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A taxonomic review of the species of *Charax* Scopoli, 1777 (Teleostei: Characidae: Characinae) with description of a new species from the rio Negro bearing superficial neuromasts on body scales, Amazon basin, Brazil

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The species of *Charax* were reviewed by Lucena (1987) who a little later (1989) added three new species to the genus. Examination of recently collected specimens from museum collections documented the more extensive geographic distribution for most species and revealed the existence of a new species in which superficial neuromasts were discovered and are herein described. These skin structures were also detected in *C. metae* Eigenmann, 1922. Anal- and pelvic-fin hooks previously observed only on the anal-fin of one species of the genus are described herein in some other species. *Charax unimaculatus* Lucena is considered a junior synonym of *C. michaeli* Lucena. All the species are redescribed and the new species described.

As espécies de *Charax* foram revistas por Lucena (1987), que pouco depois (1989) acrescentou três espécies novas ao gênero. O exame de exemplares recentemente coletados e depositados em coleções de vários museus possibilitaram a extensão da distribuição geográfica da maioria das espécies e revelou a existência de uma espécie nova, na qual foram descobertos neuromastos superficiais, caracterizados neste trabalho. Estas estruturas da pele também foram detectadas em *Charax metae* Eigenmann, 1922. Ganchos das nadadeiras anal e pélvica, anteriormente observados apenas na nadadeira anal de uma das espécies do gênero, são agora descritos em algumas outras espécies. *Charax unimaculatus* Lucena é considerada sinônimo júnior de *C. michaeli* Lucena Todas as espécies são redescritas, juntamente com a descrição da espécie nova.

Key words: Freshwater fishes, Neotropical, Ostariophysi, Systematics.

Introduction

The name *Charax* was introduced in the ichthyological literature as a valid genus by Eigenmann (1910: 444) who designated *Salmo gibbosus* Linnaeus, 1758 its type species, thus making *Characinus* Lacépède, 1803, *Epicyrtus* Müller & Troschel, 1845 and *Anacyrtus* Günther, 1864 previously used to include *gibbosus* and other species subsequently described, objective synonyms (Travassos, 1951: 137). *Charax* also appeared as a nomenclaturally invalid name (Gronow, 1768: 123) and its first nomenclaturally correct usage is credited to Scopoli (1777: 455) although without type species designation and no species mentioned. *Charax* was included by Eigenmann (1910) along with *Asiphonichthys* Cope (1784) and some other genera in the Characinae and listed nine species under *Charax*, six of which are now considered to belong in *Cynopotamus* Valenciennes, 1849 (see Menezes, 1976). By doing so, Eigenmann not only accepted but also modified Günther's (1864) definition of *Anacyrtus* for *Charax* based on presence of a single tooth row on the dentary, no external teeth on the jaws, and premaxillary teeth arranged in confluent series. Eigenmann (1912) considered *Charax* distinct from *Cynopotamus* and characterized the first genus by some morphological features including for the first time the peculiar shape of the cleithrum "… which end in a spine in front and behind". This last character would be used by Lucena (1987) as an exclusive feature shared by all the species of *Charax* and in this same paper included *Asiphonichthys*, thought by Géry & Knoppel (1976) to be close to *Charax*, and *Moralesia* in the synonymy of *Charax*. Thus, according to Lucena (1987) a deep concavity on the latero-ventral portion of the cleithrum originating a relatively long posterior spiniform projection

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extending below pectoral-fin base and an anterior shorter process oriented straight forward or inclined or bent laterally (Lucena, 1987: 68, figs. 15; 69, fig. 16) would support the monophyly of *Charax*.

More recently when attempting to phylogenetically define the genus *Roeboides*, Lucena (1998) noticed that some species of this genus have the cleithrum configuration similar to that of *Charax* and reinterpreted the phylogenetic condition of various state characters associated with the involved features. *Charax* was then redefined by two exclusive synapomorphies: (1) posteroventral portion of cleithrum with a well-developed notch originating as a posterior bony projection extending beyond the base of first pectoral-fin ray and (2) the acute posterior bony projection. Mirande (2010) and Oliveira *et al.* (2011) aiming at more inclusive phylogenetic definitions of the Characidae using morphological and molecular data respectively, included only one species of *Charax* in their analysis of intra characid relationships of this genus with other characid members. In both cases, the features used to characterize the one species representing the genus cannot be extrapolated to remaining congeners. The morphological study of Mattox & Toledo-Piza (2012) focused on the phylogenetical redefinition of the Characinae included four species of *Charax* species and their character analysis corroborated Lucena's previous findings about the shape of the cleithrum (1 above) as an exclusive derived feature of the genus which was also characterized by three additional putative synapomorphies.

After Lucena's revisionary studies (1987) and description of new species (1989) specimens of *Charax* from previously unsurveyed areas were incorporated into museum collections. Examination of these specimens provided information that substantially increased the geographic distribution and allowed better characterization of the known species and revealed the existence of an undescribed species.

In the present paper all the *Charax* species are redescribed, the new species described and the relationships of the genus with other members of the Characinae are briefly discussed. *Charax unimaculatus* previously considered a valid species is placed in the synonymy of *C. michaeli*.

Material and Methods

Methods for taking measurements and counts are described in Fink & Weitzman (1974), Lucena (1987, 1989) and Menezes (2006). The number of scale rows from the pelvic-fin origin to the lateral line was also included and the number of vertebrae includes the terminal "half centrum" but not the four vertebrae of the Weberian apparatus. Gill rakers were counted on the lower limb (including the gill raker at the junction of the epibranchial cartilage and the ceratobranchial) of the first branchial arch on the left side of the specimens and included were not only well-developed elements, but also stubs representing rudimentary gill rakers. Such structures are included in the counts only when they can be clearly recognized as a movable rudiment attached to the gill arch. The number of scale rows from the dorsal-fin origin to the lateral line is not included for the species not having scales on dorsalmost part of the body. There is a small naked area anterior to dorsal-fin origin in all the specie so that in all scale counts using the origin of the dorsal fin as a reference, the uppermost scale is actually that adjacent to the base of the first unbranched dorsal-fin ray. Counts of predorsal scales are very difficult to be done accurately because the scales are not regularly arranged. The scales on the dorsal part of the body in most species are considerably smaller than the remaining scales, but relatively accurate data can be obtained by counting the scales between the uppermost left and right adjacent scale rows from the tip of the supraoccipital spine to the origin of the dorsal fin, including the scales adjacent to the small predorsal naked area. The character was used only when the differences between the species was of large magnitude. In order to be as accurate as possible in counting the number of scale rows from the dorsal-fin origin to lateral line, it is necessary to dry out the specimen and to count longitudinal rows, not individual scales. Because the scales on the anterior dorsalmost part of the body are smaller, the rows of scales on this region are difficult to distinguish. The number of transverse scale rows between the humeral spot and the supracleithrum was counted from the anteriormost point on the anterior edge of the spot. The humeral spot distance was measured from the tip of the snout to the posteriormost point on the posterior edge of the spot. Since teeth on the premaxilla are not regularly arranged to allow the recognition of internal and external rows, only the total number of premaxillary teeth is given. Anterior dentary teeth is the number of small conical teeth between the two caniniform teeth anteriorly located on the lower jaw and posterior dentary teeth are those posterior to the second caniniform tooth. In most species with ectopterygoid teeth these are found on both ectopterygoids, but in some they occur solely on the left or the right bone; the teeth are sometimes anteriorly clustered and the count includes all teeth on the bone.

Meristic data are included in the species descriptions and the range of meristic characters is presented first, followed in parentheses by counts of the holotype for the new species described and the mean of the sample. All measurements were made point to point with digital calipers and recorded to tenths of a millimeter. Data pertaining to humeral spot distance were not considered for *Charax stenopterus* in which the spot is inconspicuous or even absent is some specimens.

In species where fin rays are damaged they were included via Adobe Photoshop in all species illustrations, but fin-ray counts have been kept accurate.

Data from specimens examined by Lucena (1987, 1989) are included in the tables, diagnoses, descriptions and distributions of the species.

The institutions from which the specimens studied by Lucena (1987, 1989) originated are not listed again. Additional specimens studied are from the following institutions:

Instituto de Investigación de Recursos Biológicos Alexander Von Humboldt, Colômbia (IAvH-P); Museo de Historia Natural de la Universidad Mayor de San Marcos, Lima, Peru (MUSM); California Academy of Sciences (CAS); Laboratório de Ictiologia, Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto, Universidade de São Paulo, Ribeirão Preto (LIRP); Universidade Federal do Tocantins, Porto Nacional (UNT). Other abbreviations: SL - Standard length; C&S - cleared and stained.

Charax **Scopoli, 1777**

"*Charax*" Gronow, 1763: 123 (Non-binominal nomenclature, article 5 of the International Code of Zoological Nomenclature).

Charax Scopoli, 1777: 445 (type species: *Salmo gibbosus* Linnaeus, 1758, by subsequent designation of Eigenmann, 1910: 444).

Characinus Lacépède, 1803: 269 (type species: *Salmo gibbosus* by subsequent designation of Jordan, 1917: 66.

Epicyrtus Müller & Troschel, 1844: 92 (type species: *Salmo gibbosus*, by monotypy).

Anacyrtus Günther, 1864: 345 (new name to replace *Epicyrtus* Müller & Troschel, preoccupied in Insecta, Dejean, 1833. Type species: *Salmo gibbosus*, by original designation).

Asiphonichthys Cope, 1894: 67 (type species: *Asiphonichthys stenopterus* Cope, by monotypy).

Moralesia Fowler, 1943: 36 (type species: *Anacyrus tectifer* Cope, 1870, by original designation).

Charaxodon Fernandez-Yepez, 1947: 1 (type species: *Charax metae* Eigenmann, 1922, by original designation).

Moralesicus Fowler, 1958: 9 (type species: *Anacyrtus tectifer* Cope, 1870, by original designation. Name erroneously proposed to replace *Moralesia* Fowler).

Diagnosis. In a recent phylogenetic analysis of characters of the genera of the Characinae, Mattox & Toledo-Piza (2012) demonstrated that *Charax* is the sister-group of *Roeboides*, with the exclusive members of the tribe Characini. *Charax* can be distinguished not only from *Roeboides*, but from all other characid genera by the presence of a notch on the posteroventral portion of the cleithrum originating a posteriorly directed spiniform projection (Lucena, 1987: 68, figs. 15; 69, fig. 16). This uniquely derived synapomorphy used in combination with the following non-exclusive characters are useful for diagnosing *Charax*.

1 - Rhinosphenoid absent (Mattox & Toledo-Piza, 2012: 837, fig. 17A).

2 - Anterodorsal branch of laterosensory canal absent on infraorbital 6 (Mattox & Toledo-Piza, 2012: 841, fig. 19A).

3 - Jaws without external teeth.

4 - Humeral dark blotch present, inconspicuous in *Charax stenopterus* and closer to vertical through dorsal-fin origin than to posterior border of opercle in some species.

Key to species of *Charax*

1a. Lateral line incomplete, represented by anterior short segment; dorsal region of body anterior to dorsal fin origin lacking scales 2

1b. Lateral line complete, perforated scales extending to base of caudal fin; dorsal region of body anterior to dorsal fin origin entirely covered with scales, except for small predorsal naked area 3

2a. Scale rows from pelvic-fin origin to lateral line 6-9 4

2b. Scale rows from pelvic-fin origin to lateral line 11-12 ..... *Charax hemigrammus*

3a. Perforated scales on lateral line 42-44; 12 scale rows around caudal peduncle ..... *Charax rupununi*

3b. Perforated scales on lateral line 50-65; 15-22 scale rows around caudal peduncle 5

4a. Ectopterygoid teeth present; 30-41 teeth on posterior dentary row ..... *Charax condei*

4b. Ectopterygoid teeth absent; 18-28 teeth on posterior dentary row ..... *Charax stenopterus*

5a. Anal-fin origin along or slightly posterior to,vertical through origin of dorsal fin; ectopterygoid teeth always present 6

5b. Anal-fin origin always anterior to vertical through origin of dorsal fin; ectopterygoid teeth absent (except in some specimens of *Charax gibbosus*) 8

6a. Superficial neuromasts absent on body; 9-10 gill rakers on lower branch of first gill arch ..... *Charax tectifer*

6b. Superficial neuromasts present, especially visible on trunk scales (Figs. 1 and 2); 7-9 (rarely 9) gill rakers on lower branch of first gill arch 7

7a. Total number of ectopterygoid teeth 20-50; humeral spot distance 41.6-47% of SL (Fig. 3); 7-9 transverse scale rows between humeral spot and supracleithrum ..... *Charax metae*

7b. Total number of ectopterygoid teeth 3-15; humeral spot distance 48-51% of SL (Fig. 3) ; 10-12 transverse scale rows between humeral spot and supracleithrum ..... *Charax delimai*

8a. Orbital diameter 25-28.5% of head length (Fig. 4) 9

8b. Orbital diameter 30.1-38.4% of head length (Fig. 4) 10

9a. Snout length 20.3-22.8% of head length (Fig. 5); 16-17 scale rows from dorsal-fin origin to lateral line; 9-13 scale rows from anal-fin origin to lateral line ..... *Charax caudimaculatus*

9b. Snout length 24.3-26.3% of head length (Fig. 5); 18-19 scale rows from dorsal-fin origin to lateral line; 14-17 scale rows from anal-fin origin to lateral line ..... *Charax notulatus*

10a. Scale rows around caudal peduncle 20-22 11

10b. Scale rows around caudal peduncle 16-19 12

11a. Perforated scales on lateral line 54-62 ..... *Charax apurensis*

11b. Perforated scales on lateral line 63-65 ..... *Charax macrolepis*

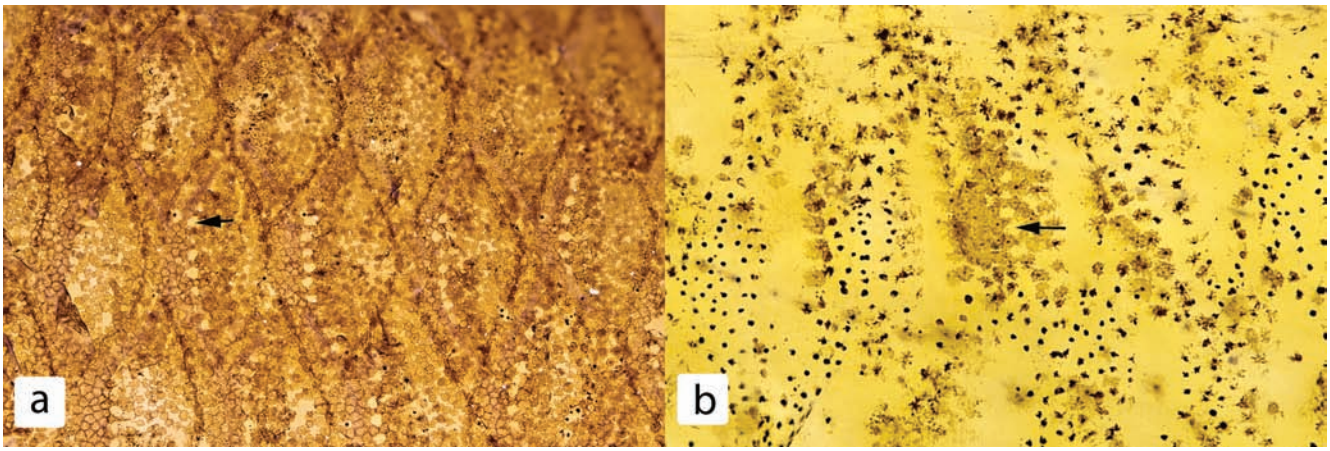

Fig. 1. Superficial neuromasts (black arrows) on lateral body scales of *Charax delimai*, male (a), MZUSP 81325, paratype, 102 mm SL, Brazil, Amazonas, igarapé Umari, tributary of rio Tiquié in community of São Pedro and female, (b), MZUSP 84988, paratype, 102 mm SL, Brazil, Amazonas, near old community of São Pedro.

Fig. 2. Superficial neuromasts (black arrow) on ventral body scales of *Charax metae*, CAS 69117, 59 mm SL.

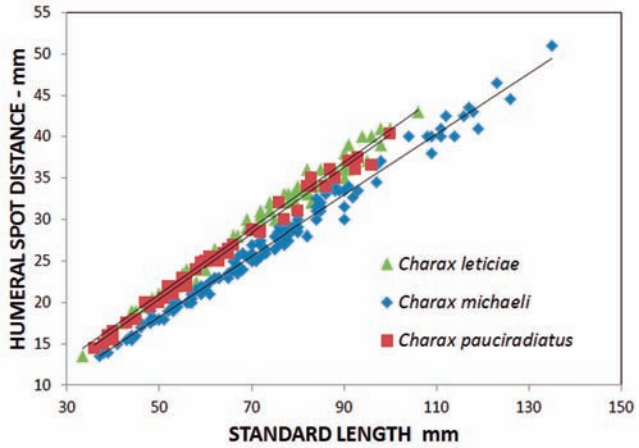

Fig. 3. Humeral spot distance as a function of standard length for species of *Charax*.

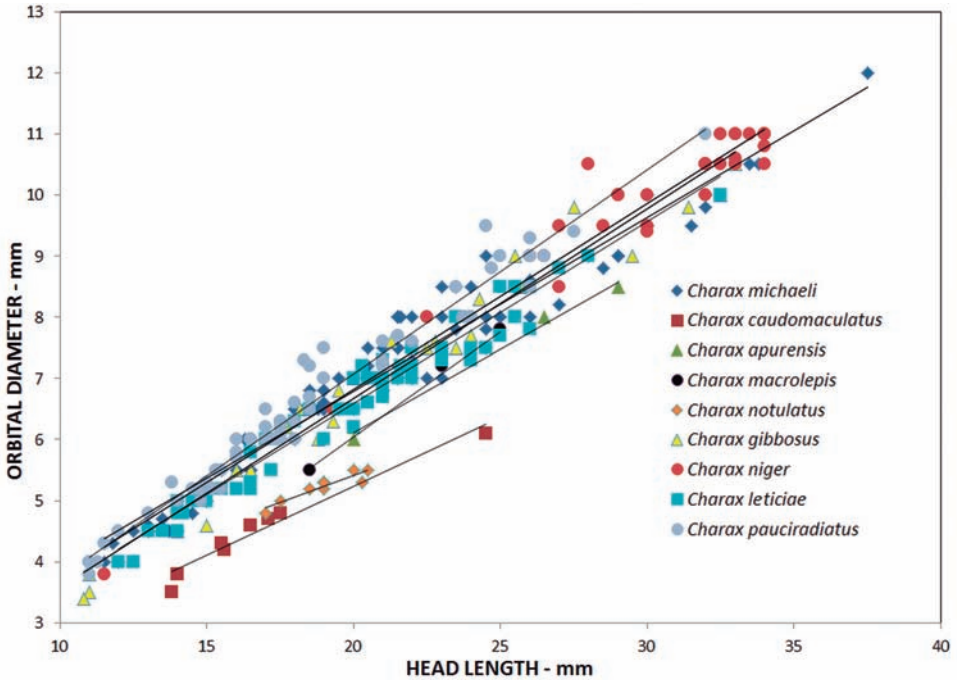

Fig. 4. Orbital diameter as a function of head length for species of *Charax*.

12a. Humeral spot distance 34.7-37.8% of standard length (Fig. 3); 4-6 transverse scale rows between humeral spot and supracleithrum 13
12b. Humeral spot distance 38-44% of standard length (Fig. 3); 8-10 transverse scale rows between humeral spot and supracleithrum 14
13a. Scale rows from dorsal-fin origin to lateral line 18-20 ..... *Charax michaeli*
13b. Scale rows from dorsal-fin origin to lateral line 15-16 ... 15
14a. Scale rows from dorsal-fin origin to lateral line 3-14 .....*Charax pauciradiatus*
14b. Scale rows from dorsal-fin origin to lateral line 16-18 ..... *Charax leticiae*
15a. Predorsal scales 38-45; ectopterygoid teeth present in most specimens examined ..... *Charax gibbosus*
15b. Predorsal scales; ectopterygoid teeth absent in all specimens examined 52-68 ..... *Charax niger*

Charax apurensis Lucena, 1987
Fig. 6

Charax apurensis Lucena, 1987: 30 (original description, type locality: Venezuela, Estado Apure, road San Fernando to Cunaviche, río el Canito); -Vari & Howe, 1991: 13 (listed in type catalog). -Provenzano *et al.*, 1998: 5 (listed in type catalog). -Lucena, 1987: 30 (diagnosis; description; comparisons; distribution; etimology). -Lucena, 1989: 104 (in key to species). -Lucena & Menezes, 2003: 201 (maximum length; distribution).

Diagnosis. *Charax apurensis* is included to the group of *Charax* species with relatively larger orbital diameters (30.1-38.4% of head length, Fig. 4) that can be distinguished from *C. caudimaculatus* and *C. notulatus* that have smaller orbital diameters (25-28.5% of head length). Among the species having larger orbital diameters, *C. apurensis* differs from *C. michaeli*, *C. pauciradiatus*, *C. gibbosus*, *C. niger*, and *C. leticiae*, except *C. macrolepis* by having 20-21 (*vs.* 16-19) scale rows around the caudal peduncle. *Charax apurensis* differs from *C. macrolepis* by having 54-62 perforated scales along the lateral line (*vs.* 63-65). It can be distinguished from *C. hemigrammus*, *C. condei*, and *C. stenopterus* by having the lateral line complete (*vs.* lateral line incomplete), and from *C. rupununi* by the number of scales around the caudal peduncle (21 *vs.* 12). *Charax apurensis* differs from *C. tectifer*, *C. metae*, and *C. delimai* by having the anal-fin origin always anterior to the vertical through the dorsal-fin origin (*vs.* anal-fin origin on the vertical, or slightly posterior to, the dorsal-fin origin) and ectopterygoid teeth absent (*vs.* ectopterygoid teeth present).

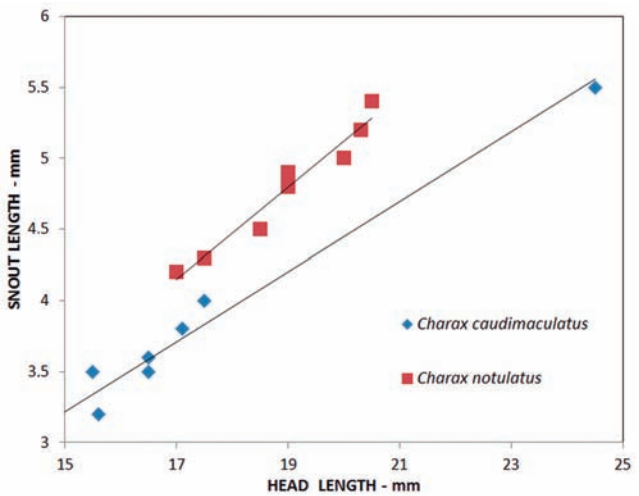

Fig. 5. Snout length as a function of head length for *Charax caudimaculatus* and *C. notulatus*.

Description. Morphometrics of examined specimens presented in Table 1. Body elongate, moderately large compared to congeners (68-104 mm SL), compressed and moderately deep. Greatest body depth slightly in advance of dorsal-fin origin. Dorsal head with body profile slightly convex on tip of snout, straight from posterior border of posterior nostril to vertical through posterior border of pupil, slightly concave from that point to base of supraoccipital spine, strongly convex from that point to dorsal-fin origin, nearly straight along dorsal-fin base and from end of dorsal-fin base to caudal peduncle and slightly concave along caudal peduncle. Ventral profile of head and body convex from tip of lower jaw to anal-fin origin, nearly straight along anal-fin base and slightly concave from end of anal-fin base to beginning of procurrent rays. Snout pointed. Lower jaw included in upper jaw when mouth closed. Maxilla extending slightly beyond vertical through posterior border of orbit.

Dorsal-fin rays ii, 8-9, 8.9; posteriormost ray unbranched. Adipose fin present. Unbranched anal-fin rays iv, branched rays 41-50, 46.5. Pectoral-fin rays i,13-15, 14. Tips of longest pectoral-fin rays almost reaching vertical through anal-fin origin. Pelvic-fin rays i,7. Longest pelvic-fin rays reaching slightly beyond anal-fin origin in mature females 93 and 104 mm SL. Principal caudal-fin ray count 10/9 in all specimens.

Lateral line complete; perforated scales 54-62, 58.8. Horizontal scale rows from dorsal-fin origin to lateral line 19-20, 19.5. Horizontal scale rows from pelvic-fin origin to lateral lateral line 11-12, 11.2. Horizontal scale rows from anal-fin origin to lateral line 14-19, 16.2. Predorsal scales 55-70, 62.2. Scale rows around caudal peduncle 21 in all specimens. One scale row extending on both sides for about ¾ of anal-fin base slightly beyond middle of anal-fin base.

Premaxillary with one anterior canine-like tooth followed by a set of smaller conical teeth and another canine-like tooth followed by one or two small conical teeth. Total number of premaxillary teeth 12-14, 13. Maxillary teeth conical, 62-70, 65.5, larger specimens in general with higher counts. Dentary with one canine-like tooth followed by 4-6, 4.5 conical teeth, another canine-like tooth and a

Fig. 6. *Charax apurensis*, MZUSP 110669, female, 104 mm SL.

posterior row of 27-34, 29.2 conical teeth. Vertebrae 33 and 34 in two specimens. Seven to 9, 8.3 gill-rakers on lower limb of first gill-arch. Branchiostegal rays 4; 3 rays originating from anterior ceratohyal and 1 from posterior ceratohyal

Color in alcohol. Body pale to light yellow, slightly darker dorsally due to more dense concentration of dark chromatophores. Ventral portion of body lighter with scattered dark chromatophores especially anteriorly. Irregularly shaped dark blotch at humeral region encompassing 5 scales of longitudinal rows and 4 scales of transverse rows. Dorsal part of head, snout and tip of lower jaw darker than remaining portions of head. Dark coloration extending to anterior upper portion of maxilla and first, second and left marginal portion of third infraorbitals. Opercle with scattered dark chromatophores. Faint dark stripe extending from posterodorsal part of humeral blotch to caudal base enlarged posteriorly in form of caudal blotch not extending to base of caudal-fin rays. Pectoral and pelvic fins hyaline with scattered dark chromatophores. Dorsal, caudal and anal fins hyaline with dark chromatophores especially concentrated on interradial membranes.

Distribution. *Charax apurensis* is known from tributaries of río Orinoco, Venezuela (Fig. 7)

Specimens examined. Venezuela: MZUSP 27947, 2, 63-93 mm SL, Guarico, lagoons W of Caño Falcón, not precisely located; MZUSP 40699, 1, 69 mm SL, Apure, estación Marisela, Caño Marisela, approximately 11 km from road San Fernando de Apure to Puerto Páez, not precisely located; MZUSP 27890, 1, 104 mm SL, Delta Amacuro, stream Guargapo, tributary of río Orinoco, approximately 8°51'N 61°26'W.

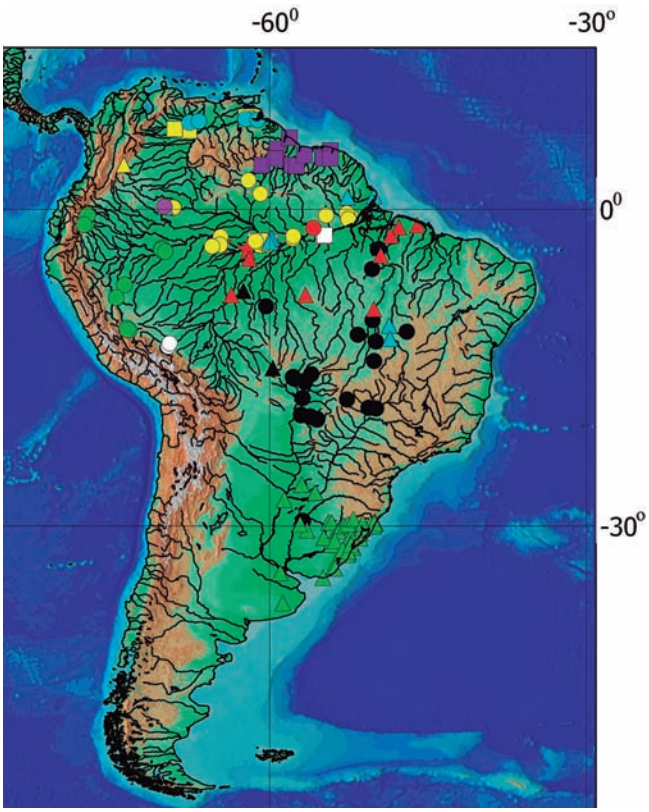

Fig. 7. Map of South America showing the collecting sites of the *Charax* species, and the type locality of *Charax delimai* (purple circle). *Charax apurensis* - yellow square; *C. caudimaculatus* - white circle; *C. condei* - white square; *C. gibbosus* - purple triangle; *C. hemigrammus* - red star; *C. leticiae* - black circle; *C. macrolepis* - black triangle; *C. metae* - yellow triangle; *C. michaeli* - yellow circle; *C. niger* - blue triangle; *C. notulatus* - blue circle; *C. pauciradiatus* - red triangle; *C. rupununi* - red circle; *C. stenopterus* - green triangle; *C. tectifer* - green circle. Some symbols may represent more than one locality.

Fig. 8. *Charax caudimaculatus*, USNM 236877, female, paratype, 95 mm SL, Peru, Madre de Dios, Reserva Nacional de Tambopata, Laguna Cocococha.

***Charax caudimaculatus* Lucena, 1987**
Fig. 8

Charax caudimaculatus Lucena, 1987: 32 (original description, type locality: Peru, Laguna Chica, Reserva Nacional de Tambopata, Madre de Dios, 12°50'30"S 69°17'30"W. -Vari & Howe, 1991: 13 (listed in type catalog). -Lucena, 1989: 104 (in key to species). -Chang & Ortega, 1995: 2 (Peru, listed). -Lucena & Menezes, 2003: 201 (maximum length; distribution). -Ortega *et al*., 2012: 35 (Peru, listed).

Table 1. Morphometrics of *Charax apurensis*. Specimens are from MZUSP 27947, 40699 and 27890.

Characters	n	Range	Mean	SD
Standard length	4	68.0 - 104.0	83.5	
Percents of standard length				
Depth at dorsal-fin origin	4	37.7 - 38.5	38.1	0.3
Snout to dorsal-fin origin	4	51.4 - 53.7	52.7	1.2
Snout to pectoral-fin origin	4	27.0 - 29.0	28.1	0.9
Snout to pelvic-fin origin	4	35.5 - 36.7	36.0	0.6
Snout to anal-fin origin	4	49.2 - 51.4	50.3	1.1
Caudal peduncle depth	4	8.0 - 9.6	9.0	0.8
Caudal peduncle length	4	5.8 - 7.0	6.5	0.5
Pectoral-fin length	4	20.2 - 21.5	21.0	0.6
Pelvic-fin length	4	21.5 - 24.0	22.6	1.1
Dorsal-fin base length	4	11.6 - 12.7	12.2	0.5
Dorsal-fin height	2	29.0 - 31.8	30.4	2.0
Anal-fin base length	4	50.7 - 51.6	51.2	0.4
Eye to dorsal-fin origin	4	39.1 - 42.0	40.7	1.2
Dorsal-fin origin to caudal-fin base	4	53.0 - 54.3	53.7	0.6
Humeral spot distance	4	40.8 - 42.0	41.4	0.7
Bony head length	4	27.8 - 29.7	28.7	0.6
Percents of head length				
Horizontal eye diameter	4	29.3 - 31.5	30.1	0.7
Snout length	4	24.5 - 25.8	25.1	0.5
Least interorbital width	4	22.5 - 24.1	23.2	0.7
Upper jaw length	4	62.0 - 62.5	62.3	0.2

Diagnosis. *Charax caudimaculatus* and *C. notulatus* differ from *C. apurensis*, *C. macrolepis*, *C. michaeli*, *C. pauciradiatus*, *C. gibbosus*, *C. niger*, and *C. leticiae* by having the orbital diameter 25.0-28.5% of head length (*vs.* 30.1-38.4% of head length, Fig. 4), and differ among themselves in the snout length (20.3-22.8% in *C. caudimaculatus vs.* 24.3-26.3% in *C. notulatus*, Fig. 5), the number of scale rows from the dorsal-fin origin to the lateral line (16-17 *vs.* 18-19), and the number of scale rows from the anal-fin origin to the lateral line (9-13 *vs.* 14-17). *Charax caudimaculatus* can be distinguished from *C. hemigrammus*, *C. condei*, and *C. stenopterus* by having the lateral line complete (*vs.* lateral line incomplete), and from *C. rupununi* by the number of scales around the caudal peduncle (16-17 *vs.* 12). *C. caudimaculatus* differs from *C. tectifer*, *C. metae*, and *C. delimai* by having the anal-fin origin always anterior to the vertical through the dorsal-fin origin (*vs.* anal-fin origin on the vertical or slightly posterior to, the dorsal-fin origin) and ectopterygoid teeth absent (*vs.* ectopterygoid teeth present).

Description. Morphometrics of specimens examined presented in Table 2. Body elongate, moderately large compared to congeners (31-123 mm SL), compressed and moderately deep. Greatest body depth slightly in advance of dorsal-fin origin. Dorsal of head and body profile slightly convex along tip of snout, straight from posterior border of posterior nostril to vertical crossing posterior border of pupil, slightly concave from that point to base of supraoccipital spine, strongly convex from that point to dorsal-fin origin, nearly straight along dorsal-fin base and from end of dorsal-fin base to caudal peduncle and slightly concave along caudal peduncle. Ventral profile of head and body convex from tip of lower jaw to anal-fin origin, nearly straight along anal-fin base and slightly concave from end of anal-fin base to beginning

of procurrent rays. Snout pointed. Lower jaw included in upper jaw when mouth closed. Maxilla extending posteriorly slightly beyond vertical through posterior border of pupil.

Dorsal-fin rays ii, 9 in all specimens; posteriormost ray unbranched. Adipose fin present. Unbranched anal-fin rays iv or v, usually iv, branched rays 46-54, 50.6. Pectoral-fin rays i, 13-15, 13.5. Tips of longest pectoral-fin rays extending to, or slightly beyond, anal-fin origin. Pelvic-fin rays i, 7. Tips of longest pelvic-fin rays reaching vertical between bases of sixth or seventh anal-fin rays. Principal caudal-fin ray count 10/9 in all specimens.

Lateral line complete, perforated scales 51-56, 53.2. Horizontal scale rows from dorsal-fin origin to lateral line 16-17, 16.2. Horizontal scale rows from pelvic-fin origin to lateral line 9-11, 10. Horizontal scale rows from anal-fin origin to lateral line 9-13, 11.8. Predorsal scales 47-55, 50.6. Scale rows around caudal peduncle 16-17, 16.6. One scale row extending along anal-fin base to slightly beyond middle of fin base.

Premaxillary with one anterior canine-like tooth followed by set of smaller conical teeth and another canine-like tooth followed by one or two small conical teeth. Total number of premaxillary teeth 9-12, 13.6. Maxillary teeth conical, 58-78, 61, larger specimens in general with higher counts. Dentary with one canine-like tooth followed by 4-5, 4.4 conical teeth, another canine-like tooth and posterior row of 24-30, 27.1 conical teeth.

Vertebrae 33 and 34 in two specimens. Eight to 9, 8.5 gill-rakers on lower limb of first gill-arch. Branchiostegal rays 4; 3 rays originating from anterior ceratohyal and 1 from posterior ceratohyal.

Color in alcohol. Body pale to light yellow, slightly darker dorsally due to denser concentration of dark chromatophores. Ventral region of body lighter with scattered dark chromatophores especially anteriorly. Irregularly shaped vertically elongate, dark blotch on humeral region extending about 3 scales horizontally and 5 to 6 scales vertically. Blotch darker on lower half due to denser concentration of dark chromatophores. Dorsal part of head, snout and tip of lower jaw darker than remainder of head; dark coloration extending to anterodorsal portion of maxilla and first, second and anterior portion of third infraorbitals. Dorsal part of opercle and preopercle and fifth and sixth infraorbitals with scattered dark chromatophores. Diamond shaped dark blotch on caudal-fin base extending onto base of median caudal-fin rays. Patch of dark chromatophores over posterior portion of middle caudal fin. Pectoral and pelvic fins hyaline with scattered dark chromatophores. Caudal and anal fins hyaline with small dark chromatophores especially concentrated on posterior portions of interradial membranes. Same pattern on dorsal fin, but dark chromatophores inconspicuous, except on first dorsal-fin ray. Pelvic fins hyaline with scattered dark chromatophores.

Table 2. Morphometrics of *Charax caudimaculatus*. Specimens are from USNM 236877

Characters	n	range	mean	SD
Standard length	9	52.5 - 90.6	64.6	
Percents of standard length				
Depth at dorsal-fin origin	9	35.8 - 38.1	36.7	0.9
Snout to dorsal-fin origin	9	50.2 - 53.0	51.1	0.9
Snout to pectoral-fin origin	9	26.1 - 27.6	26.7	0.5
Snout to pelvic-fin origin	9	31.8 - 34.8	33.4	0.8
Snout to anal-fin origin	9	43.6 - 46.4	45.6	0.9
Caudal peduncle depth	9	5.7 - 6.7	6.2	0.4
Caudal peduncle length	9	5.0 - 6.4	5.5	0.4
Pectoral-fin length	9	18.1 - 21.0	19.6	0.9
Pelvic-fin length	9	20.0 - 21.5	20.8	0.6
Dorsal-fin base length	9	10.3 - 11.0	10.8	0.4
Dorsal-fin height	5	24.0 - 26.7	25.7	1.0
Anal-fin base length	9	52.0 - 54.7	53.0	0.8
Eye to dorsal-fin origin	9	38.4 - 40.7	39.6	0.8
Dorsal-fin origin to caudal-fin base	9	53.3 - 55.4	54.4	0.9
Humeral spot distance	9	35.6 - 37.8	37.3	0.9
Bony head length	9	24.3 - 27.0	26.0	0.7
Percents of head length				
Horizontal orbital diameter	9	25.0 - 27.8	27.0	1.1
Snout length	9	20.3 - 22.8	21.7	0.8
Least interorbital width	9	19.2 - 20.6	20.4	0.7
Upper jaw length	9	54.5 - 57.5	54.8	0.5

Distribution. Examined specimens of *Charax caudimaculatus* originated from the Reserva Nacional de Tambopata, Madre de Dios, Peru (Fig. 7).

Specimens reexamined. Peru: USNM 236877, 9 paratypes, 52.5-90.5 mm SL, Madre de Dios, Reserva Nacional de Tambopata, Laguna Cocococha, 12°49'S 69°30'W.

Charax condei (Géry & Knöpel, 1976)

Fig. 9

Asiphonichthys condei Géry & Knöppel, 1976: 48 (original description, type locality: Brazil, Amazonas, rio Tarumãzinho, tributary on left margin of lower rio Negro, above Manaus). -Weber, 1998: 6 (listed on type catalog).

Charax condei, Lucena, 1987: 37 (diagnosis; description; distribution, geographic variation). -Lucena, 1989: 104 (in key to species). -Lucena & Menezes, 2003: 201 (maximum length; distribution).

Diagnosis. *Charax condei* is distinguished from congeners except *C. hemigrammus* and *C. stenopterus* by having the lateral line incomplete and the dorsal part of body anterior to the dorsal fin lacking scales (*vs.* lateral line complete and dorsal part of body anterior to dorsal fin scaled in *Charax rupununi*, *C. tectifer*, *C. metae*, *C. delimai*, *C. caudimaculatus*, *C. notulatus*, *C. apurensis*, *C. macrolepis*, *C. michaeli*, *C. pauciradiatus*, *C. gibbosus*, *C. niger*, and *C. leticiae*). It has fewer scale rows from the pelvic-fin origin to the lateral line (6-9) than *C. hemigrammus* (11-12) and can be distinguished from *C. stenopterus* in having ectopterygoid teeth and 30-41 teeth on the posterior dentary tooth row (*vs.* ectopterygoid teeth absent and 18-28 teeth on the posterior dentary tooth row).

Description. Morphometrics of examined specimens presented in Table 3. Body elongate; small compared to congeners (26-51 mm SL), compressed and comparatively low;

Fig. 9. *Charax condei*, MZUSP 95229, female, 49 mm SL, Amazonas, Santa Isabel do Rio Negro, pond on bank of rio Negro.

greatest body depth slightly in advance of dorsal-fin origin. Dorsal profile of body and head convex from tip of snout to anterior part of fontanel, slightly concave from that point to base of supraoccipital spine, convex from that point to dorsal-fin origin, nearly straight along dorsal-fin base and from end of dorsal-fin base to caudal peduncle and slightly concave along caudal peduncle. Ventral profile of body and head from tip of lower jaw to anal-fin origin, nearly straight to slightly concave along anal-fin base and slightly concave from end of anal-fin base to beginning of procurrent rays. Snout pointed. Lower jaw included in upper jaw when mouth closed. Maxilla extending posteriorly slightly beyond vertical through middle of orbit.

Dorsal-fin rays ii, 9 in all specimens; posteriormost ray unbranched. Adipose fin present. Unbranched anal-fin rays iv or v, usually iv, branched rays 35-41, 37.8. Pectoral-fin rays i, 11-14, 12.2. Tips of longest pectoral-fin rays reaching vertical through middle of pelvic-fin length. Pelvic-fin rays i, 7. Tips of longest pelvic-fin rays reaching vertical between bases of third and fourth branched anal-fin rays. Principal caudal-fin ray count 10/9 in all specimens.

Lateral line incomplete, perforated scales 6-9, 7.2. Lateral series scales 36-41, 38.4. Horizontal scale rows from pelvic-fin origin to lateral line 6-8, 7. Scale rows around caudal peduncle 13-14, 13.9. No scale rows anteriorly along anal-fin base.

Premaxillary with one anterior large conical tooth followed by set of smaller conical teeth, two large conical teeth and 1-4 smaller conical teeth; most large conical teeth with one vestigial lateral cusp on each side. Total number of premaxillary teeth 9-18, 13. Maxillary teeth conical, 42-60, 50.6, larger specimens generally with higher counts. Dentary with anterior row including 2-8, 5.3 conical teeth and posterior row with with 30-41, 34.2 conical teeth; most larger conical dentary teeth with one lateral cusp on each side; ectopterygoid teeth 11-23, 16.

Vertebrae 31-33 (3). Seven to 8, 7.5 gill-rakers on lower limb of first gill-arch. Branchiostegal rays 4, 3 rays originating from anterior cerathyal and 1 from posterior ceratohyal.

Color in alcohol. Body pale to light yellow, slightly darker dorsally due to denser concentration of dark chromatophores. Ventral region of body lightly colored with scattered dark chromatophores especially anteriorly. Roundish dark humeral blotch extending about 4 scales horizontally and 4.5 to 5 scales vertically, darker on central part due to denser concentration of dark chromatophores. Dorsal regions of head, snout and tip of lower jaw darker than remaining portions of head; dark

Table 3. Morphometrics of *Charax condei*. Specimens are from MZUSP 88002, 74262, 95229, 92884, 100420.

Characters	n	range	mean	SD
Standard length	42	26.0 - 51.0	39.4	
Percents of standard length				
Depth at dorsal-fin origin	42	27.0 - 31.8	29.2	1.3
Snout to dorsal-fin origin	42	48.0 - 52.4	50.3	1.1
Snout to pectoral-fin origin	42	27.0 - 30.7	28.7	0.7
Snout to pelvic-fin origin	42	33.0 - 36.6	34.8	0.8
Snout to anal-fin origin	42	46.1 - 50.0	48.1	1.0
Caudal peduncle depth	42	7.2 - 9.1	8.2	0.4
Caudal peduncle length	41	5.3 - 7.6	6.7	0.5
Pectoral-fin length	41	16.0 - 19.0	17.3	0.8
Pelvic-fin length	40	20.8 - 24.5	22.5	0.8
Dorsal-fin base length	42	10.0 - 13.0	11.5	0.7
Dorsal-fin height	39	23.5 - 29.2	26.5	1.4
Anal-fin base length	42	43.5 - 50.0	47.5	1.4
Eye to dorsal-fin origin	42	32.5 - 37.6	35.1	1.1
Dorsal-fin origin to caudal-fin base	42	51.2 - 57.5	56.8	1.3
Humeral spot distance	42	35.3 - 40.7	38.7	1.2
Bony head length	42	27.5 - 30.3	28.8	0.7
Percents of head length				
Horizontal orbital diameter	42	34.3 - 39.6	36.8	1.3
Snout length	42	24.7 - 28.2	29.1	1.1
Least interorbital width	42	20.5 - 26.1	23.3	1.4
Upper jaw length	42	58.3 - 61.7	61.2	1.6

Fig. 10. *Charax delimai,* MZUSP 81505, holotype, mature male, 100 mm SL, Brazil, Amazonas, community of São Pedro, rio Tiquié, rio Negro drainage.

coloration extending to anterodorsal portion of maxilla and first, second and anterior portion of third infraorbital. Area between second and third infraorbitals with conspicuous subocular dark blotch extending ventrally to posterior portion of lower jaw. Dorsal regions of opercle and preopercle and fifth and sixth infraorbitals with scattered dark chromatophores. Darker lines of chromatophores along most miosepta of epaxial muscles and some hypaxial muscles more conspicuous posteriorly on body and forming irregular V-shaped pattern. All fins hyaline with scattered dark chromatophores especially concentrated on basal portions of fins.

Distribution. This species is known from tributaries of the rio Amazonas; tributaries of rio Tapajós, near Santarém, Pará, and tributaries of rio Negro and the rio Solimões near Manaus, Amazonas, Brazil (Fig. 7).

Specimens examined. Brazil. Amazonas: MZUSP 88002, 3, 26-51 mm SL, lago Puraquequara, left bank of rio Amazonas, not precisely located; MZUSP 74262, 6, 42-49 mm SL, Amazonas, Manaus, igarapé Jarada, left bank tributary of rio Cuieiras, 3°06’44"S 59°58’14"W; MZUSP 95229, 28, 26-49 mm SL, Amazonas, Santa Isabel do Rio Negro, pond on bank of rio Negro, 00°31’00"S 65°01’00"W; **Pará:** MZUSP 92844, 1, 31.5 mm SL, Pará, Santarém, igarapé Juá, 7 km from Santarém, on road to the airport, 02°26’00"S 54°46’52"W; MZUSP 100420, 4, 31-33 mm SL, Pará, Santarém, Alter do Chão, rio Tapajós, 02°28’05"S 54°55’34"W.

Charax delimai, new species

Fig. 10

Holotype. MZUSP 81505, male, 100 mm SL, Brazil, Amazonas, community of São Pedro, rio Tiquié, rio Negro drainage, 0°16’04"N 69°58’21"W, 2004, Adão A. Barbosa.

Paratypes. Brazil, Amazonas: MZUSP 84988, mature female, 102 mm SL, near old community of São Pedro, 0°16’04.4"N 69°58’21.5"W, 2004, F. Lima; MZUSP 64359, mature female, 121 mm SL, igarapé Umari, tributary of rio Tiquié in community of São Pedro, 0°15’41"N 69°57’23"W, 25-27 October 2000, F. C. T. Lima and party; MZUSP 81325, male, 102 mm SL, igarapé Umari, tributary of rio Tiquié in community of São Pedro, 0°16’00"N 69°58’00"W, 2002, F. C. T. Lima and party.

Diagnosis. *Charax delimai* along with *C. tectifer*, *C. metae* and some specimens of *C. gibbosus*, *C. rupununi* and *C. condei* are the only members of the genus bearing teeth on the ectopterygoid. *Charax delimai* differs from *C. condei* in having the lateral line complete (*vs.* incomplete). From *Charax gibbosus* and *C. rupununi* which have the anal-fin origin anterior to the vertical through the dorsal-fin origin in having the anal-fin origin on vertical or slightly posterior to, dorsal-fin origin. *Charax delimai* can be readily distinguished from *C. tectifer* by the presence (*vs*. absence) of superficial neuromasts on body, with neuromasts dorso-ventrally arranged on trunk scales except those on the lateral line where neuromasts are absent (Fig. 1) and from *C. metae* by having fewer ectopterygoid teeth (3-15 *vs.* 20-50), more transverse scale rows between the humeral spot and the supracleithrum (10-12 *vs.* 7-9) and the humeral spot distance 48-51% of SL (*vs.* 41.6-47% of SL, Fig. 3).

Description. Morphometrics of holotype and all examined specimens presented in Table 4. Body elongate, moderately large (100-121 mm SL), compressed and moderately deep. Greatest body depth slightly in advance of dorsal-fin origin. Dorsal profile of head and body convex from tip of snout to anterior part of fontanel, concave from that point to base of supraoccipital spine, convex from that point to dorsal-fin origin, nearly straight along dorsal-fin base and from end of dorsal-fin base to caudal peduncle and slightly concave along

caudal peduncle. Ventral profile of head and body convex from tip of lower jaw to anal-fin origin, nearly straight along anal-fin base and slightly concave from end of anal-fin base to beginning of procurrent rays. Snout pointed. Lower jaw included in upper jaw when mouth closed. Maxilla extending slightly beyond vertical through middle of orbit.

Dorsal-fin rays ii, 9 in all specimens posterior most ray unbranched. Adipose fin present. Unbranched anal-fin rays iv or v, usually iv; branched rays 41-45 (iv, 45), 41.9. Anterior anal-fin rays not forming differentiated distinct lobe and not bearing bilateral hooks in two adult males (100 and 102 mm SL). Pectoral-fin rays i, 13-15 (i, 14), 14.5. Tips of longest pectoral-fin rays reaching about to vertical through middle of pelvic fin. Pelvic-fin rays i, 7. No hooks on pelvic-fin rays of adult males. Tips of longest pelvic-fin rays reaching slightly beyond anal-fin origin. Principal caudal-fin ray count 10/9 in all specimens.

Lateral line complete, perforated scales 50-53 (52), 51. Horizontal scale rows from dorsal-fin origin to lateral line 11-12 (12), 11.7. Horizontal scale rows from pelvic-fin origin to lateral line 9-10 (9), 9.2. Horizontal scale rows from anal-fin origin to lateral line 11-12 (12), 11.7. Predorsal scales 33-35 (34). Scale rows around caudal peduncle 19-20 (20), 19.5. One scale row along anal-fin base, except on last one-fifth of its length. Rostral portions of body scales of both males and females, except for lateral-line scales with vertically oriented superficial neuromasts (Fig. 1).

Premaxillary with one anterior canine-like tooth followed by set of smaller conical teeth and another canine-like tooth followed by one or two small conical teeth. Total number of premaxillary teeth 13-17 (14) 14.7. Maxillary teeth conical, 55-56 (55), 55.2. Dentary with one canine-like tooth followed by 3-5 (4) 4 conical teeth, another canine-like tooth and posterior row of 21-24 (24) 23 conical teeth. Left ectopterygoid without teeth or with 3 or 9 teeths; right ectopterygoid with 6-9 conical teeth. Total number of ectopterygoid teeth 3-15 (9), 9. Vertebrae 34-35 (34), 34.2. Eight gill-rakers on lower limb of first gill-arch in all specimens. Branchiostegal rays 4; 3 rays originating from anterior ceratohyal and 1 from posterior ceratohyal

Table 4. Morphometrics of *Charax delimai*. Specimens are from MZUSP 81505 (holotype) and 84988 (paratypes).

Characters	Holotype	n	range	mean	SD
Standard length	100.0	4	100.0 - 121.0	106.2	
Percents of standard length					
Depth at dorsal-fin origin	39.5	4	39.5 - 41.1	40.2	0.7
Snout to dorsal-fin origin	55.0	4	52.5 - 55.0	54.3	1.2
Snout to pectoral-fin origin	28.5	4	28.5 - 30.5	29.7	1.0
Snout to pelvic-fin origin	40.0	4	40.0 - 42.1	41.0	0.9
Snout to anal-fin origin	56.5	4	55.8 - 57.0	56.5	0.5
Caudal peduncle depth	9.0	4	8.8 - 10.0	8.8	0.4
Caudal peduncle length	7.5	4	6.6 - 7.5	7.8	0.4
Pectoral-fin length	19.0	4	18.0 - 22.0	20.0	1.8
Pelvic-fin length	18.0	4	27.2 - 29.0	28.1	0.9
Dorsal-fin base length	11.5	4	11.2 - 12.4	11.7	0.5
Dorsal-fin height	29.0	4	27.2 - 29.0	28.1	0.9
Anal-fin base length	47.0	4	44.6 - 47.0	46.0	1.2
Eye to dorsal-fin origin	41.0	4	41.0 - 42.1	41.4	0.5
Dorsal-fin origin to caudal-fin base	52.0	4	51.2 - 53.0	52.0	0.7
Humeral spot distance	48.5	4	48.0 - 51.0	49.5	1.4
Bony head length	29.5	4	29.4 - 30.1	29.6	0.4
Percents of head length					
Horizontal orbital diameter	30.5	4	30.1 - 33.3	31.4	1.4
Snout length	27.1	4	26.0 - 27.1	26.6	0.4
Least interorbital width	22.0	4	22.0 - 23.3	22.6	0.8
Upper jaw length	67.8	4	65.7 - 67.8	66.7	0.8

Color in alcohol. Body pale to light yellow, slightly darker dorsally than ventrally due to concentration of dark chromatophores on predorsal and postdorsal scales. Dark chromatophores mostly concentrated on basal portions of scales leaving light area on remaining portion of each scale and forming alternate pattern of dark and light spots along longitudinal scale rows on body. Whitish color of vertically arranged superficial neuromasts on skin of basal portion of each scale and contrasting strongly with background dark coloration of basal portion of scale (Fig. 1). Scales on lateral and ventral body portions with fewer chromatophores. Irregularly shaped dark humeral blotch, much closer to dorsal-fin origin than to posterior border of opercle, encompassing about 5 scales vertically and horizontally. Dark blotch on caudal peduncle approximately triangular, higher posteriorly and extending over basal portions of central caudal-fin rays. Dorsal portions of head from tip of snout to supraoccipital region darker than remainder of head, dark color extending vertically over first, second, and anterior portion of third infraorbitals below orbit, dorsal portion of prepercle and inner border of opercle. Most of third, fourth and fifth infraorbitals, ventral portion of preopercle, posterior border of opercle and subopercle largely unpigmented with scattered dark chromatophores. Tip of lower jaw dark; lighter posteriorly with scattered chromatophores. Tip of dorsal fin dark. Anal fin with faint basal dark stripe extending from about basal portion of first branched anal-fin ray to end of fin, this stripe separated by light anteriorly wide stripe involving basal and median portions of unbranched rays, narrower from this point backward. Conspicuous dark wider marginal dark stripe extending to end of fins, initially separated by small light stripe extending only to about tenth branched anal-fin ray. Tip of pelvic fin dark, pectorals light with few scattered dark chromatophores. Marginal portion of caudal fin dark, all fin with scattered dark chromatophores.

Sexual dimorphism. Males of this species much darker than females and both sexes possess superficial neuromasts vertically arranged along basal portions of each scale albeit less numerous on females (Fig. 1).

Etymology. *Charax delimai* is named after Flávio César Thadeu de Lima for his great contributions to the knowledge of neotropical freshwater fishes and for collecting most of the specimens that served as the basis for the species description.

Distribution. *Charax delimai* is known from the rio Tiquié, rio Negro basin, Brazil (Fig. 7).

Fig. 11. *Charax gibbosus* MZUSP 10674, female, 124.5 mm SL, Suriname, Sara Creek, Brokopondo District.

***Charax gibbosus* (Linnaeus, 1758)**
Figs. 11 and 12

Salmo gibbosus Linnaeus, 1758: 311 [type locality: Suriname; Wheeler, 1989: 208 (type information)].
Characinus gibbosus, Lacépède, 1803: 269 (diagnosis).
Epicyrtus gibbosus, Müller & Troschel, 1844: 346 (America meridionali; listed).
Cynopotamus gibbosus, Valenciennes, 1850: 321 (Mana River; Essequibo River; Amazon). -Lucena & Menezes, 2003: 201 [synonym of *Charax gibbosus* (Linnaeus, 1758)].
Charax gibbosus, Lucena, 1987: 36 (diagnosis; description; geographic variation). -Lucena, 1989: 104 (in key to species). -Lucena & Menezes, 2003: 201 (maximim length; distribution).
Charax gibbosa, Eigenmann, 1910: 444 (Guianas, Amazons and Paraguay; listed).

Diagnosis. *Charax gibbosus* belongs in a species group having orbital diameter 30.1-38.4% of HL as opposed to *C. caudimaculatus* and *C. notulatus* that have an orbital diameter 25-28.5% of HL (Fig. 4). *Charax gibbosus* differs from *C. condei* by having the lateral line complete (*vs.* incomplete). From *C.* and *C. rupununi* which have the anal-fin origin anterior to the vertical through the dorsal-fin origin in having the anal-fin origin posterior to the dorsal-fin origin. *Charax delimai* can be readily distinguished from *C. tectifer* by the presence (Fig. 1) (*vs*. absence, Fig. 26) of superficial neuromasts on the body with neuromasts dorso-vantrally arranged on trunk scales except the lateral line and from *C. metae* by having fewer ectopterygoid teeth (13-15 *vs.* 20-50) more transverse scale rows between the humeral spot and the supracleithrum (10-12 *vs*. 7-9) and the humeral spot distance 48-51% of the SL *vs.* 41.6-47% of the SL scale rows around the caudal peduncle (17-18) than *C. apurensis* and *C. macrolepis* (20-21), from *C. michaeli* by the number of scale rows from dorsal-fin origin to lateral line (15-16 *vs.* 18-20), from *C. pauciradiatus* by having more scale rows from the dorsal-fin origin to the lateral line (15-16 *vs.* 13-14), from *C. leticiae* by the humeral spot distance (34.7-37.5% of SL, *vs.* 38-44% of SL, the number of transverse scale rows between the humeral spot and the supracleithrum (5-6, *vs.* 8-10), and from *C. niger* by the number of predorsal scales (38-45 *vs.* 52-68) and the presence (*vs*. absence) of ectopterygoid teeth. *Charax gibbosus* differs from *C. hemigrammus*, *C. condei*, and *C. stenopterus* by having the lateral line complete (*vs.* lateral line incomplete), from *C. rupununi* by the number of scales around the caudal peduncle (17-18 *vs.* 12) and from *C. tectifer*, *C. metae*, and *C. delimai* by having the anal-fin origin always anterior to the vertical through the dorsal-fin origin (*vs.* anal-fin origin along vertical or slightly posterior to vertical through the dorsal-fin origin) and the ectopterygoid teeth absent (*vs.* ectopterygoid teeth present).

Description. Morphometrics of examined specimens presented in Table 5. Body elongate, moderately large (34-125.5 mm SL), compressed and moderately deep; greatest body depth slightly in advance of dorsal-fin origin. Dorsal profile of head an body slightly convex on tip of snout, straight from posterior border of posterior nostril to vertical line through posterior border of pupil, slightly concave from that point to base of supraoccipital spine, strongly convex from that point to dorsal-fin origin, nearly straight along dorsal-fin base and from end of dorsal-fin base to caudal peduncle and slightly concave along caudal peduncle. Ventral profile of heaf and body convex from tip of lower jaw to anal-fin origin, nearly straight along anal-fin base and concave from end of anal-fin

base to beginning of procurrent rays. Snout pointed. Lower jaw included in upper jaw when mouth closed. Maxilla extending slightly beyond vertical through posterior border of pupil.

Dorsal-fin rays ii, 9 in all specimens, posterior most ray unbranched. Adipose fin present. Unbranched anal-fin rays iv or v, usually iv, branched rays 45-56, 49.5. Single examined sexually mature male (MZUSP 10675, 64 mm SL) with tiny hooks on anterior anal-fin rays (Fig. 12). Pectoral-fin rays i, 12-17, 14.8. Tips of longest pectoral-fin rays reaching to or slightly beyond middle of pelvic-fin length. Pelvic-fin rays i, 7, without hooks in single sexually mature male examined. Tips of longest pelvic-fin rays reaching to vertical between bases of third to sixth branched anal-fin rays. Principal caudal-fin ray count 10/9 in all specimens.

Lateral line complete; perforated scales 50-62, 56. Horizontal scale rows from dorsal-fin origin to lateral line 15-16, 15.4. Horizontal scale rows from pelvic-fin origin to lateral line 10-12, 10.8. Horizontal scale rows from anal-fin origin to lateral line 9-14, 11.8. Predorsal scales 38-45, 42. Scale rows around caudal peduncle 17-18, 17.8. One scale row anteriorly along anal-fin base, extending to about middle of base.

Premaxillary with one anterior canine-like tooth followed by set of smaller conical teeth and another canine-like tooth followed by one or two small conical teeth. Total number of premaxillary teeth 11-16, 13. Maxillary teeth conical, 43-75, 59.2, larger specimens in general with higher counts. Dentary with one canine-like tooth followed by 2-5, 4 conical teeth, another canine-like tooth and posterior row of 20-31, 25.3 conical teeth.

Vertebrae 34-35, 34.5 (4). Gill-rakers on lower limb of first gill-arch 9-11, 9.7. Branchiostegal rays 4; 3 rays originating from anterior ceratohyal and 1 from posterior ceratohyal.

Color in alcohol. Body pale to light yellow, slightly darker dorsally than on lateral and ventral parts. Ventral portions of body lighter with scattered dark chromatophores especially anteriorly. Irregularly shaped vertically elongate dark blotch at humeral region about 4 scales horizontally and 3 to 4 scales vertically. Dorsal portion of head, snout and tip of lower jaw darker than remainder of head, dark coloration extending to median portion of lower jaw, dorsal portions of fifth and sixth infraorbitals, between second and third infraorbitals in young specimens and dorsal part of opercle. Inconspicuous, dark midlateral stripe extending from posterior border of humeral blotch to caudal blotch. Darker V-shaped lines of chromatophores over miosepta present along lateral stripe. Inconspicuous diamond shaped dark blotch on caudal base, more conspicuous in young specimens; dark chromatophores extending over bases of middle caudal-fin rays. All fins hyaline with scattered dark chromatophores more visible on interradial membranes. Anterior portion of first and second unbranched rays of dorsal and first unbranched rays of pectoral- and pelvic-fin rays darker than remaining rays.

Distribution. This species is known from the Nickerie, Brokopondo, Afobaka, and Courentyne Districts in Suriname; Wismar and Botanical Garden in Guyana; and rio Surumu, a tributary of rio Branco, Brazil (Fig. 7).

Sexual dimorphism. Females lack the anal-fin hooks present in males and seem to grow larger. The single examined fully mature male is only 64 mm SL whereas examined sexually mature females ranged from 75-124.5 mm SL.

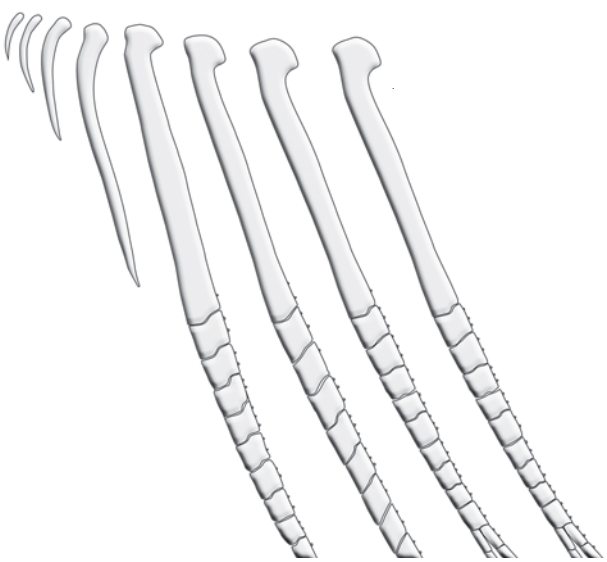

Fig. 12. Hooks on anterior anal-fin rays of *Charax gibbosus*, male, MZUSP 10675, 64 mm SL.

Table 5. Morphometrics of *Charax gibbosus*. Specimens are from MZUSP 5164, 10674, 10675, 10679, 38226, 38240.

Characters	n	range	mean	SD
Standard length	31	34.0 - 125.5	76.0	
Percents of standard length				
Depth at dorsal-fin origin	31	33.3 - 38.6	36.2	1.4
Snout to dorsal-fin origin	31	48.6 - 53.0	51.0	1.0
Snout to pectoral-fin origin	31	25.0 - 29.7	27.4	1.2
Snout to pelvic-fin origin	31	32.4 - 37.6	35.6	1.2
Snout to anal-fin origin	31	44.5 - 50.0	47.3	1.5
Caudal peduncle depth	31	7.1 - 9.4	8.4	0.6
Caudal peduncle length	31	6.1 - 8.5	7.2	0.6
Pectoral-fin length	19	18.8 - 21.5	20.4	0.8
Pelvic-fin length	28	20.1 - 23.7	21.5	1.0
Dorsal-fin base length	31	10.0 - 13.0	11.5	0.7
Dorsal-fin height	08	27.8 - 30.6	29.3	1.1
Anal-fin base length	31	50.0 - 54.3	52.4	1.3
Eye to dorsal-fin origin	31	36.5 - 41.6	39.0	1.3
Dorsal-fin origin to caudal-fin base	31	52.6 - 57.5	55.1	1.1
Humeral spot distance	31	34.7 - 37.5	36.4	0.8
Bony head length	31	24.4 - 30.0	27.3	1.3
Percents of head length				
Horizontal orbital diameter	31	30.5 - 36.0	33.4	1.7
Snout length	31	23.4 - 28.2	26.1	1.2
Least interorbital width	31	21.2 - 25.6	23.8	1.1
Upper jaw length	31	58.4 - 63.7	61.2	1.6

Fig. 13. *Charax hemigrammus*, MZUSP 62079, female, 40.5 mm SL, Brazil, Amazonas, Tapera, rio Negro.

Specimens examined. Suriname: MZUSP 38226, 1, 84 mm SL, Suriname, Corantyne River, Matappi Creek, approximately 4°07'N 57°28'W; MZUSP 38240, 5, 34-57 mm SL, Suriname, Nickerie District, Kapoeri Creek, about 4 km N of intersection with Corantyne River, approximately 4°12'N 57°55'W; MZUSP 10679, 3, 93-111 mm SL, Suriname, Zy Creek, not precisely located; MZUSP 10674, 3, 70-124.5 mm SL, Sara Creek, Brokopondo District, not precisely located; MZUSP 10675, 2, 37 and 64 mm SL, Marowijne Creek, 50 kilometers south of Afobaka, not precisely located**.** Brazil: MZUSP 5164, 1, 57 mm SL, Roraima, rio Surumu, tributary of rio Branco, 4°05'28"N 60°43'04"W.

Charax hemigrammus (Eigenmann, 1912)

Fig. 13

Asiphonichthys hemigrammus Eigenmann, 1912: 403 (original description, type locality: Guyana, Gluck Island). -Henn, 1928: 69 (listed in type catalog).

Charax hemigrammus, Lucena, 1987: 39 (diagnosis, description; distribution). -Lucena, 1989: 104; in key to species). -Lucena & Menezes, 2003: 201 (maximum length; distribution).

Diagnosis. *Charax hemigrammus* is distinguished from congeners except *C. condei* and *C. stenopterus* by having the lateral line incomplete and the dorsal part of body anterior to dorsal fin lacking scales (*vs.* lateral line complete and dorsal part of body anterior to dorsal fin scaled in *Charax rupununi*, *C. tectifer*, *C. metae*, *C. delimai*, *C. caudimaculatus*, *C. notulatus*, *C. apurensis*, *C. macrolepis*, *C. michaeli*, *C. pauciradiatus*, *C. gibbosus*, *C. niger*, and *C. leticiae). Charax hemigrammus* differs from *C. condei* in the scale rows from the pelvic-fin origin to the lateral line (11-12 *vs.* 6-9) and lateral series of scales (36-41*vs.* 42-48), respectively and can be distinguished from *C. stenopterus* in having 9-22 ectopterygoid teeth (*vs.* ectopterygoid teeth absent).

Description. Morphometrics of examined specimens presented in Table 6. Body elongate, small compared to congeners (20-40.5 mm SL), compressed and comparatively low. Greatest body depth slightly in advance of dorsal-fin origin. Dorsal profile of head and body slightly convex from tip of snout to anterior region of fontanel, slightly concave from that point to base of supraoccipital spine, convex from that point to dorsal-fin origin, nearly straight along dorsal-fin base and from end of dorsal-fin base to caudal peduncle and slightly concave along caudal peduncle. Ventral profile of head and body convex from tip of lower jaw to anal-fin origin, nearly straight to slightly concave along anal-fin base and slightly concave from end of anal-fin base to beginning of procurrent rays. Snout pointed. Lower jaw included in upper

Table 6. Morphometrics of *Charax hemigrammus*. Specimens are from MZUSP 100354, 76217, 76248, 62079.

Characters	n	range	mean	SD
Standard length	33	20.0 - 40.5	31.4	
Percents of standard length				
Depth at dorsal-fin origin	33	30.0 - 34.4	32.2	1.3
Snout to dorsal-fin origin	33	48.4 - 52.8	50.5	1.1
Snout to pectoral-fin origin	33	27.6 - 31.2	29.3	1.1
Snout to pelvic-fin origin	33	07.0 - 08.7	08.1	0.4
Snout to anal-fin origin	33	44.4 - 49.0	47.0	1.1
Caudal peduncle depth	33	7.0 - 8.7	8.1	0.4
Caudal peduncle length	33	4.4 - 6.2	5.3	0.5
Pectoral-fin length	25	17.1 - 20.0	18.2	0.8
Pelvic-fin length	32	20.8 - 24.8	23.0	1.1
Dorsal-fin base length	33	9.14 -12.0	10.4	0.6
Dorsal-fin height	31	25.0 - 30.4	27.6	1.3
Anal-fin base length	33	50.0 - 54.0	52.1	1.2
Eye to dorsal-fin origin	33	34.5 - 40.0	36.1	1.3
Dorsal-fin origin to caudal-fin base	33	51.5 - 58.3	54.5	1.7
Humeral spot distance	33	37.1 - 40.7	38.3	1.0
Bony head length	33	27.7 - 31.4	29.5	0.8
Percents of head length				
Horizontal orbital diameter	33	31.8 - 35.7	33.8	1.0
Snout length	33	22.7 - 29.2	25.7	1.4
Least interorbital width	33	20.0 - 26.0	23.8	1.4
Upper jaw length	33	48.8 - 55.6	53.0	1.7

Fig. 14. *Charax leticiae*, MZUSP 89382, female, 98 mm SL, Brazil, Goiás, between Crixás and Nova Crixás, córrego da Taboca, tributary of rio Crixás-Mirim.

jaw when mouth closed. Maxilla extending slightly beyond vertical through middle of orbit.

Dorsal-fin rays ii, 9 in all specimens, posteriormost ray unbranched. Adipose fin present. Unbranched anal-fin rays iv or v, usually iv; branched rays 41-48, 44.3. Pectoral-fin rays i, 13-15, 13.8. Posterior tips of longest pectoral-fin rays extending beyond pelvic-fin origin, but not reaching vertical crossing middle of pelvic-fin length. Pelvic-fin rays i, 7. Tips of longest pelvic-fin rays reaching vertical between bases of fifth and seventh branched anal-fin rays. Principal caudal-fin ray count 10/9 in all specimens.

Lateral line incomplete; perforated scales 7-10, 8.5. Lateral series scales 42-48, 45. Horizontal scale rows from pelvic-fin origin to lateral line 8-9, 8.7. Scale rows around caudal peduncle 15-16, 15.1. No scales anteriorly along anal-fin base.

Premaxillary with one anterior large conical tooth followed by set of smaller conical teeth, two large conical teeth and 1-7 smaller conical teeth. Total number of premaxillary teeth 13-20, 16.6. Maxillary teeth conical, 43-58, 50.6; larger specimens generally with higher counts. Dentary with anterior row including 4-8, 6.4 conical teeth and posterior row with 18-28, 22 conical teeth. Ectopterygoid teeth 9-22, 14.1.

Gill-rakers on lower limb of first gill-arch 8-9, 8.6. Branchiostegal rays 4; 3 rays originating from anterior cerathyal and 1 from posterior ceratohyal.

Color in alcohol (all examined specimens with original coloration barely preserved). Body pale, slightly darker dorsally due to presence of scattered dark chromatophores. Scattered dark chromatophores scattered over body. Roundish dark blotch at humeral region extending about two scales horizontally and one scale vertically. Clear lateral stripe from behind dorsal portion of opercle to caudal base, probably dark in recently collected specimens. Concentration of dark chromatophores on caudal base forming oval-shaped blotch extending over bases of central caudal-fin rays. Dorsal portions of the head, snout and tip of lower jaw darker than remainder of head. Opercle with scattered dark chromatophores. All fins hyaline.

Distribution. *Charax hemigrammus* is known from the Essequibo River, Guyana; tributaries of the upper Amazon basin near municípios de Codajás and Tefé and tributaries of the rio Negro, Amazonas, Brazil (Fig. 7).

Specimens examined. Brazil. Amazonas: MZUSP 100354, 13, 20-33 mm SL, MZUSP 76217, 3, 26.5-34.5 and MZUSP 76248, 1, 26.5 mm SL, rio Jurupari, Tefé, approximately 3°19'S 64°43'W; MZUSP 62079, 15, SL 30-40.5 mm SL, Tapera, rio Negro.

Charax leticiae Lucena, 1987

Fig. 14

Charax leticiae Lucena, 1987: 140 (original description, type locality: Brazil, State of Pará, rio Tocantins, igarapé Urubu near Posto Trocará). -Oyakawa, 1996: 454-455 (listed in type catalog). -Lucena, 1989: 104 (in key to species). -Britski *et al*., 1999: 55, 2007: 75 (Pantanal de Mato Grosso, description). -Lucena & Menezes, 2003: 201 (maximum length; distribution). -Lopéz *et al*., 2003: 17 (Argentina, listed). -Casciotta *et al*., 2003: 84 (Laguna Iberiá, Argentina, listed). -Menni, 2004: 74 (Argentina, listed).

Diagnosis. *Charax leticiae* belongs in the species group having an orbital diameter 30.1-38.4% of HL as opposed to *C. caudimaculatus* and *C. notulatus* that have orbital diameter 25-28.5% of HL (Fig. 4). *Charax leticiae* can be distinguished from the other species of first group by having circumpeduncular scale rows (17-19) than *C. apurensis* and *C. macrolepis* (20-22), from *C. michaeli* by the number of scale rows from the dorsal-fin origin to the lateral line (16-17 *vs.* 18-20), from *C. niger* and *C. gibbosus* by the humeral spot distance 38-44 *vs.* 34.7-37.8% of SL (Fig. 3), the number of transverse scale rows between the humeral spot and the supracleithrum 8-10 *vs.* 5-6 in *C. niger* and *C. gibbosus*. *Charax leticiae* differs from *C. pauciradiatus* in having more scale rows from the dorsal-fin origin to the lateral line (16-17 *vs.* 13-14). *Charax leticiae* differs from *C. hemigrammus*, *C. condei*, and *C. stenopterus* by having the lateral line complete (*vs.* lateral line incomplete), from *C. rupununi* by the number of scales around the caudal peduncle (17-19 *vs.* 12) and from *C. tectifer*, *C. metae*, and *C. delimai* by having the anal-fin origin always anterior to the vertical through the dorsal-fin origin (*vs.* anal-fin origin on, or slightly posterior to, the vertical through the dorsal-fin origin) and ectopterygoid teeth absent (*vs.* ectopterygoid teeth present).

Description. Morphometrics of examined specimens presented in Table 7. Body elongate, moderately large (33.5-106 mm SL), compressed and moderately deep; greatest body depth slightly in advance of dorsal-fin origin. Dorsal profile of head and body slightly convex on tip of snout, straight from posterior border of posterior nostril to vertical line through posterior border of pupil, slightly concave from that point to base of supraoccipital spine, strongly convex from that point to dorsal-fin origin, nearly straight along dorsal-fin base and from end of dorsal-fin base to caudal peduncle and slightly concave along caudal peduncle. Ventral profile of head and body convex from tip of lower jaw to anal-fin origin, nearly straight along anal-fin base and slightly concave from end of anal-fin base to beginning of procurrent rays. Snout pointed. Lower jaw included in upper jaw when mouth closed. Maxilla extending slightly beyond vertical through middle of pupil.

Dorsal-fin rays ii, 9 in all specimens, posterior most ray unbranched. Adipose fin present. Unbranched anal-fin rays iv or v, usually iv, branched rays 43-53, 48.5. Pectoral-fin rays i, 12-16, 14.2. Tips of longest pectoral-fin rays reaching slightly beyond middle of pelvic-fin length. Pelvic-fin rays i, 7. Tips of longest pelvic-fin rays reaching to vertical between bases of second to seventh branched anal-fin rays. Principal caudal-fin ray count 10/9 in all specimens.

Lateral line complete; perforated scales 54-62, 57.4. Horizontal scale rows from dorsal-fin origin to lateral line 16-17, 16.8. Horizontal scale rows from pelvic-fin origin to lateral line 9-11, 10.5. Horizontal scale rows from anal-fin origin to lateral line 12-14, 13.1. Predorsal scales 47-72, 55.6. Scale rows around caudal peduncle 17-19, 18. Scale row along anal-fin base, extending for about two thirds of fin base.

Premaxillary with one anterior canine-like tooth followed by set of smaller conical teeth and another canine-like tooth followed by one or two small conical teeth. Total number of premaxillary teeth 9-15, 12.5. Maxillary teeth conical, 50-79, 65.1; larger specimens generally with higher counts. Dentary with one canine-like tooth followed by 3-7, 4 conical teeth, another canine-like tooth and a posterior row of 21-37, 30.4 conical teeth.

Vertebrae 34 in one specimen. Gill-rakers on lower limb of first gill-arch 7-9, 7.8. Branchiostegal rays 4; 3 rays originating from anterior ceratohyal and 1 from posterior ceratohyal.

Color in alcohol. Body pale to light yellow, slightly darker dorsally. Scattered chromatophores sometimes disposed along miosepta of epaxial and hypaxial muscles forming V-shaped patterns. Irregularly shaped vertically elongate, dark humeral blotch region extending about 4-5 scales horizontally and 5 to 7 vertically. Dorsal regions of head, snout and tip of lower jaw darker; dark coloration extending to median portion of lower jaw, fifth and sixth infraorbitals, between second and third infraorbitals as subocular blotch, ventrally over anterior portion of preopercle and dorsal part of opercle. Triangular dark blotch on caudal base, posterior chromatophores less densely concentrated and extending over basal portions of median caudal-fin rays. Inconspicuous clear lateral stripe extending from above upper posterior part of opercle to caudal blotch. All fins hyaline with dark chromatophores disposed mainly on interradial membranes. Inconspicuous clear stripe slightly below anal-fin base across total expanse of fin. First and second unbranched rays of dorsal, and first unbranched rays of pectoral and pelvic fins darker than remaining rays.

Table 7. Morphometrics of *Charax leticiae*. Specimens are from MZUSP 89382, 52236, 43406, 105299, 36428, 19817, 20470, 19994, 44377, 19236,90188, 19806, 90271, 77276, 59604, 36431, 59799, 48293, 59511, 19896, 59772.

Characters	n	range	mean	SD
Standard length	78	41.0 - 116.0	73.1	
Percents of standard length				
Depth at dorsal-fin origin	74	33.3 - 41.7	37.2	1.8
Snout to dorsal-fin origin	78	50.0 - 55.4	52.1	1.4
Snout to pectoral-fin origin	78	25.0 - 31.3	28.4	1.3
Snout to pelvic-fin origin	78	34.3 - 38.3	37.0	0.9
Snout to anal-fin origin	78	44.3 - 51.2	48.1	1.7
Caudal peduncle depth	78	7.1 - 9.7	8.7	0.6
Caudal peduncle length	78	5.7 - 8.0	7.0	0.5
Pectoral-fin length	76	18.4 - 22.0	20.0	0.8
Pelvic-fin length	78	19.4 - 24.5	22.6	1.0
Dorsal-fin base length	71	11.0 - 13.6	12.0	0.5
Dorsal-fin height	74	27.6 - 32.4	30.4	1.2
Anal-fin base length	78	47.5 - 54.7	51.8	1.6
Eye to dorsal-fin origin	78	37.7 - 43.3	40.2	1.4
Dorsal-fin origin to caudal-fin base	78	53.0 - 57.7	55.1	1.0
Humeral spot distance	77	39.0 - 44.0	41.6	1.1
Bony head length	78	25.4 - 30.0	28.0	1.2
Percents of head length				
Horizontal orbital diameter	78	30.0 - 35.7	33.2	1.3
Snout length	74	23.0 - 28.7	26.0	1.5
Least interorbital width	75	20.0 - 26.8	23.6	1.4
Upper jaw length	74	59.6 - 65.4	62.2	1.4

Remarks. Data from specimens collected in tributaries of the rio Paranaíba (upper rio Paraná basin in central Brazil) are not included since there is evidence that in recent years fishes from the rio Araguaia basin, where *Charax leticiae* occurs have been released into tributaries of rio Paranaíba (Zawadzki *et al*. 2008).

No significant statistical differences in meristic and morphometric data were found through comparison of samples from the rios Tocantins/Araguaia and Paraguay basins.

Distribution. *Charax leticiae* is widely distributed in tributaries of the rios Tocantins, Araguaia, Paraguay, and Aripuanã basins, Brazil (Fig. 7).

Specimens examined. Brazil, Goiás: LIRP 7490, 3, 87-93 mm SL and LIRP 6679, 4, 73-87.5 mm SL, município de Paranaiguara, rio Mateira, tributary of rio Paranaíba, 18°51'21"S 50°38'10"W; MZUSP 89382, 19, 72-106 mm SL, between Crixás and Nova Crixás, córrego da Taboca, tributary of rio Crixás-Mirim, 14°19'27"S 50°12'32"W; MZUSP 52236, 1, 52 mm SL, road between Sandolândia and rio Verde, pools on banks of rio Água Fria, tributary of rio Tocantins, 12°32'00"S 49°55'00"W; MZUSP 43406, 1, 33.5 mm SL, Tocantins, Ilha do Bananal, Parque Nacional do Araguaia, lagoa Buritirama, 10°31'00"S 50°15'00"W; Pará: MZUSP 105299, 4, 58-88 mm SL, Marabá, rio Tocantins, 5°40'07"S 50°18'04"W; Mato Grosso: MZUSP 36428, 1, 51 mm SL, Corumbá, Nhecolandia, Fazenda Nhumirim, Baía dos Búfalos, 19°42'S 56°08"W; MZUSP 20470, 1, 96 mm SL, Cuiabá, Coxipó da Ponte, rio Coxipó da Ponte, 15°38'26"S 56°03'12"W; MZUSP 19994, 1, 100 mm SL, Ilha do Taiamã, rio Paraguay, not precisely located; MZUSP 44377, 1, 83 mm SL, Cáceres, rio Paraguay, 16°04'28"S 57°39'35"W; MZUSP 19236, 1, 80 mm SL, Poconé, rio Paraguay, 16°15'25"S 56°37'28"W; MZUSP 90188, 2, 74-78 mm SL, Cáceres, rio Sepotuba, tributary of rio Paraguay, 15°47'33"S 57°39'20"W; MZUSP 19806, 1, 91 mm SL, Campo do Jofre do rio Pixaim, Poconé, 16°14'S, 56°37'W; MZUSP 90271, 1, 72 mm SL, Cáceres, rio Sepotuba, tributary of rio Paraguay, 15°46'07"S 57°38'54"W; MZUSP 77276, 2, 63-66 mm SL, Panelas, Rio Roosevelt, above the water falls, approximately 9°17'47"S 60°43'15"W; Mato Grosso do Sul: MZUSP 59604, 1, 45 mm SL, Corumbá, Fazenda Xaraés, rio Vermelho, 18°02'48"S 52°40'44"W; MZUSP 36431, 1, 44 mm SL, Corumbá, Nhecolandia, Fazenda Nhumirim, 19°42'10"S 56°08'00"W; MZUSP 59799, 1, 45 mm SL, Aquidauana, bay near Fazenda Rio Negro, 20°00'16"S 55°33'50"W; MZUSP 19817, 1, 42 mm SL, Poconé, rio Pixaim, approximately 14°44'S 60°33'W; MZUSP 48293, 2, 50-53 mm SL, Fazenda Santo Antônio (Baía de Seda); MZUSP 59511, 20, 41-69 mm SL, Aquidauana, Fazenda Taboco, rio Taboco, 20°04'38"S 55°38'08"W; MZUSP 19896, 5 78-94 mm SL, município de Corumbá, rio Miranda, 17°55'06"S 56°52'43"W; MZUSP 59772, 2, 72-83 mm SL, Corumbá, rio Abobral, 19°27'37"S 57°01'54"W; MCP 44556, 3, 70-87 mm SL, Posto da Mata, on road BR-158 between Posto da Mata and Alô Brasil, 11°53'58"S 51°39'26"W; MCP 10735, 2, 78-80 mm SL), sanga about 20 km from Poconé, on road Transpantaneira, approximately 16°15'S 56°37'W. UNT 10279, 2, 76-95 mm SL, rio Alegre, Quirinópolis, 18º 46'31"S 50º36'31"W. Rio Grande do Sul: MCP 18389, 2, 71-116 mm SL, pond along rio Uruguai, on praia da Formosa, São Marcos; Minas Gerais: LIRP 6944, 1, 88 mm SL, Minas Gerais, município de Itaituba, rio Tijuco, tributary of rio Paranaíba, 18°48'18"S 49°51'14"W; LIRP 6603, 3, 74-82 mm SL, município de Itaituba, rio Tijuco, tributary of rio Paranaíba, 16°48'18"S 49°51'41"W. Tocantins: UNT 7041, 1, 56 mm SL, córrego Sabino (Alvorada farm), rio da Conceição, 11º28'13"S 46º55'17"W; UNT 409, 4, 76-81 mm SL, Rio Palmeiras, drenagem do rio Paranã.

Charax macrolepis (Kner, 1858)

Fig. 15

Epicyrtus macrolepis Kner, 1858: 167 (original description, type locality: Brazil, State of Mato Grosso, rio Guaporé).

Charax macrolepis, Lucena, 1987: 42 (nomenclatural notes; diagnosis; description; comparisons; distribution; lectotype designation). -Lucena, 1989: 104 (in key to species). -Lucena & Menezes, 2003: 201 (maximum length; distribution).

Diagnosis. *Charax macrolepis* and *C. apurensis* are the only species belonging in the group with an orbital diameter 30.1-38.4% of HL (Fig. 4) (*vs.* orbital diameter 25-28.5% of HL in *C. caudimaculatus* and *C. notulatus*) that have 20-22 scale rows around caudal peduncle (*vs.* 16-19 in *C. michaeli*, *C. pauciradiatus*, *C. gibbosus*, *C. niger*, and *C. leticiae*). *Charax macrolepis* additionally differs from *C. hemigrammus*, *C. condei*, and *C. stenopterus* by having the lateral line complete (*vs.* lateral line incomplete), from *C. rupununi* by the number of scales around the caudal peduncle (20-21 *vs.* 12) and perforated scales on the lateral line (63-65 *vs.* 42-44). *Charax macrolepis* can be further distinguished from *C. tectifer*, *C. metae*, and *C. delimai* by having the anal-fin origin always anterior to the vertical through the dorsal-fin origin (*vs.* the anal-fin origin on the vertical or slightly posterior to, the dorsal-fin origin) and the ectopterygoid teeth absent (*vs.* ectopterygoid teeth present).

Description. Morphometrics of examined specimens presented in Table 8. Body elongate, moderately large (65-94 mm SL), compressed and moderately deep. Greatest body depth slightly in advance of dorsal-fin origin. Dorsal profile of head and body slightly convex on tip of snout, straight from posterior border of posterior nostril to vertical through posterior border of pupil, slightly concave from that point to base of supraoccipital spine, strongly convex from that point to dorsal-fin origin, nearly straight along dorsal-fin base and from end of dorsal-fin base to caudal peduncle and slightly concave above caudal peduncle. Ventral profile of head and body convex from tip of lower jaw to anal-fin origin, nearly straight along anal-fin base and slightly concave from end of anal-fin base to beginning of procurrent rays. Snout pointed. Lower jaw included in upper jaw when mouth closed. Maxilla extending slightly beyond vertical through middle of orbit.

Dorsal-fin rays ii, 9 in all specimens, posterior most ray unbranched. Adipose fin present. Unbranched anal-fin rays

Fig. 15. *Charax macrolepis*, MZUSP 28730, female, 93.5 mm SL, Brazil, Amazonas, tributary of rio Guaporé, 30 km above Vila Bela da Santíssima Trindade.

iv or v, usually iv, branched rays 48-52, 50. Pectoral-fin rays i, 13-16, 14.7. Tips of longest pectoral-fin rays reaching slightly beyond middle of pelvic-fin length. Pelvic-fin rays i, 7. Tips of longest pelvic-fin rays reaching to vertical between bases of second to sixth branched anal-fin rays. Principal caudal-fin ray count 10/9 in all specimens.

Lateral line complete; perforated scales 62-65, 63.5. Horizontal scale rows from dorsal-fin origin to lateral line 20. Horizontal scale rows from pelvic-fin origin to lateral line 12. Horizontal scale rows from anal-fin origin to lateral line15-17, 15.7. Predorsal scales 68-80, 74.5. Scale rows around caudal peduncle 20-21, 20.7. Scale row along anal-fin base, extending slightly beyond middle of fin base.

Premaxillary with one anterior canine-like tooth followed by set of smaller conical teeth and another canine-like tooth followed by one or two small conical teeth. Total number of premaxillary teeth 11-14, 13.2. Maxillary teeth conical, 55-59, 65.2; larger specimens generally with higher counts. Dentary with one canine-like tooth followed by 4-5, 4.3 conical teeth, another canine-like tooth and posterior row of 32-37, 34.7 conical teeth. Gill-rakers on lower limb of first gill-arch 8-9, 8.6. Branchiostegal rays 4; 3 rays originating from anterior ceratohyal and 1 from posterior ceratohyal.

Table 8. Morphometrics of *Charax macrolepis*. Specimens are from MZUSP 33423, 28730.

Characters	n	range	mean	SD
Standard length	5	65.0 - 94.0	84.3	
Percents of standard length				
Depth at dorsal-fin origin	5	37.0 - 38.8	38.0	0.8
Snout to dorsal-fin origin	5	51.2 - 54.7	52.5	1.6
Snout to pectoral-fin origin	5	27.3 - 29.4	28.3	0.9
Snout to pelvic-fin origin	5	35.1 - 37.0	36.3	1.1
Snout to anal-fin origin	5	46.1 - 48.8	47.3	1.1
Caudal peduncle depth	5	8.2 - 8.9	8.5	0.2
Caudal peduncle length	5	5.8 - 7.0	6.4	0.4
Pectoral-fin length	5	19.7 - 21.5	20.4	0.7
Pelvic-fin length	5	19.7 - 23.0	21.3	1.4
Dorsal-fin base length	5	11.7 - 12.3	12.0	0.3
Dorsal-fin height	3	29.4 - 30.0	29.6	0.2
Anal-fin base length	5	50.5 - 51.5	51.0	0.3
Eye to dorsal-fin origin	5	39.0 - 42.3	41.0	1.4
Dorsal-fin origin to caudal-fin base	5	55.3 - 57.7	56.3	1.2
Humeral spot distance	5	38.5 - 41.5	40.0	1.2
Bony head length	5	26.6 - 28.4	27.5	0.5
Percents of head length				
Horizontal orbital diameter	5	29.7 - 31.3	30.7	0.6
Snout length	5	26.2 - 27.0	26.5	0.4
Least interorbital width	5	25.0 - 27.2	26.1	1.0
Upper jaw length	5	62.0 - 64.3	62.8	0.9

Color in alcohol. Body pale to light yellow, slightly darker dorsally than on lateral and ventral regions, with scattered chromatophores sometimes situated along miosepta of epaxial and hypaxial muscles forming V-shaped patterns. Irregularly shaped vertically elongate, dark blotch at humeral region encompassing about 3-4 scales horizontally and 6 to 7 vertically. Dorsal regions of head, snout and tip of lower jaw darker than remainder of head, dark coloration extending to median portion of lower jaw, fifth and sixth infraorbitals, between second and third infraorbitals as subocular blotch, and ventrally over anterior portions of preopercle and opercle. Triangular dark blotch present on caudal base, posterior chromatophores less intense and extending over basal portions of median caudal-fin rays. All fins hyaline with dark chromatophores situated mainly on interradial membranes. First and second unbranched rays of dorsal and first unbranched rays of pectoral and pelvic fins darker than remaining rays.

Fig. 16. *Charax metae*, CAS 69117, 87 mm SL, Colômbia, Meta, Puerto Barrigona (=Barrigón) at head of navigation east of Bogota.

Distribution. This species is known from drainages of the rio Guaporé, Mato Grosso and of the rio Madeira, Amazonas, Brazil (Fig. 7).

Specimens examined. Brazil, Amazonas: MZUSP 33423, 1, 65 mm SL, stream 15 km from Humaitá, rio Madeira drainage, approximately 7°30'S 63°01'W; Mato Grosso: MZUSP 28730, 4, 65-94 mm SL, tributary of rio Guaporé, 30 km above Vila Bela da Santíssima Trindade plus specimens listed in Lucena (1987).

Charax metae Eigenmann, 1922
Fig. 16

Charax metae Eigenmann, 1922: 238 (original description, type locality: Colombia, Barrigón, Orinoco system, río Meta). -Ibarra & Stewart, 1987: 22 (listed in type catalog). -Lucena, 1987: 44 (diagnosis; description; distribution). -Lucena, 1989: 201 (in key to species). -Vari & Howe, 1991: 13 (listed in type catalog). -Lucena & Menezes, 2003: 201 (maximum length; distribution).

Diagnosis. *Charax metae*, *Charax delimai*, *C. tectifer*, some specimens of *C. gibbosus*, *C. rupununi*, and *C. condei* are the only species of the genus bearing teeth on the ectopterygoid bone. *Charax metae* differs from *C. condei* by having the lateral line complete (*versus* incomplete), from *C. gibbosus* and *C. rupununi* which have the anal-fin origin anterior to the vertical through the dorsal-fin origin in having the anal-fin origin through vertical or slightly posterior to, dorsal fin-origin. *Charax metae* can be readily distinguished from *C. tectifer* by the presence (*vs.* absence) of the dorso-ventrally arranged superficial neuromasts on the trunk scales (Fig. 2), except the lateral line and from *C. delimai* by having more ectopterygoid teeth (20-50 *vs.* 3-15), fewer transverse scale rows between the humeral spot and the supracleithrum (7-9 *vs.* 10-12) and the humeral spot distance 41.6-47% of SL (*vs.* 48-51% of SL, Fig. 3).

Description. Morphometrics of examined specimens presented in Table 9. Body elongate, moderately large (37-99 mm SL), compressed and moderately deep. Greatest body depth slightly in advance of dorsal-fin origin. Dorsal profile of head and body convex from tip of snout to anterior portion of fontanel, concave from that point to base of supraoccipital spine, convex from that point to dorsal-fin origin, nearly straight along dorsal-fin base, straight to slightly convex from end of dorsal-fin base to caudal peduncle and slightly concave along caudal peduncle. Ventral profile of head and body convex from tip of lower jaw to anal-fin origin, nearly straight along anal-fin base and slightly concave from end of anal-fin base to beginning of procurrent rays. Snout pointed. Lower jaw included in upper jaw when mouth closed. Maxilla extending slightly posterior to vertical through posterior border of orbit.

Dorsal-fin rays ii, 9 in all specimens; posterior most ray unbranched. Adipose fin present. Unbranched anal-fin rays iv or v, usually iv, branched rays 39-43, 41.2. Pectoral-fin rays i, 14-16, 14.7. Tips of longest pectoral-fin rays reaching to about vertical through middle of pelvic fin length. Pelvic-fin rays i, 7. Tips of longest pelvic-fin rays reaching slightly beyond anal-fin origin. Principal caudal-fin ray count 10/9 in all specimens.

Lateral line complete; perforated scales 51-55, 53.5. Horizontal scale rows from dorsal-fin origin to lateral line 12-13, 12.4. Horizontal scale rows from pelvic-fin origin to lateral line 9-10, 9.9. Horizontal scale rows from anal-fin origin to

Table 9. Morphometrics of *Charax metae*. Specimens are from CAS 69117.

Characters	n	range	mean	SD
Standard length	16	37.0 - 99.0	62.0	
Percents of standard length				
Depth at dorsal-fin origin	16	35.3 - 38.8	37.0	1.0
Snout to dorsal-fin origin	16	52.8 - 56.8	54.6	1.2
Snout to pectoral-fin origin	16	27.7 - 30.6	29.2	0.9
Snout to pelvic-fin origin	16	36.1 - 41.6	39.1	1.5
Snout to anal-fin origin	16	51.0 - 54.5	52.8	1.2
Caudal peduncle depth	15	8.7 - 10.2	9.6	0.4
Caudal peduncle length	16	6.2 - 8.2	7.5	0.4
Pectoral-fin length	13	18.7 - 21.2	20.0	0.7
Pelvic-fin length	16	17.6 - 21.6	20.1	1.2
Dorsal-fin base length	16	10.3 - 13.0	11.2	0.7
Dorsal-fin height	14	24.6 - 30.2	28.0	1.6
Anal-fin base length	16	41.0 - 46.6	44.6	1.3
Eye to dorsal-fin origin	16	37.7 - 41.7	39.6	1.4
Dorsal-fin origin to caudal-fin base	16	49.5 - 55.0	52.4	1.5
Humeral spot distance	16	41.6 - 47.0	44.0	1.6
Bony head length	16	29.5 - 32.0	31.0	0.6
Percents of head length				
Horizontal orbital diameter	16	29.6 - 33.3	31.5	1.4
Snout length	16	23.6 - 27.8	25.5	1.1
Least interorbital width	16	23.0 - 26.7	24.2	1.0
Upper jaw length	16	54.4 - 69.3	60.5	4.6

lateral line 11-13, 12.3. Predorsal scales 30-36, 33.3. Scale rows around caudal peduncle 19-21, 20. Scale row extending for about two thirds of anal-fin base. Basal portions of trunk scales except for those on lateral line bearing dorso-ventrally arranged superficial neuromasts in specimen with unidentified sex (Fig. 2).

Premaxillary with one anterior canine-like tooth followed by set of smaller conical teeth and another canine-like tooth followed by one or two small conical teeth. Total number of premaxillary teeth 11-14, 12.5. Maxillary teeth conical, 44-56, 48.7; larger specimens generally with higher counts. Dentary with one canine-like tooth followed by 6-8, 6.5 conical teeth, another canine-like tooth and a posterior row of 17-25, 21.2 conical teeth. Left ectopterygoid bone with 10-27, and right with 10-23 conical teeth. Total number of ectopterygoid teeth 20-50, 29.7. Vertebrae 33 and 34 (2). Gill-rakers on lower limb of first gill-arch 7-9, 8.3. Branchiostegal rays 4; 3 rays originating from anterior ceratohyal and 1 from posterior ceratohyal.

Color in alcohol. Old preserved specimens show overall pale to light brown body coloration with scattered dark chromatophores especially concentrated on basal portion of scales on anterior midbody region. Superficial neuromasts vertically arranged along skin of basal portion of each scale in most specimens whitish and contrasting with background dark coloration of the scale basal portion (Fig. 2). Irregularly shaped humeral dark blotch region, much closer to dorsal-fin origin than to posterior border of opercle, encompassing about four scales vertically and horizontally. Dark blotch on caudal peduncle approximately triangular shaped, higher posteriorly and extending over basal portions of median caudal-fin rays. Scattered dark chromatophores on the tips of the snout and the lower jaw. Tip of dorsal fin dark. Anal fin with faint basal dark stripe, separated by light stripe from more conspicuous dark wider distal stripe extending to end of fin. Tip of pelvic fins dark. Pectorals light with few scattered dark chromatophores. Marginal portion of caudal fin dark with scattered dark chromatophores.

Distribution. *Charax metae* is known from the río Meta, Colombia (Fig. 7).

Specimens examined. CAS 69117, 16 paratypes, 37-87 mm SL, Colômbia, Meta, Puerto Barrigona (=Barrigón) at head of navigation east of Bogota, approximately 10°34'N 75°11'W, 73°45'W.

Charax michaeli Lucena, 1989

Figs. 17-18

Charax michaeli Lucena, 1989: 98 (original description, type locality: Brazil, Roraima, in front of ilha Maracá, rio Branco basin, igarapé Cujobim. -Oyakawa, 1996: 455 (listed in catalog). -Lucena & Menezes, 2003: 201 (maximum length; distribution).

Charax unimaculatus Lucena, 1989: 101 (type locality: Brazil, Amazonas, lago Manacapuru (3°00'36.8"S 61°20'18.6"W); holotype and paratypes examined. -Oyakawa, 1996: 456 (listed in catalog). -Lucena & Menezes, 2003: 202 (maximum length; distribution).

Diagnosis. *Charax michaeli* differs from *C. caudimaculatus* and *C. notulatus*) in the orbital diameter 30.1-38.4% of HL (Fig. 4) (*vs.* 25-28.5% of HL). *Charax michaeli* can be distinguished from *C. apurensis* and *C. macrolepis* by the number of scale rows around the caudal peduncle (17-19 *vs.* 20-22) and from *C. pauciradiatus*, *C. gibbosus*, *C. niger*, and *C. leticiae* in having 18-20 (*vs.* 13-17) scale rows from the dorsal-fin origin to the lateral line. *Charax michaeli* differs from *C. hemigrammus*, *C. condei*, and *C. stenopterus* by having a complete lateral line (*vs.* lateral line incomplete), from *C. rupununi* by the number of scales around caudal peduncle (17-19 *vs.* 12) and from *C. tectifer*, *C. metae*, and *C. delimai* by having the anal-fin origin always anterior to the vertical through the dorsal-fin origin (*vs.* anal-fin origin along vertical or slightly posterior to, vertical through the dorsal-fin origin) and ectopterygoid teeth absent (*vs.* ectopterygoid teeth present).

Description. Morphometrics of examined specimens presented in Table 10. Body elongate, moderately large (37-155 mm SL), compressed and deep. Greatest body depth slightly in advance of dorsal-fin origin. Dorsal profile of head and body slightly convex on tip of snout, straight from posterior border of posterior nostril to vertical line through posterior border of pupil, slightly concave from that point to base of supraoccipital spine, very strongly convex from that point to dorsal-fin origin, nearly straight along dorsal-fin base

Fig. 17. *Charax michaeli*, MZUSP 92343, male, 116 mm SL.

and from end of dorsal-fin base to caudal peduncle and slightly concave above caudal peduncle. Ventral profile of head and body convex from tip of lower jaw to anal-fin origin, nearly straight along anal-fin base and concave from end of anal-fin base to beginning of procurrent rays. Snout pointed. Lower jaw included in upper jaw when mouth closed. Maxilla extending slightly beyond vertical through posterior border of pupil.

Dorsal-fin rays ii, 9 in all specimens, posterior most ray unbranched. Adipose fin present. Unbranched anal-fin rays iv or v, usually iv, branched rays 45-54, 49.5. Sexually mature male (MZUSP 33417, 80 mm SL) with tiny hooks on anterior anal-fin rays (Fig. 18). Pectoral-fin rays i, 11-16, 13.4. Tips of longest pectoral-fin rays reaching about to middle of pelvic-fin length. Pelvic-fin rays i, 7. Sexually mature males with tiny hooks on branched pelvic-fin rays (Fig. 18); male specimen

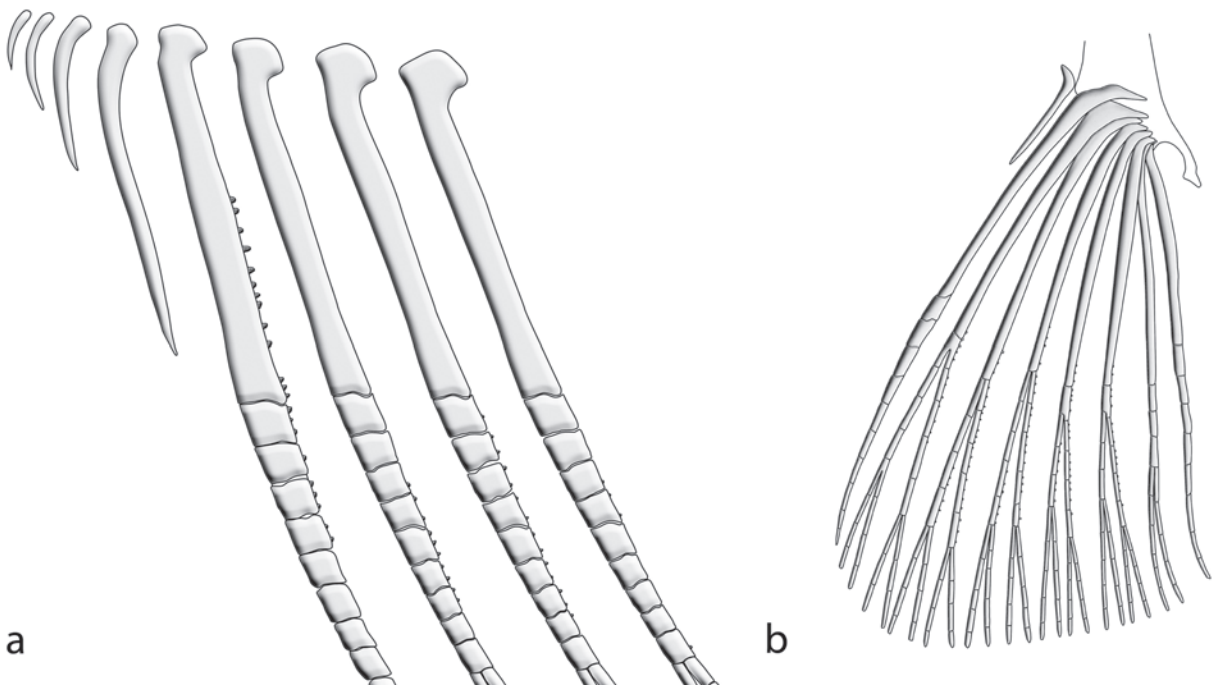

Fig. 18. Hooks on anterior anal-fin rays (a) and pelvic-fin rays (b) of *Charax michaeli*, MZUSP 33417, male, paratype, 80 mm SL.

(MZUSP 33417) with about 12 hooks on first branched ray, 26 on second, 25 on third, 25 on fourth, and 15 on fifth. Distal tips of longest pelvic-fin rays reaching vertical through bases of second to fifth branched anal-fin rays. Principal caudal-fin ray count 10/9 in all specimens.

Lateral line complete; perforated scales 53-60, 57.6. Horizontal scale rows from dorsal-fin origin to lateral line 18-20, 18.1. Horizontal scale rows from pelvic-fin origin to lateral line 9-11, 10.1. Horizontal scale rows from anal-fin origin to lateral line 11-14, 12.8. Predorsal scales 57-85, 66.8. Scale rows around caudal peduncle 17-19, 18. Scale row along anal-fin base extending for about ¾ of fin base.

Premaxillary with one anterior canine-like tooth followed by set of smaller conical teeth and another canine-like tooth followed by one or two small conical teeth. Total number of premaxillary teeth 10-17, 13.3. Maxillary teeth conical, 52-86, 65.7; larger specimens generally with higher counts. Dentary with one canine-like tooth followed by 3-8, 4.5 conical teeth, another canine-like tooth and posterior row of 21-38, 30 conical teeth. Gill-rakers on lower limb of first gill-arch 8-9, 8.7. Branchiostegal rays 4, 3 rays originating from anterior ceratohyal and 1 from posterior ceratohyal.

Color in alcohol. Body pale to light yellow, slightly darker dorsally than on lateral and ventral regions. Ventral portions of body lighter with scattered dark chromatophores especially posteriorly. Dorsal portions of head, snout and tip of lower jaw darker than remainder of head. Dark chromatophores spreading over first, second, most of third, fourth, fifth and sixth infraorbitals, between second and third infraorbitals, median portion of lower jaw and median portion of maxilla. Scattered dark chromatophores on lower central portion of preopercle, and most of opercle. Oval-shaped vertically elongate dark humeral blotch slightly roundish in some specimens encompassing about 2 to 4 scales horizontally and 3 to 5 scales vertically. Triangular, dark blotch on caudal base, faint or even absent in some specimens; dark chromatophores extending over bases of median caudal-fin rays. Inconspicuous dark lines of chromatophores along miosepta of epaxial muscles above lateral line and miosepta of hypaxial muscles below lateral line, forming V-shaped patterns more conspicuous posteriorly. Faint dark lateral stripe extending from behind dorsalmost part of opercle to caudal blotch. All fins hyaline with scattered dark chromatophores more visible on interradial membranes. Inconspicuous clear stripe extends slightly below anal-fin base across entirety of fin.

Anterior portion of first and second unbranched dorsal-fin rays and first unbranched rays of pectoral and pelvic fins darker than remaining rays.

Distribution. *Charax michaeli* is widely distributed in drainages throughout the Amazon basin and has been collected in tributaries of the rio Branco basin; tributaries of the rio Solimões near Manaus; tributaries of the rio Negro, Amazonas; and tributaries of the rio Jari, Amapá, Brazil (Fig. 7).

Sexual dimorphism. Females lack the tiny anal-fin hooks described above for males and usually reach on average larger body sizes than males. Males with fully developed testes and anal- and pelvic-fin hooks (MZUSP 33417) ranged between 49 and 80 mm SL, whereas females with fully mature ovaries (MZUSP 79607, MZUSP 33436, MZUSP 102313, MZUSP 35952, MZUSP 93071, MZUSP 93450, MZUSP 103424 and MZUSP 33417) ranged between 76 and 135 mm SL.

Remarks. Comparison of meristic and morphometric data of the holotype and all the paratypes of *Charax unimaculatus* Lucena, 1989 with the same data of the examined specimens of *C. michaeli* indicated no differences. The differences between the two species reported by Lucena (1989) are not significant since the shape of the humeral dark blotch (pointed out as roundish in *C. unimaculatus* and vertically elongate in *C. michaeli* and the absence of a dark caudal-fin blotch in the former species) vary considerably. In the specimens of *Charax michaeli* examined the shape of humeral blotch varies from roundish to vertically elongate and the spot on the caudal-fin base is absent or faint.

Specimens examined. Brazil: Amazonas: MZUSP 6534, 65 mm SL, (holotype of *Charax unimaculatus*), lago Manacapuru, 3°00'36.8"S 61°20'18.6"W; MZUSP 37277, 1, 86 mm SL, (paratype of *Charax unimaculatus*, collected with holotype); MCP 11253, 3, 76-88 mm SL, (paratypes of *Charax unimaculatus*), Manaus, lago Januari, approximately 2°37'S 60°56'W; MZUSP 6878, 8, 73-86 mm SL, (paratypes of *Charax unimaculatus*), Manaus, lago Januari, approximately 2°37'S 60°56'W; MZUSP

Table 10. Morphometrics of *Charax michaeli*. Specimens are from MZUSP 6534, 37277, 6673, 6459, 19779, 31438, 92375, 92550, 75071, 75603, 75604, 75607, 75608, 38769, 63282, 33436, 93071, 93342, 63206, 93450, 6673, 102313, 101715, 101788, 49769, 101544, 103424, MCP 11523.

Characters	n	range	mean	SD
Standard length	148	37.0 - 135.0	73.0	
Percents of standard length				
Depth at dorsal-fin origin	117	31.5 - 42.8	36.5	2.1
Snout to dorsal-fin origin	118	46.3 - 53.8	51.0	1.2
Snout to pectoral-fin origin	118	24.3 - 31.1	28.2	1.0
Snout to pelvic-fin origin	118	33.3 - 40.0	36.2	1.2
Snout to anal-fin origin	118	44.0 - 53.4	48.5	1.6
Caudal peduncle depth	118	6.8 - 9.6	8.5	0.4
Caudal peduncle length	118	6.0 - 7.8	6.6	0.3
Pectoral-fin length	116	18.0 - 21.8	20.3	0.7
Pelvic-fin length	115	19.5 - 24.6	22.0	1.0
Dorsal-fin base length	118	10.7 - 13.5	11.8	0.5
Dorsal-fin height	82	27.1 - 32.2	30.0	1.0
Anal-fin base length	118	47.0 - 54.4	51.1	1.4
Eye to dorsal-fin origin	118	33.6 - 43.2	38.5	1.8
Dorsal-fin origin to caudal-fin base	118	51.3 - 59.0	55.0	1.1
Humeral spot distance	118	33.3 - 39.6	36.5	0.8
Bony head length	118	25.2 - 31.0	28.0	1.0
Percents of head length				
Horizontal orbital diameter	118	30.1 - 37.5	33.8	1.5
Snout length	118	22.2 - 28.8	25.7	1.0
Least interorbital width	118	20.6 - 28.6	24.0	1.2
Upper jaw length	118	55.4 - 64.7	60.0	1.7

Fig. 19. *Charax niger*, MZUSP 33427, female, paratype, 113 mm SL.

6673, 12, 54-75 mm SL, (paratypes of *Charax unimaculatus*), rio Negro, around Manaus; MZUSP 6459, 4, 73-83 mm SL, (paratypes of *Charax unimaculatus*), above Manacapuru, lago Jacaré, right bank of rio Solimões, approximately 3°15'S 60°33'W; MZUSP 19779, 5, 60-76 mm SL, (paratypes of *Charax unimaculatus*), lake near canal of lago Janauacá, approximately 3°19'S 60°16'W. **Additional specimens. Amazonas:** MZUSP 31438, 1, 114 mm SL, Santa Isabel do Rio Negro, ilha Marubim, rio Marauiá, 0°24'S 65°12'W; MZUSP 92375, 2, 93-98 mm SL, community of Serra da Mucura, rio Tiquié, rio Negro drainage, 0°10'N 69°07'W; MZUSP 92550, 3, 53-97 mm SL, igarapé Castanha, tributary of rio Tiquié, rio Negro drainage, 0°12'N 69°07'W; MZUSP 75071, 79 mm SL, Urucará, paraná de Urucará, 2°32'11"S 57°45'37"W; MZUSP 75603, 2, 56-57 mm SL, paraná do Janauacá, approximately 3°25'S 60°54'W; MZUSP 75604, 4, 38-56.5 mm SL, Camaleão, ilha da Marchantaria, 2°45'33"S 57°48'24"W; MZUSP 75607, 1, 79 mm SL, paraná do Janauacá entering lago Castanho, approximately 3°25'S 60°54'W; MZUSP 75608, 1, 44 mm SL, Amazonas, Janauari, lago Terra Preta; MZUSP 38769, 2, 66-78.5 mm SL, igarapé on right bank of canal do Janauacá, 3°22'S 60°11'W; MZUSP 63282, MZUSP 63283, 10, 50-84 mm SL, Tefé, rio Tefé, 3°22'S 64°43'W; MZUSP 33436, 6, 108-123 mm SL, lake on bank of rio Marauiá, rio Negro drainage, 0°24'S 12°00'W; MZUSP 93071, 1, 126 mm SL, near sítio São Pedro, igarapé Castanha, tributary of rio Tiquié, rio Negro drainage, 0°08'N 69°35'W; MZUSP 93342, 1, 116 mm SL, community of Pirarara-Poço, rio Tiquié, rio Negro drainage, 0°08'N 69°12'W; MZUSP 63206, 6, 46-67 mm SL, Tefé, lago Amanã, mouth of rio Japurá, 2°38'S 64°39'W; MZUSP 93450, 1, 135 mm SL, near community of Serra da Mucura, rio Tiquié, rio Negro drainage, 0°10'00"N 69°07'00"W; MZUSP 6673, 6, 60-75 mm SL, Manaus, rio Negro, 03°10'S 60°00'W; Amapá: MZUSP 102313, 22, 46-11 mm SL, Laranjal do Jari, right bank of rio Jari, near Cachoeira de Santo Antônio, 0°56'S 52°33'W; MZUSP 101715, 5, 76-80 mm SL, Laranjal do Jari, Cachoeira de São Raimundo, rio Iratapuru, 0°33'59"S 52°34'40"W; MZUSP 101788, 6, 72-92 mm SL, Laranjal do Jari, upper portion of Cachoeira Santo Antônio, 0°34'16"S 54°39'31"W; Acre: MZUSP 49769, 2, 72-80 mm SL, between seringal do Paraíso and lago Amapá, not precisely located; Pará: MZUSP 101544, 2, 72-84 mm SL, Monte Dourado, rio Jari, 0°35'38"S 52°38'55"W; MZUSP 103424, 2, 69-89 mm SL, Monte Dourado, upper portion of Cachoeira de Santo Antônio, rio Jari, 0°36'S 52°31'W.

Charax niger Lucena, 1989

Figs. 19-20

Charax niger Lucena, 1989: 99 [original description, type locality: Brazil, Amapá, rio Amapá (river channel), Cachoeira Grande]. -Oyakawa, 1996: 455 (listed in catalog). -Lucena & Menezes, 2003: 201 (maximum length; distribution).

Diagnosis. *Charax niger* differs from *C. caudimaculatus* and *C. notulatus* in the orbital diameter (30.1-38.4% *vs.* 25-28.5% of HL, Fig. 4). *Charax niger* can be distinguished from *C. caudimaculatus* and *C. notulatus* in the scale rows around the caudal peduncle (17-18 *vs.* 20-22), from *C. michaeli* by the number of scale rows from the dorsal-fin origin to the lateral line (15-16 *vs.* 18-20), from *C. pauciradiatus* by the number of the scale rows from the dorsal-fin origin to the lateral line (15-16 *vs.* 13-14), from *C. gibbosus* by the number of predorsal scales (52-68 *vs.* 38-45) and the absence (*vs.* presence) of ectopterygoid teeth) and from *C. leticiae* in having the humeral spot distance (35.4-37.8% of SL, Fig.3, with 5-6 transverse scale rows in space from the humeral spot to the supracleithrum *vs.* the humeral spot distance, 38.5-44.8% of SL, with 8-10 transversal scale rows from the humeral spot to the supracleithrum). *Charax niger* differs from *C. hemigrammus*, *C. condei*, and *C. stenopterus* by having the lateral line complete (*vs.* lateral line incomplete), from *C.*

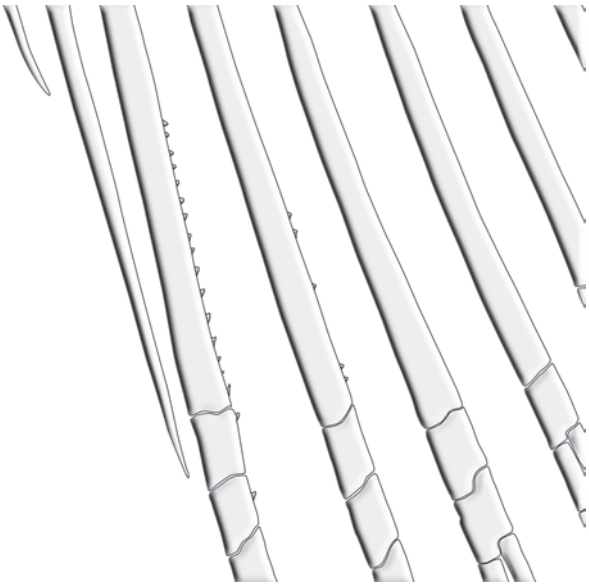

Fig. 20. Hooks on anterior anal-fin rays of *Charax niger*, MZUSP 33424, male, 105 mm SL.

rupununi by the number of scales around the caudal peduncle (17-18 *vs.* 12) and from *C. tectifer*, *C. metae*, and *C. delimai* in having the anal-fin origin always anterior to the vertical through the dorsal-fin origin (*vs.* anal-fin origin on, or slightly posterior to, the vertical through the dorsal-fin origin) and ectopterygoid teeth absent (*vs.* ectopterygoid teeth present).

Description. Morphometrics of examined specimens presented in Table 11. Body elongate, moderately large (40-127 mm SL), compressed and moderately deep. Greatest body depth slightly in advance of dorsal-fin origin. Dorsal profile of head and body straight from tip of snout to anterior portion of fontanel, slightly concave from that point to base of supraoccipital spine, convex from that point to dorsal-fin origin, nearly straight along dorsal-fin base and from end of dorsal-fin base to caudal peduncle and slightly concave along caudal peduncle. Ventral profile of head and body convex from tip of lower jaw to anal-fin origin, nearly straight along anal-fin base and slightly concave from end of anal-fin base to beginning of procurrent rays. Snout pointed. Lower jaw included in upper jaw when mouth closed. Maxilla extending to about vertical through posterior border of pupil.

Table 11. Morphometrics of *Charax niger*. Specimens are from MZUSP 31137, 81137, 81266, 81193, 87354, 87355.

Characters	Holotype	n	range	mean	SD
Standard length	122.0	39	40.0 - 127.0	101.2	
Percents of standard length					
Depth at dorsal-fin origin	38.1	39	35.6 - 41.2	38.2	1.2
Snout to dorsal-fin origin	52.0	39	50.0 - 53.0	51.6	0.5
Snout to pectoral-fin origin	28.7	39	26.7 - 30.5	28.5	1.0
Snout to pelvic-fin origin	37.7	39	35.3 - 39.5	37.4	1.0
Snout to anal-fin origin	50.8	39	47.5 - 52.7	50.5	1.3
Caudal peduncle depth	8.6	39	7.5 - 9.2	8.4	0.4
Caudal peduncle length	7.8	39	6.4 - 9.5	7.5	0.5
Pectoral-fin length	20.1	38	18.2 - 22.0	20.0	0.7
Pelvic-fin length	21.3	38	18.4 - 23.1	21.1	1.0
Dorsal-fin base length	12.3	39	11.1 - 13.1	12.1	0.4
Dorsal-fin height	-	25	28.8 - 31.1	30.0	0.6
Anal-fin base length	50.0	39	46.3 - 53.0	50.0	1.4
Anal-fin lobe length	-	39	14.4 - 18.0	16.1	0.8
Eye to dorsal-fin origin	39.3	39	36.5 - 40.8	38.8	0.8
Dorsal-fin origin to caudal-fin base	55.7	39	54.2 - 57.1	55.3	1.0
Humeral spot distance	36.4	39	35.4 - 40.0	37.6	1.2
Bony head length	27.0	39	25.6 - 28.7	27.3	0.5
Percents of head length					
Horizontal orbital diameter	33.3	39	30.8 - 35.5	32.8	0.8
Snout length	28.8	39	25.8 - 31.0	28.2	1.0
Least interorbital width	21.2	39	21.2 - 24.3	23.0	0.8
Upper jaw length	65.1	39	60.1 - 66.6	63.7	1.4

Dorsal-fin rays ii, 9-10, 9, posteriormost ray unbranched. Adipose fin present. Unbranched anal-fin rays iv or v, usually iv , branched rays 44-52, 48.2. Sexually mature males with hooks on anal-fin (Fig. 20); one male specimen (MZUSP 33424, 105 mm SL) with bilateral tiny hooks on posterior anterior 11 rays, number of hooks varying considerably, but posteriormost rays with fewer hooks: third unbranched ray with 28, fourth unbranched ray first branched ray with 22, second with 28, third with 19, fourth with 17, fifth with 17, sixth with 6, seventh with 7, eighth with 8, nineth with 9, tenth with 6, and eleventh with 3. Pectoral-fin rays i, 12-17, 14. Tips of longest pectoral-fin rays reaching slightly beyond middle of pelvic-fin length. Pelvic-fin rays i, 7. No hooks on pelvic-fin rays of sexually mature males. Tips of longest pelvic-fin rays reaching vertical through bases of second and fourth branched anal-fin rays. Principal caudal-fin ray count 10/9 in all specimens.

Lateral line complete; perforated scales 53-60, 56.3. Horizontal scale rows from dorsal-fin origin to lateral 15-16, 15.7. Horizontal scale rows from pelvic-fin origin to lateral line 9-11, 9.8. Scale rows from anal-fin origin to lateral line 11-14, 12. Predorsal scales 52-68, 58. Scale rows around caudal peduncle 17-18, 17.8. Scale row along anal-fin base extending for about $^{2}/_{3}$ of fin base.

Premaxillary with one anterior canine-like tooth followed by set of smaller conical teeth and another canine-like tooth followed by one or two small conical teeth. Total number of premaxillary teeth 9-16, 13. Maxillary teeth conical, 47-77, 67.2, larger specimens usually with higher counts. Dentary with one canine-like tooth followed by 3-6, 4.4 conical teeth, another canine-like tooth and a posterior row of 18-36, 28.2 conical teeth.

Gill-rakers on lower limb of first gill-arch 8-10, 8.4. Branchiostegal rays 4; 3 rays originating from anterior ceratohyal and 1 from posterior ceratohyal.

Color in alcohol. Body pale to light yellow, slightly darker dorsally than on lateral and ventral portions. Body lighter ventrally with scattered dark chromatophores especially posteriorly. Dorsal part of head, snout and tip of lower jaw darker than remainder of head; dark chromatophores spreading over first, second, fourth, fifth and sixth infraorbitals, between second and third infraorbitals as subocular blotch extending ventrally to ventral border of preopercle, median portion of

Fig. 21. *Charax notulatus*, USNM 260305, female, paratype, 77 mm SL, Venezuela, Guárico, 5 km N of RPV 83-4, río Portuguesa.

lower jaw and median portion of maxilla. Scattered dark chromatophores on preopercle, and opercle. Irregularly shaped vertically elongate dark blotch at humeral blotch encompassing about 3 to 4 scales horizontally and 4 to 5 vertically. Triangular dark blotch on caudal base, dark chromatophores of posterocentral portion extending over bases of median caudal-fin rays. Darker lines of chromatophores along miosepta of epaxial muscles above lateral line and miosepta of hypaxial muscles below lateral line; more conspicuous on body region posterior to vertical through termination of dorsal-fin base, forming V-shaped patterns. All fins hyaline with scattered dark chromatophores more visible on the interradial membranes. Inconspicuous clear stripe dorsally below bases of anterior anal-fin rays, approaching and extending very close to anal-fin base from about middle to end of fin base. Anterior portion of first and second unbranched dorsal-fin rays and first unbranched rays of pectoral and pelvic fins darker than remaining rays.

Sexual dimorphism. Females lack tiny anal-fin hooks described above for males and usually reach on average larger body sizes than males. The only four males available (MZUSP 33430, MZUSP 33431, MZUSP 38303, and MZUSP 33424) have fully developed testes and anal-fin hooks respectively at 83.5, 104, 101, and 105 mm SL. Females with developed ovaries (MZUSP 33430, MZUSP 33431, MZUSP 33424, and MZUSP 3830) were fully mature at sizes between 103 and 127 mm SL.
Distribution. *Charax niger* is known from rio Tocantins, rio Amapá and tributaries; rio Negro and tributaries; and a tributary of rio Preto da Eva, Brazil (Fig. 7).

Specimens examined. Brazil, Amazonas: MZUSP 31137, 1, 70 mm SL, Anavilhanas, rio Negro, 3°06'53"S 60°00'14"W; MZUSP 81137, 1, 79.3 mm SL, rio Tiquié, between communities Caruru and Boca de Sal, 0°16'N 69°54'W, rio Negro drainage; MZUSP 81266, 1, 79.3 mm SL, community of Caruru, rio Tiquié, rio Negro drainage, 0°16'N 69°54'W; MZUSP 81193, 3, 76-96 mm SL, community of Caruru, rio Tiquié, rio Negro drainage, 0°16'N 69°54"W; MZUSP 87354, 1, 40 mm SL, Recanto do Buriti, Rio Preto da Eva, rio Negro drainage, 2°41'58"S 59°54'W; MZUSP 87355, 1, 95 mm SL, Rio Preto da Eva, igarapé Agripino, tributary of rio Preto da Eva, 2°43'59"S 59°40'48"W. MZUSP 33427, 6, 97-122 mm SL, Amapá, Cachoeira Grande, canal of river, not precisely located. Tocantins: UNT 9042, 1, 83 mm SL, riacho afluente do rio Santa Tereza, Sucupira, 12º15'0"S 48º41'01"W; UNT 166, 2, 62-68 mm SL, UNT 2563, 1, 107 mm SL, Lagoa Pedra do Santo, Brejunho de Nazaré, 11º01'S 48º34'W.

Charax notulatus Lucena, 1987

Fig. 21

Charax notulatus Lucena, 1987: 46 (original description, type locality: Venezuela, Delta Amacuro, río Orinoco, small cãno near mouth of Caño Soroco). -Vari & Howe, 1991: 13-14 (listed in type catalog). -Oyakawa, 1996: 456 (listed in type catalog). -Provenzano *et al*., 1998: 5 (listed in type catalog). -Lucena, 1989: 104 (in key to species). -Lucena & Menezes, 2003: 201 (maximum length; distribution).

Diagnosis. Among congeners *Charax notulatus* differs from *C. apurensis*, *C. macrolepis*, *C. michaeli*, *C. pauciradiatus*, *C. gibbosus*, C. *niger*, and *C. leticiae* in the orbital diameter (26.1-28.5% *vs.* 30.1-38.4% of HL, Fig. 4). *Charax notulatus* can be distinguished from *C. caudimaculatus* in the snout length (24.3-26.3% *vs.* 20.3-22.8% of HL, Fig. 5). *Charax notulatus* differs from *C. hemigrammus*, *C. condei*, and *C. stenopterus* by having the lateral line complete (*vs.* lateral line incomplete), from *C. rupununi* by the number of scales around the caudal peduncle (20-22 *vs.* 12) and from *C. tectifer*, *C. metae*, and *C. delimai* by having the anal-fin origin always located anterior to the vertical through the dorsal-fin origin (*vs.* anal-fin origin on, the vertical or slightly posterior to, the vertical through the dorsal-fin origin) and ectopterygoid teeth absent (*vs.* ectopterygoid teeth present).

Description. Morphometrics of examined specimens presented in Table 12. Body elongate, moderately large (53-79 mm SL), compressed and moderately deep. Greatest body

depth slightly in advance of dorsal-fin origin. Dorsal profile of head and body straight from tip of snout to anterior region of fontanel, slightly concave from that point to base of supraoccipital spine, convex from that point to dorsal-fin origin, nearly straight along dorsal-fin base and from end of dorsal-fin base to caudal peduncle and slightly concave along caudal peduncle. Ventral profile of head and body convex from tip of lower jaw to anal-fin origin, nearly straight along anal-fin base and concave from end of anal-fin base to beginning of procurrent rays. Snout pointed. Lower jaw included in upper jaw when mouth closed. Maxilla extending to about vertical through posterior border of pupil.

Dorsal-fin rays ii, 9 posteriormost ray unbranched. Adipose fin present. Unbranched anal-fin rays iv or v, usually iv, branched rays 43-53, 48.1. Pectoral-fin rays i, 13-16, 14.6. Tips of longest pectoral-fin rays reaching to, or slightly beyond, vertical through anal-fin origin. Pelvic-fin rays i, 7. Tips of longest pelvic-fin rays reaching vertical through bases of fourth and sixth branched anal-fin rays. Principal caudal-fin ray count 10/9 in all specimens.

Lateral line complete; perforated scales 58-64, 60.5. Horizontal scale rows from dorsal-fin origin to lateral line 18-19, 18.1. Horizontal scale rows from pelvic-fin origin to lateral line 10-12, 11.5. Scale rows from anal-fin origin to lateral line 14-17, 15.1. Predorsal scales 46-52, 48.5. Scale rows around caudal peduncle 20-22, 20.7. Scale row along anal-fin base extending for about $^{2}/_{3}$ of fin base.

Premaxillary with one anterior canine-like tooth followed by a set of smaller conical teeth and another canine-like tooth followed by one or two small conical teeth. Total number of premaxillary teeth 13-15, 14. Maxillary teeth conical, 58-78, 63.6; larger specimens usually with higher counts. Dentary with one canine-like tooth followed by 3-4, 3.6 conical teeth, another canine-like tooth and a posterior row of 28-34, 30.5 conical teeth.

Vertebrae 32 in one specimen. Gill-rakers on lower limb of first gill-arch 8-9, 8.7. Branchiostegal rays 4; 3 rays originating from anterior ceratohyal and 1 from posterior ceratohyal.

Table 12. Morphometrics of *Charax notulatus*. Specimens are from MZUSP 28659, USNM 233624, 260305, 270254.

Characters	n	range	mean	SD
Standard length	9	63.2 - 76.5	69.6	
Percents of standard length				
Depth at dorsal-fin origin	9	33.5 - 38.4	35.5	2.2
Snout to dorsal-fin origin	9	48.4 - 51.7	50.2	1.2
Snout to pectoral-fin origin	8	26.3 - 30.0	27.7	1.1
Snout to pelvic-fin origin	8	33.5 - 35.4	34.4	0.6
Snout to anal-fin origin	8	46.0 - 48.6	48.0	1.0
Caudal peduncle depth	9	7.5 - 8.3	8.0	0.3
Caudal peduncle length	9	5.8 - 6.8	6.3	0.3
Pectoral-fin length	9	18.5 - 20.2	19.2	0.6
Pelvic-fin length	8	19.2 - 20.8	20.2	0.5
Dorsal-fin base length	9	9.7 - 10.4	10.0	0.2
Dorsal-fin height	7	24.8 - 27.0	26.0	0.8
Anal-fin base length	9	48.0 - 51.1	50.1	1.2
Eye to dorsal-fin origin	9	37.7 - 40.5	39.0	1.1
Dorsal-fin origin to caudal-fin base	9	53.0 - 56.0	54.0	1.0
Humeral spot distance	9	37.0 - 40.0	39.0	1.2
Bony head length	9	26.0 - 28.0	27.2	0.8
Percents of head length				
Horizontal orbital diameter	9	26.1 - 28.5	27.6	0.7
Snout length	9	24.3 - 26.3	25.2	0.6
Least interorbital width	8	19.0 - 21.0	20.4	0.7
Upper jaw length	9	58.1 - 60.6	59.0	0.8

Color in alcohol. Body pale to light yellow, slightly darker dorsally than on lateral and ventral regions. Body lighter ventrally with scattered dark chromatophores especially posteriorly. Dorsal region of head, snout and tip of lower jaw darker than remainder of head. Dark chromatophores spreading over first, second, between second and third infraorbitals as subocular blotch extending ventrally to ventral border of preopercle. Dark chromatophores scattered over median portion of lower jaw and median portion of maxilla. Scattered dark chromatophores on preopercle, and opercle. Irregularly shaped, vertically elongate, dark humeral blotch extending about 5 to 7 scales horizontally and 5 to 8 scales vertically. Small, oval-shaped, dark caudal blotch on caudal base with dark chromatophores of posterocentral portion extending over bases of median caudal-fin rays. Inconspicuous dark lines of chromatophores forming V-shaped patterns along miosepta of epaxial muscles above lateral line. All fins hyaline with scattered dark chromatophores, more visible on interradial membranes. Anterior portion of first and second unbranched dorsal-fin rays and first unbranched rays of pectoral and pelvic fins darker than remaining rays.

Distribution. This species occurs in tributaries of the río Orinoco drainage (Fig. 7).

Specimens reexamined. Venezuela: USNM 233624, 5 paratypes, 65.7-71.5 mm SL, Delta do Amacuro, 111 nautic miles above Mar de Buoy, small stream near mouth of río Socoroco, río Orinoco drainage, 08°35'N 61°42'W; USNM 260305, 1 paratype, 76 mm SL, Guárico, 5 km N of RPV 83-4, río Portuguesa, 08°14'N 67°35'W; USNM 270254, 3 paratypes, 70-74 mm SL, Monagas, Los Castillos, isolated pond between Ordoz and Barrancas, 263 nautical miles from Sea Buoy, 08°31'36"N 62°26'42"W; MZUSP 28659, 1 paratype, 62 mm SL, Delta do Amacuro, río Guarguapo, tributary of río Orinoco. Already included in Lucena (1987).

Charax pauciradiatus (Günther, 1864)

Figs. 22-23

Anacyrtus pauciradiatus Günther, 1864 [original description, type locality: Brazil, State of Pará, rio Capin (= rio Capim)].
Charax pauciradiata, Eigenmann, 1910: 444 (listed in catalog).
Charax pauciradiatus, Lucena, 1987: 48 (diagnosis; description; comparisons; distribution; geographic variation). -Lucena & Menezes, 2003: 104 (maximum length; distribution).

Diagnosis. *Charax pauciradiatus* differs from *C. apurensis* and *C. macrolepis* by having the orbital diameter 30.4-38.7% of HL (*vs.* 20-21% of HL, Fig. 4) and from *C. caudimaculatus*

Fig. 22. *Charax pauciradiatus* MZUSP 19538, female, 100 mm SL, Brazil, Pará, rio Apeú, Boa Vista.

and *C. notulatus* that have the orbital diameter 25-28.5% of HL. *Charax pauciradiatus* can be distinguished from *C. michaeli* in the number of the scale rows from the dorsal-fin origin to to the lateral line (13-14 *vs.* 18-20) and from *C. leticiae* that has 16-18 scale rows from the dorsal-fin origin to the lateral line. *Charax pauciradiatus* differs from *C. niger* and *C. gibbosus* in having the humeral spot distance 38-44% of SL (*vs.* 34.7-37.8% of SL, Fig. 3). *Charax pauciradiatus* differs from *C. hemigrammus*, *C. condei*, and *C. stenopterus* in having the lateral line complete (*vs.* lateral line incomplete), from *C. rupununi* by the number of scales around the caudal peduncle (15-17 *vs.* 12) and from *C. tectifer*, *C. metae*, and *C. delimai* by having the anal-fin origin always located anterior to the vertical through the dorsal-fin origin (*vs.* the anal-fin origin on, or slightly posterior, to the dorsal-fin origin) and the ectopterygoid teeth absent (*vs.* ectopterygoid teeth present).

Description. Morphometrics of examined specimens presented in Table 13. Body elongate, moderately large (36-100 mm SL), compressed and moderately deep. Greatest body depth slightly in advance of dorsal-fin origin. Dorsal profile of head and body slightly convex on tip of snout, straight from posterior border of posterior nostril to vertical through posterior border of pupil, slightly concave from that point to base of supraoccipital spine, strongly convex from that point to dorsal-fin origin, nearly straight along dorsal-fin base and from end of dorsal-fin base to caudal peduncle and slightly concave along caudal peduncle. Ventral profile of head and body convex from tip of lower jaw to anal-fin origin, nearly straight along anal-fin base and concave from end of anal-fin base to beginning of procurrent rays. Snout pointed. Lower jaw included in upper jaw when mouth closed. Maxilla extending slightly beyond vertical through slightly posterior of middle of orbital diameter.

Dorsal-fin rays ii, 9 in all specimens, posterior most ray unbranched. Adipose fin present. Unbranched anal-fin rays iv or v, usually iv, branched rays 43-51, 46.6. Sexually mature males with hooks on anterior anal-fin rays (Fig. 23); one male specimen (MZUSP 19538, 86 mm SL) with tiny bilateral hooks on posterior anterior 10 rays, number of hooks varying considerably, but posteriormost rays with fewer hooks: fourth unbranched ray with 13, first branched ray with 18, second with 22, third with 23, fourth with 24, fifth with 24, sixth with 22, seventh with 15, eighth with 12, nineth with 10, and tenth with 8. Pectoral-fin rays i, 13-17, 14.4. Tips of longest pectoral-fin rays reaching to, or slightly beyond, middle of pelvic-fin length. Pelvic-fin rays i, 7. Sexually mature males with tiny hooks on branched pelvic-fin rays (Fig. 23); male specimen (MZUSP 19538) with 38 hooks on first branched ray, 75 on second, 78 on third, 55 on fourth, 54 on fifth and 38 on sixth. Tips of longest pelvic-fin rays reaching to vertical between bases of third to fifth branched anal-fin rays. Principal caudal-fin ray count 10/9 in all specimens.

Lateral line complete; perforated scales 52-58, 55.7. Horizontal scale rows from dorsal-fin origin to lateral line 13-14, 13.9. Horizontal scale rows from pelvic-fin origin to lateral line 9-10, 9.4. Horizontal scale rows from anal-fin origin to lateral line 11-14, 12.6. Predorsal scales 30-38, 34.2. Scale rows around caudal peduncle 15-17, 16.7. Scale row along anal-fin base, extending posteriorly for distance between $^{2}/_{3}$ and $^{3}/_{4}$ of fin base length.

Premaxillary with one anterior canine-like tooth followed by a set of smaller conical teeth and another canine-like tooth followed by one or two small conical teeth. Total number of

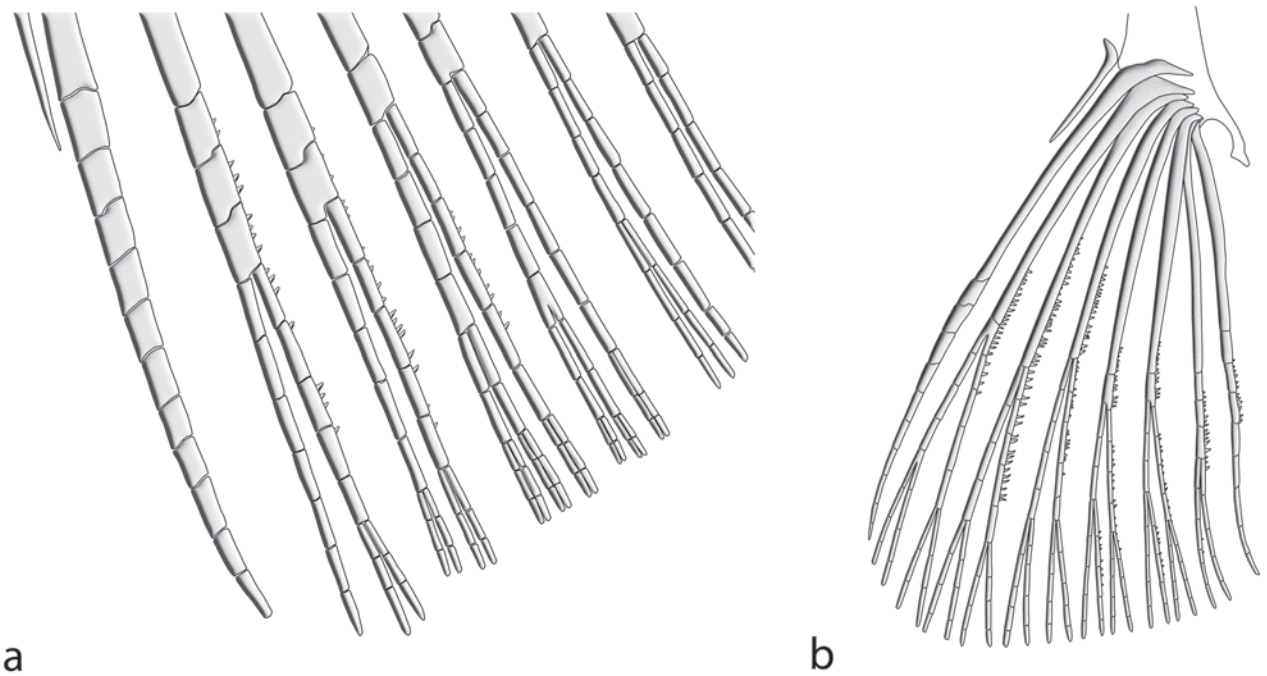

Fig. 23 Hooks on anterior anal-fin rays (a) and pelvic-fin rays (b) of *Charax pauciradiatus*, MZUSP 19538, male, 86 mm SL.

premaxillary teeth 9-15, 11.6. Maxillary teeth conical, 42-67, 52.8; larger specimens usually with higher counts. Dentary with one canine-like tooth followed by 3-5, 3.8 conical teeth, another canine-like tooth and posterior row of 20-31, 24.1 conical teeth.

Vertebrae 34 and 35, in two specimens. Gill-rakers on lower limb of first gill-arch 7-9, 8. Branchiostegal rays 4; 3 rays originating from anterior ceratohyal and 1 from posterior ceratohyal.

Table 13. Morphometrics of *Charax pauciradiatus*. Specimens are from MZUSP 26562, 33418, 20562, 83763, 62114, 60391, MCP 22537, 39032.

Characters	n	range	mean	SD
Standard length	67	36.0 - 112.0	64.0	
Percents of standard length				
Depth at dorsal-fin origin	67	32.1 - 42.1	37.1	2.1
Snout to dorsal-fin origin	67	49.2 - 53.8	51.4	1.0
Snout to pectoral-fin origin	67	27.4 - 32.0	29.4	1.1
Snout to pelvic-fin origin	67	34.6 - 40.5	37.5	1.4
Snout to anal-fin origin	67	47.5 - 53.1	50.1	1.4
Caudal peduncle depth	58	7.2 - 9.0	8.2	0.4
Caudal peduncle length	64	6.5 - 8.0	7.5	0.3
Pectoral-fin length	65	17.5 - 21.6	19.7	0.9
Pelvic-fin length	67	20.0 - 25.3	22.3	1.1
Dorsal-fin base length	67	10.8 - 13.6	12.1	0.6
Dorsal-fin height	52	27.7 - 32.0	30.1	1.0
Anal-fin base length	56	47.0 - 52.8	49.5	1.1
Eye to dorsal-fin origin	67	34.6 - 40.2	37.7	1.3
Dorsal-fin origin to caudal-fin base	67	52.0 - 57.0	54.4	1.1
Humeral spot distance	65	38.0 - 42.5	40.5	1.1
Bony head length	67	26.5 - 31.0	29.0	1.0
Percents of head length				
Horizontal orbital diameter	67	30.4 - 38.7	35.6	1.5
Snout length	67	23.6 - 30.7	27.5	1.5
Least interorbital width	67	21.2 - 25.4	23.3	1.1
Upper jaw length	67	57.8 - 64.5	62.0	1.5

Color in alcohol. Body pale to light yellow, slightly darker dorsally than on lateral and ventral regions. Ventral region of body lighter, but with scattered dark chromatophores. Irregularly shaped vertically elongate dark humeral blotch extending about three or four scales horizontally and six or seven vertically. Dorsal part of head, snout and tip of lower jaw darker than remainder of head; dark coloration extending to median and ventral portions of lower jaw, along first and second infraorbitals and between second and third infraorbitals as a very conspicuous subocular stripe extending to lower edge of preopercle. Scattered dark chromatophores on fifth and sixth infraorbitals, anterior and posterior borders of third and fourth infraorbitals and opercular bones. V-shaped lines of chromatophores over miosepta along epaxial and hypaxial muscles more visible on posterior portion of body. Approximately triangular-shaped dark blotch on caudal base more conspicuous in young specimens; posterior dark chromatophores. Inconspicuous clear stripe extending for length of fin between darker basal anal-fin region and remaining ventral portion of fin, extending for length of fin. All fins hyaline with scattered dark chromatophores, more visible on interradial membranes. Anterior portion of first and second unbranched rays of dorsal and first unbranched rays of pectoral and pelvic-fin rays darker than remaining rays.

Sexual dimorphism. Females lack tiny anal- and pelvic-fin hooks described above for males.

Fig. 24. *Charax rupununi*, MZUSP 27937, female, 38 mm SL, Brazil, Pará, lago Jacaré, rio Trombetas.

Distribution. *Charax pauciradiatus* has been collected on ilha do Marajó, tributaries of the rio Capim, Pará; Paricatuba, Amazonas; rio Aripuanã, Mato Grosso; and rio Madeira basin, Rondônia, Brazil (Fig. 7).

Specimens examined. Brazil, Pará: MZUSP 83763, 4, 48-83 mm SL, Castanhal, igarapé Apeú, rio Capim drainage, approximately 1°24'S 46°06'W; MZUSP 20562, 10, 38-83 mm SL, lago Maria Preta, rio Capim drainage; MZUSP 20552, 26, 36-96 mm SL, rio Capim; MZUSP 19538, 3, 86-100 mm SL, rio Apeú, Boa Vista, 1°36'S 47°37'W; MZUSP 33418, 9, 48-58 mm SL, rio Apeú, Boa Vista, 1°36'S 47°37'W; MCP 22537, 7, 52-90 mm SL, tributary of rio Capim and lagoa marginal between Paragominas and Tomé-Açu, about 56 km west of Paragominas, 2°29'13"S 47°9'2"W; MCP 22539, 1, 92 mm SL, Tomé-Açu, igarapé Urucare, on road between Tomé-Açu and Moju, about 49 km west of Tomé-Açu, 2°29'13"S 48°31'31"W; MCP 39032, 1, 112 mm SL, Rondônia, tributary of rio Madeira, on road BR-364 between Ariquemes and Candeias do Jamari, 8°47'23"S 63°37'37"W. Amazonas: MZUSP 62114, 2, 55-56 mm SL, Paricatuba, 4°40'31"S 61°55'33"W; Mato Grosso: MZUSP 60391, 1, 64 mm SL, Aripuanã, rio Aripuanã, on road between Colima and Panelas.

Charax rupununi Eigenmann, 1912

Fig. 24

Charax rupununi Eigenmann, 1912: 402 (original description, type locality: Guyana, Rupununi River). -Henn, 1928: 70 (listed in type catalog). -Ibarra & Stewart, 1987: 22 (listed in type catalog). -Lucena, 1987: 50 (diagnosis, description; comparisons; distribution). -Lucena, 1989: 104 (in key to species). -Lucena & Menezes, 2003: 201 (maximum length; distribution).

Charaxodon rupununi, Fernandez-Yepez, 1947 (in key to species).

Diagnosis. *Charax rupununi* is distinguished from congeners with the lateral line complete and the dorsal region of the body anterior to the dorsal fin scaled except for a small naked area anterior to the dorsal-fin origin in having 42-44 perforated scales along the lateral line (*vs.* 50-65 perforated scales on the lateral line in *C. tectifer*, *C. metae*, *C. delimai*, *C. metae*, *C. caudimaculatus*, *C. notulatus*, *C. apurensis*, *C. macrolepis*, *C. michaeli*, *C. pauciradiatus*, *C. gibbosus*, *C. niger*, and *C. leticiae*). *Charax rupununi* differs from *C. hemigrammus*, *C. condei* and *C. stenopterus* by having the lateral line complete and the dorsal region of the body anterior to the dorsal fin, except for a small naked area anterior to dorsal-fin origin scaled (*vs.* the lateral line incomplete and scales lacking on the dorsal region of the body anterior to the dorsal fin).

Description. Table with complete morphometric data not presented since only the poorly preserved holotype and another more recently collected specimen of this rare species were available for study. Body elongate, small compared to congeners (38-45 mm SL), compressed and comparatively low. Greatest body depth slightly in advance of dorsal-fin origin. Dorsal profile of head and body slightly convex from tip of snout to anterior region of fontanel, slightly concave from that point to base of supraoccipital spine, slightly convex from that point to dorsal-fin origin, nearly straight along dorsal-fin base and from end of dorsal-fin base to caudal peduncle and very slightly concave along caudal peduncle. Ventral profile of head and body convex from tip of lower jaw to anal-fin origin, nearly straight to slightly concave along anal-fin base and slightly concave from end of anal-fin base to beginning of procurrent rays. Snout pointed. Lower jaw included in upper jaw when mouth closed. Maxilla extending slightly beyond vertical through middle of orbit.

Dorsal-fin rays ii, 9 (2) posteriormost ray unbranched. Adipose fin present. Unbranched anal-fin rays iv, branched rays 44-46. Pectoral-fin rays i, 12-15. Tips of longest pectoral-fin rays extending beyond pelvic-fin origin, but falling short

Fig. 25. *Charax stenopterus*, MZUSP 19919, male, 75 mm SL, Brazil, Rio Grande do Sul, Marquês de Souza, rio Forqueta, rio Jacuí drainage.

of vertical through middle of pelvic-fin length. Pelvic-fin rays i, 7 (2). Tips of longest pelvic-fin rays reaching slightly beyond anal-fin origin. Principal caudal-fin ray count 10/9 (2).

Lateral line complete; perforated scales 42-44. Horizontal scale rows from dorsal-fin origin to lateral line 13 (1). Horizontal scale rows from pelvic-fin origin to lateral line 7 (1). Horizontal scale rows from anal-fin origin to lateral line eigth and nine. Scale rows around caudal peduncle 12 (1). No scales anteriorly along anal-fin base.

Premaxillary with one anterior large conical tooth followed by set of smaller conical teeth, one large conical teeth and six smaller conical teeth (1). Total number of premaxillary teeth 14 (1). Maxillary teeth conical, 41-42. Dentary with anterior row including six conical teeth and posterior row with 21 conical teeth (1). Ectopterygoid conical teeth 14 (1).

Vertebrae 32 (1). Gill-rakers on lower limb of first gill-arch 8 (1). Branchiostegal rays 4; 3 rays originating from anterior cerathyal and 1 from posterior ceratohyal (1).

Color in alcohol. Most of original coloration not preserved. Body pale, slightly darker dorsally. Scattered dark chromatophores all over body. Roundish dark humeral blotch extending about two scales horizontally and one scale vertically. Concentration of dark chromatophores on caudal base forming oval-shaped blotch extending over bases of median caudal-fin rays. Dorsal portions of head, snout and tip of lower with scattered dark chromatophores. Opercle with scattered dark chromatophores. All fins hyaline.

Distribution. The two known specimens of this species have been collected respectively in Rupununi, Guyana and Lago Jacaré, rio Trombetas, Brazil (Fig. 7).

Specimens examined. FMNH 53663, holotype, 45 mm SL, Guyana: Rupununi, 4°21'43"N 59°09'30"W; MZUSP 27937, 1, 38 mm SL, Brazil, Pará, lago Jacaré, rio Trombetas, 1°20'S 56°51'W. Previously included in Lucena (1987).

Charax stenopterus (Cope, 1894)

Fig. 25

Asiphonichthys stenopterus Cope, 1894: 67 (original description, type locality: Brazil, Rio Grande do Sul State, headwaters of rio Jacuí). -Böhlke, 1984: 54 (listed in type catalog).

Charax stenopterus, Lucena, 1987: 26 (diagnosis; description; comparisons; distribution; geographic variation; morphometric data). -Lucena, 1989: 104 (in key to species). -Lucena & Menezes, 2003: 201 (maximum length; distribution). -López *et al*., 2003: 17 (Argentina, listed). -Casciotta *et al.*, 2003: 83 (Laguna Iberiá, Argentina, listed). -Menni, 2004: 74 (Argentina, listed).

Diagnosis. *Charax stenopterus* is distinguished from congeners except *C. condei* and *C. hemigrammus* by having the lateral line incomplete and the dorsal part of the body anterior to the dorsal fin without scales (*vs.* lateral line complete and the dorsal part of body anterior to dorsal fin with scales). *Charax stenopterus* differs from *C. hemigrammus* in the number of scale rows from the pelvic-fin origin to the lateral line (7-9 *vs.* 11-12) and from *C. condei* in lacking ectopterygoid teeth and 18-28 teeth on the posterior dentary row (*vs.* ectopterygoid teeth present and 30-41 teeth on the posterior dentary row).

Description. Morphometrics of examined specimens presented in Table 14. Body elongate, moderately large compared to congeners (33-85 mm SL), compressed and comparatively low. Greatest body depth slightly in advance of dorsal-fin origin. Dorsal profile of head and body slightly convex from tip of snout to anterior region of fontanel, slightly concave from that point to base of supraoccipital spine, convex from that point to dorsal-fin origin, nearly straight along dorsal-fin base and from end of dorsal-fin base to caudal peduncle and very slightly concave along caudal peduncle. Ventral profile of head and body convex from tip of lower jaw to anal-fin origin, nearly straight to slightly concave along anal-fin base and concave from end of anal-fin base to beginning of procurrent rays. Snout pointed. Lower jaw included in upper jaw when mouth closed. Maxilla extending to about vertical through middle of orbit.

Dorsal-fin rays ii, 8-10, 9, posteriormost ray unbranched. Adipose fin present. Unbranched anal-fin rays iv or v, usually iv, branched rays 37-48, 43.2. No hooks on anterior anal-fin rays of all examined mature males. Pectoral-fin rays i, 11-17, 14. Tips of longest pectoral-fin rays extending slightly beyond vertical through middle of pelvic-fin length. Pelvic-fin rays i, 7. No hooks on pelvic-fin rays of all examined mature males. Tips of longest pelvic-fin rays reaching vertical through bases of second and fourth branched anal-fin rays. Principal caudal-fin ray count 10/9 in all specimens.

Lateral line incomplete; perforated scales 2-10, 6. Lateral series scales 40-47, 43.4. Horizontal scale rows from pelvic-fin origin to lateral line 7-9, 8.1. Scale rows around caudal peduncle 16-18, 16.7. No scale rows anteriorly along anal-fin base.

Premaxillary with one anterior large conical tooth followed by set of smaller conical teeth, one to two large conical teeth and 1-4 smaller conical teeth. Total number of premaxillary teeth 10-17, 13. Maxillary teeth conical, 37-52, 42.6; larger specimens generally with higher counts. Dentary with anterior row including 4-7, 5.2 conical teeth and posterior row with 18-28, 21.1 conical teeth.

Vertebrae 31-33, 32.1. Gill-rakers on lower limb of first gill-arch 7-10, 8.3 . Branchiostegal rays 4, 3 rays originating from anterior cerathyal and 1 from posterior ceratohyal.

Table 14. Morphometrics of *Charax stenopterus*. Specimens are from MZUSP 9616, 4499, 19884, 19919, 19975, 19968, 19726, 19730, 19683, 19734, 19375.

Characters	n	range	mean	SD
Standard length	31	33.0 - 85.0	54.5	
Percents of standard length				
Depth at dorsal-fin origin	31	33.6 - 39.2	36.3	1.5
Snout to dorsal-fin origin	31	50.0 - 55.8	52.0	1.5
Snout to pectoral-fin origin	31	23.4 - 28.0	26.4	1.0
Snout to pelvic-fin origin	31	32.5 - 37.8	34.7	1.2
Snout to anal-fin origin	31	42.4 - 49.2	46.0	1.7
Caudal peduncle depth	31	8.5 - 10.2	9.4	0.5
Caudal peduncle length	31	5.4 - 8.0	6.6	0.6
Pectoral-fin length	29	17.5 - 20.4	18.8	0.8
Pelvic-fin length	31	18.5 - 22.2	21.0	1.0
Dorsal-fin base length	31	10.0 - 12.5	11.5	0.7
Dorsal-fin height	29	27.4 - 33.3	30.0	1.1
Anal-fin base length	31	48.2 - 56.0	52.6	1.6
Eye to dorsal-fin origin	31	36.2 - 43.9	39.3	1.9
Dorsal-fin origin to caudal-fin base	31	50.0 - 56.8	55.0	1.4
Humeral spot distance				
Bony head length	31	24.8 - 29.1	27.0	1.0
Percents of head length				
Horizontal orbital diameter	31	30.7 - 35.5	32.7	1.2
Snout length	31	25.6 - 32.2	28.6	1.5
Least interorbital width	31	23.0 - 27.7	25.5	1.3
Upper jaw length	31	49.5 – 55.0	51.6	1.5

Color in alcohol. Body pale, with scattered dark chromatophores more concentrated on dorsal part of head and dorsal and lateral portions of trunk, extending over snout, maxillae, tip of jaws, and infraorbitals, less so ventrally. Dark humeral blotch inconspicuous to well-developed; blotch extending about two scales horizontally and one scale vertically. Concentration of dark chromatophores on caudal-fin base forming tringular-shaped blotch with chromatophores on posterocentral portion extending onto bases of central caudal-fin rays. Chromatophores darker slightly above midbody, forming V-shaped lines along miosepta of epaxial and hypaxial musculature; lines more conspicuous on posterior portion of body. All fins hyaline with scattered dark chromatophores, especially abundant on interradial membranes of dorsal, anal, and basal portion of caudal fins; fewer chromatophores on pectoral and pelvic fins.

Distribution. This species is widely distributed in tributaries of rio Jacuí and coastal lagoons of Rio Grande do Sul, Brazil and Uruguay. It occurs also in tributaries of the rio Uruguay, Brazil and lower rio Paraná, Brazil, Paraguay, and Argentina (Fig. 7).

Specimens examined. Brazil: Rio Grande do Sul. MZUSP 9616, 4, 52.5-67.0 mm SL, Pelotas, lagoa dos Patos, 31°46'S 52°20"W; MZUSP 14182, 1, 85 mm SL, Osório, lagoa dos Quadros, 29°43"S 50°07'W; MZUSP 4499, 4, 58-70 mm SL, São Leopoldo, Porto do Vicente, rio dos Sinos, rio Jacuí drainage, 29°45"S 51°10"W; MZUSP 19884, 1, 69 mm SL, near Porto Alegre, arroio in município de Belém Novo, 30°12"S 51°12"W; MZUSP 19919, 1, 75 mm SL, Marquês de Souza, rio Forqueta, rio Jacuí drainage, 29°20"S 52°05"W; MZUSP 19975, 1, 51 mm SL, Estação Ecológica do Taim, lagoa Mirim, stream near fazenda Caçapava, 32°29S, 52°35"W; MZUSP 19968, 1, 64 mm SL, near Arroio Grande, on road between Pelotas and Jaguarão, 32°14'S 53°05"W; MZUSP 19726, 2, 44-46 mm SL, São Leopoldo, rio dos Sinos, rio Jacuí drainage, 29°45'S 51°10'W; MZUSP 19730, 2, 45-46 mm SL, Pelotas, rio Pelotas near bridge, 31°37'S 52°19"W; MZUSP 19683, 3, 43-46 mm SL, Montenegro, Vapor Velho, 27°47'45"W; MZUSP 19734, 4, 33-40 mm SL, km 124 on road BR-116, between Schailan and Montenegro, near arroio Preto. Uruguay: MZUSP 19375, 3, 69-83 mm SL, arroyo Toledo.

Charax tectifer (Cope, 1870)

Fig. 26

Anacyrtus tectifer Cope, 1870: 565 [original description, type locality: Ecuador, Pebas (actually Pebas, Peru)]. -Böhlke, 1984: 55 (listed in type catalog).

Fig. 26. *Charax tectifer*, MUSM 38670, male, 85 mm SL, Peru, Satipo, río Tambo, Quebrada Pukakunga.

Hydrolicus copei Gill, 1870: 266 (original description, type locality: río Marañon or río Napo, Amazon system, Peru or Ecuador). -Vari & Howe, 1991: 26 (listed in type catalog). -Toledo Piza *et al*., 1999: 256 [synonym of *Charax tectifer* (Cope, 1870)].

Anacyrtus sanguineus Cope, 1872: 266 (original description, type locality: Peru, río Ambyiacu). -Böhlke, 1984: 53 (listed in type catalog). -Fowler, 1907: 453 (lectotype designation). -Lucena & Menezes, 2003: 202 [synonym of *Charax tectifer* (Cope, 1870)].

Moralesia tectifer. -Fowler, 1943: 96 (Peru; original description).

Moralesicus tectifera. -Fowler, 1958: 9. -Ortega & Vari, 1986: 91 (Peru, listed).

Charax (*Moralesia*) *tectifer tectifer*. -Géry & Vu-Tan-Tuê, 1963: 243 (diagnostic characters in key).

Charax tectifer. -Lucena, 1987: 60 (diagnosis; description; distribution; geographic variation). -Lucena, 1989: 104 (in key to species; Chang & Ortega, 1995: 5 (Peru, listed). -Lucena & Menezes, 2003: 202 (maximum length; distribution).

Diagnosis. *Charax tectifer* differs from congeners except *C. delimai*, *C. metae*, some specimens of *C. gibbosus*, *C. rupununi*, and *C. condei* in bearing teeth on the ectopterygoid. *Charax tectifer* differs from *C. condei* in having the lateral line complete (*versus* incomplete) and from *Charax gibbosus* and *C. rupununi* in having the anal-fin origin along, or slightly posterior to, the vertical through the dorsal-fin origin (*vs.* anterior to the dorsal-fin origin). *Charax tectifer* can be distinguished from *C. delimai* and *C. metae* by the absence (*vs.* presence) of the superficial neuromasts on body scales present in those two species (Figs. 1 and 2).

Description. Morphometrics of examined specimens presented in Table 15. Body elongate, moderately large (38-94 mm SL), compressed and moderately deep. Greatest body depth slightly in advance of dorsal-fin origin. Dorsal profile of head and body convex from tip of snout to anterior region of fontanel, concave from that point to base of supraoccipital spine, convex from that point to dorsal-fin origin, nearly straight along dorsal-fin base and straight to slightly convex from end of dorsal-fin base to caudal peduncle and slightly concave along caudal peduncle. Ventral profile of head and body convex from tip of lower jaw to anal-fin origin, nearly straight along anal-fin base and slightly concave from end of anal-fin base to beginning of procurrent rays. Snout pointed. Lower jaw included in upper jaw when mouth closed. Maxilla extending to vertical through posterior border of orbit.

Dorsal-fin rays ii, 9 in all specimens, posterior most ray unbranched. Adipose fin present. Unbranched anal-fin rays iv or v, usually iv, branched rays 38-43, 40.3. Anterior anal-fin rays not bearing bilateral hooks in examined mature males. Pectoral-fin rays i, 12-16, 13.8. Tips of longest pectoral-fin rays reaching about to vertical through middle of pelvic fin length. Pelvic-fin rays i, 7. No hooks on pelvic-fin rays of all adult males examined. Tips of longest pelvic-fin rays reaching slightly beyond vertical through anal-fin origin. Principal caudal-fin ray count 10/9 in all specimens.

Lateral line complete; perforated scales 50-56, 53.6. Horizontal scale rows from dorsal-fin origin to lateral line 13-14, 13.4. Horizontal scale rows from pelvic-fin origin to lateral line 9-10, 9.5. Horizontal scale rows from anal-fin origin to lateral line 11-13, 12.3. Predorsal scales 29-37, 32.8. Scale rows around caudal peduncle 19-21, 19.5. One scale row along anal-fin base, extending for about two thirds of its length.

Premaxillary with one anterior canine-like tooth followed by set of smaller conical teeth and another canine-like tooth followed by one or two small conical teeth. Total number of premaxillary teeth 11-17, 13.5. Maxillary teeth conical, 34-54, 44.3. Dentary with one canine-like tooth followed by 3-7, 4.5 conical teeth, another canine-like tooth and posterior row of

18-25, 20.7 conical teeth. Left ectopterygoid bone with 3-14, 7.7, right with 2-14 conical teeth. Total number of ectopterygoid teeth 5-25, 15.2. Vertebrae 33 and 34 (2). Gill-rakers on lower limb of first gill-arch 9-10, (9.3). Branchiostegal rays 4; 3 rays originating from anterior ceratohyal and 1 from posterior ceratohyal.

Color in alcohol. Body pale to light yellow, slightly darker dorsally than ventrally. Dark chromatophores mostly concentrated on basal portions of scales leaving posterior borders and creating alternating pattern of longitudinal dark and light spots along body. Lateral and ventral portions of body lighter. Dorsal portion of head, snout and tip of lower jaw darker, dark coloration extending over anterior part of maxilla, first and second infraorbitals and between latter bone and anterior border of third infraorbital and defining conspicuous subocular blotch extending ventrally to ventral border of third infraorbital. Remaining portion of third infraorbital, fourth, fifth and sixth infraorbitals, opercle, subopercle and interopercle with scattered dark chromatophores. Irregularly shaped dark humeral blotch, much closer to dorsal-fin origin than to posterior border of opercle; extending two or three scales vertically and horizontally. Dark midlateral stripe extending from humeral blotch to caudal base where it joins oval-shaped dark blotch extending to basal portions of central caudal-fin rays. V-shaped darker lines of chromatophores follow miosepta between musculature. Anal fin with faint basal dark stripe separated by light stripe from wider dark marginal dark stripe. Pelvic and pectoral fins hyaline with very few scattered dark chromatophores. Dorsal and caudal fins hyaline with scattered dark chromatophores mostly located on interradial membranes.

Table 15. Morphometrics of *Charax tectifer*. Specimens are from MZUSP 38709, MUSM38670, 37932, 38759.

Characters	n	range	mean	SD
Standard length	36	38.0 - 94.0	61.5	
Percents of standard length				
Depth at dorsal-fin origin	35	32.7 - 37.3	35.3	1.3
Snout to dorsal-fin origin	36	51.8 - 57.4	54.3	1.3
Snout to pectoral-fin origin	36	27.6 - 32.3	29.6	1.1
Snout to pelvic-fin origin	36	37.5 - 41.0	39.3	1.0
Snout to anal-fin origin	36	48.0 - 54.5	51.8	1.4
Caudal peduncle depth	36	8.3 - 10.5	9.4	0.5
Caudal peduncle length	36	6.2 - 8.6	7.0	0.5
Pectoral-fin length	35	18.7 - 21.2	20.0	0.8
Pelvic-fin length	36	17.0 - 22.6	20.0	1.2
Dorsal-fin base length	36	10.0 - 12.3	11.4	0.6
Dorsal-fin height	36	25.3 - 30.7	28.4	1.4
Anal-fin base length	36	42.0 - 47.6	44.8	1.6
Eye to dorsal-fin origin	36	37.1 - 41.0	39.0	0.9
Dorsal-fin origin to caudal-fin base	36	50.0 - 53.5	51.8	0.9
Humeral spot distance	36	44.8 - 51.5	47.7	2.0
Bony head length	36	29.1 - 32.0	30.5	0.6
Percents of head length				
Horizontal orbital diameter	36	30.0 - 35.7	32.4	1.8
Snout length	36	23.5 - 29.2	26.1	1.6
Least interorbital width	36	21.4 - 25.8	23.5	1.1
Upper jaw length	36	57.1- 64.8	61.0	1.9

Distribution. *Charax tectifer* is known from the río Ucayali and río Tambo systems, Peru, rivers from the río Amazonas drainage in Colombia, and río Napo system, Ecuador (Fig. 7).

Remarks. No significant statistical differences in meristics and morphometrics and no differences in other morphological features were found among the samples from Colombia, Ecuador, and Peru.

Specimens examined. **Colômbia:** IAvH-P 8222, 19, 7, 35.3-101.7 mm SL, Amazonas, tributary to Quebrada Matamatá, comunidad Mocagua, 3° 47' 53"S 70° 15' 57" W. IAvH-P 8698, 2, 1, 83.9 mm SL, Amazonas, Quebrada Tucuchira, 3° 58' 54"S 70° 6' 44"W. IAvH-P 8223, 13, 1, 71.9 mm SL, Amazonas, tributary to Quebrada Matamatá, comunidad Mocagua, 3° 47' 53"S 70° 15' 57"W. IAvH-P 8226, 3, 2, 89.9-91.7 mm SL, Amazonas, tributary to río Purité 3° 41' 37"S 70° 12' 20"W. IAvH-P 8231, Amazonas, Afluente río Purité, 3° 41' 53"S 70° 12' 24"W. IAvH-P 8232, 1, 77.0 mm SL, Amazonas, tributary to río Purité, 3° 41' 53"S 70° 12' 24"W. IAvH-P 8791, 4, 42.0-69.0 mm SL, Amazonas, Quebrada Clímaco, 3° 58' 44"S 70° 7' 32"W. IAvH-P 8227, 25, 2, 67.0-89.5 mm SL, Amazonas, tributary to Quebrada Matamatá, 3° 47' 53"S 70° 15' 57"W. IAvH-P 8225, 23, 1, 92.6 mm SL, Amazonas, tributary to Quebrada Matamatá, comunidad Mocagua, 3° 47' 53"S 70° 15' 57"W. IAvH-P 8986, 1, 81.6 mm SL, Amazonas, Quebrada Sufragio in front of Estación Zafire, 4° 0' 19"S 69° 53' 55"W. IAvH-P 9021, 1, 94.2 mm SL, Amazonas, Quebrada Sufragio frente a la Estación Zafire 4° 0' 19"S 69° 53' 55"W. IAvH-P 11183, 2, 65.0-120.9 mm SL, Amazonas, Leticia, Caño Gravilla tributary of caño Zufragio, tributary of rio Tacana, Estación Biologica El Zafir, IAvH-P 11184, 2, 75.8-100.3 mm SL, Amazonas, Leticia, Caño tributary to caño Salado tributary of caño Zufragio tributary of rio Tacana atLa Estación Biologica El Zafire. Ecuador: MZUSP 38709, 2, 44-56 mm SL, Provincia Napo, stream Ahuano, above Ahuanopaccha waterfall, 0°31'2"S 77°20'07"W. Peru: MUSM 38670, 10, 52-93 mm SL, Satipo, río Tambo, Quebrada Pukakunga, 11°24'38"S 73°28'02"W; MUSM 37932, 4, 44-67 mm SL, La Convención, Echarate, Kinteroni, Quebrada Naca-Naca, 11°28'12"S 73°18'02"W; MUSM 38579, 6, 45-59 mm SL, Satipo, río Tambo, río Nayapo, 11°15'47S, 73°33'46"W; MUSM 37857, 4, 62-82 mm SL, Satipo, Mashira, río Tambo, Quebrada Mayapo, 11°23'45"S 73°34'20"W.

Discussion

Charax has always been considered a member of the subfamily Characinae, but the number and phylogenetic relationships of the genera included in this subfamily have been a matter of dispute (Lucena & Menezes, 2003: 200). Mattox & Toledo-Piza (2012) undertook a cladistic analysis based on 150 morphological characters of 35 species representing all the genera previously included in the Characinae. They redefined Characinae and delimited five main clades (tribes) into which the 13 genera found to be the members of the subfamily were grouped. The Characini was proposed to house *Charax* and *Roeboides* as sister-groups. The first genus was considered monophyletic and it was also suggested (Mattox & Toledo-Piza, 2012: 885) that some analysed characters might be useful for a phylogenetic study of intrageneric relationships. Size, predorsal body convexity,

body depth, length of the supraoccipital spine, presence or absence of ectopterygoid teeth, color patterns vary considerably among the species herein studied and might also be useful to define smaller subunits within the genus. In spite of these differences, all species studied to date share the unique derived synapomorphy defining the genus as monophyletic.

Sexual dimorphism expressed by presence of hooks on the anal- and pelvic-fin rays of adult males of *Charax pauciradiatus* and *C. michaeli* and only on the anal-fin rays of *C. gibbosus* and *C. niger* was not detected in other species represented by males and females in the examined samples. Most species are herein represented by a large proportion of females and just a few males, but judging from our preliminary findings it seems that absence of hooks on the anal- and pelvic-fin rays of male specimens is predominant across *Charax.*

The discovery that *Charax delimai*, the new species herein described, and *C. metae* have superficial vertically arranged neuromasts on the basal portions of the scales with the exception of the lateral line scales (Figs. 1 and 2) apparently not common in other members of the Characidae. Such neuromasts have also been reported by Baker (1999) in *Astyanax fasciatus*, by Teyke (1990) in *A. mexicanus* and by Campenhausen *et al*. (1981) in *Anoptichthys jordani* (= *Astyanax jordani*). Although no histological sections have been taken, these structures look remarkably similar to those described for *Carassius auratus* by Schmitz *et al.* (2008: 753, fig. 1A.) who characterized them as "… organized in dorso-ventrally oriented and slightly arched lines located on the rostral part of a scale just behind the caudal edge of the preceding scale." This peculiar organization is different from the breeding tubercles reported by Protogino *et al.* (2006) in *Astyanax aramburui* or the reminiscent of the breeding tubercles described by Zanata & Akama (2004) in *Myxiops aphos* in which they occur on the head and the body scales where they are distributed on the free posterior border or caudal portion of the scale. Comparative studies are needed to better characterize these structures histologically.

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