

***Bryconops magoi* and *Bryconops collettei* (Characiformes: Characidae), two new freshwater fish species from Venezuela, with comments on *B. caudomaculatus* (Günther)**

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Abstract

Bryconops collettei and *B. magoi* are described from the Caura and Miamo (Bolívar State), Iguapo (Amazonas State) and Moquete (Anzoátegui State) rivers, Venezuela. These new species belong to the subgenus *Bryconops*, based upon apomorphies of the jaws and gill rakers and are compared with members of the subgenus. Based on morphology, meristics and color patterns, *B. collettei* and *B. magoi* are distinguished from *B. caudomaculatus*, the closest species in the subgenus, by having a generally more slender body, pored scales of the lateral line extending beyond the hypural plate, and a diffuse ocellus partially filled with red color only on the upper lobe of the caudal fin. *Bryconops collettei* is distinguished from *B. magoi* on the basis of meristic and morphometric characteristics. *B. caudomaculatus* has been largely misidentified in the literature and we provide comments as a guide to its proper recognition.

Resumen

Se describen a *Bryconops collettei* y *Bryconops magoi* dos nuevas especies de peces de agua dulce de Venezuela provenientes de los ríos Caura y Miamo (Edo. Bolívar), Iguapo (Edo. Amazonas) y Moquete (Edo. Anzoátegui). Estas nuevas especies pertenecen al subgénero *Bryconops*, basado en apomorfías de las mandíbulas y branquias y son comparadas con todos los miembros del subgénero. Basado en las características morfológicas, merísticas y de coloración, *B. collettei* y *B. magoi* se distinguen de *B. caudomaculatus*, la especie más cercana en el subgénero, por poseer un cuerpo más delgado, escamas perforadas de la línea lateral extendiéndose más allá de la placa hipural y un ocelo difuso parcialmente llenado con color rojo sólo en el lóbulo superior de la aleta caudal. *Bryconops collettei* se distingue de *B. magoi* sobre la base de caracteres morfométricos y merísticos. *B. caudomaculatus* ha sido ampliamente confundido en la literatura y proveemos comentarios como una guía para su reconocimiento seguro.

Introduction

The genus *Bryconops* contains 15 species (Chernoff *et al.*, 1994, 2002; Chernoff and Machado-Allison, 1999; Machado-Allison *et al.* 1993, 1996; Machado-Allison and Chernoff, 1997), including the two species that are described herein. The genus is widely distributed in the cis-Andean lowlands of South America from the Orinoco to the Paraná-Paraguay basins, including many coastal basins of the Guyanas and Brazil. Although *B. alburnoides* Kner, 1859, is known to inhabit relatively basic, white-water habitats (e.g., flood plain lakes of the lower Orinoco [Rodríguez and Lewis, 1990]), most species are found in lotic habitats that are typically acidic and transparent, despite the color of the water. Many species inhabit morichal (aguajal, vereda) habitats that are dominated by the moriche palm (*Mauritia* sp.).

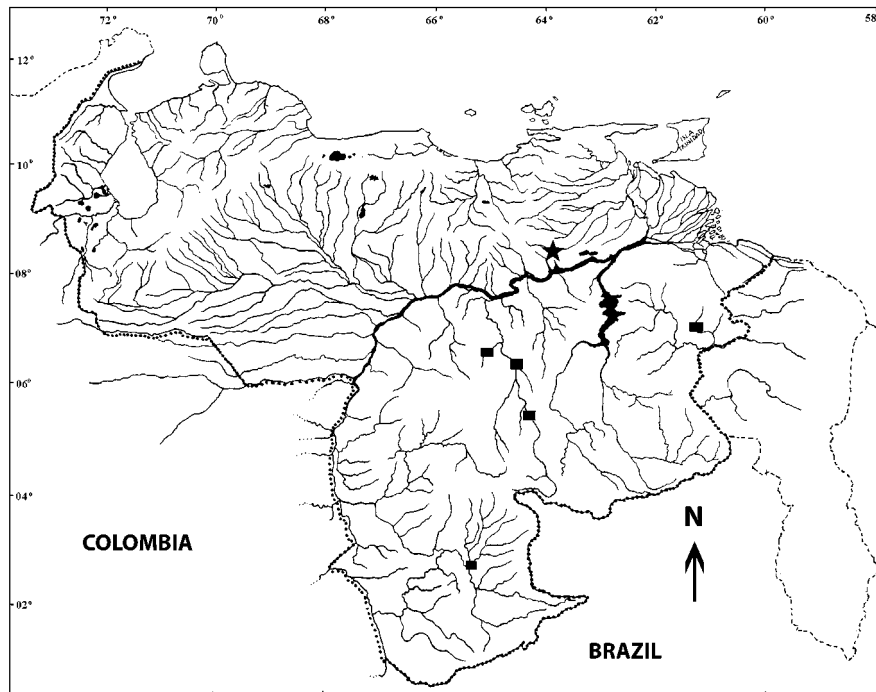


FIGURE 1. Map of Venezuela showing known distribution of *Bryconops magoi* (star) and *B. collettei* (squares)

The two new species inhabit the Orinoco and Cuyuni watersheds (Fig. 1). The latter occurs on the Guyana Shield above the cataracts in the Essequibo River basin. The two new species belong to the subgenus *Bryconops* because of the synapomorphies of the jaws and gill rakers that they share (discussed below) with the other members of the subgenus: *Bryconops alburnoides*, *Bryconops caudomaculatus* (Günther, 1864), *Bryconops disruptus* Machado-Allison and Chernoff, 1997, and *Bryconops durbini* (Eigenmann 1908). Within this group the new species superficially resemble *B. caudomaculatus*, an enigmatic taxon,

B. disruptus, and *B. durbini* because of the colorful ocellus on the dorsal lobe of the caudal fin. Indeed, the new species have been identified as *B. caudomaculatus* in collections.

In this paper we describe two new species of the genus *Bryconops*, compare them with other member of the subgenus, and discuss some aspects on the morphometry and shape changes in these species. We comment on the characteristics of *B. caudomaculatus* in order to clarify its status. Lastly, we provide an artificial key to the species of *Bryconops*.

Methods

Ninety-four specimens of *B. collettei* from three river basins and 26 specimens of *B. magoi* from a single drainage were studied. Thirty-three morphometric and 22 meristic traits were enumerated according to definitions in Fink and Weitzman (1974), Chernoff *et al.* (2002), and Machado-Allison *et al.* (1996). Values of meristic traits of the holotype are indicated by asterisks, with the following clarification and addition. The number of lateral scales (L) include both pored and unpored scales along the lateral line, from the head to the end of the hypural plate. The number of pored scales (P) is the total number of pored scales in the lateral line from the head to the tip of the caudal fin. In the species described herein, the number of pored scales exceeds the number of lateral scales, hence P-L is positive; the value of P-L is negative in other species, such as *B. disruptus*.

Two dimensional coordinates of 14 landmarks were obtained by optically digitizing images of the specimens on a flat-screen monitor (pitch=0.19) using TPSDIG version 1.20 (Rohlf 1998). Landmark positions were identified by inserting 0000 insect pins into the specimens. The images were captured using an HP CS-195 flatbed scanner with a resolution of 1200 dpi, noninterpolated. The error of the scanner, <.002 mm, was estimated from multiple scans of fine graph paper. Twenty-eight measurements (Table 1) were calculated as distances among 14 landmarks (Chernoff and Machado-Allison, 1999). Least depth of the caudal peduncle and length of the dorsal, anal, pectoral, and pelvic fins were measured with Helios digital needle-point calipers to the nearest 0.1 mm.

The shapes of *B. magoi* and *B. collettei* were compared in two ways: i) from their interlandmark distances using principal components analysis, PCA, (Bookstein *et al.*, 1985); and ii) from their landmark configurations directly using relative warp analysis, RWA, (Rohlf, 1993). Neither PCA nor RWA require the a priori identification of specimens to groups. For PCA, the eigenvectors of the covariance matrix of the logs of the measured distances among landmarks demonstrated that there was a confounding of size and shape on the first several PCs. Thus, the confounding was removed by shearing PC 2 on a common estimate of size (Bookstein *et al.*, 1985).

In order to remove the effect of scaling, rotation and orientation in the coordinate data, specimens of both species were aligned to their joint consensus configuration using procrustes analysis. Alpha was set to zero. Relative warps are the principal components of the partial warps. Subsequent scatter of relative warp scores on their eigenvectors

allows potential group structure to be evaluated. Deformation grids of landmark configurations show differences in shape between the species. All of these analyses were performed with TPSRELW, version 1.18 (Rohlf 1999). Based upon the relative warp results and standard principal components analysis a few diagnostic, traditional interlandmark measurements were scattered against standard length.

TABLE 1. Morphometric data from the type series of *Bryconops magoi* (N=27). All values in % SL, except for SL in mm. Abbreviations: min. = minimum value; max. = maximum value; S.D. = standard deviation.

	Holotype	Mean	Min.	Max.	S.D.
Standard length	63.7	48.8	18	68.1	15.3
Snout-occipital length	23.9	24.6	22.6	28.9	1.6
Predorsal length	52.4	50.5	49	52.3	1
Prepectoral length	26.4	27.2	25.7	30.4	1.2
Prepelvic length	52.4	51.4	49.5	55.3	1.2
Preanal length	66.9	65.3	62.2	67.5	1.2
Maximum body depth	26.7	25	21.8	26.8	1.2
Dorsal fin base length	12.2	12.8	11.6	14.3	0.8
Anal fin base length	24.9	26.6	24.8	27.9	0.8
Interdorsal fin length	23.7	24	22.1	25.9	1
Caudal peduncal length	12.1	12	10.5	13.9	0.8
Adipose to anal fin terminus length	11.7	11.5	10.6	12.3	0.5
Dorsal fin terminus to anal fin origin	23.1	22.8	17.8	25.3	1.6
Dorsal fin terminus-pelvic fin insertion	27.5	26.4	22.7	28.4	1.1
Dorsal fin origin to anal fin origin	29.2	28.5	23.5	30.8	1.8
Adipose fin to anal fin origin	28.4	29.4	27.4	30.9	0.9
Adipose fin to hypural base	15.1	15.6	13.5	17.3	0.8
Dorsal fin terminus to anal fin terminus	30.2	30.5	28.3	32.1	1
Dorsal fin origin to pectoral fin origin	35.7	33.7	31.3	35.7	1.3
Pelvic fin to pectoral fin insertion	26.7	25.1	21.5	27	1.2
Head length	25.4	25.5	23.6	27.8	1.2
Eye diameter	9.6	9.8	8.8	11.3	0.6
Snout length	6.8	6.8	5.8	8	0.6
Lower jaw length	12.3	11.8	10.4	12.9	0.7
Postorbital head length	9	9.1	8.3	10.6	0.6
Posterior tip maxilla to anterior orbit margin	7.9	7.6	6.9	9	0.5
Posterior tip maxillato postorbital margin	10	10.3	8.9	12	0.8
Posterior tip maxilla to pelvic fin insertion	41.9	41.2	38.6	45.7	1.4

Comparisons within the subgenus *Bryconops*

Bryconops collettei and *B. magoi* possess the derived characters of the subgenus *Bryconops* (Chernoff and Machado-Allison, 1999), which include reduction in the ossification and denticulation of the gill rakers, despite being large fishes, and lack of maxillary teeth, with at most (and rarely) only a single, small conical tooth on one side. The subgenus *Bryconops* contains six species. *B. alburnoides* differs from the other five species by being much larger, reaching almost 200mm SL, and by having more lateral scales and branched anal-fin rays (see key). Importantly, *B. alburnoides* lacks an ocellus or clear areas containing coloration on the caudal fin. *B. alburnoides* often has pale to bright yellow suffused among the caudal fin rays, but this color is not concentrated within a circumscribed area on either fin lobe. Furthermore, the dorsal and adipose fins of *B. alburnoides* are dusky to pale yellow, never red.

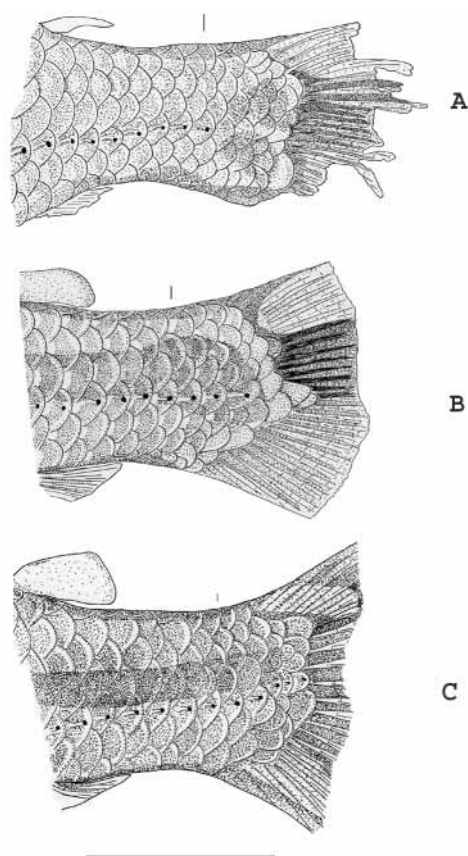


FIGURE 2. Drawings of caudal peduncle and anterior portion of caudal fins of: A) *Tetragonopterus caudomaculatus*, holotype, BMNH 1852.9.13.74; B) *Bryconops collettei*, holotype, MBUCV 30780; C) *B. magoi*, holotype, MBUCV 30782. Vertical line indicates position of hypural plate; scale bar = 10 mm.

The remaining five species in this subgenus comprise the *B. caudomaculatus* species complex. We refer the five species to this informal group because of their phenotypic similarity and because they have all been referred to, or synonymized with *B. caudomaculatus* at some point in their history. The following characteristics are common to the complex: (i) the dorsal fin has a crescent of red (a potential synapomorphy), (ii) the adipose fin is entirely red, and (iii) the caudal fin has at least a clear circumscribed area on the upper lobe that is either entirely, or partially, filled with red color. This ocellus is either well formed or irregular (Fig. 2). *B. magoi* and *B. collettei* differ from the other members by having the dorsal-fin ocellus only partially filled with red color (Fig. 3), the overall form of which appears as a streak or narrow ellipse; the color becomes diffuse and extends beyond the ocellus among the upper caudal-fin rays. This condition in the new species is independent of sex or state of maturity, since even specimens as small as 35 mm SL show the diffuse coloration pattern, though the color may be slightly less intense. Both *B. disruptus* and *B. durbini* have very few pored lateral scales (< 31), whereas *B. caudomaculatus*, *B. collettei*, and *B. magoi* have more numerous pored scales (>36) that extend nearly to or beyond the end of the hypural plate.

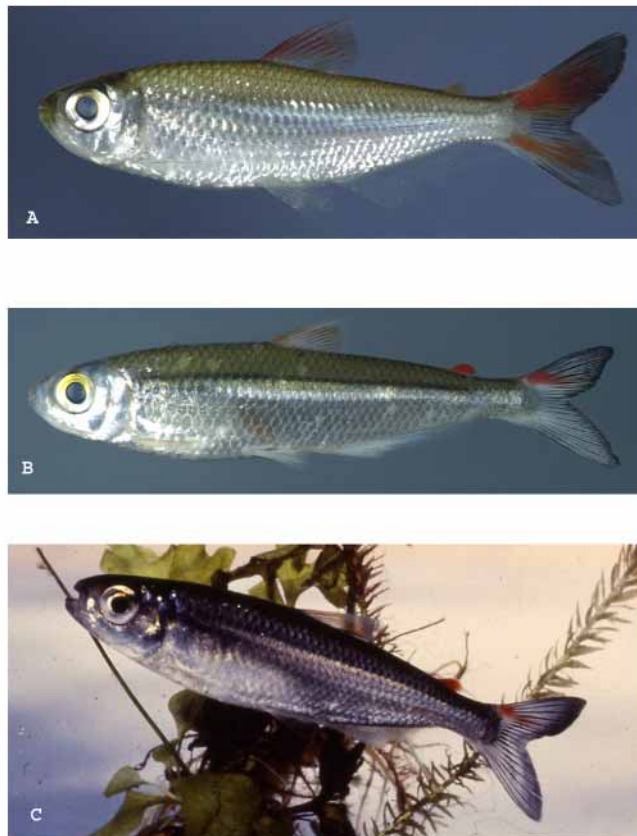


FIGURE 3. Color photographs of: A) *Bryconops caudomaculatus*, 72 mm SL, from Potaro River, near Tumatumari, Essequibo Drainage, Guyana; B) *B. collettei*, holotype, 74 mm SL, MBUCV 30780; C) *B. magoi*, paratype, 55 mm SL, MBUCV 30783

Comments on *Bryconops caudomaculatus*

Tetragonopterus caudomaculatus was described by Günther (1864) from a single specimen (BMNH 1852.9.13.74), which is in very good condition given its age, though the caudal fin is broken. The type locality was given as South America. We believe that the specimen originated from Guyana (formerly British Guiana) for two reasons. First, and most importantly, the holotype corresponds most closely to historic and recent material from the Essequibo River drainage. Second, Günther described many other species of freshwater fishes from Guyana, including *Tetragonopterus affinis* (= *B. affinis*), that live sympatrically with *B. caudomaculatus*.

In the original description, Günther (1864: 330) wrote that the holotype had "... caudal fin black, with a pair of large red spots on its basal half." This statement raises three important issues: i) that "spot" could be consistent with a non-circular color mark; ii) that the term "spot" is consistent with the term "ocellus" as applied to a clear area on the caudal fin; and iii) that there is a "spot" of color on the ventral lobe of the caudal fin.

First, while "spot" implies circularity, a somewhat round or elliptical mark, as well as any blotch, may have been referred to as a "spot" by Günther (1864), Eigenmann (1912), and other authors. If present, the color "spot" found on the caudal fins of species of *Bryconops* are rarely exact circles. Rather they are quasi-circular, elliptical, or irregular in shape (e.g., Fig. 2). Günther (1864) did not observe the fishes in the field but depended upon notes from naturalist collectors, in this case those associated with the Zoological Society. We interpret "spot" as a general description rather than as a strict indicator of circularity.

Second, the caudal fin coloration in *Bryconops* is most often associated with a relatively clear area over the fin membranes and rays, termed an ocellus, in which the color is displayed prominently. We restrict use of the term "ocellus" to a well circumscribed area lacking melanophores. In a number of species of *Bryconops*, including *B. collettei*, the postero-dorsal margin of the unpigmented area is fuzzy—lacking a clearly differentiated border with the melanophores. In the case of species with a fuzzy ocellus, the color extends posteriorly beyond the ocellus on the interradial membranes. The surviving portion of the upper caudal lobe of the holotype of *B. caudomaculatus* shows a clearly circumscribed ocellus (Fig. 2a). The lower caudal lobe is not present and we cannot ascertain if there was an unpigmented area close to the fin base in which the color was displayed. However, such a condition with red color corresponds to recent and historic material from the Essequibo River drainage of Guyana.

Third, in *Bryconops* a "spot" of color on the dorsal lobe of the caudal fin is possessed by most species; a color "spot" on the ventral lobe, however, is relatively rare.

Other than *B. caudomaculatus*, only *B. melanurus* and *B. affinis* have such markings, but these two taxa belong to the subgenus *Creatochanes*. Recent material of *B. caudomaculatus* from the Essequibo River has an irregular clear area across the base of the ventral caudal fin lobe in which the red color is expressed (Fig. 3a). This color pattern

distinguishes the true *B. caudomaculatus* from all other members of the subgenus. Despite the fact that Eigenmann (1912) had collected many of the true *B. caudomaculatus* in the Essequibo River basin, he failed to observe the color mark or the clear unpigmented area near the base of the lower caudal lobe, and only mentions the single red mark on the dorsal lobe (Eigenmann, 1912; Eigenmann and Myers, 1929). This has led to much confusion about the identity of *B. caudomaculatus*.

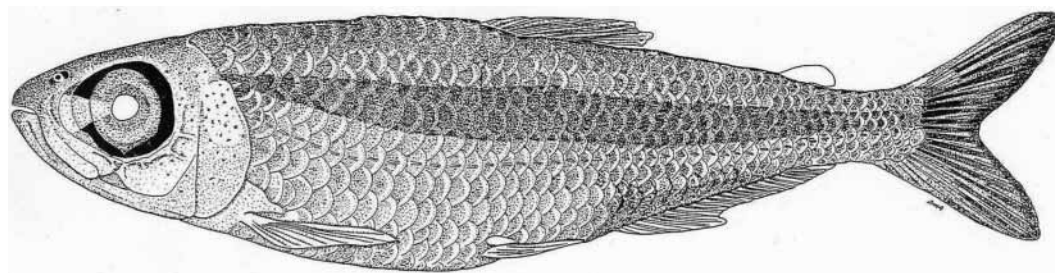
The holotype has 41 lateral scales and 41 pored scales; the pored scales do not extend beyond the hypural plate onto the scales attached to the caudal-fin rays. The type's pored and lateral scales represent a somewhat ambiguous condition with respect to other individuals. There are two large phenotypic groups comprising individuals formerly referred to *B. caudomaculatus*. One group has the number of pored scales exceeding 41, usually 42 or more while the other group is usually 41 or less. The type sits on the boundary. Similarly, the former group has the pored scales extending beyond the hypural plate and onto the caudal fin such that the number of pored scales exceeds the number of lateral scales by at least one scale. We refer to this as the complete condition. The latter group usually has one or fewer pored scales than lateral scales, referred to as the incomplete condition. Approximately 10% of all individuals have equal numbers of lateral and pored scales. Most of the populations with individuals having equal numbers of pored and lateral scales also possess relatively high numbers of scales; thus, they are considered to possess the complete condition. There is one collection from the lower Potaro River, Essequibo drainage, at Tumatumari (FMNH 69672, n=122) that matches the type almost exactly. This collection has a relatively low number of lateral and pored scales in comparison to other populations with the complete condition: 40–42, modally 40, and 41–45, modally 42, respectively. There is one individual in this collection with equal numbers of pored and lateral scales. Thus, we consider the type specimen of *B. caudomaculatus* to possess the complete condition.

The type is also slightly unusual with respect to body depth. The type is very deep bodied (28.7%) relative to all other measured specimens that could be identified as *B. caudomaculatus* from across the continent (n>600 examined). The collection from near Tumatumari, Guyana is also relatively deep bodied, 24.5–27.9%, mean = 26.3%, n=75. Though apparently shallower than the type, we note that body depth is strongly dependent upon size, and that the type specimen is larger than the specimens in FMNH 69672. Thus, we conclude that the typical *Bryconops caudomaculatus* possesses the following traits: (i) a caudal fin with a well developed ocellus containing red color in the dorsal lobe and a clear area in the ventral lobe also with red color; (ii) the complete condition with relatively few lateral scales, 40–42; and (iv) relatively deep body. This phenotype is best found in the Essequibo River basin and other watersheds draining the Guyana Shield.

***Bryconops magoi* n. sp.**

(Figs. 3c–4)

Holotype. MBUCV-V-30782 (64 mm SL); Venezuela: Anzoátegui: Río Moquete at Paso Bajito, AN; L. Aguana, 4 Feb.1984.



FIGURES. *Bryconops magoi*, holotype, 64 mm SL, MBUCV 30782.

Paratypes. All lots collected at type locality, but some with different dates and/or collectors. MBUCV-V-30783, 10 (17.0–54.0 mm SL). FMNH 113936, 2 (35.5–55.5 mm SL) (preceding two series collected with holotype). MBUCV-V-30784, 2 (52.5–53.0 mm SL); A. Machado, 4 Oct.1984. FMNH 113937, 2 (40.0–45.5 mm SL); A. Machado, 4 Oct.1984. MBUCV-V-30785, 6 (56.2–69.5 mm SL); A. Machado, 1 Feb.1984. FMNH 113938, 3 (65.0–67.0 mm SL); A. Machado, 1 Feb.1984.

Diagnosis. A species of *Bryconops*, subgenus *Bryconops*, that is distinguished from all other congeners except *B. collettei* by its unique color pattern, in which red coloration occupies the upper half of a diffuse caudal fin ocellus. It is further distinguished from members of the subgenus *Bryconops* by the following traits: pored lateral scales 43–47, modally 44 or 45 (>57 in *B. alburnoides*, <31 in *B. disruptus* and *B. durbini*, and 44–48, modally 47 in *B. collettei*); pored lateral scales extending 2–3 scales beyond end of hypural plate onto caudal fin rays (pored lateral scales reaching end of hypural plate and not onto caudal fin rays in *B. caudomaculatus*); snout length 5.8–8.0% SL, mean 6.8% (4.2–5.4%, mean 4.7% in *B. collettei*); length of anal fin base 24.8–27.9%, mean 26.6% (27.3–29.8% SL, mean 28.8% in *B. collettei*); and total vertebrae 40–42, modally 41–42 (42–44, modally 42–43 in *B. collettei*).

Description. Morphometric data are given in Table 1 and a summary of meristic data appears in Table 2. A moderate to small-sized species of *Bryconops*, known from specimens less than 70 mm SL. Overall body shape with convex dorsum and slightly rounded belly, tapering to relatively short and deep caudal peduncle 10.5–13.9 (12.0 % SL). Dorsal fin origin at level of pelvic origin, almost at center of the body 49.0–52.3 (50.5 % SL).

Head 23.6–27.8 (25.5 % SL); posterior margin of opercle slightly sinusoidal. Border between second and third infraorbitals with naked ventral area; third infraorbital moderately developed, not reaching preopercle ventrally or at angle (Fig. 5). Eye large,

8.8–11.3 (9.8 % SL). Snout bullet-shaped; mouth terminal, opening just ventral to horizontal diameter through orbit. Maxilla extending posteriorly not reaching posterior margin of the 2nd infraorbital., length 5.8–8.0 (6.8 % SL). Ventroanterior margin of maxilla not heavily recurved (Fig. 5). Outer two rows of premaxillary teeth small and not prominent. Premaxilla with 2–5 teeth, bearing 3 to 5 cusps. Inner premaxillary teeth uniformly five, with 5 to 7 cusps; teeth basically symmetrical. Maxilla without teeth, rarely a small and single unicuspid tooth. Dentary with 4–5 large teeth, bearing 5–7 cusps. Smaller dentary teeth few.

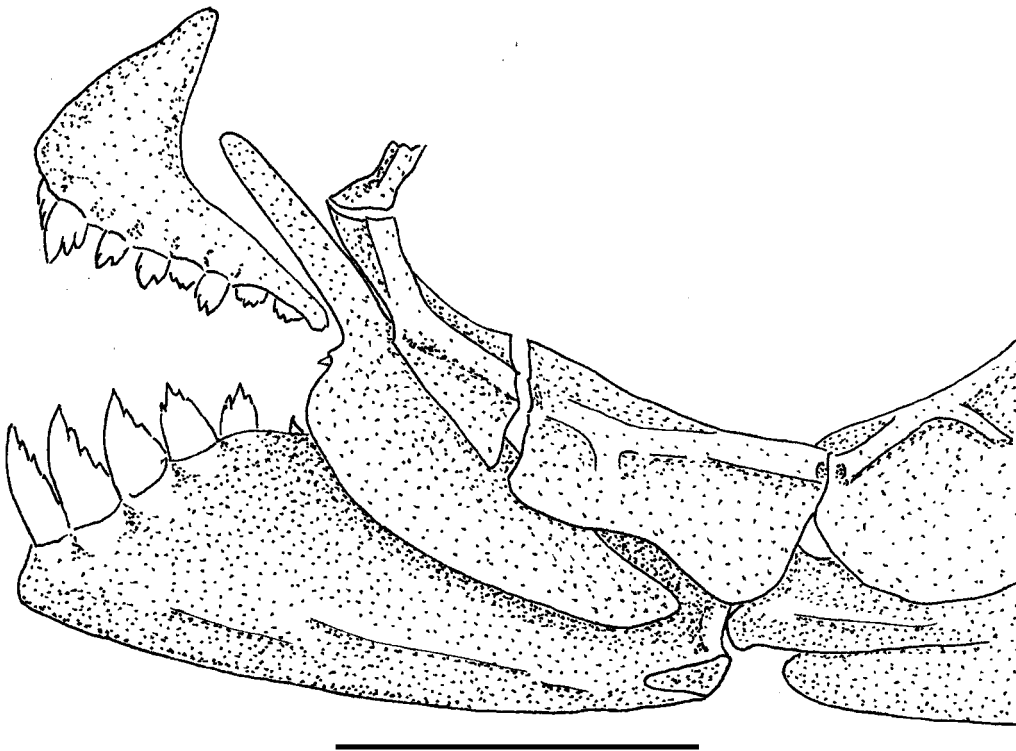


FIGURE 5. Jaws and anterior infraorbital series of *B. magoi*, paratype, FMNH 113936, 55.3 mm SL. Scale bar = 5 mm.

Dorsal fin with straight to slightly convex distal margin; either the first or second branched ray longest. Posterior base of dorsal fin separated from anterior base of adipose fin by 12 to 13 scales, irregularly arranged. Adipose fin with convex dorsal margin and straight ventral margin. Lobes of caudal unequal, upper with rounded tip, and lower lobe longer and more pointed. Anal fin origin at level of end of dorsal fin base, its base 24.8–27.9 (26.6 % SL); distal margin slightly falcate in adults and straight in juveniles. Pelvic fin not reaching origin of anal fin; distal margin of pelvic fin rounded. Distal margin of pectoral fin pointed and slightly falcate, not reaching pelvic insertion.

Widths of scales on sides of body above lateral line and below row along dorsal fin greater than, or equal to, length of scale; anterior margins of these scales almost circular, somewhat irregular; circuli present on anterior two-thirds of scale; posterior field lacking circuli, possessing 2–3 centrally located, and almost parallel, striae.

Dorsal-fin rays: unbranched 2*(23); branched 9*(23); total 11*(23). Anal-fin rays: unbranched 3(5), 4*(17); branched 26(6), 27(9), 28*(6), 29(1); total 29(1), 30(7), 31(9), 32*(4), 33(1). Pectoral-fin rays 12*(11), 13(10). Scales: predorsal 9(1), 11(4), 12*(16); lateral 41(6), 42(10), 43*(7), 44(1); pored lateral-line scales 43(2), 44(10), 45*(10), 46(1), 47(1); P–L scales 1(1), 2*(12), 3(11); rows above lateral line 7*(11), 8(10); rows below lateral line 4*(11), 5(10). Gill rakers: upper 5*(2), 6(19); lower 8(1), 9(16), 10*(4); total 14(2), 15*(16), 16(3). Vertebrae: precaudal 17(1), 18*(26); caudal 23(14), 24*(13); total 40(1), 41(13), 42*(13); dorsal-fin origin 11*(25), 12(2); anal-fin origin 17(1), 18*(26).

Pigmentation in alcohol. Overall moderate dusky species in preservation, countershaded above and below lateral stripe. Dorsal profile of head dark, fully covered with fine melanophores homogeneously distributed. Anterior area of mouth dark. Nares not covered with pigment. Orbit with a black dorsal band. Infraorbitals and preopercle sparsely pigmented, more conspicuous at sutures. Opercle with star-like diffused spots, more evident in dorsal region. Lateral stripe originating just behind head, somewhat prominent in preservation; increasing in depth and intensity just posterior to dorsal fin origin, occupying three to four scale rows just behind midbody and ending in darker, oblong-shaped expansion just anterior to caudal fin. Centers of upper lateral scales pigmented densely. First 14 scales of lateral line canal outlined with pigment. Below lateral line, melanophores distributed along myosepta from just anterior to anus to midpoint of anal fin. Anal-fin base with a diffuse basal band formed by series of melanophores along pterygiophores. Dorsal, pectoral, and pelvic fins with melanophores outlining lower portion of fin rays. Adipose fin lacking melanophores. Both lobes of caudal fin densely covered by melanophores. A clear but diffuse area on anterobasal part of upper caudal lobe, not forming a well-defined ocellus. Distal margin of caudal fin area with a dark, almost black terminal band, especially on upper lobe.

Coloration in life (Fig. 3c). Body usually grayish or metallic dorsolaterally, becoming silvery toward lateral and ventral flanks. A black lateral stripe extends from opercular opening to caudal fin base. Below this stripe there is a wider silvery stripe, limited dorsally by an iridescent metallic-yellow stripe.

Head silver laterally. Iris yellow dorsally and silver ventrally. Cheek and opercular regions silvery. Dorsal part of head, snout and lower jaw dark. Dorsal fin slightly orange. Pectoral, pelvic and anal fins transparent. Adipose intense red. Caudal fin with dark distal margin, especially on upper lobe. Caudal-fin lobes with transparent areas near fin base diffuse and without well-formed ocelli. Upper lobe with red coloration in upper part of the diffuse area, the red extending posteriorly beyond this area, almost to end of the fin rays.

Distribution. This new species is only known from the type locality, the Río Moquete, Anzoátegui State, Venezuela. The Río Moquete is a northern tributary of the Río Orinoco.

Habitat. *Bryconops magoi* is known only from a morichal with fast moving waters over sandy bottoms. This species frequently is found in water from mid-depth to the surface, at the center of the main channel, where it schools with other characid species. Individuals feed at the surface and are attracted to allotochtonus material that falls into the water. Cursory examination shows that they feed on several groups of terrestrial insects.

Etymology. The species-group name, *magoi*, is dedicated to the memory of Dr. Francisco Mago-Leccia, pioneer of modern ichthyological studies in Venezuela.

Comparison with *B. collettei*. *Bryconops magoi* differs in body shape from *B. collettei*. The results of sheared principal components analysis and relative warp analysis show that all individuals of both species are discriminated by either the second sheared principal component (Fig. 6) or by the first relative warp. In both analyses all individuals of *B. magoi* fell at, or inside, the boundary of the 95% confidence ellipse, whereas three individuals of *B. collettei* fell just outside the 95% confidence ellipse, but with a morphology most different from *B. magoi* (Fig. 6). The first two eigenvectors of the PCA described 99.1% of the variance. The second sheared PC identified a contrasting suite of traits such that *B. magoi* has a longer snout and *B. collettei* has a longer anal fin base, a larger orbit, and a greater distance between the dorsal fins (Fig. 7). RWA produced identical results to the PCA. Even though individuals of *B. collettei* from the Río Iguapo have slightly longer snouts relative to other populations, there is no overlap in snout length between the species. For each of the other metric traits the differences between the species are statistically significant, but there is some overlap between the species.

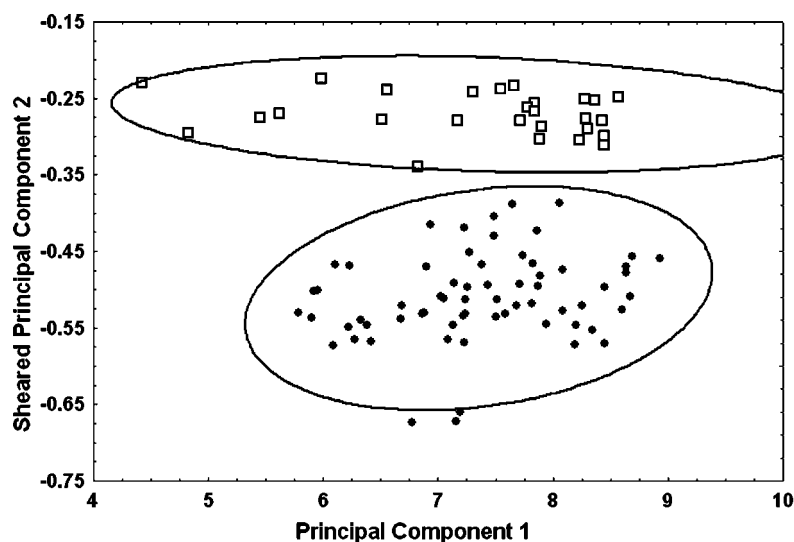


FIGURE 6. Scatter plot of sheared principal component 2 vs. principal component 1 for *B. magoi* (squares), N= 27, and *B. collettei* (circles), N=66. Each symbol represents at least one specimen. 99% confidence limits are shown.

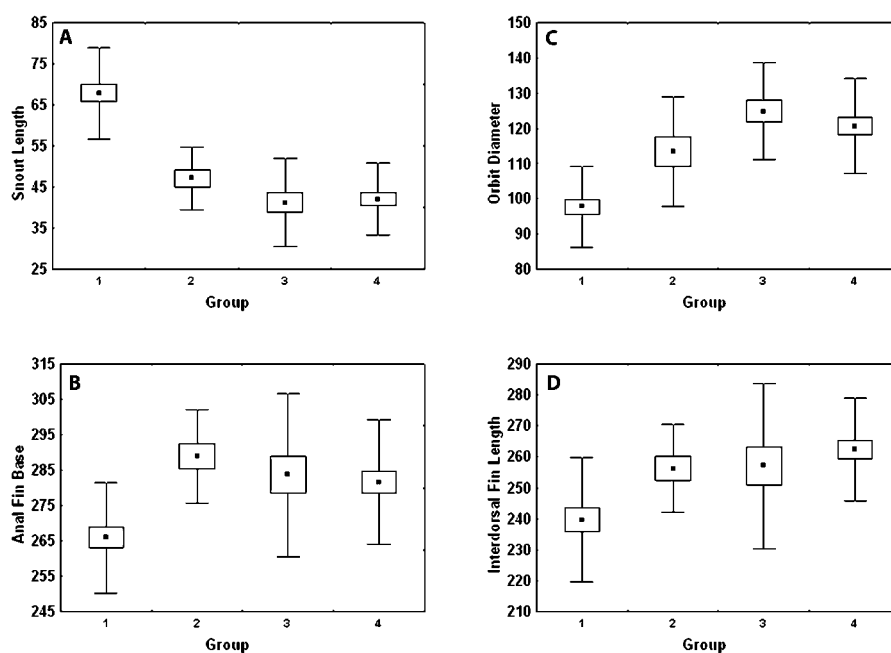


FIGURE 7. Box plots of four morphometric traits of *Bryconops magoi* and *B. collettei*: A) snout length; B) anal fin base; C) orbit diameter; and D) interdorsal fin length. Group 1 = *B. magoi*, Río Moquete, N = 27; Group 2 = *B. collettei*, Río Caura, type locality, N=14; Group 3 = *B. collettei*, Río Iguapo, N=20; and Group 4 = *B. collettei*, Río Miamo, N=32. In

***Bryconops collettei* n.sp.**

(Figs. 3b, 8)

Holotype. MBUCV-V-30780, 74.0 mm SL; Venezuela: Bolívar: Río Nichare at Wakawajai, tributary of the Río Caura, 6° 19 21 N 64° 57 13 W; A. Machado-Allison, F. Provenzano, A. Marcano, 6 Dec. 2000.

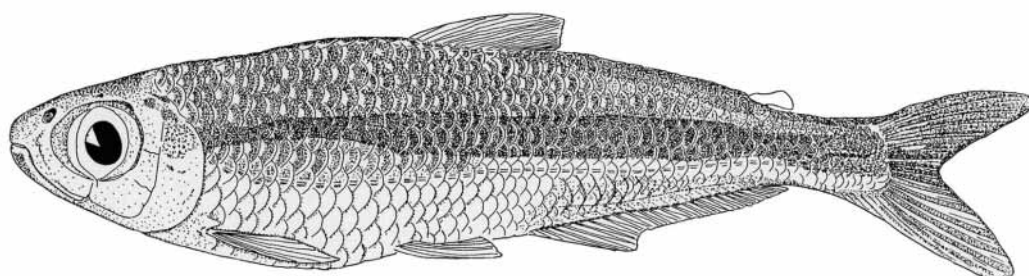


FIGURE 8. *Bryconops collettei*, holotype, 74 mm SL, MBUCV 30780.

Paratypes. All localities in Venezuela: FMNH 109350, 3 (42.8–52.4 mm SL); MBUCV-V-30781, 2 (43.1–52.6 mm SL); collected with the holotype. FMNH 109348, 2 (55.0–58.5 mm SL); Río Caura, beach in front of El Playón, 6° 19 31 N 64° 31 37 W; A. Machado-Allison et al., 3 Dec. 2000. FMNH 109347, 1 (46.0 mm SL); Río Caura, Caño at Katuwadi Chenu down-river from El Playón, 6° 19 44 N–64° 31 40 W; A. Machado-Allison et al., 3 Dec. 2000. ANSP 139597, 6 (45.9–58.0 mm SL); Río Mato, sandy beach, tributary of Río Caura, 7° 02 N 65° 14 W; J.E. Bohlke et al., 1 Feb. 1977.

Additional Material (non-types). FMNH 109349, 20 (10.6–16.0 mm SL); Río Tawadu, raudal Dimoshi Soodii, tributary of the Río Caura, 6° 19 38 N–65° 02 52 W; A. Machado-Allison et al., 5 Dec. 2000. ANSP 168006, 18 (33.5–71.0 mm SL); MBUCV-V-21791. 20 (36.0–76.0 mm SL); Río Miamo, on Guasipati-El Miamo road, 20 km S of El Miamo, Río Yuruari/Cuyuní basin, 7° 38 N 61° 50 W; S. Schaefer et al., 24 Jan. 1991. ANSP 161536, 21 (29.0–66.0 mm SL); Río Iguapo, tributary of Río Orinoco, ca. 1 hr. above its mouth by boat. 03° 09 N 65° 28 W; H. López *et al.*, 13 Mar. 1987.

Diagnosis. A species of *Bryconops*, subgenus *Bryconops*, that is distinguished from all other congeners except *B. magoi* by its unique color pattern, in which red coloration occupies the upper half of a diffuse caudal-fin ocellus. It is further distinguished from members of the subgenus *Bryconops* by the following traits: pored lateral scales 44–48, modally 47 (>57 in *B. alburnoides*, <31 in *B. disruptus* and *B. durbini*, and 43–47, modally 44 or 45, in *B. magoi*); pored lateral scales extending 2–3 scales beyond end of hypural plate onto caudal fin rays (pored lateral scales reaching end of hypural plate and not onto caudal fin rays in *B. caudomaculatus*); snout length 4.2–5.4% SL, mean 4.7% (5.8–8.0%, mean 6.8% in *B. magoi*); length of anal fin base 27.3–29.8% SL, mean 28.8% (24.8–27.9%, mean 26.6% in *B. magoi*); and total vertebrae 42–44, modally 43 (40–42, modally 41–42 in *B. magoi*).

Description. Morphometric data are given in Table 3 and a summary of meristic data appear in Table 2. A moderate to small-sized species of *Bryconops*, known from specimens less than 70 mm SL. Overall body shape with convex dorsum and slightly rounded belly, tapering to relatively long and slender caudal peduncle. Dorsal fin originating at mid-body and just posterior to insertion of pelvic fin.

Head bullet shaped. Posterior margin of opercle slightly sinusoidal. Second and third infraorbitals not joining ventrally, with a naked area. Third infraorbital moderate in size not reaching the ridge of the preopercle or angle. Eye large. Mouth terminal, opening just ventral to horizontal diameter through orbit. Maxilla not reaching the posterior margin of the second infraorbital; ventro-anterior margin of maxilla not heavily recurved. Outer two rows of premaxillary teeth small and not prominent. Premaxilla with 3–5 teeth, bearing 3–5 cusps, arranged in two loosely defined rows. Inner premaxillary teeth uniformly five, with 5 to 7 cusps; teeth basically symmetrical, exposed portions wider than high with concave outer surface. Maxilla without teeth or rarely with a single small monocuspid tooth. Dentary with 4–5 large teeth, bearing 5 to 7 cusps, higher than wide, not symmetrical, posterolateral edge prominent, cusps recurved posterolaterally.

TABLE 2. Meristic data of *Bryconops collettei* and *B. magoi*. Abbreviations: N = number of specimens; min. = minimum; max. = maximum; P-L scales = the number of pored lateral line scales minus the number of lateral line scales.

	<i>B. collettei</i>				<i>B. magoi</i>			
	N	Mode	Min.	Max.	N	Mode	Min.	Max.
Unbranched dorsal fin rays	54	2	2	2	23	2	2	2
Branched dorsal fin rays	54	9	9	9	23	9	9	9
Unbranched anal fin rays	54	4	4	4	22	4	3	4
Branched anal fin rays	54	28	25	32	22	27	26	29
Total anal fin rays	54	32	29	36	22	31	29	33
Pectoral fin rays	54	13	11	13	21	12	12	13
Lateral line scales	58	42	41	45	24	42	41	44
Pored lateral line scales	58	45	43	48	24	44	43	47
P-L scales	58	2	1	4	24	2	1	3
Predorsal scales	53	12	10	13	21	12	9	12
Scales above lateral line	54	7	7	8	21	7	7	8
Scales below lateral line	54	4	4	4	21	5	4	5
Gill rakers, upper	54	8	6	9	21	6	5	6
Gill rakers, lower	54	11	8	13	21	9	8	10
Gill rakers, total	54	19	14	21	21	15	14	16
Premaxillary teeth, outer	54	4	3	5	21	4	2	5
Premaxillary teeth, inner	54	5	5	5	21	5	5	5
Maxillary teeth	54	0	0	1	21	0	0	1
Large teeth on dentary	54	5	4	5	18	5	4	5
Precaudal vertebrae	58	18	16	19	27	18	17	18
Caudal vertebrae	58	24	23	26	27	23	23	24
Total vertebrae	58	42	40	44	27	41,42	40	42
Vertebra under dorsal fin pterygiophore origin	58	11	10	12	27	11	10	12
Vertebra above anal fin pterygiophore origin	58	18	18	19	27	18	17	18

Dorsal fin with straight to slightly convex distal margin; either first or second branched ray longest. Posterior base of dorsal fin separated from anterior base of adipose fin by 12 to 14 scales, irregularly arranged. Adipose fin with convex dorsal margin and straight ventral margin. Lobes of caudal fin unequal, upper lobe with rounded tip, lower lobe longer and pointed. Anal-fin origin at level of end of base of the dorsal fin; distal margin of anal fin straight in juveniles and slightly falcate in adults. Pelvic fin not reaching origin of anal fin; distal margin of pelvic fin rounded. Distal margin of pectoral fin pointed and slightly falcate; not reaching pelvic insertion.

TABLE 3. Morphometric data from the type series of *Bryconops collettei* (N=14). All values in % SL, except for SL in mm. Abbreviations: min. = minimum value; max. = maximum value; S.D. = standard deviation.

	Holotype	Mean	Min.	Max.	S.D.
Standard length	74.5	52.9	41.9	74.5	0.9
Snout-occipital length	21.0	23.4	21.0	24.6	1.0
Predorsal length	48.0	50.3	48.4	52.4	1.1
Prepectoral length	23.9	25.6	23.9	27.3	1.0
Prepelvic length	45.9	48.7	45.9	50.6	1.3
Preanal length	59.8	62.0	59.8	63.5	1.0
Maximum body depth	23.9	23.2	21.2	25.0	1.2
Dorsal fin base length	10.4	11.5	9.6	12.8	0.8
Anal fin base length	28.8	28.9	27.3	29.9	0.7
Interdorsal fin length	26.6	25.6	24.6	26.6	0.7
Caudal peduncal length	14.6	12.3	10.9	14.6	0.9
Adipose to anal fin terminus length	10.6	10.9	10.3	12.1	0.5
Dorsal fin terminus to anal fin origin	22.1	21.2	19.9	22.5	1.0
Dorsal fin terminus-pelvic fin insertion	25.7	25.3	23.7	26.6	1.0
Dorsal fin origin to anal fin origin	26.2	25.7	24.0	27.8	1.1
Adipose fin to anal fin origin	30.6	30.6	29.5	31.5	0.6
Adipose fin to hypural base	17.3	15.2	13.6	17.3	1.2
Dorsal fin terminus to anal fin terminus	32.5	31.6	29.8	33.1	1.0
Dorsal fin origin to pectoral fin origin	33.0	33.3	31.4	35.5	1.3
Pelvic fin to pectoral fin insertion	22.6	23.6	22.3	24.6	0.8
Head length	22.2	23.9	22.0	25.0	1.0
Eye diameter	10.2	11.3	10.0	12.4	0.8
Snout length	42.1	4.7	4.3	5.4	0.4
Lower jawl length	97.9	11.5	9.8	12.3	0.7
Postorbital head length	8.1	8.1	6.6	8.8	0.5
Posterior tip maxilla to anterior orbit margin	7.6	8.1	7.3	8.8	0.6
Posterior tip maxilla to postorbital margin	9.7	9.7	8.8	10.7	0.7
Posterior tip maxilla to pelvic fin insertion	37.2	38.6	37.2	40.0	0.8

Widths of scales on sides of body above lateral line and below row along dorsal fin greater than, or equal to, length of scale; anterior margins of scales almost circular to wavy, with a central notch and rounded posterior margin; circuli present in anterior two thirds of scale; posterior field lacking circuli, possessing 2–3 centrally located, almost parallel, striae.

TABLE 4. Morphometric data from non-type specimens of *Bryconops collettei* from the Río Iguapo, Amazonas, and the Río Miamo, Bolívar, Venezuela. All values in mm. N = number of specimens; min. = minimum value; max. = maximum value; S.D. = standard deviation.

	<i>B. collettei</i> , Ro Iguapo					<i>B. collettei</i> , Ro Miamo				
	N	Mean	Min.	Max.	S.D.	N	Mean	Min.	Max.	S.D.
Standard length	20	38.3	27	64.6	8.5	32	52.5	31.3	77.5	12.6
Snout-occipital length	20	24.9	22.5	27.2	1.3	32	22.9	20.9	26.1	1.3
Predorsal length	20	51.9	49.6	55.0	1.5	32	49.2	47.5	50.5	0.8
Prepectoral length	20	26.6	23.5	29.5	1.7	32	25.6	24.1	27.0	0.8
Prepelvic length	20	50.9	47.5	55.7	2.0	32	49.6	47.4	51.2	1.0
Preanal length	20	63.7	61.3	66.5	1.3	32	63.6	61.6	65.2	0.8
Maximum body depth	20	24.8	21.9	27.2	1.4	32	26.6	23.0	27.7	1.1
Dorsal fin base length	20	11.7	10.2	13.2	0.9	32	12.8	10.8	14.2	0.7
Anal fin base length	20	28.4	26.6	30.7	1.2	32	28.2	26.2	29.9	0.9
Interdorsal fin length	20	25.7	23.5	27.8	1.3	32	26.2	24.6	28.2	0.8
Caudal peduncal length	20	11.4	9.8	13.5	1.0	32	12.0	10.7	13.2	0.6
Adipose to anal fin terminus length	20	11.8	10.9	12.6	0.6	32	11.4	10.5	12.0	0.4
Dorsal fin terminus to anal fin origin	20	22.6	21.2	24.3	1.0	32	23.6	21.1	25.3	1.1
Dorsal fin terminus-pelvic fin insertion	20	26.8	24.0	29.1	1.5	32	26.8	24.0	28.6	1.1
Dorsal fin origin to anal fin origin	20	26.8	24.4	28.4	1.1	32	29.3	26.1	31.3	1.3
Adipose fin to anal fin origin	20	31.3	29.2	33.6	1.1	32	30.9	28.8	32.5	0.9
Adipose fin base length	20	13.9	12.1	15.5	1.1	32	15.2	14.0	16.4	0.7
Dorsal fin terminus to anal fin terminus	20	31.8	29.1	33.1	1.1	32	32.4	30.8	34.1	0.8
Dorsal fin origin to pectoral fin origin	20	34.6	32.1	36.9	1.3	32	33.8	32.0	36.3	1.0
Pelvic fin to pectoral fin insertion	20	24.9	23.2	27.6	1.2	32	24.7	23.0	26.3	0.8
Head length	20	24.7	21.8	27.8	1.6	32	23.2	21.1	25.2	0.9
Eye diameter	20	12.5	11.5	13.8	0.7	32	12.1	11.1	13.9	0.7
Snout length	20	4.1	2.8	5.0	0.5	32	4.2	2.9	5.1	0.4
Mandibular length	20	10.9	9.5	12.2	0.7	32	11.4	10.7	12.3	0.5
Postorbital head length	20	8.6	6.4	10.7	0.9	32	7.3	5.0	8.6	0.6
Posterior tip maxilla to anterior orbit margin	20	8.2	6.1	9.5	0.7	32	8.0	7.1	8.9	0.4
Posterior tip maxilla to postorbital margin	20	10.9	9.7	13.1	0.8	32	9.8	8.9	10.6	0.5
Posterior tip maxilla to pelvic fin insertion	20	41.2	38.5	45.8	1.8	32	39.4	37.7	41.9	0.9

Dorsal-fin rays: unbranched 2*(54); branched 9*(54); total 11*(54). Anal-fin rays: unbranched 4*(54); branched 25(1), 26(2), 27(6), 28(16), 29(16), 30*(11), 32(2); total 29(1), 30(2), 31(7), 32(16), 33(15), 34*(11), 36(2). Pectoral-fin rays: 11(1), 12*(19), 13(34). Scales: predorsal 10(2), 11(8), 12 (28), 13*(8); lateral 41(5), 42(16), 43(12),

44(14), 45*(10); pored lateral 43(1), 44(11), 45(18), 46(9), 47(13), 48*(5); P-L 1(2), 2(26), 3*(27), 4(2); rows above lateral line 7*(52), 8(1); rows below lateral line 4*(53), 5(1). Gill rakers: upper 6(16), 7(15), 8*(19), 9(4); lower 8(1), 9(1), 10(18), 11*(28), 12(5), 13(1); total 14(1), 15(1), 16(7), 17(11), 18(15), 19*(12), 20(6), 21(1). Vertebrae: precaudal 16(1), 18*(55), 19(2); caudal 23(6), 24(37), 25(14), 26*(1); total 40(1), 41(6), 42(34), 43(16), 44*(1); dorsal fin origin 10(3), 11(42), 12*(13); anal fin origin 18*(56), 19(2).

Pigmentation in alcohol. Overall, specimens moderately dusky in preservation, countershaded above and below lateral stripe. Dorsal profile of head dark, fully covered with fine melanophores distributed homogeneously. Anterior area of mouth dark. Orbit with black dorsal and ventral bands. Infraorbitals and preopercle sparsely pigmented. Opercle with diffuse spots, almost star-like. Dorsolateral portion of opercle darker. Lateral stripe originating just behind head, somewhat prominent in preservation, increasing in depth and intensity just posterior to dorsal-fin origin, occupying three to four scale rows just behind midbody and ending at caudal peduncle in diffuse, oblong darkened area. Upper lateral scales densely pigmented in central region, tending to form lateral stripes of lightly pigmented spots. Lateral-line canal of the first 14 scales outlined with pigment. Series of melanophores following myosepta below lateral line anterior to vent, extending posteriorly to midpoint of fin base. Anal-fin base with series of melanophores outlining bases of fin rays, forming diffuse band. Dorsal fin partly covered with melanophores, with central area of fin clear. Caudal fin with clear diffuse area in dorsal lobe; remainder of fin covered with melanophores; distal portion of dorsal lobe dark almost black.

Coloration in life (Fig. 3b). Body overall iridescent greenish dorsolaterally turning silver laterally and ventrally. Head usually silver. Iris yellow dorsally and silver ventrally. Cheek and opercular regions silvery. Dorsal area of head, snout, and lower jaw dark. A black stripe extending from opercular opening to caudal peduncle. Below this stripe there is a wider silvery stripe, limited dorsally by an emerald-green metallic stripe. Dorsal fin light red, with a central clear area. Pectoral fins slightly orange. Pelvic and anal fins transparent. Adipose fin intense red. Dorsal lobe of caudal fin with intense red in upper part of diffuse clear area; red color extending posteriorly as streak, almost to end of fin.

Distribution. This new species is known from the Caura and Miamo rivers, Bolívar State, and Rio Iguapo, Amazonas State, Venezuela.

Habitat. *Bryconops collettei* is found in habitats with moderate to fast flowing waters over rocky and sandy bottoms. The species is found in both acidic, black waters as well as in clear, but slightly acid waters. In the Caura, it was found in rapids covered by vascular plants (Podostemonaceae), as well as in small springs with sandy bottoms. This species inhabits the upper part of the water column in the main channel, usually in schools with other characid species. Cursory examination shows that food items include several groups of terrestrial insects.

Etymology. The species group-name, *collettei*, is named in honor of Dr. Bruce B. Collette, who has made important contributions to systematic ichthyology and to our careers.

Within species variation. There is important variation in meristic and morphometric traits among populations of *B. collettei*, such that the populations from the Río Caura differ from those in the upper Río Orinoco (Río Iguapo) and from those in the Río Cuyuní (Río Miamo). The scatters of scores from sPCA (Fig. 9) and RW of morphometric traits or landmarks show that there is overlap among the phenotypes of the populations but that the Río Caura specimens have longer snouts and anal-fin bases, and shorter orbits (Fig. 7) than do the other *B. collettei*. The Río Caura populations also have more numerous lateral and pored scales but fewer total gill rakers, on average, than other populations: 42–45, modally 44 (vs. 41–44, modally 42) lateral scales; 44–48, modally 47 (vs. 43–46, modally 45) pored scales; and 14–19, modally 16 (vs. 17–21, modally 18) gill rakers, respectively. Without other evidence, we do not recognize these populations as separate species due to the large degree of overlap among them. These differences may be due to environmental influences upon the phenotype (see Sidlauskas *et al.* 2006); for example, the waters of the Río Caura are much more basic (pH > 6.2) than the waters in the other rivers (pH < 5.7). However, this is speculation at present. As a precaution, we have restricted the types to the Río Caura populations.

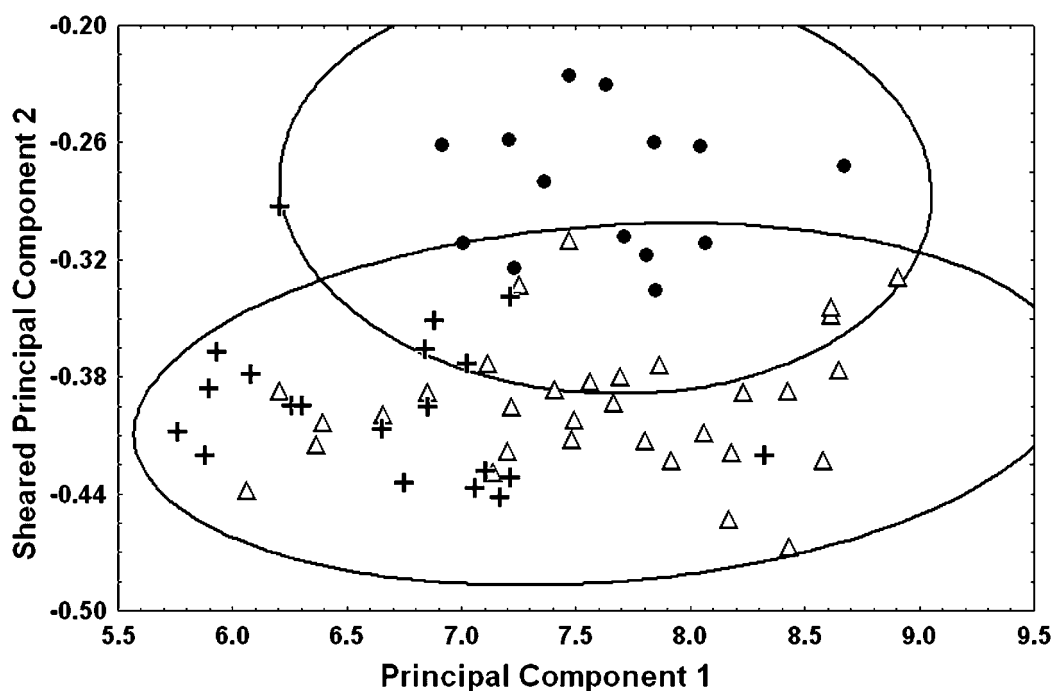


FIGURE 9. Scatter plot of sheared principal component 2 vs. principal component 1 among populations of *B. collettei*: Río Caura, type locality (crosses), N=14; Río Iguapo (circles) N=20 ; Río Miamo (triangles) N=32. Each symbol represents at least one specimen. 99% confidence limits are shown.

Comparative material of *Bryconops caudomaculatus*.

Holotype: BMNH 1852.9.13.74, South America, Zoological Society of London.

Nontype material: All material from Guyana (formerly British Guiana), Essequibo Drainage: ANSP 176611 (11 specimens), ANSP 176617 (11); FMNH 69762 (122); FMNH 52943 (3); FMNH 52944 (2); FMNH 52945 (1); FMNH 52946 (26); FMNH 52947 (2); FMNH 52948 (26); FMNH 52949 (1); FMNH 52950 (6); FMNH 52951 (1); FMNH 52952 (3); FMNH 69624 (23); FMNH 69625 (4); FMNH 69696 (5); FMNH 7443 (2); FMNH 7448 (1); FMNH 7449 (5); FMNH 7450 (1); FMNH 7553 (1); FMNH 81642 (25); INHS 49391 (1); INHS 49509 (8); UMMZ 216145 (5).

Artificial key to the species of *Bryconops*

- 1 Posterior extension of maxilla not reaching junction of second and third infraorbital bones. Border between second and third infraorbital bones leaving a small naked triangle between them. Maxilla without teeth, rarely a single small conical tooth, usually on just one side (subgenus *Bryconops*) 2
- Posterior extension of maxilla reaching junction of second and third infraorbital bones. Ventro-posterior margin of second infraorbital squared-off, forming a complete border with third infraorbital, without naked area between them. Maxilla with one to three teeth on both sides (subgenus *Cretochanes*) 7
- 2 Snout pointed slightly. Lower jaw included in upper jaw when closed. Premaxillary teeth generally in three rows. Caudal fin with yellow in life on both dorsal and ventral portions, lacking any ocellus; posterior margin dusky to dark. Anal fin long with 32–37 branched rays. Pored lateral line scales 57–61. Scales above lateral line 9–10. Scales below lateral line 5–6.....*B. alburnoides*
- Snout blunt and rounded. Lower jaw terminal or only slightly included in upper jaw. Premaxillary teeth generally in two rows. Caudal fin with well formed ocellus on dorsal lobe, intense red in life (clear in preserved material); remainder of fin dark to dusky. Anal fin with 22–30 branched rays. Pored lateral line scales 9–43. Scales above lateral line 7–8. Scales below lateral line 4–5..... 3
- 3 Pored lateral line scales >36, extending beyond base of last anal fin ray 4
- Pored lateral line scales <31, not extending to base of last anal fin ray 6
- 4 Pored lateral scales reaching end of hypural plate. Ocellus on dorsal lobe of caudal fin well-formed, completely filled with red color. Clear area at base of ventral lobe of caudal fin with red color *B. caudomaculatus*
- Pored lateral scales extending 2–3, rarely 1, scales beyond hypural plate onto caudal fin rays. Ocellus on dorsal lobe of caudal fin irregular or diffuse, only upper half filled with red color. Without red color in ventral lobe of caudal fin 5
- 5 Snout length 5.8–8.0% SL (mean 6.8%). Length of anal fin base 24.8–27.9% SL

- (mean 26.6%). Lateral scales 41–44, modally 42. Pored lateral scales 43–47, modally 44–45. Total vertebrae 40–42, modally 41–42. Gill rakers on lower arch, 8–10, modally 9 *B. magoi*, n. sp.
- Snout length 4.2–5.4% SL (mean 4.7%). Length of anal fin base 27.3–29.8% SL (mean 28.8%). Lateral scales 42 – 45, modally 44. Pored lateral scales 44– 48, modally 47. Total vertebrae 42–44, modally 43. Gill rakers on lower arch, 8–11, modally 11 *B. collettei*, n. sp.
- 6 Pored lateral line scales not extending beyond second or third branched anal fin rays, 9–23 pored scales. Branched anal fin rays 26–28 *B. disruptus*
- Pored lateral line scales extending beyond third branched anal fin ray, 30 pored scales. Branched anal fin rays 25 *B. durbini*
- 7 Humeral mark(s) present 8
- Humeral mark(s) absent 10
- 8 Two humeral marks. Dark to dusky pigment obscuring the caudal peduncle from over the middle of the anal-fin base onto the central part of the caudal fin. Caudal fin dusky without ocelli on either lobe. Body metallic blue in life *B. inpai*
- Single humeral mark. Caudal peduncle not obscured by pigment. Caudal fin with ocellus on dorsal lobe. Body silver to olivaceous in life 9
- 9 Scales below lateral line 4–5. Gill rakers on the lower limb of first arch 10–11. Caudal peduncle least depth 6.6–10.2 % SL (mean 8.0 % SL). Upper jaw length 11.8–16.9 % SL (mean 14.5 % SL) *B. humeralis*
- Scales below lateral line 6. Gill rakers on lower limb of first arch 9–10. Caudal peduncle least depth 9.2–11.1 % SL (mean 10.0 % SL). Upper jaw length 15.2–20.6 % SL (mean 16.9 % SL) *B. vibex*
- 10 Caudal fin with well developed ocellus on dorsal lobe 11
- Caudal fin pigmented but lacking a well formed ocellus 12
- 11 Caudal fin with almost symmetrical well-formed ocelli on both lobes *B. affinis*
- Caudal fin with only a single, well-formed ocellus on the dorsal lobe *B. giacopinii*
- 12 Caudal fin with prominent black stripe, width almost equal to the pupil, asymmetrically from the central fin rays onto the dorsal lobe; remainder of fin clear to lightly pigmented and with dusky margin. Outer teeth on premaxilla 3–6, modally 4. Precaudal vertebrae 17–18. Anal fin originates under 17th–18th centrum *B. melanurus*
- Darkened central caudal rays not principal pigment pattern on fin; wide stripe absent. In life, caudal fin either completely blackened or carmine red with dusky posterior margin. In preservation, caudal fin with black striations along all fin rays. Outer teeth on premaxilla 4–6, modally 5. Precaudal vertebrae 18–20. Anal fin originates under 19th–20th centrum, rarely 18th centrum 13
- 13 Caudal fin principally black with some red suffused among outer 3–4 principal rays of both lobes. Anal fin with broad prominent black stripe along entire base of fin. Cheek with conspicuous blotch of pigment. Lower lobe of caudal fin longer than upper lobe

- *B. colanegra*
- Caudal fin completely carmine red. Anal fin with pigment along fin rays, not in membranes, not forming prominent wide stripe along entire length of fin. Cheek lacking conspicuous blotch of pigment. Upper lobe of caudal fin longer than lower lobe ... 14
 - 14 Circumdorsal scales 14–16, modally 15. Maxilla reaching articulation of second and third infraorbitals. Third infraorbital contacting preopercle at angle..... *B. colaroja*
 - Circumdorsal scales 17–19, modally 17. Maxilla not reaching articulation of second and third infraorbitals. Third infraorbital not contacting preopercle at angle
-*B. imitator*

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