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Supplementary Material

Fish from the Garagoa river, upper Orinoco basin, Boyacá, Colombia: A taxonomic key for their identification

Peces del río Garagoa, cuenca alta del Orinoco, Boyacá, Colombia: Una clave taxonómica para su identificación

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ANNEX 1

Description of fish species currently recorded for the Garagoa river basin

The following is a compendium with information on the fish species recorded for the Garagoa river basin (CRG). However, we encourage you to consult the original descriptions of each species.

Order Characiformes

Family Characidae

1. *Astyanax integer* Myers, 1930

Description. Dorsal fin origin closer to tip of snout than to base of caudal, dorsal fin height 3.5 in standard length. Adipose fin well developed; caudal fin lobes pointed; anal fin origin equidistant from caudal base and pectoral origin. Pectoral fins reach the origin of pelvic fins; pelvic fins barely reach anal origin; lateral line slightly decurved. Five teeth in inner series of each premaxilla, second, third and fourth teeth heptacuspid, the last very small; four teeth in outer series of each premaxilla; dentary with four graduated teeth. Head four times in standard length (Myers, 1930).

Distribution. South America. Upper Meta River (DoNascimiento et al., 2024).

Biology. It is omnivorous, its diet is based on Diptera and Trichoptera species, microalgae and allochthonous plant material (Ortaz, 1992). Annual reproduction is linked to the rainy season and has a preference for sites with rapids (Ramírez-Gil et al., 2011).

2. *Corynopoma riisei* Gill, 1858

Description. Body subfusiform, abdominal contour convex to the termination of the anal fin, with greater depth of the body in the middle area before the insertion of the dorsal fin to the belly. Pointed head. Caudal fin where the distance from the proximal to the distal margin is greater in the lower lobe. Anal fin with 27 rays (Gill, 1858). Absence of adipose fin. Upper mouth. The opercular bones are distinguishable and have a silvery-grayish hue. The body has a silvery coloration with yellow streaks and a black line passing over the midline of the body from the anterior to the posterior area. The fins have a white base coloration but fading to yellow in the distal part of the fins. This species presents sexual dimorphism, where the major difference between males and females is that the former present a greater extension of the filaments in the fins. Males have a claviform prolongation starting from the operculum (Gill, 1858).

Distribution. South America. Colombia. Orinoco

Basin (DoNascimiento et al., 2024).

Sampling site. S26.

Number in the collection. UPTC-Pe-00180

Biology. It inhabits lagoons and streams of foothills and lowlands with heterogeneous substrates; it is carnivorous feeding mainly on insects, being oviparous with internal fertilization and spawning that coincides with high rainfall (Rodríguez-Olarte et al., 2021a).

3. *Creagrutus atratus* Vari and Harold, 2001

Description. Fusiform body, somewhat tubular. Head pointed and obtuse. Lower subterminal mouth, since the lower jaw ends slightly posterior to the upper jaw. The insertion of the dorsal fin is in the middle of the body. Anal fin with nine to 13 branched rays. Marked opercular bone. Typically, six teeth in primary series of each premaxillary, three or four maxillary teeth, five or six teeth in each dentary (Vari & Harold, 2001). Silver coloration with yellow streaks, the fins at the distal margin have a yellow coloration that fades to hyaline at the proximal margin. Presence of humeral spot.

Distribution. South America. Colombia. Orinoco Basin (DoNascimiento et al., 2024).

Sampling sites. S25, S26, S27, S28, S29, S30, S31, S32, S33, S35, S36.

Number in the collection. UPTC-Pe-00172

Biology. Species endemic to Colombia restricted to the upper basins of the Upía, Meta and Arauca rivers; with environments characterized by clear waters, heterogeneous substrates (mud, sand, gravel, rocks), the species of this genus are omnivorous, feeding on both aquatic and terrestrial insects, plants and seeds (Mojica et al., 2021).

4. *Creagrutus calai* Vari and Harold, 2001

Description. Bodies relatively slender in small specimens, becoming increasingly robust in larger specimens; dorsal fin rays ii,8, dorsal fin origin approximately vertical through pelvic fin insertion, distal margin profile straight to slightly concave; anal fin with ii, 10-12 or iii, 10-12, with first unbranched ray, very short when three unbranched rays present, distal profile of anal fin concave; Pectoral fins with rays i, 12-14, the tip of the pectoral fin reaching up to two or three scales before the insertion of the pelvic fins; Pelvic fin rays i,6,i or i,7 the second occurring only in large individuals; the tip of the pelvic fin reaches posteriorly almost to the origin of the anal fin (Vari & Harold, 2001). Upper jaw longer and more protruding than the lower jaw. Premaxillary dentition in three series, primary row with six teeth, three tricuspid maxillary teeth (Vari & Harold, 2001).

Distribution. South America. Colombia. Orinoco Basin (DoNascimiento et al., 2024).

Biology. Chopped seeds and insect parts were found in stomach contents of two specimens (Vari & Harold, 2001).

5. *Creagrutus taphorni* Vari and Harold, 2001

Description. Body moderately deep; dorsal fin rays ii, 8, origin of dorsal fin located vertically through pelvic fin insertion; anal fin with ii, 10-12 or iii, 10-12, distal margin slightly sinusoidal; pectoral fin rays i, 10-12, the tip of the fin approaching or reaching the pelvic insertion; pelvic fin rays i, 6 in some cases i,7, the tip of the fin extending almost to the origin of the anal fin (Vari & Harold, 2001). Upper jaw longer and more protruding than lower jaw, premaxillary dentition in three series: primary row usually consisting of six teeth, maxillary with three or four teeth, in rare cases five, all tricuspid; dentary with five tricuspid teeth (Vari & Harold, 2001).

Distribution. South America. Colombia. Orinoco Basin (DoNascimiento et al., 2024).

Biology. Typical species of montane cloud forest streams, found in stomach contents: firefly larvae, caterpillars, beetles and other species that could not be determined (Vari & Harold, 2001).

6. *Hemibrycon metae* Myers, 1930

Description. Fusiform body, compressed. They have a decurved midline. Presents 41- 44 lateral scales (Myers, 1930). Preventral area narrow, usually scaly. Obtuse head. The pelvic fins reach the anus, the anal fin has a large basal scale on each lobe. Minimum depth of caudal peduncle

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equal to its length (Myers, 1930). Terminal mouth. Five teeth on the outer row of each premaxillary, the last away from the others; dentary with five large teeth on each side, the last two descending to the row of small teeth behind (Myers, 1930). Its coloration is silvery, but on the dorsum, it tends to have dark streaks. It has a humeral spot. In part of the caudal peduncle and the dorsal fin has black and yellow shades that extend into the middle rays.

Distribution. South America. Present in the Orinoco River basin and the Caribbean coastal basins of Venezuela (Bertaco & Malabarba, 2010).

Sampling sites. S27, S30, S31, S33, S36.

Number in the collection. UPTC-Pe-00168

Biology. Species of the genus *Hemibrycon* are omnivorous, preferring Diptera, Trichoptera, terrestrial insects and drifting seeds; reproducing periodically both in times of drought and rain. It is characteristic of streams and piedmont rivers with heterogeneous substrates, being less frequent in the plains (Rodríguez-Olarte et al., 2021b).

7. *Grundulus bogotensis* (Humboldt, 1821)

Description. Fusiform body, somewhat robust with absence of scales in the predorsal area. Incomplete and slightly curved midline. Obtuse head. Caudal fin homocerca. Anal fin with 21 rays (Dahl, 1971). Pectoral fins with 15 rays (Dahl, 1971). Absence of adipose fin. Upper subterminal mouth. Conical teeth arranged in a single row. It has a sexual dimorphism, since males have a marked pigmentation in the ventral region while females have a silvery coloration in the isthmus (Forero & Garzón, 1974). The fins are hyaline.

Distribution. South America. Colombia. Magdalena-Cauca Basin. Species endemic to the Cundiboyacense highlands (Fowler, 1942; Maldonado-Ocampo et al., 2005).

Sampling sites. S02, S03, S04, S08.

Number in the collection. UPTC-Pe-00185

Biology. It inhabits slow-flowing waters with the presence of vegetation (Mesa-Salazar *et al.*, 2016a). It is a species that tolerates extreme oxygen and pH conditions (Rivera-Rondón et al., 2008). It reproduces twice a year and seeks the presence of vegetation for spawning (Forero & Garzón, 1974). It usually dies after completing its fourth reproduction (Mesa-Salazar et al., 2016a). Its diet is based on detritus, larvae, microcrustaceans and some macroinvertebrates (Roa-Fuentes et al., 2013). This species has been used as food by the native population (Rivera-Rondón et al., 2008) and is used as fodder for trout (*Oncorhynchus mykiss*) (Leon et al., 2005).

8. *Knodus alpha* (Eigenmann, 1914)

Description. It has a compressed fusiform body. In turn, it has a dark lateral line that reaches the middle caudal rays. It has 34-38 lateral scales (Roman-Valencia, 2003). Obtuse head with posterior opening nostrils located on each side. The anal fin has scales at its base that cover part of the rays, with 19 branched rays (Roman-Valencia, 2003). The pelvic fins reach the origin of the insertion of the anal fin. Forked caudal fin. Terminal mouth. Tricuspid teeth located on each jaw in two rows, in the outer row presence of four or five teeth oriented in zigzag. Its coloration is silvery but darkens slightly on the back. It has a humeral spot (Eigenmann, 1914).

Distribution. South America. Orinoco Basin (DoNascimiento et al., 2024).

Sampling sites. S25, S26, S27, S33.

Number in the collection. UPTC-Pe-00169

Biology. It feeds on benthic aquatic invertebrates and allochthonous invertebrates (Galvis et al., 1997).

9. *Knodus cismontanus* (Eigenmann, 1914)

Description. Compressed fusiform body. Predorsal area with a median series of 10 scales. Lateral line straight. Obtuse head. Anal fin with 16 rays and with some scales at the base of the rays (Eigenmann et al., 1914). Terminal mouth. Presence of two rows of teeth. The outer row has five or six teeth arranged in a zigzag pattern. Its coloration is silvery. It has a vertical humeral spot. The fins are hyaline, except for the middle caudal rays, which have a dark coloration (Eigenmann et al., 1914).

Distribution. South America. Orinoco Basin (DoNascimiento et al., 2024).

Sampling sites. S25, S26, S28, S29.

Number in the collection. UPTC-Pe-00179

Biology. It is an omnivorous species that feeds on aquatic and terrestrial insects, including small seeds, reproduces in the dry season, and inhabits areas with heterogeneous substrates, among gravel, stones and submerged plants (Rodríguez-Olarte et al., 2021c).

10. *Knodus deuterodonoides* (Eigenmann, 1914)

Description. Fusiform body, compressed. Lateral line complete and decurved. Caudal fin with scales at its base. Anal fin with 17-18 rays (Eigenmann et al., 1914). Terminal mouth. Presence of two rows of teeth, in the external presence of two to three teeth. Its coloration is silvery. It has a humeral spot. Fins hyaline except for the caudal fin, which has a dark coloration at its base (Eigenmann et al., 1914).

Distribution. South America. Orinoco Basin (DoNascimiento et al., 2024) and in the Maracaibo Lake basin (IUCN, 2023).

Sampling sites. S15, S16, S17, S18, S19, S20, S21, S22, S25, S26, S27, S28, S29, S31, S32, S33, S35, S36, S37.

Number in the collection. UPTC-Pe-00173

Biology. Currently no studies have been advanced on its biology and ecology. However, van der Sleen and Albert (2018) report for the genus that its diet is based on terrestrial and aquatic insects, in addition to plant matter.

Family Crenuchidae

11. *Characidium chupa* Schultz, 1944

Description. Fusiform and robust body. Obtuse head. Lower subterminal mouth. Dorsal fin with 14 or fewer rays; pelvic fin with one unbranched ray; pectoral fin with 11 or more rays (Buckup, 1993). Conical teeth. It has a brownish coloration on the dorsum and whitish on the ventral area; From the edge of the operculum to the base of the caudal fin and over the lateral line there are 12 vertical spots (van der Sleen & Albert, 2018). At the base of the caudal fin a dark spot is present. Over the midline some golden flashes are visible.

Distribution. South America. The basins of Lake Maracaibo and the Orinoco River (Buckup, 1993). Caribbean Basin (DoNascimiento et al., 2024).

Sampling sites. S13, S17, S31, S32, S36.

Number in the collection. UPTC-Pe-00183

Biology. It inhabits fast flowing waters, small tributaries with rocky substrate and aquatic plants (Buckup, 1993).

Order Cypriniformes

Family Cyprinidae

12. *Cyprinus carpio* Linnaeus, 1758

Description. Fusiform body. Obtuse head. Terminal and protractile mouth. It has four barbels on the upper lip. Adipose fin absent. Extensive dorsal fin with 15-20 branched rays (Kottelat & Freyhof, 2007). Anal fin with the last ray serrated posteriorly (Kottelat, 2001). Pharyngeal teeth. Its coloration is olive on the back and whitish on the belly. The fins have a coppery hue.

Distribution. Naturally distributed in tributaries draining the Aral, Caspian and Black Seas (Kottelat & Freyhof, 2007). It has now been introduced into most of the world's basins (Bíró, 1995; Welcomme, 1988).
Sampling site. S20.

Number in the collection. UPTC-Pe-00187

Biology. It inhabits medium and slow flowing waters with depth (Kottelat & Freyhof, 2007), preferring temperatures between 18 and 30° C, although it has the plasticity to survive adverse environmental conditions (Gutiérrez et al., 2012). It has nocturnal habits, and its diet is omnivorous and at the same time it can be considered an opportunistic species due to its ability to adapt to new habitats (Kottelat & Freyhof, 2007). Some individuals can reach sexual maturity in a year and a half and in tropical areas they can reproduce throughout the

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year. However, they have a preference for the rainy season (Gutiérrez et al., 2012). For spawning, they look for shallow depths and the presence of plants (Balon, 1990). This species is of commercial and ornamental interest.

Order Cyprinodontiformes

Family Poecilidae

13. *Poecilia caucana* (Steindachner, 1880)

Description. Small and deep body. Short pointed head. The dorsal fin has a yellow band surrounded by a black band at the base of the fin. Caudal fin rounded. Ventral fin with 11-13 rays (Jiménez-Segura et al., 2014; Roman-Valencia et al., 2018). Adipose fin absent. Adult males have a modification on the first rays of the anal fin forming a gonopodium. Upper mouth. Conical teeth. The coloration of the body is silver. Their fins are hyaline except for the dorsal fin. It presents sexual dimorphism.

Distribution. Central and South America. Pacific drainage from the Darien (Panama), Magdalena-Cauca Basin and Caribbean Basin (DoNascimiento et al., 2024; Galvis et al., 1997).

Sampling site. S20.

Number in the collection. UPTC-Pe-00167

Biology. Insectivorous (Maldonado-Ocampo et al., 2012). Prefers to inhabit slow-moving waters with sand, rock and organic matter substrate (Maldonado-Ocampo et al., 2005). Viviparous with short reproductive cycles ranging from six to eight weeks (Maldonado-Ocampo et al., 2005).

14. *Poecilia reticulata* Peters, 1859

Description. Short and depressed body. Full lateral line. Short pointed head. Rounded caudal fin. Dorsal fin with 15-20 branched rays (Jiménez-Segura et al., 2014; Roman-Valencia et al., 2018). Ventral fins with five rays. Adipose fin absent. The anal fin in adult males has a modification in the first rays to form a gonopodium. Upper mouth. Conical teeth. The base coloration is silver, with some black and orange spots along the body. The caudal fin in males has a yellow coloration, while females have softer or hyaline shades. Regarding the sexual dimorphism of the species, the main difference is that the females have smaller fins and a faint coloration that is not as showy (Jiménez-Segura et al., 2014; Roman-Valencia et al., 2018).

Distribution. South America. Species native to Venezuela (Rosen & Bailey, 1963). Also recorded as native to Barbados, Trinidad, Guyanas and northern Brazil (Kottelat & Whitten, 1996). Africa. Natal River and in Lake Otjikoto in Namibia (Skelton, 1993). It is currently reported as introduced in 73 countries and islands (Deacon, 2023).

Sampling sites. S08, S26, S27, S29, S31, S32, S35, S36.

Number in the collection. UPTC-Pe-00171

Biology. It is a fairly tolerant species, as it can inhabit from crystal clear to turbid waters (Kenny, 1995). It feeds on invertebrates, organic matter and small fish (Roman-Valencia et al., 2018). They present internal fertilization, which occurs through the gonopodium (modification of the anal fin) presented by males (Roman-Valencia et al., 2018). Their reproduction is permanent (Jiménez-Segura et al., 2014).

Order Gymnotiformes

Family Apteronotidae

15. *Apteronotus galvisi* de Santana, Maldonado-Ocampo & Crampton, 2007

Description. Compressed body. Two gill slits. Greater depth after the vertical through the origin of the pectoral fin and gradually decreasing in thickness up to the caudal peduncle. Compressed head, being wider at the opercular part and deeper at the nape. Full midline of the body. Caudal fin small and short. The anal fin extends along the ventral margin. Elongated snout. Terminal mouth. Small eyes covered by a thin membrane. Its coloration is brown and has a band at the base of the caudal fin. The anal and caudal fins have an ocher coloration (De Santana et al., 2007).

Distribution. South America. Colombia. Orinoco River basin (DoNascimiento et al., 2024).

Sampling site. S28.

Number in the collection. UPTC-Pe-00177

Biology. For the moment, no studies have been made on the biology and ecology of the species, but its habitat is known to be found in piedmont rivers, with crystalline waters, associated with rocky bottoms, boulders and gravels (Provenzano-Rizzi, 2022).

Order Salmoniformes

Family Salmonidae

16. *Oncorhynchus mykiss* (Walbaum, 1792)

Description. Elongated, fusiform and compressed body. Fins without spines, with 10-12 dorsal, 19 caudal and 8-12 anal rays. Adipose fin present. Terminal mouth. With 100 to 150 cycloid scales on median lateral line (Kottelat & Freyhof, 2007; Gutiérrez et al., 2012). Coloration variable according to habitat, specimens collected with grayish-green dorsum, whitish belly, iridescent lateral stripe with pink and purple colors from head to caudal base, with black spots arranged longitudinally.

Distribution. Its native distribution includes the United States, Mexico and Canada (Page & Burr, 1991). It has been introduced in 85 countries on all continents (Gutiérrez et al., 2012).

Sampling sites. S01, S02, S03, S04, S06, S23, S24, S38.

Number in the collection. UPTC-Pe-00186

Biology. Benthopelagic and anadromous fish, with a preference for flowing waters with high oxygenation. They are found seeded in lakes, rivers and streams with temperatures between 12 and 25 °C (Gutiérrez et al., 2012); as is the case of the CRG, which has temperatures between 11.4 and 23 °C and dissolved oxygen percentages between 90.5 and 100%. In the ecosystems where it has been introduced, it feeds on insects, mollusks, small fish and tadpoles (Gutiérrez, 1984; Bastardo et al., 1994). It is registered in the list of the 100 most harmful invasive species in the world and in Colombia (Lowe et al., 2004; Gutiérrez et al., 2012).

Order Siluriformes

Family Astroblepidae

17. *Astroblepus latidens* Eigenmann, 1918

Description. Elongated body, compressed caudal peduncle, depressed head. Pectoral fins narrowly surpass the origin of the ventral fins. Adipose fin consisting of a fleshy spine and a small membrane. Presence of dorsal and pectoral spines. Ventral mouth disc-shaped, both lips broad, external teeth of the premaxilla chisel-shaped, broad-tipped, sometimes one or two pairs of the middle forked, about seven teeth in each premaxilla (Eigenmann, 1918; Maldonado-Ocampo et al., 2005), the observed specimens presented between seven and ten teeth per premaxilla. The chin of the maxilla generally does not extend beyond the posterior margin of the lip, although in some large individuals it may extend beyond the margin. Nasal fold short, not continuous as a barbellum. Body dark or mottled with dark spots, base of caudal fin with some distal dark spots, sometimes uniform; dorsal and pectoral fins sometimes with dark markings (Eigenmann, 1918; Maldonado-Ocampo et al., 2005). Naked body, specimens collected with variable coloration, some with dark brown coloration without noticeable spots, others with yellowish brown coloration and visible dark spots.

Distribution. South America. Colombia. Orinoco River basin (DoNascimiento et al., 2024).

Sampling sites. S06, S14, S15, S16, S17, S20, S21, S22, S25, S26, S27, S28, S29, S30, S31, S32, S33, S34, S35, S36, S37.

Number in the collection. UPTC-Pe-00176

Biology. Species endemic to Colombia, carnivorous habits, being sensitive to changes in habitat, water temperature and oxygen saturation (Mesa-Salazar et al., 2016b).

18. *Astroblepus mariae* (Fowler, 1919)

Description. Body elongate, higher at dorsal fin origin; caudal peduncle compressed; head depressed. Dorsal fin origin at midpoint between tip of snout and base of posterior radius of anal; adipose obsolete; anal inserted slightly closer to base of caudal than origin of ventral, median rays

longer (Fowler, 1942). Eyes small. Ventral mouth. Mouth disc broad, posterior edge with slight emargination in middle and somewhat papillose surface; maxillary barbellum begins near middle of snout and extends to gill opening; about eight slightly large simple conical conical teeth on each side of mandible and broad inner band of three to four rows of similar bifid teeth; lower jaw with three rows of bifid teeth, about six along outer edge of each mandibular ramus and inner row of about 12 smaller bifid teeth in each ramus. Body naked, dark brown with no noticeable spots (Fowler, 1942).

Distribution. South America. Orinoco River basin. Upper Meta River basin (DoNascimiento et al., 2024).

Sampling site. S23.

Number in the collection. UPTC-Pe-00188

Biology. Consumption of dipterans by this species is recorded.

Order Siluriformes

Family Callichthyidae

19. *Hoplosternum littorale* Hancock, 1828

Description. Body elongated, laterally compressed, head higher at the origin of the pectoral fins. Pectoral fins pointed, short anal fin with six to nine rays, adipose fin preceded by a spine and concave caudal fin (Santos et al., 1984; van der Sleen & Albert, 2018). Elongated snout, terminal mouth, well-developed jaws, dentary with teeth and a pair of barbels on each rictus surpassing the gill slit (Santos et al., 1984; van der Sleen & Albert, 2018). It is characterized by the presence of lateral bony plates, arranged in longitudinal rows forming a zigzag-like pattern. The observed specimen presents dark gray coloration.

Distribution. It is naturally distributed in cisandine tributaries and coastal rivers from the Guianas to northern Argentina (Reis et al., 2003; van der Sleen & Albert, 2018). In the present study, a specimen of the species was found at the sampling site located at the Boyacá bridge (S04), said specimen was found in an advanced state of decomposition, therefore, it was identified by a specialist by means of photographic registration. Taking into account that there was no material to deposit in the collection, that the species was not observed in the rest of the sampling and that it does not fit the habitat conditions described for the species (e.g., warm waters at low altitude; Baensch & Riehl, 1985), we proceeded to make a new visit to the site (2022/10/14), in which no specimens of this species were captured.

Sampling site. S04.

Biology. It inhabits moderate flowing tributaries (Freita et al., 2018) and swampy areas since it can use its gut to capture oxygen in areas with low availability (van der Sleen & Albert, 2018). It has a preference for waters ranging from 18 to 26 °C (Baensch & Riehl, 1985). The site where it was collected presented an oxygen percentage of 92%, mean temperature of 13.8 °C, and elevation of 2730 m. Nocturnal habits, its diet during the dry season is based on benthic invertebrates and some allochthonous, in turn it also consumes detritus (Freita et al., 2018; van der Sleen & Albert, 2018). It reaches sexual maturity at one year, its reproduction is characterized by the nesting of floating bubbles elaborated by the males during reproduction, and which will subsequently provide protection to the eggs during their incubation period (Hostache & Mol, 1998). This species is of ornamental and commercial interest, the latter for crops since they provide them as food for other fish species (Freita et al., 2018; van der Sleen & Albert, 2018).

Order Siluriformes

Family Cetopsidae

20. *Cetopsis umbrosa* Vari, Ferraris & de Pinna, 2005

Description. Body moderately elongate, slightly compressed anteriorly and progressively compressing posteriorly, head in lateral view generally triangular, dorsal profile of head nearly straight from tip of snout to base of nape (Vari et al., 2005). Dorsal fin moderately large, with base length 0.40-0.43 of head length, first ray lacks spine, but with distal filament present; caudal fin bifurcated; anal fin with moderately long base, with origin well posterior to half of standard length, close to vertical projected at half of total length, margin slightly convex, with most

posterior ray without membranous attachment to body; pelvic fin with nearly straight margin, longest first radius, located anterior to half the standard length, tip of pelvic adpressed extending beyond half the standard length, middle radius has membranous attachment to the body in the first two thirds basal; pectoral fin with a length approximately two thirds the length of the head, first radius lacking a spinneret (Vari et al., 2005). Eye visible from dorsal view, but not from ventral view, center of orbit located approximately in anterior third of head length, diameter of eye approximately half the length of snout; anterior narinal opening circular, surrounded by a short tubular rim of skin; posterior narina, located on dorsal surface of head, nearly round and with anterior two-thirds surrounded by a flap of skin. Mouth ventral, width about half the length of the head, lower margin of the mandible rounded (Vari et al., 2005).

Distribution. Endemic to the Colombian Orinoco piedmont (Urbano-Bonilla et al., 2021).

Biology. Its habitat is associated with drainages with constant water flow and with beds with roots and palisades, there is no information on the diet of the species, but for other species of the genus a diet based on a variety of terrestrial and aquatic insects is reported (Urbano-Bonilla et al., 2021).

Order Siluriformes

Family Heptapteridae

21. *Cetopsorhamdia orinoco* Schultz, 1944

Description. Head depressed in its anterior portion, body becoming compressed as it reaches the caudal fin; caudal fin bifurcated, with its lobes rounded and of equal length; dorsal fin, with the first soft ray, equal in length to the longest first branched ray, with the margin truncated; Anal fin with simple graduated rays, the first ray branched longer; Pectoral fin with the first ray thickened but not spinelike, approximately equal in length to the first ray branched; Adipose fin long and in turn high, entering about four times its standard length (Schultz, 1944). Mouth subterminal, villiform teeth in a band in premaxillary and dentary; one pair of maxillary barbicels, two pairs of mental barbels, with the outermost pair reaching almost to the posterior part of the pectoral fin base (Schultz, 1944).

Distribution. South America. Colombia. Orinoco River basin (DoNascimiento et al., 2024).

Biology. Their diet is based on detritus and allochthonous invertebrates (Coleoptera, Ephemeroptera, Hymenoptera, Plecoptera and Trichoptera) and autochthonous invertebrates (Zamudio et al., 2008).

22. *Chasmocranus rosae* Eigenmann, 1922

Description. Body elongate, caudal peduncle compressed; head depressed. Dorsal fin truncate, second ray longer than others, first ray shorter in length, spineless; caudal fin slightly bifurcated; anal rounded, middle ray longer than others. Pectoral and ventral fins large, rounded, first pectoral ray not spiny. Maxillary barbels reaching to pectoral fins or slightly beyond; premaxillary teeth in two separate pads, each about twice as wide as deep, with no backward projecting angle. Body coloration light yellow, top of head dark; six dark brown bands well marked on dorsum; the first band located between the two pectoral fins, the second and third under the ends of the dorsal, the fourth and fifth under the ends of the adipose; the last crossing the end of the caudal peduncle.

Distribution. South America. Orinoco River basin (DoNascimiento et al., 2024).

Sampling sites. S25, S26, S27, S28, S29.

Number in the collection. UPTC-Pe-00182

Biology. No ecological studies are recorded for the species, so data were taken from studies describing the genus, where it is recorded that the species inhabits crevices formed at the bottom of bedrock or among aquatic weeds, feeding mainly on aquatic insects (Bockmann et al., 2018).

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

Description. Elongated, cylindrical body, elevated in the predorsal portion. Head depressed in the anterior portion. Presence of multiple sensory pores on the dorsum of the head, eight pores on the ventral region of the head, near the mandible,

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coinciding with the description of Silfvergrip (1996). Pectoral fins with serrated spine on posterior margin; dorsal, ventral and anal fins lack spines; dorsal with seven branched rays; ventral fins originate where dorsal fins end. Adipose, high and long, from the end of the dorsal to just before the beginning of the caudal, which is moderately bifurcated and with equal lobes. Lateral line with a curve on the pectoral and then continues straight to the caudal. Mouth developed, terminal; jaws rounded, the upper one slightly more advanced than the lower one; teeth small and numerous, pharyngeal bones with teeth on their surface. Six maxillary barbels, the upper two are longer, reaching the anal fin and sometimes reaching the caudal peduncle. Nostrils with a single opening on each side; oval eyes. Naked body of variable color, some specimens collected were dark brown all over, other specimens, marbled brown darker on the back and head and pale yellowish belly; dark spots all over the body more evident on the back, black band along the side, with faint reddish tints on the sides and near the caudal fin. Fins pale yellowish (Quoy & Gaimard, 1824).

Distribution. Central and South America. Occurs in all countries except Chile (Bockmann & Guazzelli, 2003; Froese & Pauly, 2023).

Sampling site. S26.

Number in the collection. UPTC-Pe-00181

Biology. Its diet is omnivorous and consists of fish, plant material, crustaceans, insects and others (detritus, worms, other viscera, etc.) in order of importance (Olaya-Nieto et al., 2012).

24. *Rhamdia laukidi* Bleeker, 1858

Description. Elongated, cylindrical body, elevated in the predorsal portion. Head depressed in the anterior portion. Pectoral fins with serrate spines; caudal fin with six to nine procurrent rays on upper lobe, depth of lower lobe twice that of caudal peduncle; adipose fin occupying 44.6-51% of standard length (SL) (Silfvergrip, 1996). Multiple sensory pores on head; eight gill rays; maxillary barbels 42.9-90.6% of SL (Silfvergrip, 1996). Dark brown with contrasting light diagonal light stripe from upper corner of gill slit to near base of pelvic fin; prominent spot pattern on sides; predorsal spot occasionally visible (Silfvergrip, 1996).

Distribution. South America. Amazon, Orinoco and Essequibo basins (Silfvergrip, 1996).

Note: Species not collected in this work

Biology. Species that prefers to be found in lowland environments (Silfvergrip, 1996).

Order Siluriformes

Family Loricariidae

25. *Chaetostoma chimu* Urban-Bonilla and Ballen, 2020

Description. Body and head broad and slightly depressed. Dorsal fin typically with ii-8 rays, in some cases ii-9, when pressed not reaching origin of adipose fin, distal margin of dorsal fin slightly convex; Caudal fin with i-14-i rays, oblique with lower lobe longer than upper lobe, with branched rays shorter than unbranched, distal margin emarginate; anal fin with four branched rays, short base; pectoral fin tip reaching the middle of the pelvic fin, pectoral fin with six unbranched rays; anal fin with five unbranched rays, with rounded convex distal margin in females and angular convex in mature males (Urbano-Bonilla & Ballen, 2021). Head in dorsal view oval or rounded, fleshy snout covered with fleshy papillae, parieto-supraoccipital excrescence present; hypertrophied, short and curved odontodes of the operculum, generally not exceeding the posterior margin (Urbano-Bonilla & Ballen, 2021).

Distribution. South America. Orinoco River basin (DoNascimiento et al., 2024).

Biology. It inhabits rivers and streams in the plain foothills (Urbano-Bonilla et al., 2021).

26. *Chaetostoma dorsale* Eigenmann, 1922

Description. Body elongate in shape, gradually tapering from head to caudal fin, head and body slightly depressed. Width of head equal to its length, bare part of snout one-fourth the length of head, measuring from snout to end of occipital; dorsal spine equal to snout or shorter; base of dorsal equal to distance from caudal to last radius of adipose; adipose well developed (Eigenmann, 1922). Head rounded. Interoperculum with seven to 11 straight spines (odontodes) in three groups,

none of them bent below operculum, about eight shorter spines on top of interoperculum. Body covered with bony plates, except for the abdominal area and snout which are completely naked; dark brown color with yellow round spots distributed throughout the body, but more concentrated on the dorsal portion and fins; caudal fin with light yellow outer edge.

Distribution. South America. Orinoco River basin (DoNascimiento et al., 2024).

Sampling sites. S18, S21, S25, S26, S27, S28, S29, S30, S31, S32, S33, S35, S36.

Number in the collection. UPTC-Pe-00193

Biology. It is recorded in rivers of the piedmont of the plains, with rocky substrates, leaf litter and submerged vegetation. It joins the other Loricariidae in maintaining spatial heterogeneity and benthic diversity. It is suggested that it has breeding periods associated with the rainy season (Rodríguez-Olarte et al., 2021d).

27. *Chaetostoma joropo* Ballen, Urbano-Bonilla and Maldonado-Ocampo, 2016.

Description. Body elongated, head and body slightly wide and depressed. Dorsal profile of the body straight to slightly convex to the insertion of the dorsal fin, from which it is concave to the origin of the caudal fin. The posterior tip of the dorsal fin reaches or exceeds the origin of the adipose spine when closed over the body. Pectoral spine extends from one-third to one-half the length of the main radius of the pelvic fin, with hypertrophied, short, thickened odontodes present at the tip (Ballen et al., 2016a). Odontodes of dentary 32-157, premaxillary 24-128 (Ballen et al., 2016a). Odontodes of interoperculum hypertrophied and strongly recurved distally, usually not exceeding posterior margin of operculum when adpressed. Body covered by bony plates, belly and snout naked, the latter covered by small fleshy papillae. Body with yellowish light brown coloration, with uniform rounded black markers all over the body, being smaller on the head and absent on the abdomen; fins with a slight reddish coloration.

Distribution. South America. Orinoco River basin (DoNascimiento et al., 2024).

Sampling sites. S21, S22, S27, S28, S31, S32, S36.

Number in the collection. UPTC-Pe-00198

Biology. It is characteristic of mountain rivers to piedmont plains, preferring rocky substrates and shallow waters (Villa-Navarro et al., 2021). This species feeds on insect larvae, but mainly on algae (Ballen et al., 2016a).

28. *Dolichancistrus fuesslii* (Steindachner, 1911)

Description. Body elongate, head depressed. Distal margin of pelvic fin in mature males is "W" shaped; adpressed pectoral spine in mature males surpasses tip of adpressed pelvic fin spine; in mature females pectoral spine extends in inner area from middle of pelvic spine to its tip. Odontodes on the dorsal surface of the pectoral spine extending over the distal half in mature males (Ballen & Vari, 2012). Snout rounded with enlarged odontodes present along entire anterolateral region and anterior margins of snout and in median region anterior to nares; buccal papilla present within oral cavity at symphysis of premaxillae. Odontodes of the interoperculum hypertrophied and decurved at the tip. Body covered by bony plates except for abdomen and snout; two to three preadipose plates; middle plates 24-25; anterior margin of posterior cheek plate in contact with anterior exposed margin of operculum. Anterior and posterior lateral cheek plates rectangular and approximately the same size (Ballen & Vari, 2012). Dark brown coloration with light abdomen.

Distribution. South America. Orinoco River basin (DoNascimiento et al., 2024).

Sampling sites. S05, S06, S07, S08, S09, S10, S11, S12, S14, S15, S16, S17, S18, S19, S20, S21, S22, S25, S28, S31, S32, S34, S35, S36, S37.

Number in the collection. UPTC-Pe-00178

Biology. Its reproductive strategy is probably associated with rainy seasons. It inhabits well oxygenated streams and rivers with rocky beds,

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stones and gravels (Ballen & Vari, 2012).

29. *Farlowella colombiensis* Retzer and Page, 1997

Description. Body elongate and slender, higher from the head to the origin of the dorsal; caudal peduncle long and slender. The ratio snout/ pectoral fin length is <0.6 (Galvis et al., 2007; Retzer & Page, 1997). There are multiple medium-sized odontodes on the snout which decrease in abundance or disappear on the preorbital ridge or the side of the head. Body covered with bony plates, may present up to four anterior medium-sized abdominal scutes. Dark coloration on the back up to the second row of lateral plates, light coloration on the belly; dark stripes covering part of the caudal fin lobes; the pelvic, pectoral and anal fins have spots on the rays.

Distribution. South America. Orinoco River drainage, Meta River basin (DoNascimiento et al., 2024).

Sampling sites. S25, S26, S27, S28, S29, S30.

Number in the collection. UPTC-Pe-00175

Biology. The genus has facultative aerial respiration. Algivorous (Galvis et al., 2007).

30. *Farlowella mitoupibo* Ballen, Urbano-Bonilla & Zamudio, 2016.

Description. Body subcylindrical and elongate, completely covered by plates, except tip of snout; head long 0.21-0.26 of standard length, head plates and bones covered by flat, short, depressed odontodes, dorsal surface of head keeled over parieto-supraoccipital bone (Ballen et al., 2016b). Dorsal fin with i-6 rays, and anal fin with i-5 rays, both with a straight margin, dorsal fin origin slightly anterior to anal fin origin, anal fin with i-10-i rays, emarginate with the dorsal lobe longer than the ventral lobe, with the outermost rays in each lobe extending into filaments; Pectoral fin with i-6-i rays, margin straight, tip not reaching the origin of the pelvic fin; Pelvic fin with i-4-i or i-4-i rays, margin slightly curved, tip reaching the anus, but not the origin of the anal fin (Ballen et al., 2016b). Eye small 0.04-0.08 of head length, situated laterally; Snout long 0.33-0.47 of head length, slightly pointed, with rounded tip; mature males with odontodes on both sides of snout and head; Mouth ovate with lower lip larger than upper lip, both expressing papillose margins, premaxillary wider than dentary, buccal papilla present (Ballen et al., 2016b).

Distribution. South America. Orinoco River basin (DoNascimiento et al., 2024).

Biology. Habitat associated with submerged vegetation, near shores (Ballen et al., 2016b).

31. *Farlowella vittata* Myers, 1942

Description. Body subcylindrical and elongate, medium-sized reproductive odontodes present on snout, but small to absent on side of head and preorbital ridge. Clear ocelli on caudal fin lobes, usually fused to form a transparent bar-like ocellus between two pigmented stripes, one or two pigmented rays on lower lobe. Snout-mouth length divided into pectoral fin length >1.0; Pectoral fin length divided into distance between pectoral fin origin to pelvic fin origin <0.9 (Retzer & Page, 1997).

Distribution. South America. Orinoco River basin (DoNascimiento et al., 2024; Urbano-Bonilla et al., 2021).

Biology. It is found associated with rocky substrates with vegetation and palisades on the bottom; feeding on phytoplankton, zooplankton, plant material and occasionally some insect remains (Urbano-Bonilla et al., 2021).

Family Trichomycteridae

32. *Trichomycterus knerii* Steindachner, 1882

Description. Body slender, anterior half of torso strongly compressed; head flattened. Pectoral fins with outermost radius ending in a soft elongation; dorsal begins vertically behind insertion point of ventral ones, last dorsal radius falls above or only slightly in front of base of first anal radius; caudal weakly convex at posterior margin. Snout with rounded edge, terminal mouth. Two maxillary barbels, four nasal barbels, two of which extend posteriorly from the gill slit, surpassing the base of the pectorals. Body naked, chocolate brown with

small dark spots (Steindachner, 1882).

Distribution. South America. Colombia, Orinoco River Basin (DoNascimiento et al., 2024). Ecuador, Canelos (Reis et al., 2003).

Sampling site. S17, S21, S26, S27, S28, S29, S31, S33, S35, S36, S37.

Number in the collection. UPTC-Pe-00197

Biology. Zamudio and collaborators (2008) recorded that their diet consisted of fish, invertebrates, plant remains and detritus.

Order Synbranchiformes

Family Synbranchidae

33. *Synbranchus marmoratus* Bloch, 1795

Description. Anguilliform body; ventral gill opening in the form of pores. Pectoral and ventral fins absent, from the ventral region posterior to the anus presents a fleshy membrane that joins with the vestigial caudal fin and culminates in the dorsal region. Mouth subterminal; premaxillae, mandibles and palatines with conical tooth patches. Dorsum of body dark, belly light, body covered by scattered dark spots (Maldonado-Ocampo et al., 2005).

Distribution. South America. Amazon, Magdalena-Cauca and Orinoco-river basins (DoNascimiento et al., 2024).

Sampling site. S35.

Biology. It inhabits rivers with gravel, sandy and silt bottoms, it is a predator of nocturnal habits, it can move small distances out of the water, it consumes aquatic insects in its juvenile stages reaching to feed on small fish in adult stages; it is a sequential hermaphrodite (Maldonado-Ocampo et al., 2005; Daniels & Maiz-Tome, 2019).

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LIST OF SPECIES COLLECTED AT THE 38 SAMPLING SITES, GARAGOA RIVER BASIN

Table 1. List of species collected in the Garagoa river basin and collection number in the Natural History Museum "Luis Gonzalo Andrade". The letter X indicates that the species occurs in the locality.

Species	*Corynopoma riisei*	*Creagrutus atratus*	*Hemibrycon metae*	*Grundulus bogotensis*	*Knodus alpha*	*Knodus cismontanus*
Number in the collection	UPTC-Pe-00180	UPTC-Pe-00172	UPTC-Pe-00168	UPTC-Pe-00185	UPTC-Pe-00169	UPTC-Pe-00179
Sampling sites						
S01						
S02				X		
S03				X		
S04				X		
S05						
S06						
S07						
S08				X		
S09						
S10						
S11						
S12						
S13						
S14						
S15						
S16						
S17						
S18						
S19						
S20						
S21						
S22						
S23						
S24						
S25		X			X	X
S26	X	X			X	X
S27		X	X		X	
S28		X				X
S29		X				X
S30		X	X			
S31		X	X			
S32		X				
S33		X	X		X	
S34						
S35		X				
S36		X	X			
S37						
S38						

Species	*Knodus deuterodonoides*	*Characidium chupa*	*Cyprinus carpio*	*Poecilia caucana*	*Poecilia reticulata*	*Apteronotus galvisi*
Number in the collection	UPTC-Pe-00180	UPTC-Pe-00172	UPTC-Pe-00168	UPTC-Pe-00185	UPTC-Pe-00169	UPTC-Pe-00179
Sampling sites						
S01						
S02						
S03						
S04						
S05						
S06						
S07						
S08					X	
S09						
S10						
S11						
S12						
S13		X				
S14						
S15	X					
S16	X					
S17	X	X				
S18	X					
S19	X					
S20	X		X	X		
S21	X					
S22	X					
S23						
S24						
S25	X					
S26	X				X	
S27	X				X	
S28	X					X
S29	X				X	
S30						
S31	X	X			X	
S32	X	X			X	
S33	X					
S34						
S35	X				X	
S36	X	X			X	
S37	X					
S38						

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Species	*Oncorhynchus mykiss*	*Astroblepus latidens*	*Astroblepus mariae*	*Hoplosternum littorale*	*Chasmocranus rosae*	*Rhamdia quelen*
Number in the collection	UPTC-Pe-00186	UPTC-Pe-00176	UPTC-Pe-00188	-	UPTC-Pe-00182	UPTC-Pe-00181
Sampling sites						
S01	X					
S02	X					
S03	X					
S04	X			X		
S05						
S06	X	X				
S07						
S08						
S09						
S10						
S11						
S12						
S13						
S14		X				
S15		X				
S16		X				
S17		X				
S18						
S19						
S20		X				
S21		X				
S22		X				
S23	X		X			
S24	X					
S25		X			X	
S26		X			X	X
S27		X			X	
S28		X			X	
S29		X			X	
S30		X				
S31		X				
S32		X				
S33		X				
S34		X				
S35		X				
S36		X				
S37		X				
S38	X					

Species	*Chaetostoma dorsale*	*Chaetostoma joropo*	*Dolichancistrus fuesslii*	*Farlowella colombiensis*	*Trichomycterus knerii*	*Synbranchus marmoratus*
Number in the collection	UPTC-Pe-00180	UPTC-Pe-00172	UPTC-Pe-00168	UPTC-Pe-00185	UPTC-Pe-00169	UPTC-Pe-00179
Sampling sites						
S01						
S02						
S03						
S04						
S05			X			
S06			X			
S07			X			
S08			X			
S09			X			
S10			X			
S11			X			
S12			X			
S13						
S14			X			
S15			X			
S16			X			
S17			X		X	
S18	X		X			
S19			X			
S20			X			
S21	X	X	X		X	
S22		X	X			
S23						
S24						
S25	X		X	X		
S26	X			X	X	
S27	X	X		X	X	
S28	X	X	X	X	X	
S29	X			X	X	
S30	X			X		
S31	X	X	X		X	
S32	X	X	X			
S33	X				X	
S34			X			
S35	X		X		X	X
S36	X	X	X		X	
S37			X		X	
S38						

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