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NOTA CORTA / SHORT NOTE

RANGE EXTENSION OF *Synbranchus marmoratus* (SYNBRANCHIDAE) TOWARDS ARGENTINA'S CENTRAL ANDES

Ampliación de distribución de *Synbranchus marmoratus* (Synbranchidae) hacia los Andes Centrales de Argentina

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ABSTRACT

This work provides a new record that extends the western limit of the geographic distribution of *Synbranchus marmoratus* towards the Central Andes of Argentina, in the Department of Calingasta, Province of San Juan. In addition, an update of the geographical distribution map of the species in the country is provided based on this record and a complete literature review. We collected a specimen of this species on 12 September 2016 during an ichthyofaunal survey of high Andean rivers. This record corresponds to the westernmost distribution in the country. This finding is interesting since this species is considered an indicator of the ichthyofauna of the Biogeographic Provinces Greats Rivers and Pampean, while the ichthyofauna of the study area of this new record belongs to the Andean Cuyo Province.

Keywords: Andes mountains, marbled swamp eel, Neotropical region, San Juan.

RESUMEN

En este trabajo se aporta un nuevo registro que amplía el límite occidental de la distribución geográfica de *Synbranchus marmoratus* hacia los Andes Centrales de Argentina, en el Departamento de Calingasta, Provincia de San Juan. Además, se brinda una actualización del mapa de distribución geográfica de la especie en el país basado en este registro y en una revisión bibliográfica completa. Recolectamos un espécimen de esta especie el 12 de septiembre de 2016 durante un muestreo de ictiofauna en ríos altoandinos. Este registro corresponde al más occidental en su distribución en el país. Este hallazgo es interesante ya que esta especie es considerada como indicadora de la ictiofauna de las Provincias Biogeográficas Grandes Ríos y Pampeana, mientras que la ictiofauna del área de estudio de este nuevo registro pertenece a la Provincia Andino Cuyana.

Palabras clave: Anguila de pantano veteada, Cordillera de Los Andes, región Neotropical, San Juan.

The genus *Synbranchus* Bloch, 1795 is endemic to Central and South America and is characterized by being very specialized in many aspects, including the anatomical, physiological, and behavioral (Rosen and Greenwood, 1976). Currently, it contains three recognized species (Rosen and Greenwood, 1976; Favorito et al., 2005). *Synbranchus marmoratus* Bloch, 1795, popularly known as the marbled or creole swamp eel, is the only species found in Argentina (Liotta, 2005). It prefers freshwater habitats and lives in muddy areas, riverbanks, streams, and lagoons. It can grow to be approximately 1000 mm long, with body scales. Rayless dorsal and anal fins; represented by long skin folds. No paired fins except for membranous larval pectoral fins

(Ringuelet, 1975). It's characterized by having gills reduced to a single branchial membrane and by being able to breathe air through oropharyngeal breathing. It lacks an air bladder and can leave the water and move along the ground until it finds another water body (Fernández, 2018).

Liotta (2005) defined the distribution of this species in Argentina without completing an exhaustive revision of the bibliography, as then it was impossible to obtain old articles that had been published in foreign journals without free or unrestricted access. On the other hand, although the International Union for the Conservation of Nature [IUCN] considers the conservation status of *S. marmoratus* as "Least Concern", given that it has a wide distribution in Central and South America (Daniels and Maiz-Tome, 2019), we believe that each country where the species is distributed should carry out its own evaluation of the status of conservation.

Therefore, the objective this study is to provide a new latitudinal and altitudinal record that widens the distribution of the species at its most western point towards Argentina's Central Andes in the Calingasta Department of the San Juan Province. Additionally, this new record is at least 300 meters higher than previous records of the species, whose altitudinal range observed in the Colombian and Ecuadorian Andes is above 10 masl and below 1000 masl (Maldonado-Ocampo et al., 2005; Rodríguez-Galarza et al., 2017). Finally, we update the distribution map for *S. marmoratus* in Argentina based on this record and a complete review of the literature, to generate base information that serves for a future categorization of the conservation status in the country.

On September 12, 2016, during an ichthyofaunal survey of mountain rivers in the Calingasta Department of San Juan Province, Argentina, we placed tuna as bait in a double cone fish trap for an entire day along the floodplain at the southern edge of the Agua Negra Stream (31°15' S, and 69°25' W, 1330 m. a. s. l.). This body of water's origin is subterranean, and it is the last tributary of the Castaño River before it joins the Los Patos River, which later forms the San Juan River downstream. In the trap, we captured an individual of *Synbranchus marmoratus* (Fig. 1).

Figure 1. (a) Specimen of *Synbranchus marmoratus* found in Calingasta Department. (b) Detail of the dorsal view of the fish, showing the coloration pattern of the live specimen. (c) Detail of the ventral view of the fish, showing the coloration pattern of the live specimen.

In addition, we carried out a specific bibliographic search of the keywords "*Synbranchus marmoratus*" + "Marbled swamp eel" + "Argentina" in Google Scholar. This search turned up 58 papers, for which we obtained data related to geographical distribution whenever possible. With this information, we created a map of the new distribution of *S. marmoratus* in Argentina, based on that of Liotta (2005) together with the ecoregions of freshwater fish found in the country, as described by Abell et al. (2008). Furthermore, we have provided a table with information on the new points of distribution.

Based on the new record and points of distribution obtained for *S. marmoratus* through the literature, we have created an updated map with the current distribution of the species in Argentina (Fig. 2). Likewise, in Table 1, we include information on its new locations. The new location of *S. marmoratus* (Fig. 1) in the Province of San Juan is highly relevant since it corresponds to the most western point of its current distribution known in Argentina (Fig. 2). This

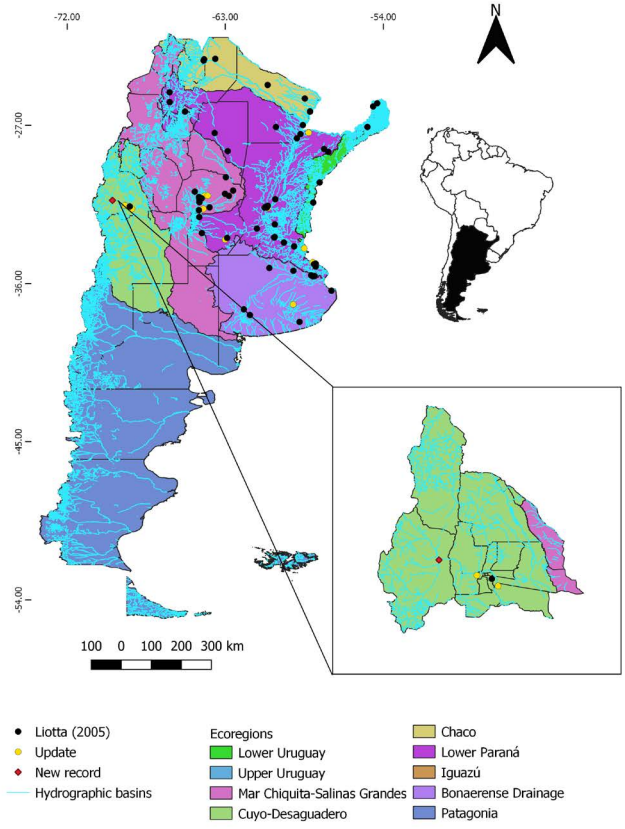

Figure 2. Map of the current distribution of *Synbranchus marmoratus* based on data obtained from Liotta (2005) and using the Freshwater Ecoregions of the World (*sensu* Abell et al., 2008) as an ecological unit. (a) Records from the previous study of Liotta (2005) and the updated records. (b) The new records for the Province of San Juan are shown.

Table 1. Details of the newly updated records of the distribution of *Synbranchus marmoratus* in Argentina.

Locality	Province	Body of water	Ecoregions	Altitude (m. a. s. l.)	Voucher number	Reference
–	Santa Fé	Paraná River	Lower Parana	11	-	Junges et al. (2010)
Distrito Federal	Buenos Aires	–	Lower Parana	28	USNM 176020	Rosen and Rumney (1972)
Villa Warcalde	Córdoba	Primero River	Mar Chiquita – Salinas Grandes	569	-	Rosen and Rumney (1972)
Villa Warcalde	Córdoba	Primero River	Mar Chiquita – Salinas Grandes	444	-	Rosen and Rumney (1972)
El Retiro	Córdoba	San Francisco River	Mar Chiquita – Salinas Grandes	641	-	Rosen and Rumney (1972)
Bialet Massé	Córdoba	Cosquín River	Mar Chiquita – Salinas Grandes	680	-	Rosen and Rumney (1972)
Despeñaderos	Córdoba	Segundo River	Mar Chiquita – Salinas Grandes	430	-	Rosen and Rumney (1972)
Villa Serranita	Córdoba	Los Quebrachos Stream	Lower Parana	123	-	Rosen and Rumney (1972)
Tandil	Buenos Aires	Langueyú Stream	Bonaerensean Drainages	149	IIMyC - UNMDP	Bertora et al. (2018)
Ensenada	Buenos Aires	El Coronillo Lagoon	Lower Parana	3	-	Llompart et al. (2011)
–	Corrientes	Lagoon	Lower Parana	65	-	Lo Nostro et al. (2003)
25 de Mayo	San Juan	Muddy bed of irrigation ditch	Cuyan – Desaguadero	568	-	Gómez (2001)
Zonda	San Juan	–	Cuyan – Desaguadero	772	-	Acosta et al. (2016)
Calingasta	San Juan	Agua Negra Stream	Cuyan – Desaguadero	1330	UNSJ-6294	This study

new record also widens the distribution of the species in the Province of San Juan approximately 90 to 120 km in a straight line from previous records, which are mentioned for 9 de Julio, 25 de Mayo and Zonda Departments (Murúa and Acosta, 1997; Gómez, 2001; Acosta et al., 2016). Though all the records until now have been found in the San Juan River basin, we must highlight the fact that the new location is found in the Calingasta Valley, between the Andes and the Pre-Andes foothills, while the other records were found east of the Pre-Andes in plains and valleys at lower elevations and in different environments.

This finding is interesting from a biogeographical point of view, as Ringuelet (1975) considers *S. marmoratus* to be an indicator of the ichthyofauna of the Great River and Pampa Biogeographical Provinces (López et al., 2008), while the ichthyofauna of the Province of San Juan belongs to the Andean Cuyo Province, whose indicator species include *Hatcheria macraei, Olivaichthys (Diplomystes) cuyanus* and *Percichthys trucha* (López et al., 2008). Even though these Biogeographical Provinces share *S. marmoratus*, Ringuelet (1975) believes that the border between the ichthyological territories is determined by an ecological barrier and not by hydrographic basins or physiographic barriers. In this way, we provide a new record latitudinal and altitudinal that allows us to extend the western distribution limit of the species in the country to the Central Andes of Argentina and contribute to the knowledge of the southernmost distribution of this species widely distributed in Central and South America.

AUTHORS PARTICIPATION

FMVO contributed to the fieldwork, preparation of the figures, composition of the map and writing of the main manuscript; JCA contributed to the fieldwork, took the photographs, and conducted the final revision of the manuscript; RA, RF, and LC contributed to fieldwork and text revision.

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CONFLICT OF INTEREST

We declare that there are no conflicts of interest in this research.

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