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TAXONOMIC REVISION OF THE SOUTHERNMOST POPULATION OF *Hypostomus commersoni* VALENCIENNES, 1836 (SILURIFORMES: LORICARIIDAE) AND COMMENTS ON DISPERSAL ROUTES

Revision taxonómica de las poblaciones más australes de Hypostomus commersoni *Valenciennes, 1836 (Siluriformes: Loricariidae) y comentarios sobre las vías de dispersión*

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Abstract. *Hypostomus* is one of the most diverse genus of South American freshwater catfishes. In Argentina, *Hypostomus commersoni* Valenciennes, 1836 is distributed throughout the major river networks of the La Plata River basin and in the Pampa Plain. The recent record of *H. commersoni* in the Langueyú stream, represents the southernmost occurrence for this species and highlights the role of Samborombón bay as a likely dispersal route. It also supports the role of artificial channels in the translocation of freshwater fauna. In this study, a taxonomic revision of *H. commersoni* from the Langueyú stream was performed and aspects about ichthyofauna dispersal routes are discussed. The taxonomy of populations in the extreme of the species' distribution range contributes with information about geographic variation of characters.

Key words. Hypostominae, distribution, La Plata River basin, taxonomy, Langueyú stream.

Resumen. *Hypostomus* es uno de los géneros más diversos de peces de agua dulce de Sudamérica. En Argentina, *Hypostomus commersoni* Valenciennes, 1836 se distribuye a lo largo de las principales redes de ríos de la cuenca del río de la Plata y en la llanura Pampeana. El reciente registro de *H. commersoni* en el arroyo Langueyú, representa la ocurrencia más austral de esta especie y destaca el papel de la bahía de Samborombón como probable ruta de dispersión. También apoya el rol de los canales artificiales en la translocación de la fauna de agua dulce. En este estudio se realiza una revisión taxonómica de *H. commersoni* del arroyo Langueyú y se discuten aspectos sobre las rutas de dispersión de la ictiofauna. La taxonomía de las poblaciones en los extremos del rango de distribución de las especies contribuye con información sobre la variación geográfica de los caracteres.

Palabras clave. Hypostominae, distribución, cuenca del Río de La Plata, taxonomía, arroyo Langueyú.

INTRODUCTION

The order Silurifomes is a cosmopolitan group with more than 6,000 species (Eschmeyer and Fong, 2018). Likewise, Characiformes, its large specific richness matches a large diversity of habitats, body sizes, feeding strategies and reproduction (Nelson, 2006). The Neotropical family Loricariidae, is the richest among the 39 families of Siluriformes, in terms of species diversity and accounts for near 15% of the number of species of this order. Within Loricariidae, Hypostominae is the subfamily with the highest specific richness and the most geographically widespread (Eschmeyer and Fong, 2018). Included in this subfamily, *Hypostomus* Lacepède 1803 is one of the most diverse genus of Neotropical freshwater catfishes (Reis *et al*., 1990), occurring from Colombia to Salado River basin in Buenos Aires province, Argentina (López and Miquelarena, 1991; Ferraris, 2007). Its wide geographic distribution corresponds to its capacity to populate both lotic and lentic ecosystems (Lundberg *et al*., 1998). *Hypostomus commersoni* was originally described by Valenciennes (1836) from La Plata River, Montevideo, Uruguay. In Argentina, *H. commersoni* is distributed throughout the major river networks of the La Plata River basin and in the Pampa Plain (Liotta, 2017). The presence of *H. commersoni* in the Pampa Plain, is considered as an indicator of parano-platense ichthyofauna (Ringuelet, 1975). Previous studies recorded this species in the Alsina shallow lake (Schwerdt and López Cazorla, 2009) and del Azul stream (Grosman and Merlos, 2011), both southern tributaries of the Vallimanca-Salado basin. Just recently, the southernmost population of *Hypostomus commersoni* was recorded in the Langueyú stream (Bertora *et al*., 2018) a small prairie stream artificially connected with the Samborombón bay. Populations living at the species' range edges impinge on diverse biological aspects, including species' range dynamics, population variability (including taxonomic characterization), speciation and conservation biology (Hardie and Hutchings, 2010). In this study a taxonomic revision of *H. commersoni* from the Langueyú stream was performed. We also argue about the role of artificial channel networks in the translocation of freshwater fauna and highlight the role of Samborombón bay as a dispersal route.

MATERIALS AND METHODS

Examined specimens of *Hypostomus* were collected in the Langueyú stream (36°55'38.66"S, 58°56'8.70"W), Buenos Aires province, Argentina (Figure 1 and 2), during the course of an ichthyological exploration of this small stream from November 2016 to March 2017. The Langueyú stream is located in the Pampa Plain belonging to the homonym basin (600 km^2). Langueyú stream heads in the Tandilia sierras (50-250 m) in the southeast of the Buenos Aires province. Water flows in SW-NE direction, without receiving tributaries of relevance (Ruíz de Galarreta *et al*., 2013). An artificial channel connects this small highland stream with the Samborombón bay. Climate is temperate semi-moist to moist (Thornthwaite and Mather, 1957) with annual average rainfall of 838 mm and average temperature of 13.8 ºC.

Fish were caught using trammel nets, with a scientific fishing permit issued by the Ministerio de Agroindustria (Permission Nº409). 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), Reis *et al.* (1990) and López and Miquelarena (1991). Voucher specimens were deposited at the

fish collection of the Instituto de Investigaciones Marinas y Costeras (UNMDP), in Mar del Plata, Argentina.

Morphometric and meristic measurements were taken following Boeseman (1968) modified by Weber (1985) and Zawadzki *et al.* (2008), and Schaefer (1997) modified by Oyakawa *et al.* (2005), respectively. Morphometric measurements were taken using caliper to the nearest 0.01 mm and were expressed as percentage of standard and head lengths.

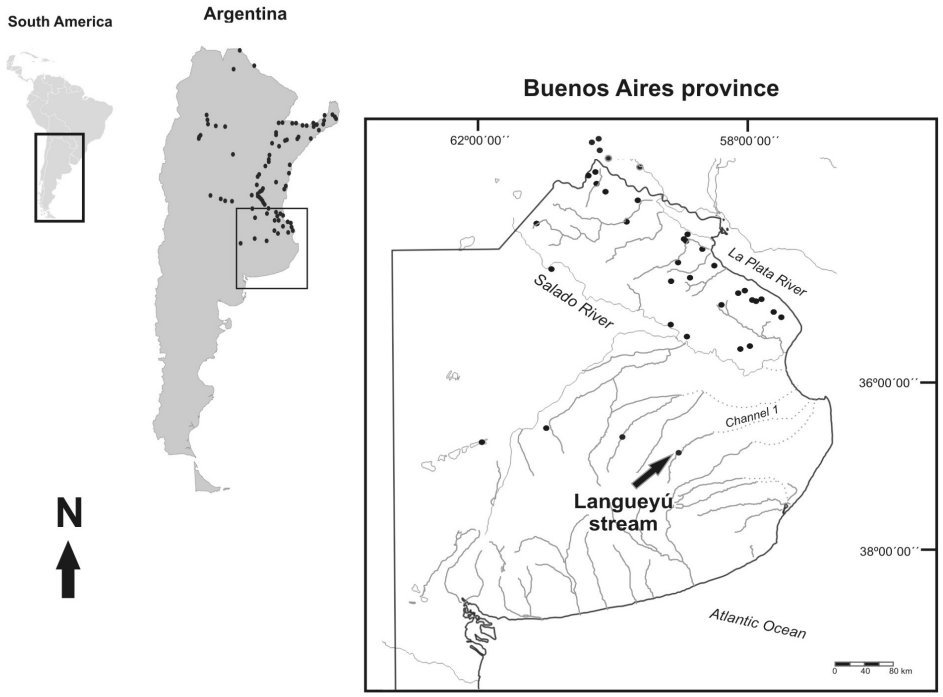

Figure 1 - Distribution records of *Hypostomus commersoni* in Argentina and Buenos Aires province. Arrow indicates the geographic location of the collecting site in the Langueyú stream (36°55'38.66"S, 58°56'8.70"W).

Figure 2 - Langueyú stream reach, where specimens of *Hypostomus commersoni* were collected. The southernmost occurrence of this species (36°55'38.66"S, 58°56'8.70"W).

RESULTS

Hypostomus commersoni Valenciennes, 1836
Material examined. UNMDP 4840, 1 specimen, 325 mm SL; UNMDP 4865, 1 specimen, 280 mm SL; UNMDP 4868, 1 specimen, 280 mm SL; UNMDP 4869, 1 specimen, 300 mm SL; UNMDP 4870, 1 specimen, 175 mm SL; UNMDP 4871, 14 specimens, 72-395 mm SL; Argentina, Buenos Aires, Langueyú stream, 36°55'38.66"S, 58°56'8.70"W, Nov 2016, Bertora, Grosman, Sanzano and Rosso.
Remarks. Collected specimens of *H. commersoni* have their dorsal surface of body with dark grey roundish dots over a grey background, 28-29 lateral scutes, lateral keels strong, 1-3 scutes bordering the posterior margin of the supraoccipital bone, cleithral width 3.4-4.2 in standard length (SL), mandibular ramus length 2.4-4.1 in interorbital distance, pectoral length 3.1-3.8 in SL, interdorsal length greater than 4.5 in SL, dorsal fin base greater than its distance to adipose fin and lower caudal ray 2.4-2.9 in SL (Table 1 and Figure 3).

Specimens in alcohol have ground colour of dorsal surface light to dark brown, slightly lighter to whitish ventrally. All body and fins covered with small, round-

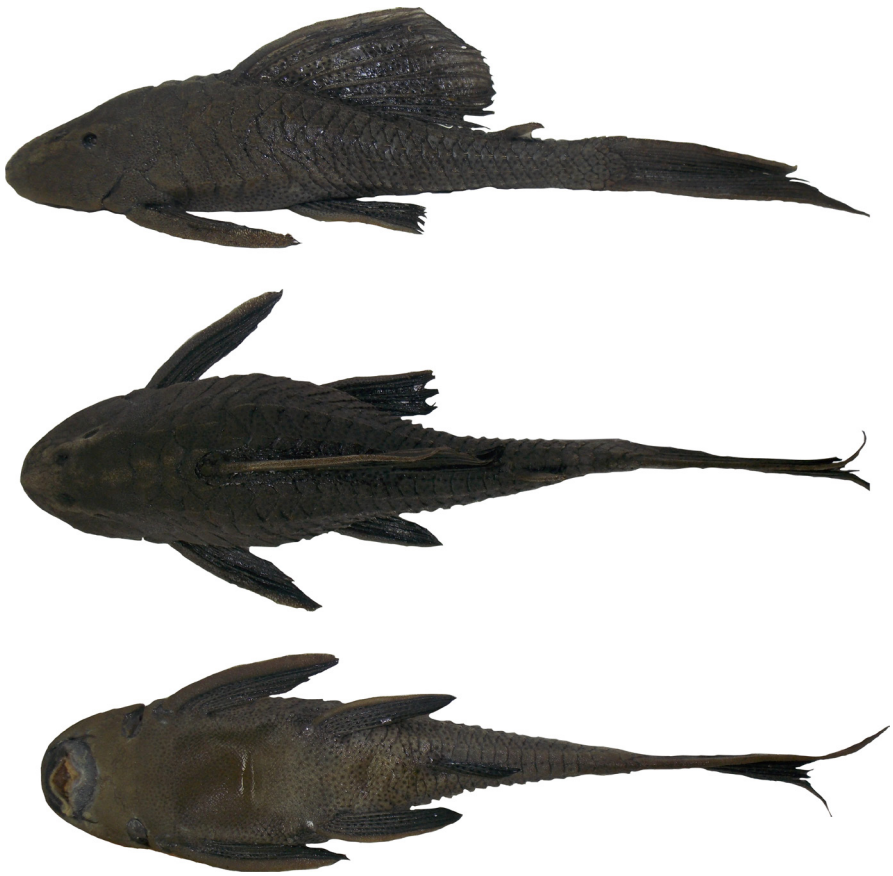

Figure 3 - Lateral, dorsal and ventral views of *Hypostomus commersoni* (UNMDP 4840, 325 mm SL) collected in Langueyú stream (36°55'38.66"S, 58°56'8.70"W).

Table 1 - Morphometric and meristic measurements of *Hypostomus commersoni* specimens captured in Langueyú stream (n=19). SD= standard deviation.

Measurements	Range	Mean	SD
Standard length (mm)	72.4 – 395	277.2	72.1
Percentage of standard length			
Head length	2.8 – 3.6	3.4	0.1
Predorsal length	2.3 – 2.7	2.5	0.1
Thoracic length	3.4 – 4.8	4.1	0.3
Abdominal length	4.5 – 5.4	4.7	0.2
Caudal peduncle length	2.9 – 3.4	3.1	0.2
Caudal peduncle depth	10.5 – 12.3	11.4	0.5
Dorsal-fin spine length	2.7 – 3.7	3.1	0.2
Dorsal-fin spine base length	3.4 – 4.1	3.8	0.2
Adipose-fin spine length	12.3 – 15.1	13.5	0.7
Pectoral-fin spine length	3.1 – 3.8	3.4	0.2
Pelvic-fin spine length	3.7 – 4.9	4.1	0.2
Anal-fin spine length	6.3 – 8.4	7.2	0.5
Upper caudal-fin ray length	2.5 – 3.2	2.9	0.2
Lower caudal-fin ray length	2.4 – 2.9	2.7	0.1
Cleithral width	3.4 – 4.2	3.8	0.2
Percentage of head length			
Head depth	1.4 – 1.7	1.5	0.1
Snout length	1.5 – 1.9	1.7	0
Interorbital width	2.2 – 2.7	2.4	0.1
Orbital diameter	6.8 – 12.8	10.0	1.3
Lower lip width	4.6 – 11.6	8.0	1.2
Lower lip length	2.1 – 2.7	2.4	0.1
Maxillary barbel length	6. 3 – 11.1	8.6	1.0
Mandibular ramus length	6.0 – 9.7	8.2	0.7
Counts			
Lateral scutes	28 – 29	28.1	0.1
Predorsal scutes	3	3.0	0
Scutes at dorsal fin base	8 – 9	8.8	0.3
Dorsal to adipose fin scutes	6 – 8	7.2	0.4
Adipose to caudal fin scutes	4 – 6	4.8	0.6
Scutes at anal fin base	2 – 3	2.8	0.3
Anal to caudal fin scutes	13 – 15	13.9	0.5
Plates bordering supraoccipital	1 – 3	1.5	0.7

ish, black or dark-brown dots, smaller and closer together on head. This pattern is sometimes inconspicuous on caudal fin and ventral portion of caudal peduncle. Live specimens are darker than alcohol-fixed individuals.

DISCUSSION

According to Reis *et al.* (1990) *H. commersoni* has 28-30 lateral scutes (25-27 in remaining species except *H. aspilogaster*, *H. cordovae*, *H. laplatae* and *H. regani*). From *H. regani* it is distinguished by a smaller eye, snout, mandibular ramus and number of teeth and by the inverse color pattern, that is, dark dots on lighter ground vs. light dots on darker ground. From *H. aspilogaster* and *H. cordovae* it is distinguished by the presence of four very rough lateral ridges on flanks (vs. absence). The lower number of plates bordering the posterior margin of the supraoccipital bone (1-2/3 vs. 2-4) and lower lateral scutes (31-32 in *H. laplatae*) further distinguishes *H. commersoni* from *H. laplatae*. A larger count of dentary teeth also differentiates *H. commersoni* (16-40) from *H. laplatae* (14-32).

The occurrence of *H. commersoni* in the Langueyú stream represents the southernmost record for this species (Bertora *et al.*, 2018). Moreover, it represents additional evidence supporting the role of artificial channel networks and the Samborombón bay as an alternative route in the translocation of freshwater fauna.

The Salado River basin, from where previous records of *H. commersoni* are known, may currently exchange species with the La Plata River basin by two ways: the headwaters of the river and its confluence with the Samborombón bay (Menni, 2004). Channelization also enhances faunal exchange and allows introduction of fish species from the Salado River basin in others aquatic environments (López *et al.*, 2001). Indeed, Colautti (1997) postulated the artificial channel connection as the hypothesis behind the introduction and dispersion of *Cyprinus carpio* in different freshwater ecosystems of the Pampa Plain. The Langueyú stream is artificially connected with the Samborombón Bay by means of a man-made channel, the Canal 1. It could be hypothesized therefore, that migration of *H. commersoni* from the mixohaline waters of the Samborombón bay to the Langueyú stream likely occur under the prevalence of freshwater conditions of these coastal waters.

The interaction between freshwater discharge of La Plata River and others rivers, channels and streams in the coastal seawater system generates an almost permanent salt wedge that defines the estuarine area. Salinity and hydrography are influenced by La Plata River discharge and wind patterns within the estuary and its adjacent marine coastal waters (Jaureguizar *et al.*, 2016). Fish assemblages of La Plata River estuary are intimately associated with the horizontal gradient of salinity, reflecting the transition from fish assemblage dominated mostly by freshwater species in the inner zone to marine species assemblage, characteristic of the external zone (Jaureguizar *et al.*, 2003). According to Cortés *et al.* (2011), during winter season, cool and salt waters cover a large area of the Atlantic coastal system allowing the intrusion of marine species into La Plata River estuary. Contrary, during spring, low salinity conditions restricts the intrusion of marine species and favors the dispersion of freshwater species.

Downstream intrusions of freshwater species like *Pimelodus maculatus* Lacepède, 1803, *Luciopimelodus pati* (Valenciennes, 1836), *Parapimelodus valenciennis* (Lütken, 1874), *Megaleporinus obtusidens* (Valenciennes, 1837), *Prochilodus lineatus* (Valenciennes, 1837) and species of Loricariidae

into the estuary are governed by the relative position of the inner and central estuarine areas (Jaureguizar *et al*., 2016).

According to Gómez (2008) the distribution of some parano-platense species, like *H. commersoni*, is enhanced by canalizations, besides the increase of the temperature and the rainfall. Artificial channels have had an important biologic impact because they had connected fluvial basins in a permanent way that otherwise are isolated or occasionally connected (Colautti, 1997). In the Pampa Plain, many fish species where recorded in the Encadenadas del Oeste shallow lakes after its artificial connection with the Vallimanca stream (Salado River basin). Particularly, the presence of some parano-platense species as *Hoplias malabaricus*, *Loricariichthys anus* and *Parapimelodus valenciennis* should be considered in association with the artificial channel that extend the distribution of fish populations (Miquelarena and López, 1995). Their adaptation to these particular lentic environments depends on the ecological fidelity and resistance capability of each species (Ringuelet, 1975). The richness of the fish fauna in the Encadenadas del Oeste shallow lakes increased from 7 to 18 species in about thirty years (Ringuelet, 1975; Miquelarena and López, 1995) and currently have 75% of similarity with the ichthyofauna of the Salado River basin (López *et al*., 2008).

Translocation of species from other basins could generate diverse impacts in an aquatic ecosystem, being able to alter its former species composition, structure and dynamic. Gómez (2008) suggested that *H. commersoni* may either compress or fragment the *Loricariichthys anus* niche. For instance, in Chascomús shallow lake, *H. commersoni* biomass occupies the third place in catches, while *L. anus* the sixth place (Berasain *et al*., 2005).

The freshwater fish distribution is a result of historical, ecological and zoogeographical factors (Ringuelet, 1961). Indeed, some species of the genus *Hypostomus* have recently extended their distribution in Argentina (Cardoso *et al*., 2011; Terán *et al*., 2016), where this species is widely spread throughout all major river systems (Liotta, 2017). In South America, *H. commersoni* inhabits a large array of Neotropical freshwaters environments being mostly confined to the La Plata River basin. This species is very common in the Paraná and Uruguay drainages but is less frequently collected in the Paraguay River (Neris *et al*., 2008). *Hypostomus commersoni* is also known from the São Francisco River (Casatti and Castro, 1998) and Laguna dos Patos basin (Bertaco *et al*., 2016). A proper knowledge about geographic distribution of taxa is crucial for defining priorities areas in conservation planning. In this respect, the extended geographic range of *H. commersoni* covering its southernmost occurrence is a relevant element aiding to the conservation of this species.

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