.0 mm - 48.7 mm SL. Cl FML 7925, 2 ex, 27°12' 36.21"S; 65°37' 22.80"W Pueblo Viejo River.

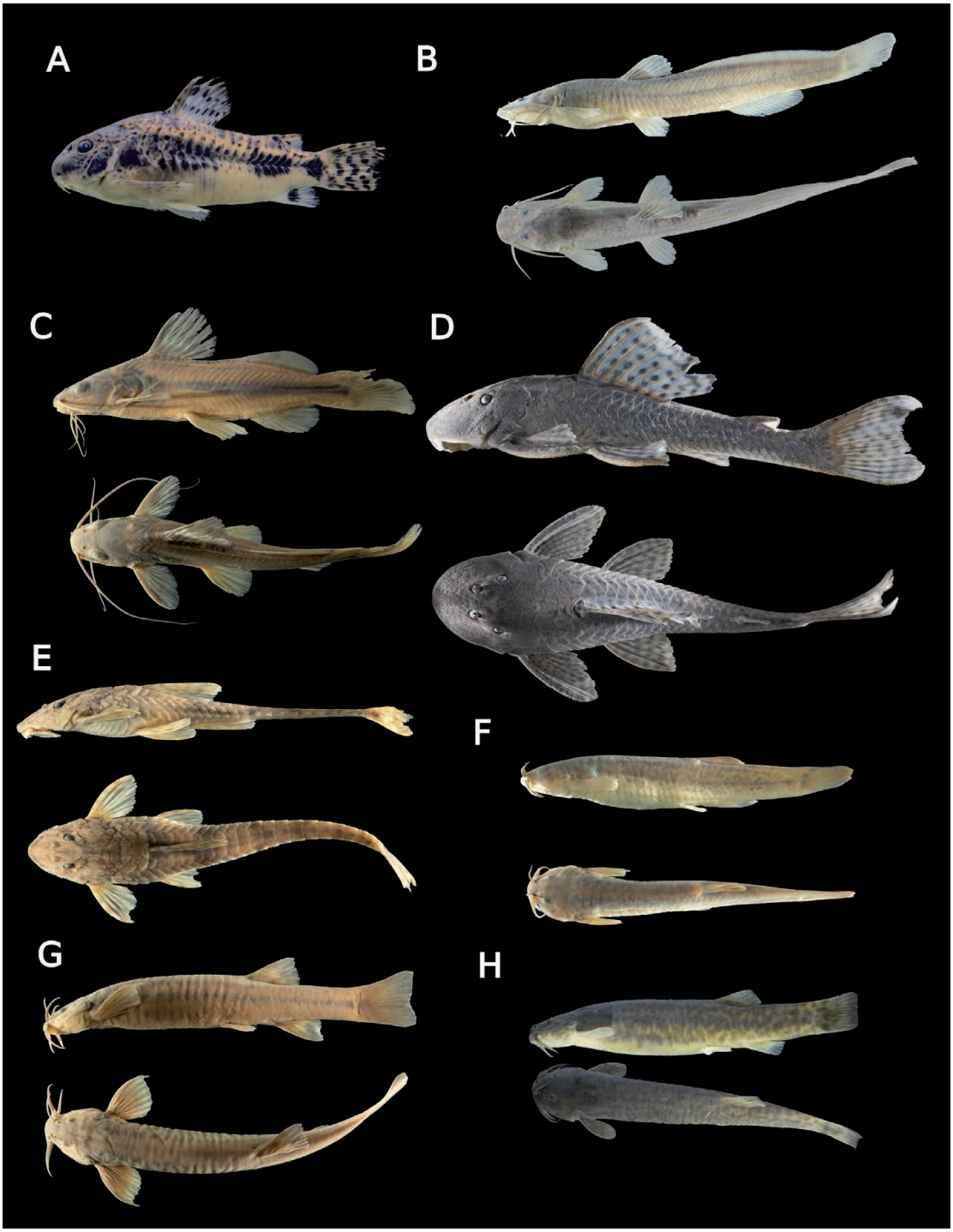

Figure 4. Siluriformes: **A.** *Corydoras longipinnis* CI FML7925, 48.7 mm SL. **B.** *Heptapterus qenqo* CI FML 7926, 73.9 mm SL. **C.** *Pimelodella laticeps* CI FML 7821, 62.7 mm SL. **D.** *Hypostomus paranensis* CI FML 7922, 124.4 mm SL. **E.** *Rineloricaria catamarcensis* CI FML 7834, 74.9 mm SL. **F.** *Trichomycterus alterus* CI FML 7942, 34.6 mm SL. **G.** *Trichomycterus barbouri* CI FML 7849, 68.7 mm. SL. **H.** *Trichomycterus corduvensis* CI FML 7935, 60.1 mm SL.

Figura 4. Siluriformes: **A.** *Corydoras longipinnis* CI FML7925, 48,7 mm SL. **B.** *Heptapterus qenqo* CI FML 7926, 73,9 mm SL. **C.** *Pimelodella laticeps* CI FML 7821, 62,7 mm SL. **D.** *Hypostomus paranensis* CI FML 7922, 124,4 mm SL. **E.** *Rineloricaria catamarcensis* CI FML 7834, 74,9 mm SL. **F.** *Trichomycterus alterus* CI FML 7942, 34,6 mm SL. **G.** *Trichomycterus barbouri* CI FML 7849, 68,7 mm. SL. **H.** *Trichomycterus corduvensis* CI FML 7935, 60,1 mm SL.

Identification. Body completely covered with 2 longitudinal rows of plates on the flanks; number of plates in the upper row of the dorsal base 20-21; number of plates in the lower row of the ventral base 18-20; short barbels that do not reach the base of the pectoral fins; short snout 43.5-52.6 % in head length (HL); dorsal and pectoral fin elongated in males; anterior region of the dorsal fin with black spots or bars (Knaack, 2007; Tencatt et al., 2016).

Family Heptapteridae

Heptapterus qenqo Aguilera, Mirande & Azpelicueta 2011

Material examined. 11 exemplars; 39.5 - 252.2 mm SL. CI FML 7813, 1 ex, 27° 12' 29.6"S, 65° 37' 39.2"W Pueblo Viejo River. CI FML 7851, 1 ex, 27° 17' 39.8"S, 65° 51' 02.0"W Jaya River. CI FML 7856, 3 ex, 27° 17' 39.8"S, 65° 51' 02.0"W Jaya River. CI FML 7907, 2 ex, 27° 12' 29.6"S, 65° 37' 39.2"W Pueblo Viejo River. CI FML 7912, 3 ex, 27° 19'27.29 "S , 65° 53'20.28 "W Cochuna River. CI FML 7926, 1 ex, 27°12' 36.21"S; 65°37' 22.80"W Pueblo Viejo River.

Identification. Very elongate (eel-like) body form; small eyes (7,4–14,2% of the head length); maxillary barbels do not reach pectoral-fin base in adults and reach or scarcely surpass first pectoral-fin ray in small juveniles; adipose fin is attached to the caudal fin; without a pectoral spine; presence of small serrae on the anterior proximal margin of the first pectoral-fin ray; anal-fin rays iv-v, 11-13 (15–17 total anal-fin rays); adipose-fin base 40,9-47,4% of the SL (Aguilera et al., 2011).

Pimelodella laticeps Eigenmann 1917

Material examined. 1 exemplar. 62.7 mm SL. Cl FML 7821, 1 ex, 27° 12' 29.6"S, 65° 37' 39.2"W Pueblo Viejo River.

Identification. Postcleithral process as a spine-shaped projection; bases of mentonian barbels located in straight line; short adipose fin 25.0-30.3 % of SL; lobes of the caudal fin equal; developed pectoral and dorsal spines; background color gray with dark band on the midline of flank; area behind operculum with a leaden spot, a dark spot in front of dorsal fin and another in front of adipose fin; dorsal fin dark, with a middle hyaline band; rest of fins hyaline with few scattered chromatophores on rays and membranes (Almirón et al., 2015).

Family Loricariidae

Hypostomus paranensis Weyenbergh 1877

Material examined. 23 exemplars; 38.8 - 139.2 mm SL. CI FML 7819, 2 ex, 27° 12' 29.6"S, 65° 37' 39.2"W Pueblo Viejo River. CI FML 7828, 4 ex, 27° 19' 07.5"S, 65° 41' 51.2"W Jaya River. CI FML 7854, 11 ex, 27° 19' 07,5"S, 65° 41' 51,2"W Jaya River. CI FML 7881, 2 ex, 27° 19' 07.5"S, 65° 41' 51.2"W, Jaya River. CI FML 7886,

1 ex, 27° 19’ 07.5”S, 65° 41’ 51.2”W Jaya River. Cl FML 7922, 3 ex, 27°12’ 36.21”S; 65°37’ 22.80”W Río Pueblo Viejo.

Identification. Height body 13.3-18.1% in SL and head length 25.9-30.7% in SL; rounded snout; deep caudal peduncle; body completely covered with more than two rows of plates on the flanks; absence of lateral ridges on flanks; 28-30 lateral series plates; bifid teeth; presence of adipose fin; strong pectoral spines, with large odontodes; subequal caudal fin; dark spots on a light background (Cardoso et al., 2019).

Rineloricaria catamarcensis (Berg 1895)

Material examined. 7 exemplars; 51.7 - 76.7 mm SL. CI FML 7834, 1 ex, 27° 19’ 07.5”S, 65° 41’ 51.2”W Jaya River. CI FML 7923, 6 ex, 27°12’ 36.21”S; 65°37’ 22.80”W Pueblo Viejo River.

Identification. Body and caudal peduncle greatly depressed; pointed snout; depressed caudal peduncle; abdomen completely covered by plates, but not forming regular series; dorsal margin of orbit markedly elevated; triangular and well-developed postorbital notch; undivided lips with short barbels; without adipose fin; pectoral fin barely surpasses ventral-fin origin; pectoral spines similar to the first pectoral ray; upper caudal-fin ray prolonged into a filament (Alcaraz et al., 2011; Liotta, 2016).

Family Trichomycteridae

Trichomycterus alterus (Marini, Nichols & LaMonte 1933)

Material examined. 10 exemplars; 32.5 - 34.6 mm SL. CI FML 7841, 4 ex, 27° 19’ 07.5”S, 65° 41’ 51.2”W Jaya River. CL FML 7843, 3 ex, 27° 19’ 07.5”S, 65° 41’ 51.2”W Jaya River. Cl FML 7942, 2 ex, 27°12’ 36.21”S; 65°37’ 22.80”W Pueblo Viejo River. Cl FML 7943, 1 ex, 27° 17’ 39.8”S, 65° 51’ 02.0” W Jaya River.

Identification. Lack of a thick, rugose layer of fatty tissue on body and head; small or not visible body papillae; approximately triangular head shape in dorsal view; operculum and interoperculum with odontodes directed towards posterior region; without mentonian barbels; without adipose fin; first pectoral-fin ray as a distinct filament; 12 principal caudal-fin rays and distal margin concave; unpigmented region on the body anteroventral region to dorsal-fin origin, white dots at origin and end of dorsal-fin base (Fernández and Vari, 2002; Fernández et al., 2017).

Trichomycterus barbouri (Eigenmann 1911)

Material examined. 4 exemplars; 19.5 - 59.9 mm SL. Cl FML 7847, 3 ex, 27° 19’ 07.5”S, 65° 41’ 51.2”W Jaya River. Cl FML 7849, 1 ex, 27° 17’ 39.8”S, 65° 51’ 02.0” W Jaya River.

Identification. Small or not visible body papillae; rugose layer of fatty tissue on the body and head; very elongated body; triangular head shape in dorsal view; operculum and interoperculum with odontodes directed towards the posterior region; without mentonian barbels; first pectoral-fin ray elongated caudal fin border emarginated with 13 principal rays; without adipose fin; longitudinal band along the side of the body (Fernández, 2000).

Trichomycterus corduvensis Weyenbergh 1877

Material examined. 25 exemplars; 35.2 - 60.1 mm SL. CI FML 7811, 4 ex, 27° 12' 29.6"S, 65° 37' 39.2"W Pueblo Viejo River. CI FML 7820, 1 ex, 27° 12' 29.6"S, 65° 37' 39.2"W Pueblo Viejo River. CI FML 7830, 1 ex, 27° 19' 07.5"S, 65° 41' 51.2"W Jaya River. CI FML 7836, 2 ex, 27° 19' 07.5"S, 65° 41' 51.2"W Jaya River. CI FML 7838, 1 ex, 27° 19' 07.5"S, 65° 41' 51.2"W Jaya River. CI FML 7839, 2 ex, 27° 19' 07.5"S, 65° 41' 51.2"W Jaya River. CI FML 7848, 2 ex, 27° 17' 39.8"S, 65° 51' 02.0"W Jaya River. CI FML 7889, 1 ex, 27° 17' 39.8"S, 65° 51' 02.0"W Jaya River. CI FML 7920, 1 ex, 27° 21'23.8" S, 65° 48'33.3"W Cochuna River. CI FML 7921, 1 ex, 27° 12' 29.6"S, 65° 37' 39.2"W Pueblo Viejo River. CI FML 7932, 8 ex, 27°12' 36.21"S; 65°37' 22.80"W Pueblo Viejo River. CI FML 7935, 1 ex, 27° 09'33.3" S 65° 42' 37.6"W Pueblo Viejo River.

Identification. Papillae-like structures present on body; round head shape in dorsal view; operculum and interoperculum with odontodes directed towards the posterior region; without mentonian barbels; caudal peduncle smoothly continuous with dorsal and ventral profiles of trunk; 13 principal caudal-fin rays with distal margin straight; without adipose fin; first ray of pectoral fins is non-prolonged, similar size to the rest of the fin rays; unpigmented region on the dorsal-fin origin absent (Ringuelet et al., 1961; Fernández et al., 2007).

Order Cyprinodontiformes (Figure 5. A)

Family Anablepidae

Jenynsia lineata (Jenyns 1842)

Material examined. 11 exemplars; 18.1 - 49.3 mm SL. CI FML 7829, 2 ex, 27° 19' 07.5"S, 65° 41' 51.2"W Jaya River. CI FML 7883, 1 ex, 27° 19' 07.5"S, 65° 41' 51.2"W Jaya River. CI FML 7930, 8 ex, 27°12' 36.21"S; 65°37' 22.80"W Pueblo Viejo River.

Identification. Body elongate, slightly compressed laterally; protractile mouth with tricuspid teeth; absence of adipose fin; males with an intromittent organ or gonopodium formed by the modification of the anal fin presence of a swelling between the urogenital opening and the base of the anal fin of females; body with small spots forming 5-7 irregular lines (Amorim, 2018; Aguilera et al., 2013).

Figure 5. A. *Jenynsia lineata* CI FML 7930, 46.8 mm SL. **B.** *Odonthestes bonariensis, (*first dorsal fin adpresed) CI FML 7936, 93.3 mm SL. **C.** *Oncorhynchus mykiss* CI FML 7911, 146.3 mm SL.

Figura 5. A. *Jenynsia lineata* CI FML 7930, 46,8 mm SL. **B.** *Odonthestes bonariensis*, (primera aleta dorsal adpresa) CI FML 7936, 93,3 mm SL. **C.** *Oncorhynchus mykiss* CI FML 7911, 146,3 mm SL.

Order Atheriniformes (Figure 5 B)

Family Atherinopsidae

Odontesthes bonariensis (Valenciennes 1835)

Material examined. 6 exemplars; 81.7 - 98.3 mm SL. CI FML 7936, 6 ex, 27° 16' 56.04"S 65° 57' 58.24"W, Tesoro Lagoon.

Identification. Less than 60 scales on the lateral line; 11-15 scales on a transversal row; dorsal and anal fins with a spiny unsegmented anterior ray; 2 dorsal fins; dorsal fin at the vertical line that passes through the anus; second dorsal finishes at the same level than the anal fin, or slightly posterior; with horizontal silver stripes on the sides of the body (Serra et al., 2014; Ringuelet et al., 1961; Dyer, 2000).

Order Salmoniformes (Figure 5 C)

Family Salmonidae

Oncorhynchus mykiss (Walbaum 1792)

Material examined. 3 exemplars; 41.6 - 146.3 mm SL. CI FML 7911, 1 ex, 27° 19' 27.29"S , 65° 53' 20.28"W, Cochuna River. CI FML 7933, 2 ex, 27° 09' 33.3" S 65° 42' 37.6"W Pueblo Viejo River.

Identification. Tiny scales; lateral line scales roughly circular; 115-130 scales in mid-lateral row; base of the anal fin is less than half the length of the head; usually 6-9½ branched anal rays; body with black or dark spots (mainly on the dorsal region) on a greenish or coperish background; caudal with black spots at least on upper lobe, usually on whole fin; flank with pinkish to red midlateral stripe or band; no or few small black spots on opercle; juveniles with 5-10 spots (Kottelat and Freyhof, 2007; Ringuelet et al., 1961).

DISCUSSION

The current contribution fills an information gap regarding to fish species composition and their distribution within the Aconquija National Park. The results of this study are consistent with the fish species list from the Salí-Dulce basin provided by Buti and Cancino (2005). More specifically, the species herein recorded correspond with those species cited for the upper section of the basin, where the Aconquija National Park is located. They also correspond to the species mentioned for the central endorheic ichthyological ecoregion by López et al. (2002), and with the historical description of the Sali-Dulce basin: composition and diversity similar to the Paraná basin, but impoverished and with certain endemism typical of endorheic basins (Eigenmann, 1929; Ringuelet, 1975; López et al., 2008).

In addition to the fish fauna list of Buti and Cancino (2005), new species have been recently discovered in the Sali-Dulce basin that were recorded during samplings in Aconquija National Park, such as *Corydoras longipinnis*, *Heptapterus qenqo* and *Psalidodon puka*.

Given the fact that protected areas have the main goal of preserving biodiversity, it is essential to know precisely what biodiversity is there inside the areas to protect. In this regard, providing a National Park with a species list helps accomplishing the goals of the NP and helps with management and regulations. The report of two exotic species, one confined and the other spread, are also crucial reports at the time of decision-making and management.

This article represent a baseline for further investigation and could help creating a precedent. More detailed biodiversity analyses should be made based on seasonal samplings, in order to minimize possible "one time event" biases. This research presents a solid baseline of information regarding the ichthyofauna present in Aconquija National Park that will help in future research regarding the ichthyofauna of the study area. This information will allow better decision-making and better management planning regarding the waters present in the Aconquija National Park.

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