

## Confirmation of the occurrence for seven fish species in Paraguay.

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### Abstract

The aim of this paper is to corroborate listed species from Paraguay based on the examination of voucher specimens from scientific collections. Seven species were examined from specimens deposited at the Museo Nacional de Historia Natural del Paraguay and the Colección Zoológica de la Facultad de Ciencias Exactas y Naturales: 1) *Erythrinus erythrinus* (Characiformes, Erythrinidae) is recognized by having the maxillary bone not very long, its distal tip not surpassing vertical line of posterior margin of eye, with conical teeth only and canine teeth absent on maxilla, and body color pattern with irregular marbles on flanks. 2) *Phenacogaster tegatus* (Characiformes, Characidae) is diagnosed by having an incomplete lateral line with 5-9 perforated scales, and a small to moderate size humeral spot that has its height smaller than the eye diameter. 3) *Clupeacharax anchoveoides* (Characiformes, Characidae) is recognized by having a body with keeled belly and a complete lateral line running low just above the anal-fin base. 4) *Ossancora punctata* (Siluriformes, Doradidae) is diagnosed by having the dorsum of the head with the anterior nuchal plate pentagonal in shape, and a maxillary barbel with a single row of smooth elongate fimbriae on its inferior margin. 5) *Pseudopimelodus mangurus* (Siluriformes, Pseudopimelodidae) is characterized by having a premaxillary teeth plate projected backward on its distal tip, viliform teeth, and vomerian teeth absent on the roof of the mouth. 6) *Rhamphichthys hahni* (Gymnotiformes, Rhamphichthyidae) is recognized by having a long snout, minute eye, long anal fin with about 370 rays, and body color pattern with several inverted Y-shaped vertical bars. 7) *Laetacara dorsigera* (Cichliformes, Cichlidae) is diagnosed by having cycloid scales on head and the dorsal fin color pattern with a distinct blotch above fifth vertical bar of trunk.

### Resumen

El objetivo de este trabajo es corroborar especies listadas para Paraguay mediante el examen de especímenes testimonio depositados en colecciones científicas. Siete especies fueron examinadas en base a especímenes del Museo Nacional de Historia Natural del Paraguay y la Colección Zoológica de la Facultad de Ciencias Exactas y Naturales: 1) *Erythrinus erythrinus* (Characiformes, Erythrinidae) se reconoce por poseer el hueso maxilar no muy alargado, su margen distal no ultrapasando la línea vertical que baja de la margen posterior del ojo, maxila con dientes cónicos únicamente, sin dientes caninos, y el patrón de coloración del cuerpo con manchas irregulares en los costados. 2) *Phenacogaster tegatus* (Characiformes, Characidae) se diagnostica por poseer una línea lateral incompleta con 5-9 escamas perforadas, y una mancha humeral pequeña a mediana cuya altura es menor al diámetro del ojo. 3) *Clupeacharax anchoveoides* (Characiformes, Characidae) se reconoce por poseer el cuerpo con un vientre aquillado y una línea lateral completa que corre muy ventralmente, justo arriba de la base de la aleta anal. 4) *Ossancora punctata* (Siluriformes, Doradidae) se diagnostica por poseer el dorso de la cabeza con una placa nuchal anterior de forma pentagonal, y una barbilla maxilar compuesta de una serie única de fimbrias lisas y alargadas en su margen inferior. 5) *Pseudopimelodus mangurus* (Siluriformes, Pseudopimelodidae) se caracteriza por poseer la placa premaxilar proyectada posteriormente en su margen externa, y el techo de la boca sin dientes en el vómer. 6) *Rhamphichthys hahni* (Gymnotiformes, Rhamphichthyidae) se reconoce por poseer un hocico muy largo, ojo diminuto, aleta anal muy larga con cerca de 370 rayos, y el patrón de coloración del cuerpo con barras verticales en forma de Y invertida. 7) *Laetacara dorsigera* (Cichliformes,

Cichlidae) se diagnostica por poseer escamas cicloides en la cabeza y patrón de coloración de la aleta dorsal con una macha distintiva por encima de la quinta barra vertical del costado del cuerpo.

## Introduction

The Republic of Paraguay is a country located in the center of South America, irrigated by the Río Paraguay and the Río Parana systems, both belonging to the Río de la Plata basin. Paraguayan fish diversity is composed of approximately 300 species (Bertoni, 1939; Vera & Castillo, 2006). Most of this diversity is based in listings of species from a wide array of different kind of literature, many of these lacking examination of voucher specimens. The aim of this paper is to confirm the presence in Paraguay for some fishes whose records so far are only based on mere listings in literature, now based on the examination of voucher specimens deposited in scientific collections.

## Material and Methods

Local names of rivers are provided in the text in connection with the respective hydrological unit (Lago, Río, or Arroyo). We examined general external features diagnostic to characiform, siluriform, gymnotiform, and cichliform fishes in accordance with Britski et al. (2007). Specific diagnostic characters for *Erythrinus* follow Géry (1977), for *Phenacogaster* follow Lucena & Malabarba (2010), for *Clupeacharax* and *Rhamphyichthys* follow Britski et al. (2007), for *Ossancora* follow Birindelli & Sabaj Pérez (2011), for *Pseudopimelodus* follow Eigenmann & Eigenmann (1890) and Borodin (1927), and for *Laetacara* follow Ottoni & Costa (2009). Species valid names and synonyms are in accordance with Reis et al. (2003) and Eschmeyer et al. (2017). Bars in figures equate to 1 cm.

**Measurements and counts.** Performed with a digital caliper to the nearest millimeter. Counts (and also measurements of small specimens) were done under an stereoscopic microscope. For characiform fishes we follow Fink & Weitzmann (1974), for *Ossancora* Sabaj (2005), for *Laetacara* Ottoni & Costa (2009). Remaining species follow Britski et al. (2007).

Standard Length (SL): From tip of snout to end of body where bending the tail produces a wrinkle. Total length (TL): From tip of snout to posterior tip of body tail (for gymnotiforms). Head length (HL): From tip of snout to posterior end of opercle (not including fleshy flap, except for *Ossancora* which includes fleshy opercular flap). All measurements related to body are in percentages of SL, unless otherwise indicated. Dorsal-fin rays: The last two dorsal-fin rays are counted as two separate rays. Anal-fin rays: The last two anal-fin rays are counted as a single ray split to the base. Fin ray counts: First rays are unbranched, represented in lower case Roman numerals when are soft rays and in upper case Roman numerals when are spines. Remaining rays are branched, represented in Arabic numerals. Vertical bars: For *Laetacara*, bars on flanks are counted from caudal peduncle to pectoral fin.

**Examined material.** All from Paraguayan Museum Collections: Museo Nacional de Historia Natural del Paraguay (MNHNP), Secretaría del Ambiente, and from the Colección Zoológica de la Facultad de Ciencias Exactas y Naturales (CZCEN), Universidad Nacional de Asunción. Data are arranged in Departamentos, the major national political unit in Paraguay (similar to State, Estado, Provincia, or Región of other countries), and then arranged by the catalog numbers of the respective collection. Museum data were provided as follows: acronym and catalog number, number of specimens in alcohol (alc.), locality, and county. Localities are provided as recorded in the catalog of the respective collections, usually in Spanish language.

## Results and Discussion

### *Erythrinus erythrinus* (Bloch & Schneider, 1801)

**Synonyms.** *Synodus erythrinus* Bloch & Schneider, 1801. *Erythrinus salmoneus* Gronow, in Gray, 1854. *Erythrinus brevicauda* Günther, 1864. *Erythrinus longipinnis* Günther, 1864.

**Morphology.** Head robust, snout short; anterior nare opening on mouth margin, posterior nare opening upside proximal tip of premaxilla; eye large, infraorbitals large, horizontally elongated; premaxilla and dentary with large canine and conical teeth, maxilla with small conical teeth only, distal

tip of maxilla not surpassing posterior margin of eye. Body cylindrical; dorsal profile of body convex to dorsal-fin insertion, slightly concave to caudal peduncle; ventral profile of body convex. Large scales on body. Dorsal fin posterior to midpoint of body, adipose fin absent, low pectoral-fin insertion, pelvic-fin insertion opposite to dorsal-fin insertion, caudal fin rounded.

**Measurements.** Based in seven specimens. Head length 22.9-28.8% in SL. Eye diameter 4.0-6.2% in SL.

**Counts.** Based in seven specimens, unless otherwise indicated in parenthesis. Dorsal fin ii+9-10. Lateral line scales 32-34 (5), upper lateral series 3-4, lower lateral series 4, caudal peduncle series 16-18 (5).

**Coloration in alcohol.** Head and body dark brown dorsally and pale brown ventrally. Irregular dark brown spots on posteriormost infraorbital; horizontal stripe posterior to eye, projecting backward diffusely on body; oblique stripe below eye. Body with dark brown irregular marbles on flanks; irregular dark brown spots on caudal peduncle. Dorsal, pectoral, pelvic, and caudal fin with numerous transverse stripes.

**Remarks.** First listed in Paraguay by Géry et al. (1987), no specimens analyzed.

**Examined material.** All from Paraguay: Departamento de Presidente Hayes: MNHNP 239, alc. 7, 65.9-126.3 mm SL, Estancia La Golondrina, lugar pantanoso aprox. a 25 km al noroeste por el Río Confuso.



fig. 1. *Erythrinus erythrinus*. MNHNP 239. Paraguay, Departamento de Presidente Hayes, Estancia La Golondrina, lugar pantanoso aprox. a 25 km al noroeste por el Río Confuso

### ***Phenacogaster tegatus* (Eigenmann, 1911)**

**Synonyms.** *Vesicatrus tegatus* Eigenmann, 1911.

**Morphology.** Head large; snout short, tip acuminate; eye large. Body compressed, subrhomboidal; dorsal profile of body concave from snout to dorsal-fin insertion, straight from dorsal fin to caudal peduncle; ventral profile convex. Dorsal-fin insertion on midpoint of body; adipose fin small; low pectoral-fin insertion, its distal tip surpassing ventral-fin insertion; ventral fin surpassing anal-fin insertion; anal-fin base large, anal-fin insertion opposite to dorsal-fin insertion; caudal fin forked. Lateral line incomplete.

**Measurements.** Based in 5 specimens. Head length 26.8-29.3% in SL. Snout length 7.0-8.9% in SL. Upper jaw length 9.1-11.2% in SL. Eye diameter 7.6-10.5% in SL. Body depth 32.7-36.2% in SL.

**Counts.** Based in 5 specimens. Lateral line scales 5-9. Anal-fin rays iii-iv+32-35.

**Coloration in alcohol.** Body ground yellow with dispersed dark brown chromatophores. Small to moderate size humeral spot, its height smaller than eye diameter, located anterior to vertical line of dorsal-fin insertion and reaching second dorsal-fin ray vertical line. Caudal peduncle spot shape rhomboidal, posterior margin located on caudal-fin rays. All fins with dispersed small chromatophores on rays, more evident on anal fin distal tips.

**Remarks.** First listed in Paraguay by Mandelburger et al. (1996) in Lima, Departamento de San Pedro, no record of specimens.

**Examined material.** All from Paraguay: Departamento de San Pedro: MNHNP 442, alc. 2, 30.5-33.3 mm SL, Valle a 3 km al noroeste de Lima, Lima. Departamento de Misiones: MNHNP 2474, alc. 30, 18.9-27.5 mm SL, Arroyo Atinguy, Ayolas.

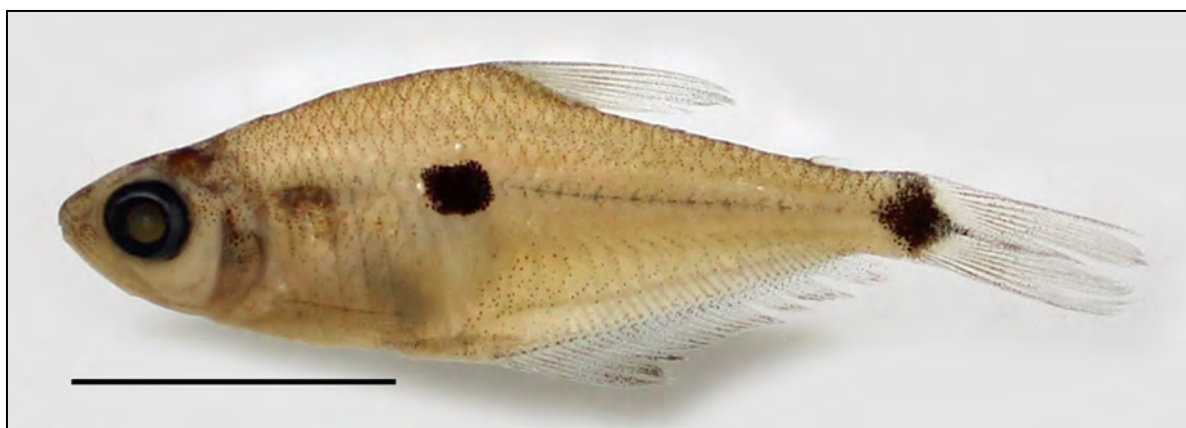


fig. 2. *Phenacogaster tegatus*. MNHNP 2474. Paraguay, Departamento de Misiones, Arroyo Atinguy, Ayolas

#### ***Clupeacharax anchoveoides* Pearson, 1924**

**Morphology.** Body elongated, compressed, belly keeled. Dorsal profile of body straight to slightly concave; ventral profile convex, pronounced below pectoral-fin insertion. Head small; eye large; strong teeth present on mouth, long maxilla, surpassing vertical line of anterior margin of the eye; gill membranes free of isthmus. Dorsal-fin insertion behind midpoint of body; adipose fin present; pectoral-fin insertion low, pectoral fin long, surpassing ventral-fin insertion; pelvic-fin short, not reaching anal-fin insertion; anal-fin base long; caudal fin forked. Lateral line complete, running low on body just above anal fin base.

**Counts.** Based in four specimens. Lateral line scales 34-38. Lateral scales of the upper series 3-4, lateral scales of the lower series 2.

**Coloration in alcohol.** Body ground yellow with dispersed dark brown chromatophores on dorsal portion. Dark brown chromothophores concentrated on mouth, posterior margin of dorsum of head, and anal fin base. A silver diffuse lateral stripe on midline of flanks, dark brown chromatophores forming a lateral band bellow silver stripe.

**Remarks.** First listed in Paraguay by Chernoff et al. (2001) in the Río Apa, no record of specimens.

**Examined material.** All from Paraguay: Departamento de Presidente Hayes: CZCEN 396, alc. 5, 25.7-32.9 mm SL, Riacho Paloma. CZCEN 397, alc. 1, 36.7 mm SL, Rio Negro, Nanawa.



fig. 3. *Clupeacharax anchoveoides*. CZCEN 396. Paraguay, Departamento de Presidente Hayes, Riacho Paloma

***Ossancora punctata*** (Kner, 1853)

**Synonyms.** *Doras (Corydoras) punctatus* Kner, 1853. *Doras punctatus* Kner, 1855.

**Morphology.** Dorsal and ventral profile of body convex, dorsal profile of head elevated and straight. Head shape triangular, pointed snout, cranial fontanel occluded, anterior nuchal plate shape pentagonal; mouth small, subterminal, teeth small, long maxillary barbel surpassing pectoral fin insertion, barbel with a single row of smooth elongate fimbriae on inferior margin, mental barbels short with papillae. Posterior cleithral process length equal posterior coracoid process. Lateral series of midlateral scutes complete, tympanal scutes present. Dorsal-fin insertion anterior to midpoint of body; adipose fin present; pectoral fin insertion long, pectoral fin long, surpassing ventral fin insertion; ventral-fin insertion on midpoint of body, anal-fin base short; caudal fin moderately forked.

**Measurements.** Based in two specimens. Head length 28.9-30.1% SL. Snout to coracoid process 47.0-47.3% in SL. Snout to cleithral process 44.4-45.1% in SL. Eye diameter 20.2-21.0% in HL.

**Counts.** Based in two specimens. Scutes of midlateral series 29. Tympanal scutes 3.

**Coloration in alcohol.** Dorsum of head and body ground color dark brown, ventral body ground pale yellow. Dorsal fin and adipose fin dark brown, pectoral, pelvic, anal and caudal fin pale yellow. Small black chromatophores dispersed on flanks.

**Remarks.** First listed in Paraguay by Neris et al. (2010) in the Río Manduvirá, Departamento de Cordillera, no record of specimens.

**Examined material.** All from Paraguay: Departamento de Cordillera: MNHNP 2787, alc. 2, 121.3-123.3 mm SL, Lago Ypacaraí en el Club Náutico San Bernardino, San Bernardino.



fig. 4. *Ossancora punctata*. MNHNP 2787. Paraguay, Departamento de Cordillera, Lago Ypacaraí en el Club Náutico San Bernardino, San Bernardino

***Pseudopimelodus mangurus*** (Valenciennes, 1835)

**Synonyms.** *Pimelodus mangurus* Valenciennes, 1835. *Pseudopimelodus roosevelti* Borodin, 1927.

**Morphology.** Head wide and short, width almost equal its length, depressed, covered by thick layer of skin; eye small, orbit without free margin; mouth barbels flattened, maxillary barbel long reaching pectoral-fin insertion, mental barbels short; premaxillary teeth plate projected backward on its distal tip, teeth viliform, vomerian teeth absent; gill membranes free of isthmus. Dorsal profile of head straight until dorsal fin, gently concave to adipose fin, ventral profile gently convex. Dorsal fin anterior; adipose-fin base large; pectoral fin low and short, not reaching pelvic-fin insertion; pelvic fin anterior to midpoint of body; anal-fin base small, anal-fin insertion opposite to adipose-fin insertion; caudal fin

forked. Dorsal- and pectoral-fin spine short with strong serrations on inner margin. Genital papilla long, reaching half distance anus to anal-fin insertion.

**Measurements.** Based in three specimens. Body depth 21.6-32.0% in SL. Head length 28.8-35.6% in SL.

**Counts.** Based in three specimens. Dorsal-fin rays I+6-7. Pectoral-fin rays I+7-9. Pelvic-fin rays i+5-7. Anal-fin rays i+8. Caudal-fin rays i+14-16+i.

**Coloration in alcohol.** Body pale brown with four black transverse bands, first on nape, second on dorsal-fin insertion, third on adipose-fin insertion, fourth on caudal-peduncle distal tip. Head with black vermiculation on the top. Body with black dots on transverse bands. Dorsal, pectoral, pelvic, and anal fin with two black transverse bands, first on its base, second not reaching distal margin. Adipose fin with a black transverse band on its base. Caudal fin with a black transverse band on distal tip not reaching its margin.

**Remarks.** First listed in Paraguay by Bertoni (1914), no record of specimens.

**Examined material.** All from Paraguay: Departamento de Itapúa: MNHNP 3978, alc. 2., 267.0-229.5 mm SL, Río Paraná en el Club de Caza y Pesca Bella Vista, Bella Vista. MNHNP 3979, alc. 1, 310.0 mm SL, Río Paraná en el Club de Caza y Pesca Capitán Meza, Capitán Meza.



fig. 5. *Pseudopimelodus mangurus*. MNHNP 3978. Paraguay, Departamento de Itapúa, Río Paraná en el Club de Caza y Pesca Bella Vista, Bella Vista

### ***Rhamphichthys hahni*** (Meinken, 1937)

**Synonyms.** *Sternarchorhamphus hahni* Meinken, 1937.

**Morphology.** Body compressed, elongated; tail slender, acuminate. Head long; snout long; eye minute, covered by skin; mouth small, subterminal; nares anterior. Dorsal profile of head concave, dorsal profile of body convex; ventral profile of head and body concave. Pectoral fin long, pectoral-fin insertion high, about middle of flank; anal fin base long, anal-fin insertion anterior just posterior to gill openings. Body scales small.

**Measurements.** Based in one specimen. Head length 13.9% in TL. Preanal distance 10.2% in TL. Snout length 50.0% in HL.

**Counts.** Based in one specimen. Anal-fin rays 378.

**Coloration in alcohol.** Body color ground pale brown with irregular dark brown marks on flanks, forming inverted transversal Y shaped bands reaching anal fin, marks on dorsum darker. Head color ground dark brown with irregular pale brown dots ventrally.

**Remarks.** First listed in Paraguay by Neris et al. (2010), in the Río Manduvirá, Departamento de Cordillera, no record of specimens.

**Examined material.** All from Paraguay: Departamento de Alto Paraguay: MNHNP 2299, alc. 1, 257.0 mm TL, Río Negro, aprox. 2 km aguas arriba de la desembocadura.



fig. 6. *Rhamphichthys hahni*. MNHNP 2299. Paraguay, Departamento de Alto Paraguay, Río Negro, aprox. 2 km aguas arriba de la desembocadura

### *Laetacara dorsigera* (Heckel, 1840)

**Synonyms.** *Acara dorsiger* Heckel, 1840.

**Morphology.** Body moderately elongated, compressed. Head large; snout short, rounded tip; eye large; first gill arch with short rakers, upper limb without fleshy lobe. Dorsal profile of body from snout tip to end of dorsal-fin insertion convex; ventral profile of body convex; nearly straight between pelvic fin and anal fin; straight dorsally and ventrally on final portion of caudal peduncle. Dorsal fin long, posterior portion distal margin almost reaching caudal fin margin; pectoral fin short; pelvic fin long, reaching middle of anal-fin insertion; anal fin long, posterior portion distal margin almost reaching caudal fin margin, anal-fin base medium; caudal fin short, rounded. Head scales cycloid, body scales ctenoid.



fig. 7. *Laetacara dorsigera*. MNHNP 3411. Paraguay, Departamento de Itapúa, Estancia Santa Teresa, charco aprox. a 30 mt del casco de la estancia, San Pedro del Paraná

**Measurements.** Based in four specimens. Head length 29.3-40.5% in SL. Head depth 97.5-109.9% in HL.

**Counts.** Based in four specimens. Dorsal-fin rays XIV-XV+9-10. Anal-fin rays III+8-9. Scales of upper lateral line series 14-15. Scales of lower lateral line series 5-8. Scales of longitudinal series 22-23.

**Examined material.** All from Paraguay: Departamento de San Pedro: MNHNP 71, alc. 3, 27.1-39.5 mm SL, Valle a 3 km al noroeste de Lima, Lima. Departamento de Ñeembucú: MNHNP 1404, alc. 7,

25.41-32.41 mm SL, Arroyo Paso Cornelio, después de Arroyo Hondo, camino Isla Umbú-Humaitá, Pilar. Departamento de Misiones: MNHNP 1766, alc. 2, 26.6-29.9 mm SL, Arroyo Yabebyry en la Estancia Nú Porá. Departamento de Itapúa: MNHNP 3411, alc. 59, 9.7-40.0 mm SL, Estancia Santa Teresa, charco aprox. a 30 mt del casco de la estancia, San Pedro del Paraná.

**Coloration in alcohol.** Head and body ground color pale brown, seven dark brown vertical bars on flank, from caudal peduncle to dorsal fin insertion. Opercle with a large black blotch on ventral portion. A black horizontal stripe posterior to eye margin reaching anteriormost vertical bar (seventh), a black blotch on penultimate vertical bar (sixth). All fins except pectoral fin with dark brown to black transversal stripes. Dorsal fin with a black blotch at vertical line of seventh bar of body flank.

**Remarks.** First listed in Paraguay by Bertoni (1914), no record of specimens.

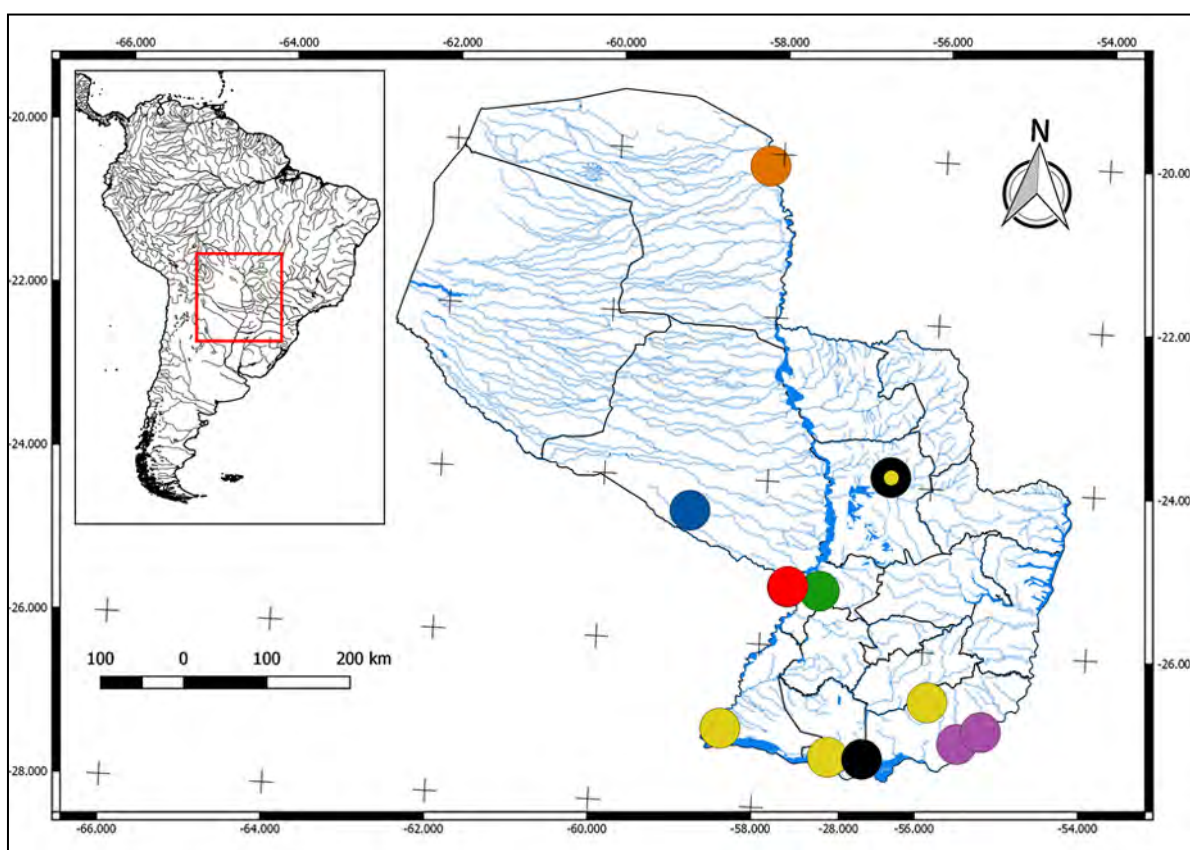


fig. 8. Map of Paraguay showing the geographical distribution of corroborated species: *Erythrinus erythrinus* (blue), *Phenacogaster tegatus* (black), *Clupeacharax anchoveoides* (red), *Ossancora punctata* (green), *Pseudopimelodus mangurus* (purple), *Rhamphichthys hahni* (orange), and *Laetacara dorsigera* (yellow)

## Conclusion

Seven fish species are corroborated from Paraguay based in the examination of voucher specimens from Museum Collections. *Erythrinus erythrinus* (Characiformes, Erythrinidae) is recognized by having the maxillary bone not very long, its distal tip not surpassing vertical line of posterior margin of eye, with conical teeth only and canine teeth absent on maxilla, and body color pattern with dark brown irregular marbles on flanks. *Phenacogaster tegatus* (Characiformes, Characidae) is diagnosed by having an incomplete lateral line with 5-9 perforated scales, and a small to moderate size humeral spot that has its height smaller than the eye diameter. *Clupeacharax anchoveoides* (Characiformes, Characidae) is recognized by having a body with keeled belly and complete lateral line running low on body just above the anal-fin base. *Ossancora punctata* (Siluriformes, Doradidae) is diagnosed by having the dorsum of the head with the anterior nuchal plate shape pentagonal and maxillary barbel with a single row of smooth elongate fimbriae on its inferior margin. *Pseudopimelodus mangurus* (Siluriformes, Pseudopimelodidae) is characterized by having a premaxillary teeth plate projected backward on its distal tip with viliform teeth, and vomerian teeth absent on the roof of the mouth.



*Rhamphichthys hahni* (Gymnotiformes, Rhamphichthyidae) is recognized by having a long snout, minute eye, long anal fin with about 370 rays, and body color pattern with inverted Y-shaped vertical bars. *Laetacara dorsigera* (Cichliformes, Cichlidae) is diagnosed by having cycloid scales on head and the dorsal fin color pattern with a blotch above fifth vertical bar of trunk.

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