

Records of clupeiform fishes from Paraguay.

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Abstract

Neotropical clupeiform fishes are represented by 14 genera. So far two species were listed from Paraguay without providing voucher specimens, *Lycengraulis grossidens* since the end of 19th century, and *Pellona flavipinnis* since late 20th century. The aim of this paper is to corroborate clupeiform fishes from Paraguay based in the examination of voucher material from museum collections. *L. grossidens* is recognized by a large subterminal mouth, long maxilla reaching subopercle, and a underslung dentary. *P. flavipinnis* is recognized by a small superior mouth and the belly with sharp scutes. Distribution pattern of *L. grossidens* includes the lower portions of the Río Paraguay, with its left margin tributaries, to the lower portion of the Río Paraná, reaching upstream to the Yacyretá Dam. Distribution of *P. flavipinnis* based in museum records is restricted to the Lago Ypacaraí, Río Salado drainage, Río Paraguay basin. Previous listing of clupeiform species and the distribution reports according to the literature are discussed.

Resumen

Peces clupeiformes neotropicales están representados por 14 géneros. Hasta ahora dos especies fueron listadas para Paraguay sin proveer especímenes testimonio. *Lycengraulis grossidens* a finales del siglo 19, y *Pellona flavipinnis* desde las últimas décadas del siglo 20. El objetivo de este trabajo es corroborar los peces clupeiformes del Paraguay en base al examen de especímenes testimonio depositados en colecciones científicas. *L. grossidens* es reconocido por una boca subterminal grande, maxila larga alcanzando el subopérculo, y un dentario suspendido. *P. flavipinnis* se reconoce por una boca superior pequeña y región abdominal con escudos puntiagudos. El patrón de distribución de *L. grossidens* incluye la porción inferior de la cuenca del Río Paraguay, con sus tributarios de la margen izquierda, hasta la porción inferior del Río Paraná, alcanzando aguas arriba de la Represa Yacyretá. La distribución de *P. flavipinnis* en base a registros de museo es restricta al Lago Ypacaraí, drenaje del Río Salado, cuenca del Río Paraguay. Se discute listados anteriores de especies clupeiformes para el Paraguay y los datos de distribución reportados en la literatura.

Introduction

Fishes of the Order Clupeiformes are commonly known as herrings, sardines, or anchovies and are considered a very important group in commercial fisheries across the world. This order totalize 405 valid species classified into seven families: Chirocentridae, Clupeidae, Denticipitidae, Dussumeriidae, Engraulidae, Pristigasteridae, and Sundasalangidae (Eschmeyer et al., 2016).

Neotropical clupeiform fishes are constituted by 14 genera distributed in three families: Clupeidae, Engraulidae, and Pristigasteridae. Clupeidae contains four Neotropical genera: *Dorosoma* Rafinesque, 1820, *Platanichthys* Whitehead, 1968, *Ramnogaster* Whitehead, 1965, and *Rhinosardinia* Eigenmann, 1912 (Kullander & Ferraris, 2003a). Engraulidae includes seven Neotropical genera: *Amazonsprattus* Roberts, 1984, *Anchoa* Jordan & Evermann, 1927, *Anchovia* Jordan & Evermann, 1895, *Anchoviella* Fowler, 1911, *Jurengraulis* Whitehead, 1988, *Lycengraulis* Günther, 1868, and *Pterengraulis* Günther, 1868 (Kullander & Ferraris, 2003b). And finally, Pristigasteridae is composed of three Neotropical

genera: *Ilisha* Richardson, 1846, *Pellona* Valenciennes, 1847, and *Pristigaster* Cuvier, 1816 (de Pinna & Di Dario, 2003).

The Republic of Paraguay is a country located in the center of South America, irrigated by the Río Paraguay and the Río Parana systems, which belong to the Río de la Plata basin. Clupeiform fishes previously reported from Paraguay are based only in literature with listing species, without being corroborated by the examination of voucher specimens deposited in Museum Collections. Listings of *Lycengraulis* from the Paraguayan territory date since the end of the 19th century, first provided by Boulenger (1896). The listings of *Pellona* from the Paraguayan territory date from late 20th century, first provided by Ramlow (1989). The aim of this paper is to report on the clupeiform fishes from Paraguay based on the examination of voucher material deposited in museum collections.

Material and Methods

We examined external features diagnostic to clupeiform fishes following Whitehead (1985). Local names of rivers and others are used along the text, including the hydrological bodies (Lago, Río, or Arroyo) on the names provided.

Measurements. Performed with a digital caliper to the nearest millimeter. Standard Length (SL): from tip of snout to end of body where bending the tail produces a wrinkle. Body Depth: at deepest point, usually under origin of dorsal fin.

Counts. Done under the observation of an stereoscopic microscope. Anal-fin Rays: firsts rays unbranched (anteriormost small, sometimes missed) represented in lower case Roman numerals, remainder rays branched (posteriormost branched at base, counted as one) represented in Arabic numerals. Gillrakers: from the first gill arch, those located on ceterobranchial bone are lower gillrakers, those located on epibranchial bone are upper gillrakers. Scales: there are no pored lateral line scales along the flank, lateral series of scales counted along the midline flank is sometimes diagnostic (not provided for *Lycengraulis* because typically lost scales). Scutes: there is a pelvic scute in front of the pelvic fins (absent in *Lycengraulis* and all Neotropical Engraulidae), this scute and those continuing forward to the gill opening form the pre-pelvic series, the scutes behind the pelvic scute are smaller and form the post-pelvic series.

Examined material. All from the Museo Nacional de Historia Natural del Paraguay (MNHNP), Secretaría del Ambiente, Paraguay. Data are arranged in Departamentos, the major national political units in Paraguay (similar to State, Estado, Provincia, or Región of other countries), and then arranged by the catalog numbers from the museum collection. Museum data were provided as follows: Acronym and catalog number, specimens in alcohol (alc.), county, locality. Localities are provided as recorded in the catalogue of MNHNP, usually in Spanish language.

Results and Discussion

Lycengraulis grossidens (Spix & Agassiz, 1829)



fig. 1. *Lycengraulis grossidens*. MNHNP 3304: Paraguay, Departamento de Misiones, Río Aguapey

Synonyms. *Engraulis grossidens* Spix & Agassiz, 1829. *Engraulis janeiro* Spix, 1829. *Engraulis dentex* Valenciennes, 1848. *Engraulis olidus* Günther, 1874. *Anchovia abbotti* Fowler, 1915. *Clupea inermis* Larrañaga, 1923. *Clupea vigintiquiniradiata* Larrañaga, 1923. *Lycengraulis schroederi* Hildebrand, 1943. *Lycengraulis simulator* Fuster de Plaza, 1962

Morphology. Head laterally compressed; straight dorsal profile; snout short, tip rounded, projected. Mouth large, sub-terminal, oblique to body axis; teeth large and conical; long maxilla reaching subopercle, slender, two supra-maxillae; dentary underslung, slender, articulation of lower jaw well behind eye position. Body elongated, laterally compressed, convex dorsal and ventral profile, greatest body depth at vertical through dorsal-fin origin. Body scales large, usually shed. Scutes on belly absent. Pelvic fin present, large, longer than half-pectoral length. Anal-fin origin below midpoint of dorsal-fin position; anal-fin base short, slightly surpassing half caudal-peduncle length. Two axillary gland on paired fins.

Measurements. Body Depth 17 to 24 % SL.

Counts. Anal-fin rays ii to iii + 17 to 25, total 20 to 28 (30). Lower gillrakers 20 to 29, upper gillrakers 17 to 23, total gillrakers 37 to 49 (30).

Coloration in alcohol. Body coloration pale yellow, silver lateral band on midline body and opercle, gill cavity black. Longitudinal band on midline reaching ventral margin of body. Caudal fin with black margins.

Distribution. Lower portions of Río Paraguay and Río Paraná in Paraguay, including the Lago Ypacaraí in the Río Salado drainage and Río Tebicuary (fig. 3, green dots).

Examined material. All from Paraguay: No data: MNHNP 45, alc. 1. Departamento de Presidente Hayes: MNHNP 2416, alc. 2, Río Paraguay (including remnant pool) under West end of Puente Remanso. Departamento Central: MNHNP 35, alc. 2, Villeta, Río Paraguay en el muelle. MNHNP 46, alc. 13, Areguá, Lago Ypacaraí. MNHNP 38, alc. 2, Areguá, Itauguá, Lago Ypacaraí 6 km Suroeste de Areguá. Departamento de Misiones: MNHNP 36, alc. 1, San Miguel, Laguna a 200 m Oeste entre confluencia de los Ríos Tebicuary y Tebicuary-mi. MNHNP 37, alc. 2, San Miguel, Dos lagunas próximas a la confluencia de los Ríos Tebicuary y Tebicuary-mi. MNHNP 2537, alc. 6, Villa Florida, Centu-Cué. MNHNP 3304, alc. 4, Río Aguapey. Departamento de Itapúa: MNHNP 2444, alc. 1, San Cosme y Damián, Playa en el Embalse de la Represa Yacyretá. MNHNP 2473, alc. 2, San Cosme y Damián, Arroyo Aguapey.

Pellona flavipinnis (Valenciennes, 1837)



fig. 2. *Pellona flavipinnis*. MNHNP 34: Paraguay, Departamento Central, Areguá, Lago Ypacaraí

Synonyms. *Pristigaster flavipinnis* Valenciennes, 1837. *Pellona orbignyana* Valenciennes, 1847.

Morphology. Head laterally compressed; straight dorsal profile; snout short, tip notched dorsally. Mouth small, superior, perpendicular to body axis; teeth minute; maxilla long, deep, two supra-maxillae, one hypo-maxilla; dentary projected, deep, articulation of lower jaw in front of eye position. Body elongated, highly compressed laterally, convex dorsal and highly convex ventral profile, greatest

body depth at vertical through dorsal-fin origin. Body scales small. Belly scutes prominent, sharp. Pelvic fin present, small, shorter than half-pectoral length, axillary scale present. Anal-fin origin posterior to dorsal-fin position; anal-fin base long, almost equal caudal-peduncle length.

Measurements. Body Depth 28 to 32 % SL.

Counts. Pre-pelvic body scutes 21 to 23, post-pelvic body scutes 11 to 13, total 30 to 35 scutes (5). Lower gillrakers 26 to 29, upper gillrakers 14 to 15, total gillrakers 40 to 43 (4). Anal-fin rays iv + 34 to 37, total 38 to 41 (5). Scales 65 to 70 (4) in lateral series.

Coloration in alcohol. No distinctive color pattern, body brown. Dark brown chromatophores densely arranged in mouth, dorsum of head, and upward of body, sparsely arranged below eye and on midline body. Pectoral, pelvic, anal, and caudal fin dark brown, chromatophores densely arranged on distal margins.

Distribution. Lago Ypacaraí, Río Salado drainage, Río Paraguay basin (Figure 3, red dots).

Examined material. All from Paraguay: Departamento Central: MNHNP 32, alc. 3, Itauguá, Lago Ypacaraí a 6 km Sureste de Areguá. MNHNP 33, alc. 1, Lago Ypacaraí. MNHNP 34, alc. 1, Areguá, Lago Ypacaraí.

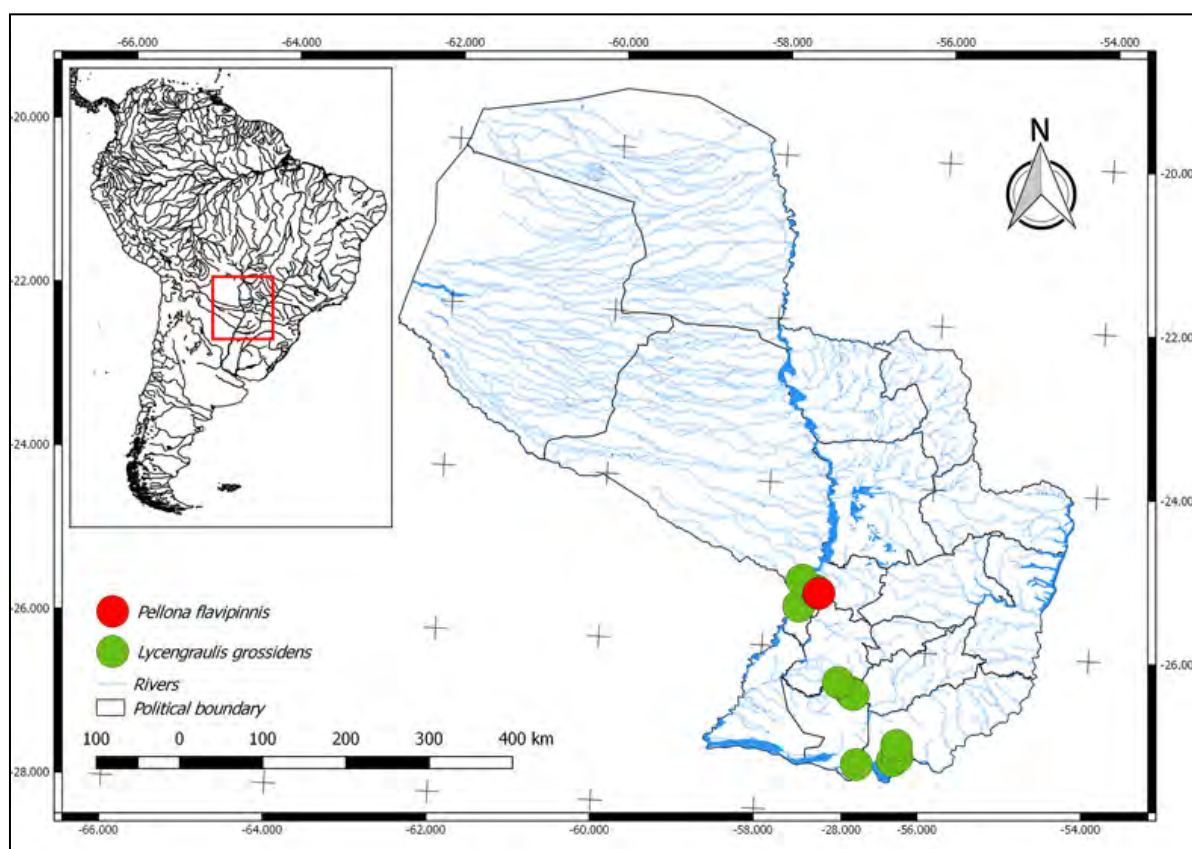


fig. 3. Map of Paraguay showing the geographical distribution of *Pellona flavipinnis* (red) and *Lycengraulis grossidens* (green)

The genus *Lycengraulis* Günther, 1868 comprises five valid species entirely distributed in Neotropical region: *Lycengraulis batesii* (Günther, 1868), *Lycengraulis figueiredoi* Loeb & Alcântara, 2013, *Lycengraulis grossidens* (Spix & Agassiz, 1829), *Lycengraulis limnichthys* Schultz, 1949, and *Lycengraulis poeyi* (Kner, 1863) (Eschmeyer et al., 2016). *L. grossidens* is the most widespread Neotropical species, distributed in most river basins of South and Central America. It is followed by *L. figueiredoi* which is distributed in the Amazonas, Orinoco, and Guianas. Next is *L. poeyi* which inhabits

Pacific River Basins from El Salvador to Peru. Finally, species with restricted distributions are *L. figueiredoi* (Amazonas in Brazil) and *L. limnichthys* (Lago Maracaibo in Venezuela).

The genus *Pellona* comprises several species with a wide distribution in the tropics across the world, but only with three Neotropical valid species: *Pellona flavipinnis* (Valenciennes, 1837), *Pellona castalnaeana* Valenciennes, 1847, and *Pellona harroweri* (Fowler, 1917) (Whitehead, 1985). *P. flavipinnis* is the most widespread freshwater Neotropical species, ranging from the Amazonas to the La Plata basins. The other freshwater species, *P. castalnaeana*, is restricted to the Amazonas basin. Finally, *P. harroweri* is a marine species but entering estuaries, its distribution is the Western Atlantic ranging from Panama to Southern Brazil.

Records of *Lycengraulis grossidens* from the Paraguayan territory consist merely in listing of species. The first record was done by Boulenger (1896) under *Engraulis olidus* without giving a precise locality. Ramlow (1989) also listed *L. olidus* from the Lago Ypacaraí. This author did not provide data of the examined material, but we believe this report includes the material that she analyzed. Insaurralde et al. (2012, 2013) listed *L. simulator* from Lago Ypacaraí, Jejuí, and Tebicuary basins. The name *E. olidus* and *L. simulator* were placed under synonymy of *L. grossidens* by Whitehead et al. (1988). Other listings were provided by Mandelburger et al. (1996) from Villeta, Lago Ypacaraí, and Ríos Tebicuary and Tebicuary-mí. This report also includes material from those localities, so we conclude that the specimens here examined are the same from the 1996 listing. Vera & Castillo (2006) listed *L. grossidens* for the Río Paraguay based in a compilation of available literature. Neris et al. (2008) also listed this species from the Río Manduvirá. We add new records to the distribution of *L. grossidens* in Paraguay, including the Río Paraná on its lower portion.

The other clupeiform fish listed from the Paraguayan territory is *Pellona flavipinnis*, first provided by Ramlow (1989) from the Lago Ypacaraí and Río Paraná upstream to the Itaipú Dam. This species was also reported from the Lago Ypacaraí by Mandelburger et al. (1996) and Insaurralde et al. (2013). Neris et al. (2008) listed this species to the Río Manduvirá. After examining specimens from the MNHNP, we assumed that the present report confirms the listings of Ramlow (1989) (with exception the record upstream to the Itaipú Dam, specimen not found) and Mandelburger et al. (1996).

Conclusion

Two Neotropical clupeiform fishes are distributed in the river basins of the Paraguayan territory, *Lycengraulis grossidens* and *Pellona flavipinnis*. *L. grossidens* is recognized by the morphology of the head, which has a large subterminal mouth, long maxilla reaching subopercle, and an underslung dentary. *P. flavipinnis* is recognized by the shape of its head and body, having a small superior mouth and the belly with sharp scutes. The examination of museum records of *L. grossidens* draws a distribution pattern which includes the lower portions from the Río Paraguay, and its left margin tributaries, to the lower portion of the Río Paraná, reaching upstream of the Yacyretá Dam. On the other hand, the distribution of *P. flavipinnis* based in museum records is restricted to the Lago Ypacaraí, Río Salado drainage, Río Paraguay basin. However, the distribution pattern of both species should be larger than those reported herein, as show the literature based in listing species.

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