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PENSOFT

Fish fauna from the Langueyú basin, Argentina: a prairie stream in a heavily modified landscape

Andrea Bertora,[1, 2] Fabián Grosman,[2] Pablo Sanzano,[2] Juan J. Rosso[3, 4]

1 Comisión de Investigaciones Científicas de la Provincia de Buenos Aires (CIC), Buenos Aires, Argentina. **2** Universidad Nacional del Centro de la Provincia de Buenos Aires, Facultad de Ciencias Veterinarias, Instituto Multidisciplinario sobre Ecosistemas y Desarrollo Sustentable - CIC, Pinto 399, CP 7000, Tandil, Buenos Aires, Argentina. **3** Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET). **4** Instituto de Investigaciones Marinas y Costeras, Grupo de Biotaxonomía Morfológica y Molecular de Peces, Rodríguez Peña 4046, CP 7600, Mar del Plata, Buenos Aires, Argentina.

Corresponding author: Andrea Bertora, bertorandrea@gmail.com

Abstract

On the Pampa plain, one of the most productive modified areas of Argentina, important changes in land uses have drastically altered the landscape during the last decades. This has led to an increased deterioration of surface waters affecting fish that inhabit them. We provide a list of fish species inhabiting an unsurveyed prairie stream of this region. Environmental variables were measured and fish samplings were conducted in 3 sites of the Langueyú stream. A total of 15 species belonging to 10 families and 6 orders were collected. Characiformes and Siluriformes were the richest orders. Characidae was the most representative family. Species richness was highest when compared with other similar regional environments without connection with the Salado river basin. Most of the fish species collected are typical of the region but others are species which typically do not progress beyond the Salado river basin. The role of human intervention in fish species distribution is discussed.

Key words

List of species; freshwater; richness; Pampean Plain; Langueyú stream.

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Introduction

South America hosts the richest freshwater fish fauna in the world, with more than 5,000 species (Reis et al. 2003). In Argentina, 548 fish species live in freshwaters, with 17 introduced (Mirande and Koerber 2015, Koerber et al. 2017). Despite this great richness, knowledge on the fish fauna inhabiting rivers and streams is still incipient (Casciotta et al. 1999, Almirón et al. 2000, Paracampo et al. 2015).

The freshwater fishes of Argentina are included in 2 major Neotropical Biogeographic subregions: the Brazilian subregion occupying North and Central-East territories and the Austral subregion extending in Patagonia and part of Central-West territories (Ringuelet 1975, Arratia et al. 1983). The southern boundary of the Brazilian subregion is located in drainages south of Ventania hills and extends to the Río Negro (Almirón et al. 1997). Well before reaching its southern limit, the Neotropical fish fauna already clearly shows a pattern of diversity pauperization southwards (Ringuelet 1975, Gómez 1996). This significant decrease in fish richness is explained by the temperature (by deficit) and dissolved

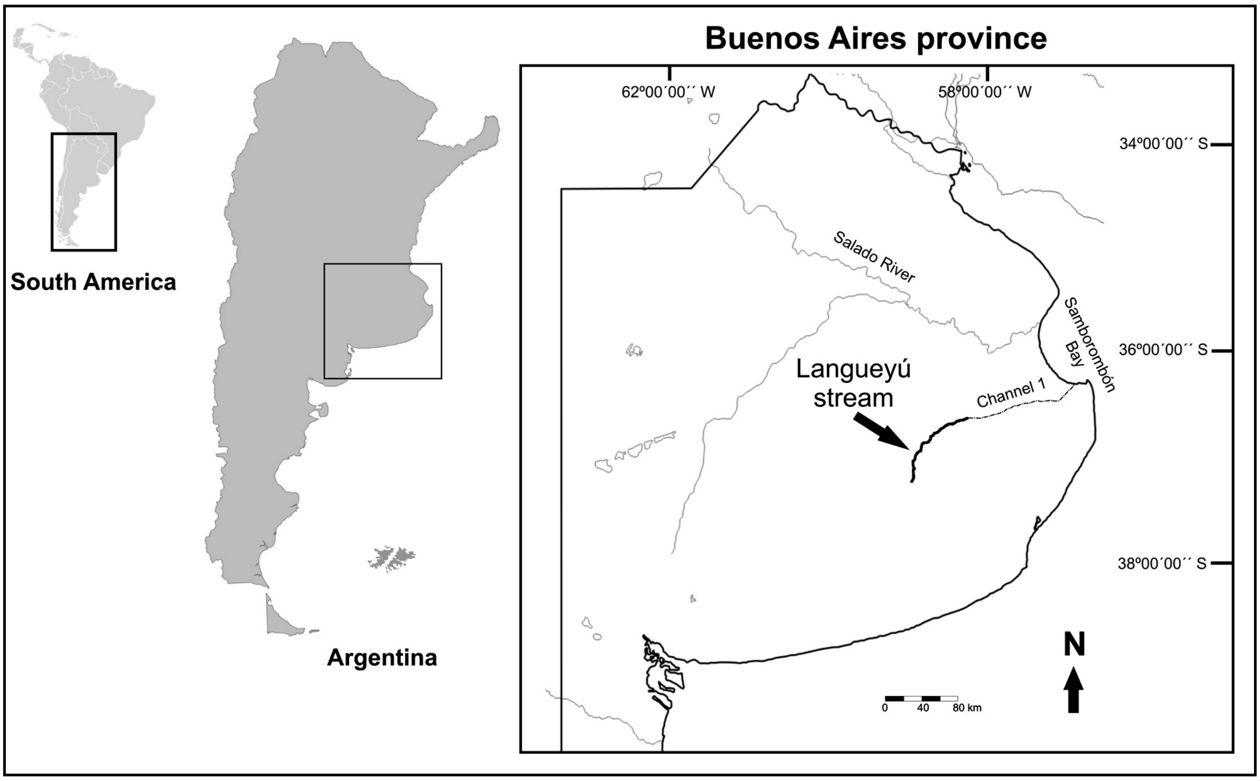

Figure 1. Location of Langueyú on the Pampean Plain, Buenos Aires province, Argentina.

salt concentration (by excess). Particularly, many freshwater fish species that are common in La Plata river drainages are scarcely collected in the lower Salado River and are absent beyond this fluvial network (López et al. 2001).

The Pampa plain, one of the most productive modified landscapes of Argentina (Baldi et al. 2006), is poorly protected from, and one of the most impacted by, anthropic activities. During the last years, important changes in land uses have been produced in the Pampean region as a consequence of the advance of the agricultural frontier (Viglizzo et al. 2001) and the consequent displacement of livestock to marginal flooded areas. This scenario of habitat fragmentation by changes in land use brings an increase in the deterioration of surface waters (Quirós et al. 2006), which has an effect on the biota that inhabits them, including fishes (Granitto et al. 2016). Habitat fragmentation has been implicated as the major threat to the biodiversity of freshwater ecosystems in South America (Reis et al. 2016). Therefore, cataloging the fish species of regions where the landscape has been strongly altered from its original condition is highly relevant, especially if its ichthyofauna has been poorly explored. Information about the geographic distribution of species is also central for conservation purposes, such as by the International Union for Conservation of Nature (IUCN). The IUCN uses diverse knowledge of each species, including geographical distribution (IUCN 2001), and georeferenced distributional data are needed to calculate extent of occurrence, an important piece of information used in extinction risk assessments (Joppa et al. 2016).

The Langueyú stream, belonging to the basin Langueyú (area: 600 km^2) is a prairie ecosystem located in the Pampa Plain. This stream drains water from agricultural and livestock lands but also receives effluents from urban and industrial lands (Banda Noriega and Díaz 2010). To be able to evaluate potential impacts of anthropic activities on the fish fauna in this stream, the baseline information of a fish assemblage composition is mandatory. Therefore we provide a list of fishes species inhabiting this unsurveyed prairie stream of the Pampa Plain, Argentina.

Methods

Study area. The Langueyú stream has its headwaters in the Tandilia hills (elev. 50–250 m) in southeastern Buenos Aires province (Fig. 1). Water flows in a southwest to northeast direction without receiving tributaries of relevance (Ruíz de Galarreta et al. 2013). An artificial channel connects the lowland reaches of this small stream with Samborombón Bay (Río de la Plata estuary). The climate is temperate semi-moist to moist (Thornthwaite and Mather 1957), with annual average rainfall of 838 mm and an average temperature of 13.8 °C. As for many basins in temperate latitudes of the globe (Allan 2004), drastic changes in land uses have been occurred in the Langueyú basin during the last decades (Vásquez and Zulaica 2011).

Data collection. Three sites (1: 37°11′15″ S, 059°08′ W; 2: 37°05′47″ S, 059°06′29″ W; 3: 36°55′38″ S, 058°56′ 08″ W) were sampled bimonthly in the Langueyú stream (Fig. 2) during 2 different periods from November 2016

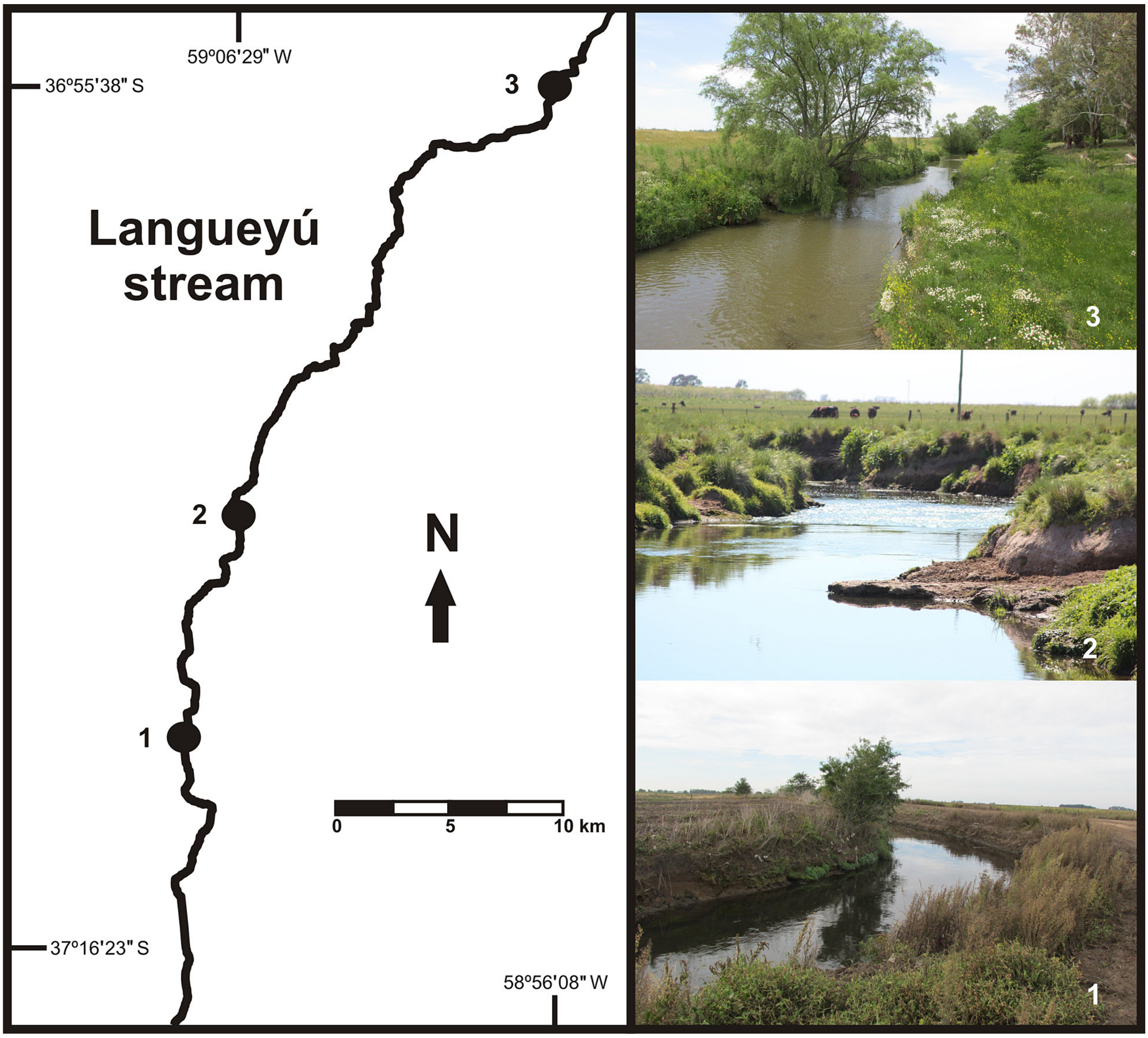

Figure 2. Sampling sites localization in Langueyú stream (1, 2 and 3).

to March 2017 and from October 2017 to February 2018. Field samplings were conducted under scientific fishing permit issued by the Ministerio de Agroindustria of Buenos Aires Province (Permission No. 409). Fish sampling was performed using different nets and fishing devices: trammel nets (12 m), beach seine net (12 m), artisanal tramps and long-lines (9 m). Fish captured were euthanized by an overdose in benzocaine solution, fixed in 10% formalin solution and preserved in 70% ethanol. Fish species were identified following Ringuelet et al. (1967), López et al. (1987), Casciotta et al. (2005), Rosso (2006), Miquelarena et al. (2008), and Almirón et al. (2015). Valid species names, their authorities, year of publication and synonyms are listed following Eschmeyer et al. (2017) and Mirande and Koeber (2015). Tolerance to diverse environmental variables, ecology, and behavior aspects for all collected species were summarized by Rosso (2006). Voucher specimens were deposited at the fish collection of the Instituto de Investigaciones Marinas y Costeras (UNMDP), in Mar del Plata, Argentina. Environmental variables measured *in situ* included: dissolved oxygen, water temperature, water specific conductance, and pH. Total suspended solids were quantified after processing water samples in the laboratory. Depth of water column and fine sediment substrate and wet channel width were also reported.

Results

The environmental variables that characterized the study sites are summarized in Table 1. Fish sampling yielded a total of 15 species (Figs 3, 4) belonging to 10 families and 6 orders (Table 2). Characiformes and Siluriformes were the richest orders (Fig. 5) with 5 (33% of species collected) species each. Characidae was the most representative family with 4 species (Fig. 6). The remaining fish families all contained 1 species except for the Heptapteridae and Loricariidae, which were represented by 2 species each. All fish species collected are native, with the exception of *Cyprinus carpio*. The meristic and morphometric characteristics used to identify each species are provided below.

Table 1. Environmental characteristics in different reaches of the Langueyú stream.

Variables	Sampling sites		
	1	2	3
Temperature (°C)	22.64 ± 3.07	23.11 ± 2.49	23.20 ± 2.40
Conductivity (µS)	1150 ± 69	1034 ± 77	943 ± 116
Total solids suspended (mg/L)	8.32 ± 5.46	12.53 ± 9.64	34.42 ± 9.22
Dissolved Oxygen (mg/L)	11.26 ± 3.12	11.47 ± 2.74	12.49 ± 3.02
pH	9.15 ± 0.32	8.88 ± 0.32	9.16 ± 0.26
Average depth of substrate (cm)	1.71 ± 1.04	1.23 ± 0.85	0.76 ± 0.55
Average width of humid channel (m)	7.52 ± 0.78	8.78 ± 0.86	9.26 ± 0.28
Average depth (cm)	37.74 ± 4.20	46.13 ± 9.42	59.97 ± 4.39

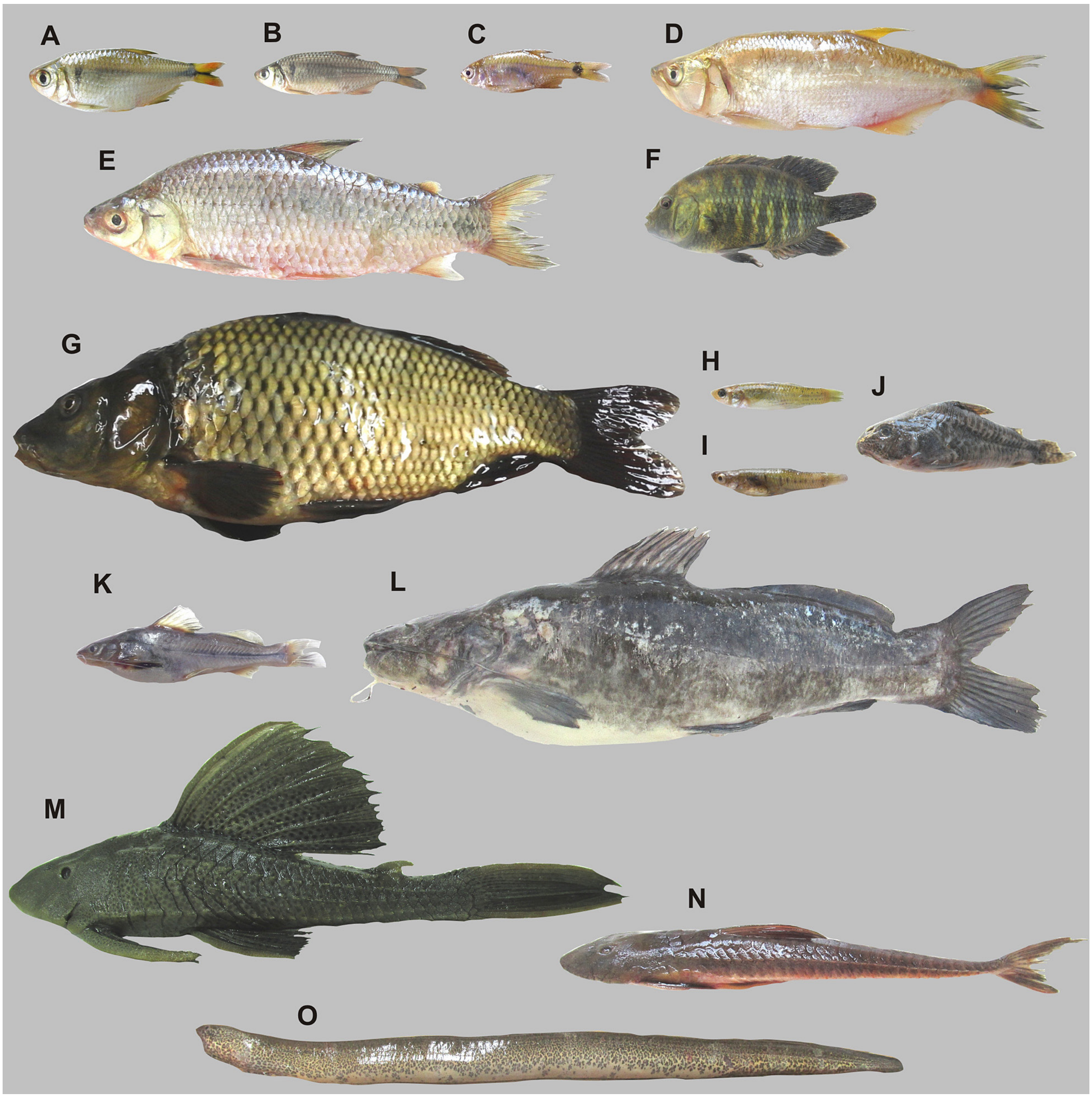

Figure 3. Fishes of Langueyú stream. **A.** *Astyanax pampa*, UNMDP 4853, 60 mm SL. **B.** *Bryconamericus iheringii*, UNMDP 4854, 53 mm SL. **C.** *Cheirodon interruptus*, UNMDP 4855, 40 mm SL. **D.** *Oligosarcus jenynsii*, UNMDP 4857, 120 mm SL. **E.** *Cyphocharax voga*, UNMDP 4856, 193 mm SL. **F.** *Australoheros facetus*, UNMDP 4858, 73 mm SL. **G.** *Cyprinus carpio*, UNMDP 4859, 350 mm SL. **H.** *Jenynsia multidentata*, UNMDP 4860, 38 mm SL. **I.** *Cnesterodon decemmaculatus*, UNMDP 4861, 25 mm SL. **J.** *Corydoras paleatus*, UNMDP 4862, 58 mm SL. **K.** *Pimelodella laticeps*, UNMDP 4863, 86 mm SL. **L.** *Rhamdia quelen*, UNMDP 4864, 345 mm SL. **M.** *Hypostomus commersoni*, UNMDP 4865, 280 mm SL. **N.** *Loricariichthys anus*, UNMDP 4866, 205 mm SL. **O.** *Synbranchus marmoratus*, UNMDP 4867, 430 mm SL.

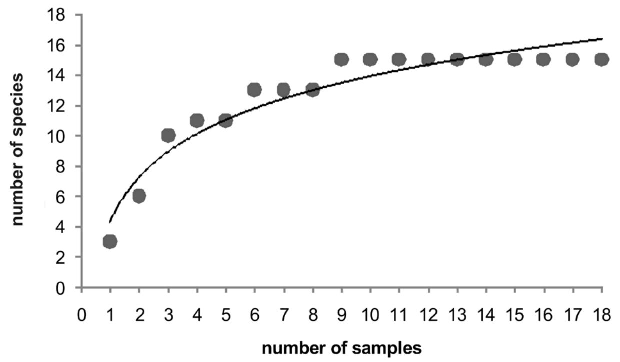

Figure 4. The species-accumulation curve in Langueyú stream.

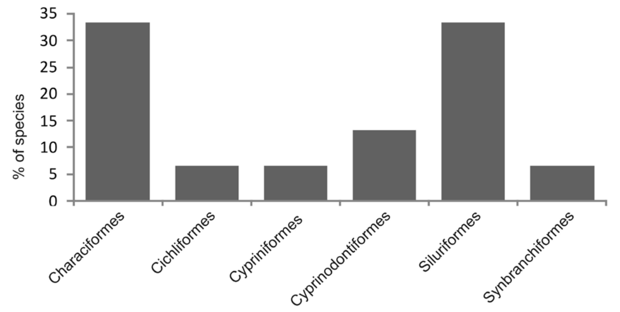

Figure 5. Number of species for each order expressed as percentages of the total of species collected in the Langueyú stream.

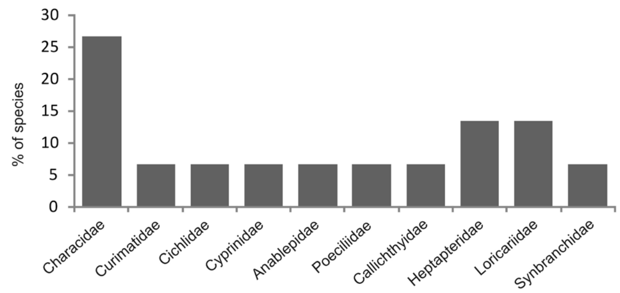

Figure 6. Number of species of each family expressed as percentages of the total of species collected in the Langueyú stream.

Characiformes

Characidae

Astyanax pampa **Casciotta, Almirón & Azpelicueta, 2005**
Astyanax pampa Casciotta et al. 2005: 402.

Material examined. Table 2, Figure 3A

Mouth horizontal and terminal. Lower jaw slightly longer than upper jaw. Two rows of teeth on premaxilla, the inner row with 5 teeth; 1 small, most frequently tricuspidate tooth in the maxillary bone. Three to 4 small teeth following main dentary teeth. Third infraorbital not contacting laterosensory canal of preopercle. Lateral line complete with 35–37 perforated scales. Four scales in contact with the supraoccipital bone. Less than 20 branched anal fin rays.

Bryconamericus iheringii **(Boulenger, 1887)**
Tetragonopterus iheringii Boulenger 1887: 172.
Tetragonopterus pliodus Cope 1894: 90.
Bryconamericus boops Eigenmann 1908: 105.

Material examined: Table 2, Figure 3B

Blunt snout. Mouth opening at the ventral margin of the orbit. Upper jaw slightly larger than lower jaw. Two rows of teeth on the premaxilla with four teeth in the inner series and maxilla with 2 to 4 teeth. A large third infraorbital contacting the preopercle along its posterior and ventral margins; a complete lateral line with 35 to 40 perforated scales. Two to two and a half scales in contact with the supraoccipital bone. Anal-fin rays 18-23.

Cheirodon interruptus **(Jenyns, 1842)**
Tetragonopterus interruptus Jenyns 1842: 127.
Chirodon monodon Cope 1894: 91.
Cheirodon meinkeni Ahl 1928: 320.
Cheirodon leuciscus Ahl 1936: 19.
Hyphessobrycon nigrifrons Ahl 1936: 23.
Pedalibrycon felipponei Fowler 1943: 314.

Material examined. Table 2, Figure 3C

One row of 5 teeth on premaxilla and 1 tooth in the maxilla. Pseudotympanum present. Lateral line incomplete with 5– 8 perforated scales. Ventral procurrentrays 22–29, more notorious in males. Caudal-fin rays 14–17. A conspicuous dark rhombus mark in the peduncle. Pelvic fin with 6 branched rays.

Oligosarcus jenynsii **(Günther, 1864)**
Xiphorhamphus jenynsii Günther 1864: 356.
Xiphorhamphus brachycephalus Cope 1894: 84.
Sphyraenocharax brachycephalus Fowler 1906: 84.
Acestrorhamphus jenynsii Eigenamnn and Ogle 1907: 35.
Acestrorhamphus brachycephalus Eigenamnn 1907: 452.
Acestrorhynchus jenynsii Devincenzi 1924: 178.
Acestrorhamphus purpureus Messner 1962: 1.

Material examined. Table 2, Figure 3D

A large, oblique head. Orbital diameter 25–34% of the head length. Upper jaw slightly larger than lower jaw when the mouth is closed. Both jaws with canine teeth. Maxilla with 19–28 teeth. Large (may reach 220 mm SL) compressed body with 54–65 scales in the lateral line system. Ten to 13 scales from lateral line origin to dorsal fin. Anal-fin rays 26–30. Scale around lateral peduncle 21–25.

Curimatidae

Cyphocharax voga **(Hensel, 1870)**
Curimatus voga Hensel 1870: 78.
Curimatopsis maculatus Ahl 1934: 240.

Material examined. Table 2, Figure 3E

Large, robust body. Toothless jaws. Nine branched dorsal-fin rays. Prepelvic region flattened. Median keel present posterior to insertion of pelvic fin. Pectoral fin does not reach pelvic fin and the latter does not reach the anus. Lateral line with 32– 39 scales. Presence of patch of dark pigmentation on the midlateral surface of the caudal peduncle ranging in shape from vertically ovoid to rotund. In juveniles and many adults a series of spots on the lateral and dorsolateral surfaces of body randomly arranged.

Table 2. List of species collected in the Langueyú stream, Buenos Aires province, Argentina.

Order/Family/Species	Sampling sites			Collection code
	1	2	3	
Characiformes				
Characidae				
Astyanax pampa Casciotta, Almirón & Azpelicueta, 2005			X	UNMDP 4853
Bryconamericus iheringii (Boulenger, 1887)		X	X	UNMDP 4854
Cheirodon interruptus (Jenyns, 1842)	X	X		UNMDP 4855
Oligosarcus jenynsii (Günther, 1864)			X	UNMDP 4857
Curimatidae				
Cyphocharax voga (Hensel, 1870)			X	UNMDP 4856
Cichliformes				
Cichlidae				
Australoheros facetus (Jenyns, 1842)			X	UNMDP 4858
Cypriniformes				
Cyprinidae				
Cyprinus carpio Linnaeus, 1758			X	UNMDP 4859
Cyprinodontiformes				
Anablepidae				
Jenynsia multidentata (Jenyns, 1842)		X		UNMDP 4860
Poeciliidae				
Cnesterodon decemmaculatus (Jenyns, 1842)	X	X		UNMDP 4861
Siluriformes				
Callichthyidae				
Corydoras paleatus (Jenyns, 1842)	X	X		UNMDP 4862
Heptapteridae				
Pimelodella laticeps Eigenmann, 1917		X	X	UNMDP 4863
Rhamdia quelen (Quoy&Gaimard, 1824)	X	X	X	UNMDP 4864
Loricariidae				
Hypostomus commersoni Valenciennes, 1836			X	UNMDP 4865
Loricariichthys anus (Valenciennes, 1836)			X	UNMDP 4866
Synbranchiformes				
Synbranchidae				
Synbranchus marmoratus Bloch, 1795	X	X		UNMDP 4867

Cichliformes

Cichlidae

Australoheros facetus (Jenyns, 1842)

Chromis facetus Jenyns 1842:104.
Chromys oblonga Castelnau 1855:14.
Heros jenynsii Steindachne 1869:149.

Material examined. Table 2, Figure 3F

Orbicular, compressed body with 23–27 scales in the longitudinal series. Upper lateral line scales 15–19, lower lateral line scales 7–10. Dorsal fin with 15–16 spines and 9–12 soft rays. Anal fin with 5–7 spines and 7–10 soft rays. Dorsal and anal fin bases covered by scales. A midlateral blotch of variable size, 6 vertical flank bars and the caudal fin blotch make up the principal coloration markings. A very short-caudal peduncle where the vertical bar many often mixes with the caudal spot.

Cypriniformes

Cyprinidae

Cyprinus carpio Linnaeus, 1758

Cyprinus carpio Linnaeus 1758: 320.
See details in Eschmeyer et al. (2017) for a complete list of synonyms.

Material examined. Table 2, Figure 3G

Large, robust body, often surpassing 500 mm SL. Toothless mouth, pharyngeal teeth. Branchial openings widely attached to isthmus. Large scales, 38 or 39 in the lateral line. Long dorsal fin, with anterior 3 or 4 rays undivided, of which the last conformed into spine with posterior denticles. Caudal fin with rounded lobes. Color pattern: greenish brown with golden and blue reflections.

Cyprinodontiformes

Anablepidae

Jenynsia multidentata (Jenyns, 1842)

Lebias multidentata Jenyns 1842: 117.
Poecilia punctata Valenciennes in Cuvier and Valenciennes 1846: 133.
Xiphophorus heckelii Weyenbergh 1874: 292.

Material examined. Table 2, Figure 3H

Small, subcilindrical body. A large central scale on the dorsal surface of head. Predorsal series with 13 or 14 scales. Lateral lines series with 30–32 scales. A tubular gonopodium formed by modified anal-fin rays in males. A swelling between the urogenital papilla and the origin of anal fin in females. Anal fin with 13 or 14 rays. Color pattern: dash-shaped spots arranged in longitudinal lines, with 4 or 5 lines on caudal peduncle.

Poeciliidae

***Cnesterodon decemmaculatus* (Jenyns, 1842)**

Poecilia decemmaculata Jenyns 1842: 115.
Poecilia gracilis Valenciennes in Cuvier and Valenciennes 1846: 133.

Material examined. Table 2, Figure 3I

Small, subcylindrical body with a pointed snout. Longitudinal series with 31–33 scales. Males with modified anal-fin rays forming a gonopodium. Bony style at gonopodium tip in adult males long and slightly arched with its membrane forming a distal filament. Color pattern: dark brown blotches along body sides forming regularly spaced vertical bars.

Siluriformes

Callichthyidae

***Corydoras paleatus* (Jenyns, 1842)**

Callichthys paleatus Jenyns 1842: 113.
Corydoras marmoratus Steindachner 1879: 26.
Corydoras maculates Steindachner 1879: 32.
Silurus quadricostatus Larrañaga 1923: 376.
Silurus septemradiatus Larrañaga 1923: 385.

Material examined. Table 2, Figure 3J

Small, deep body. Head compressed, triangular in dorsal view. Maxillary barbels moderate in size, not reaching gill opening. Outer mental barbels slightly longer than maxillary barbels. Body covered by 2 series of plates. Dorsal series with 23–25 plates. Ventral series with 20–22 plates. Serrae along the entire posterior margin of the pectoral spine perpendicularly oriented. A longitudinal series of 3 large black blotches along midline of flank. Ventral surface yellowish.

Heptapteridae

***Pimelodella laticeps* Eigenmann, 1917**

Pimelodella laticeps Eigenmann 1917: 243.

Material examined. Table 2, Figure 3K

Naked, low and long body. Maxillary barbels reaching the posterior most tip of dorsal fin. Mental barbels reaching the pectoral-fin base. Adipose fin short, 3.3–4 times in SL. Pectoral fin with anterior and posterior margins serrated. Caudal-fin lobes equals in size. Color pattern: a dark grey background with a midlateral darker band.

***Rhamdia quelen* (Quoy & Gaimard, 1824)**

Pimelodus quelen Quoy & Gaimard 1824: 228.
Pimelodus sapo Valenciennes 1835: pl. 2.
Pimelodus hilarii Valenciennes in Cuvier and Valenciennes 1840: 180.
See details in Silfvergrip (1996) for a complete list of synonyms.

Material examined. Table 2, Figure 3L

Large body, often surpassing 350 mm SL. Large adipose fin. Pectoral fin only posteriorly finely serrated. A forked caudal fin with rounded unequal lobes. Color pattern: background dark-brown to black with profuse small darker spots irregularly distributed along body margins.

Loricariidae

***Hypostomus commersoni* Valenciennes, 1836**

Hypostomus commersoni Valenciennes 1836: pl. 7.
Plecostomus spiniger Hensel 1870: 73.
Plecostomus limosus Eigenmann and Eigenmann 1888: 168.

Material examined. Table 2, Figure 3M

Large body, frequently larger than 500 mm SL. Body covered by 28–30 lateral scutes. Four lateral keels strong, sometimes very rough. One or 2 scutes bordering the posterior margin of supraoccipital bone. Lower caudal-ray 2.5–2.9 in SL. Color pattern: dark dots on lighter ground. All fins covered with very small, roundish, black or dark-brown dots.

***Loricariichthys anus* (Valenciennes, 1836)**

Loricaria anus Valenciennes 1835: pl. 6.

Material examined. Table 2, Figure 3N

Head triangular; tip of snout rounded in dorsal view. Dorsal margin of orbit slightly elevated; postorbital notch well developed. Lateral profile of snout between its tip and orbits, straight. Abdominal plates, between thoracic plates, irregularly arranged in 2 rows; anterior-most abdominal plates smaller and more numerous than posterior ones. Midventral plate series with 33–37 plates. Preanal plate bordered anteriorly by 2 to 4 plates. Upper caudal fin longer than lower one.

Synbranchiformes

Synbranchidae

***Synbranchus marmoratus* Bloch, 1795**

Synbranchus immaculatus Bloch 1795: 87.
Synbranchus marmoratus Bloch 1795: 87.
Typhlobranchus spurius Bloch and Schneider 1801: 537.
Unibranchapertura lineata Lacepède 1803: 656, 658.
Synbranchus pardalis Valenciennes 1836: pl. 13.
Synbranchus fuliginosus Ranzani 1839: 75.
Synbranchus vittatus Castelnau 1855: 84.
Symbranchus hieronymi Weyenbergh 1877: 14.
Symbranchus doeringii Weyenbergh 1877: 15.
Symbranchus tigrinus Weyenbergh 1877: 16.
Symbranchus mercedarius Weyenbergh 1877: 22.
Falconeria aptera Larrañaga 1923: 381.
Falconeria pinnata Larrañaga 1923: 381.

Material examined. Table 2, Figure 3O

Long body very often reaching 1 m SL, lacking scales. Sole branchial opening in ventral midline. Upper lip and the nuchal hump well developed. Lack of pectoral and pelvic fins. Black or dark brown roundish blotches scattered homogeneously along body with marbled pattern.

Discussion

The species richness of the Langueyú stream almost parallels the mean species richness that can be found in any locality in temperate streams worldwide (Matthews 1998). Moreover, the 10 fish species observed in site 3 of the Langueyú stream coincides with the mode of the average species per site reported by Matthews (1998) for temperate streams. When compared with its counterparts of the southern Pampa Plain, the observed fish species richness in the Langueyú stream is still high. Particularly, this stream showed the richest fish communities among other similar streams and rivers of the Pampa Plain without connection with the Salado river basin. For instance, 11 species were recorded in 35 lotic systems in the Southern Pampean region with Atlantic slope (Casciotta et al. 1999). In a study encompassing 23 streams in the Ventania hills, Menni et al. (1988) recorded only 7 species. Later, 9 species were collected in the Sauce Grande River (López Cazorla et al. 2003). Ringuelet et al. (1967) mentioned *Australoheros facetus, Cheirodon interruptus* and *Synbranchus marmoratus* near the city of Tandil without precise an exact locality. All the species mentioned in these previous studies were collected by us.

More than 65% of the species collected in the Langueyú stream were grouped in only 2 orders: Characiformes and Siluriformes. A fish community dominated by species of Characiformes and Siluriformes is a common pattern in Pampean region (Rosso 2006) as it is in most of the Neotropical fish assemblages (Lowe-Mc Connell 1987). Even being a marginal Neotropical fluvial ecosystem, the Langueyú stream shares this pattern of fish assemblage organization with other Neotropical streams of lower latitudes. However, the marked proliferation of species richness within 1 family explaining the local species diversity in fish assemblages is not a universal pattern. In the Pampa Plain, a marked proliferation of species within Characidae with the remaining families accounting for no more than 2 species is commonly observed (Rosso and Quirós 2010). Conversely, in tropical fish assemblages (Angulo et al. 2013, Casatti et al. 2013), as in many other streams worldwide (Matthews 1998, Muchlisin et al. 2015), an increased local richness is explained by an increased number of families instead a proliferation of species within families.

As it is observed in many freshwater ecosystems of Argentina and in the Pampa Plain (Maiztegui et al. 2016), the exotic and invasive common carp *Cyprinus carpio* was present in the Langueyú stream. This species has a wide trophic spectrum, high fecundity, lacks predators, and displays high tolerance to environmental change (Colautti 1997). These characteristics could explain its success in Argentina and fast colonization since its introduction at the end of the 19th century, extending its distribution as far as Río Negro (Liotta 2017). The presence of the common carp in this environment could generate resuspension of sediments increasing turbidity which would finally affect the visibility of sight-oriented species such as *O. jenynsii* and other small species of Characidae. In addition, given the food spectrum of this invasive species, it could compete for food with native species, mainly with *H. commersoni* and *L. anus* (detritivorous–alguivorous species) and *C. voga* (a detritivorous species).

Most collected fish species are typical of the marginal fish fauna of the Pampa Plain (Ringuelet 1975) but others are species which typically do not progress beyond the Salado river basin. For instance, the occurrence of *Cyphocharax voga, Hypostomus commersoni*, and *Loricariichthys anus* in the Langueyú stream challenges the historical biogeography of these latitudes (Ringuelet 1961). Indeed, they are representatives of the typical fauna of the Salado river basin (Rosso 2006).According to Gómez (2008), the distributions of some parano-platense species in the Pampa Plain are enhanced by channelization and by increases in temperature and rainfall. Langueyú stream is artificially connected with Samborombón Bay by means of an artificial channel, the Canal 1. Before the construction of Canal1, Langueyú stream, as well as most of the northern streams of the Tandilia System flowed to a very low elevation area of the Buenos Aires province without a natural drainage to the Samborombón Bay (Fucks et al. 2012). It could be hypothesized, therefore, that migration of *H. commersoni, C. voga*, and *L. anus* from Samborombón Bay to Langueyú stream could have been facilitated by the anthropogenic modification of the natural fluvial network.

The freshwater fish distribution is a result of historical, ecological, and zoogeographical factors (Ringuelet 1961), but man-made interventions has drastically modified these historical patterns and homogenized the freshwater faunas (Rahel 2007). A better knowledge of the geographic distribution of species in various environments is needed for defining priorities areas in conservation planning, evaluating the anthropic impacts on communities and proposing successful management measures.

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Authors' Contributions

All authors conceived the research question, collected data and confirmed the taxonomic identity of specimens. PS took all the photographs. AB and JJR wrote the first draft of the manuscript. AB, JJR FG and PS reviewed the final version of the manuscript.

References

Allan D (2004) Landscapes and riverscapes: the influence of land use on stream ecosystems. Annual Review of Ecology, Evolution and Systematics 35: 257–284. https://doi.org/10.1146/annurev.ecolsys.35.120202.110122

Almirón A, Azpelicueta M, Casciotta J, López Cazorla A (1997) Ichthyogeographic boundary between the Brazilian and Austral subregions in South America, Argentina. Biogeographica 73 (1): 23–30.

Almirón AE, García ML, Menni RC, Protogino L, Solari LC (2000) Fish ecology of a seasonal lowland stream in temperate South America. Marine and Freshwater Research 51: 265–274. https://doi.org/10.1071/MF98040

Almirón A, Casciotta J, Ciotek L, Giorgis P (2015) Guía de los peces del Parque Nacional Pre-Delta. Administración de Parques Nacionales, Ciudad Autónoma de Buenos Aires, 300 pp.

Angulo A, Garita-Alvarado CA, Bussing WA, López MI (2013) Annotated checklist of the freshwater fishes of continental and insular Costa Rica: additions and nomenclatural revisions. Check List 9 (5): 987–1019. https://doi.org/10.15560/9.5.987

Arratia G, Peñafort MB, Menu-Marque S (1983) Peces de la región sureste de los Andes y sus probables relaciones biogeográficas actuales. Deserta 7: 48–107.

Baldi G, Guerschman JP, Paruelo JM (2006) Characterizing fragmentation in temperate South America grasslands. Agriculture, Ecosystems & Environment 116 (3–4): 197–208. https://doi.org/10.1016/j.agee.2006.02.009

Banda Noriega R, Díaz AA (2010) Estimación de Cargas Contaminantes del Arroyo Langueyú, Tandil, Buenos Aires. Ciencia 5 (20): 157–171.

Bloch ME (1795) Naturgeschichte der ausländischen Fische. Berlin, Auf Kosten des Verfassers und in Commission bei dem Buchhändler Hr. Hesse: 1–192, pls 397–429. https://doi.org/10.5962/bhl.title.63303

Boulenger GA (1887) Descriptions of new South-American characinoid fishes. Annals and Magazine of Natural History (series 5) 19 (111): 172–174.

Casatti L, Pérez-Mayorga MA, Carvalho FR, Brejão GL, da Costa ID (2013) The stream fish fauna from the rio Machado basin, Rondônia State, Brazil. Check List 9 (6): 1496–1504. https://doi.org/10.15560/9.6.1496

Casciotta J, Almirón A, Cione A, Azpelicueta M (1999) Brazilian freshwater fish assemblages from southern Pampean area, Argentina. Biogeographica 75 (2): 67–78.

Casciotta J, Almirón A, Azpelicueta M (2005) Astyanax pampa (Characiformes, Characidae), a new species from the southernmost boundary of the Brazilian subregion, Argentina. Revue Suisse de Zoologie 112 (2): 401–408.

Casciotta J, Almirón A, Bechara J (2005) Peces del Iberá—Hábitat y diversidad. Fundación Ecos, Corrientes, 244 pp.

Colautti DC (1997) Ecología de la carpa *Cyprinus carpio* en la cuenca del río Salado, provincia de Buenos Aires. Doctoral thesis Universidad Nacional de La Plata, La Plata, Argentina, 215 pp.

Eigenmann CH (1917) *Pimelodella* and *Typhlobagrus*. Memoirs of the Carnegie Museum 7 (4): 229–258, pls. 29–35.

Eschmeyer WN (2017) Catalog of Fishes, Electronic Version. http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp.

Accessed on: 2017-12-20.

Fucks E, Pisano F, Carbonari J, Huarte R (2012) Aspectos geomorfológicos del sector medio e inferior de la Pampa Deprimida, provincia de Buenos Aires. Revista de la Sociedad Geológica de España 25 (1–2): 107–118.

Gómez SE (1996) Resistenza alla temperatura e salinita in pesci della provincia di Buenos Aires (Argentina) con implicazioni zoogeografiche. In: Associazione Italiana Ittiologi Acque Dolci (Eds) Atti Congressuali, IV Convegno Nazionale. A.I.I.A.D. Freshwater Italian Association, Trento, 171-192.

Gómez SE (2008) Notas sobre el cambio ambiental en ictiología. Biología Acuática 24: 1–6.

Granitto M, Rosso JJ, Boveri M, Rennella AM (2016) Impacto del uso del suelo sobre la condición de ribera en arroyos pampeanos y su relación con la estructura de la comunidad de peces. Biología Acuática 31: 19–27.

Günther A (1864) Catalogue of the fishes in the British Museum. Catalogue of the Physostomi, containing the families Siluridae, Characinidae, Haplochitonidae, Sternoptychidae, Scopelidae, Stomiatidae in the collection of the British Museum 5: 1–455.

Hensel R (1870) Beiträgezur Kenntniss der Wirbelthiere Südbrasiliens (Fortsetzung). Archiv für Naturgeschichte 36 (1): 50–91. https://doi.org/10.5962/bhl.part.25780

IUCN Species Survival Commission (2001) IUCN Red List categories and criteria. IUCN, Switzerland, 32 pp.

Jenyns L (1842) Fish. In: Darwin C (Ed) The zoology of the voyage of H. M. S. Beagle, under the command of Captain Fitzroy, R. N., during the years 1832 to 1836. Part 4. Smith, Elder and Co., London, 172 pp. https://doi.org/10.5962/bhl.title.14216

Joppa LN, Butchart SHM, Hoffmann M, Bachman SP, Akçakaya HR, Moat JF (2016) Impact of alternative metrics on estimates of extent of occurrence for extinction risk assessment. Conservation Biology 30 (2): 362–70. https://doi.org/10.1111/cobi.12591

Koerber S, Litz TO, Mirande JM (2017) CLOFFAR—update 4—supplement to Checklist of the Freshwater Fishes of Argentina. Ichthyological Contributions of Peces Criollos 55: 1–11.

Linnaeus C (1758) Systema naturae per regna tria naturae: secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis, ed. 10. Laurentii Salvii, Holmiae, 824 pp. https://doi.org/10.5962/bhl.title.542

Liotta J (2017) Base de datos de peces de aguas continentales de Argentina. http://www.pecesargentina.com.ar. Accessed on: 2017-11-30.

López Cazorla A, Durán W, Tejera L (2003) Alimentación de la ictiofauna del Río Sauce Grande, Provincia de Buenos Aires, Argentina. Biología Acuática 20: 73–79.

López H, Menni R, Miquelarena A (1987) Lista de los peces de agua dulce de la Argentina. Biología Acuática 12: 1–50.

López H, Baigún CRM, Iwaszkiw JM, Delfino RL, Padín OH (2001) La Cuenca del Salado: Uso y posibilidades de sus recursos pesqueros. Editorial de la Universidad de La Plata, La Plata, 90 pp.

Lowe-McConnell RH (1987) Ecological studies in tropical fish communities. Cambridge University Press, Cambridge, 382 pp.

Maiztegui T, Baigún CRM, García de Souza JR, Minotti P, Colautti DC (2016) Invasion status of the common carp *Cyprinus carpio* in land waters of Argentina. Journal of Fish Biology 89 (1): 417–430. https://doi.org/10.1111/jfb.13014

Matthews WJ (1998) Patterns in freshwater fish ecology. Chapman & Hall, London, 756 pp.

Menni RC, Lopez HL, Aramburu RH (1988) Ictiofauna de Sierra de la Ventana y Chasicó (Pcia. de Buenos Aires, Argentina). Zoogeografía y parámetros ambientales. Anales del Museo de Historia Natural de Valparaíso 19: 75–84.

Miquelarena A, Mantinian J, López H (2008) Peces de la Mesopotamia Argentina (Characiformes: Characidae: Cheirodontinae). Miscelánea 7: 51–90.

Mirande JM, Koerber S (2015) Checklist of the Freshwater Fishes of Argentina (CLOFFAR). Ichthyological Contributions of Peces Criollos 36: 1–68.

Muchlisin ZA, Akyun Q, Rizka S, Fadli N, Sugianto S, Halim A, Siti-Azizah MN (2015) Ichthyofauna of Tripa Peat Swamp Forest, Aceh province, Indonesia. Check List 11 (2): 1–9. https://doi.org/10.15560/11.2.1560

Paracampo A, García I, Mugnia H, Marrochi N, Carriquiriborde P, Bonetto C (2015) Fish assemblage of a Pampasic stream (Buenos Aires, Argentina): temporal variations and relationships with environmental variables. Studies on Neotropical Fauna and Environment 3 (50): 1–9. https://doi.org/10.1080/01650521.2015.1065658

Quirós R, Boveri MB, Petracchi CA, Rennella AM, Rosso JJ, Sosnovsky

A, vonBernard HT (2006) Los efectos de la agriculturización del humedal pampeano sobre la eutrofización de sus lagunas. In: Tundisi JG, Tundisi TM, Galli CS (Eds) Eutrofizaçãona América do Sul: Causas, conseqüências e tecnologias de gerenciamento e controle. Eutrosul, São Carlos, 1–16.

Quoy JRC, Gaimard JP (1824) Description des Poissons. Chapter IX. In: Freycinet L Voyage autour du Monde … exécuté sur les corvettes de L. M. "L'Uranie" et "La Physicienne," pendant les années 1817, 1818, 1819 et 1820. Chez Pillet aìné, Paris, 192–401. https://doi.org/10.5962/bhl.title.15862

Rahel FJ (2007) Biogeographic barriers, connectivity and homogenization of freshwater faunas: it's a small world after all. Freshwater Biology 52 (4): 696–710. https://doi.org/10.1111/j.1365- 2427.2006.01708.x

Reis RE, Kullander SO, Ferraris CJ (2003) Check list of freshwater fishes of South and Central America (CLOFFSCA). Edipucrs, Porto Alegre, 729 pp.

Reis RE, Albert JS, Di Dario F, Mincarone MM, Petry P, Rocha LA (2016) Fish biodiversity and conservation in South America. Journal of Fish Biology 89 (1): 12–47. https://doi.org/10.1111/jfb.13016

Ringuelet RA (1961) Rasgos fundamentales de la Zoogeografía de la Argentina. Physis 22 (63): 151–170.

Ringuelet RA (1975) Zoogeografía y ecología de los peces de aguas continentales de la Argentina y consideraciones sobre las áreas ictiológicas de América del Sur. Ecosur 2(3): 1–122.

Ringuelet RA, Arámburu RH, Alonso A (1967) Los Peces Argentinos de Agua Dulce. Comisión de Investigaciones Científicas de la Provincia de Buenos Aires, La Plata, 602 pp.

Rosso J (2006) Peces pampeanos: guía y ecología. Literature of Latin America, Buenos Aires, 224 pp.

Rosso JJ, Quirós R (2010) Patterns in fish species composition and assemblage structure in the upper Salado River lakes, Pampa Plain, Argentina. Neotropical Ichthyology 8: 135–144. https://doi.org/10.1590/S1679-62252010005000007

Ruíz de Galarreta VA, Banda Noriega RB, Najle R, Rodríguez CI, Barranquero RS, Díaz AA, Miguel RE, Pereyra M, Priano ME (2013) Análisis de la calidad del agua del arroyo Langueyú, Tandil, Buenos Aires. Estudios ambientales 1 (1): 2–28.

Silfvergrip AM (1996) A systematic revision of the Neotropical catfish genus *Rhamdia* (Teleostei, Pimelodidae). Ph.D. thesis, University of Stockholm, Stockholm.

Thornthwaite CW, Mather JR (1957) Instructions and tables for computing potential evapotranspiration and the water balance. Climatology Drexel Institute of Technology, Laboratory of Climatology 10: 185–311.

Valenciennes A (1836) Poissons. In: d'Orbigny A (Ed) Voyage dans l'Amérique méridionale: (le Brésil, la république orientale de l'Uruguay, la République argentine, la Patagonie, la république du Chili, la république de Bolivia, la république du Pérou), exécuté pendant les années 1826, 1827, 1828, 1829, 1830, 1831, 1832, et 1833. Bertrand et Levrault, Paris, pls. 1–16.

Vásquez P, Zulaica L (2011) Cambios en el uso de la tierra del partido de Tandil y principales impactos ambientales. Párrafos Geográficos 10 (2): 242–267.

Viglizzo EF, Lértora F, Pordomingo AJ, Bernardos JN, Roberto ZE, Del Valle H (2001) Ecological lessons and applications from one century of low external-input farming in the pampas of Argentina. Agriculture, Ecosystems and Environment 83: 65–81. https://doi.org/10.1016/S0167-8809(00)00155-9