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Redescription of *Hemibrycon jelskii*, with comments on *H. huambonicus*, and description of five new species from the Amazon River basin (Characiformes: Characidae: Stevardiinae)

Abstract

We examined 407 specimens and images of *Hemibrycon jelskii*[1] and *H. huambonicus*[2] (31 types and 376 non-types) and analyzed them using four analytical approaches: (i) traditional morphometry, (ii) morpho-geometric analysis, (iii) comparison of meristics (scales and fin rays), and (iv) comparison of color and pigment patterns. Our study determined that only 18 individuals from the 28 type specimens have characters that correspond with the description of *H. jelskii*. *Hemibrycon jelskii* was described from specimens of unknown, possibly multiple origins, raised in aquaria by Konstanty Jelski. A high morphological disparity exists among the individuals that make up the type series, so it is assumed that they are different forms, probably from different locations in the Huambo River drainage, in the Peruvian Andes. The reported variation in morphological and pigmentation characters observed in the type specimens is due to two main facts: 1) the incorrect taxonomic identification of one lot, which is a curimatid, *Cyphocharax* sp., and 2) the probability that specimens of the type series were collected from different localities. In addition, morphological differences were observed in the type series of *H. huambonicus*, consisting of three specimens in two lots. Our study also revealed five new species of *Hemibrycon* described herein.

Keywords: biodiversity, morphological variation, South America, teleostei

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Introduction

The genus *Hemibrycon* includes 51 valid species,[3] with its greatest diversity in the Andes, from Bolivia to Colombia, along with a wide Amazonian distribution: Bolivia, Peru, Ecuador, Colombia, and Brazil.[4–11] The type species, *Hemibrycon polyodon*,[12] was described based on a unique holotype from Guayaquil, on the eastern Pacific slope of Ecuador.[13] Previous taxonomic treatments of *Hemibrycon*[6,13–17] dealt with Cisandine species, including *H. polyodon*,[12] *H. coxeyi* Fowler 1943 and *H. pautensis* Román-Valencia, Ruiz-C., and Barriga Salazar,[8] described from the Amazon slope. Diversity was also addressed by investigating variation in the character that defines *H. divisorensis* Bertaco, Malabarba, Hidalgo and Ortega:[18] …a wide asymmetrical black spot that covers the base of the caudal-fin rays and extends along the entire length of caudal-fin rays 9 to 12-13…[18] Variations of this character are also present in *H. surinamensis* Géry 1962, *H. helleri* Eigenmann[19] and in populations from the Ucayali River related to *H. jelskii*[6] as well as in *H. jabonero* Schultz 1944 from the Lake Maracaibo basin and *H. metae* Myers 1930 from the Orinoco River basin.

The identity of *H. jelskii* is uncertain because: 1) although Steindachner[1] described it as an Andean species from "Monterico in Peru", from the Pacific basin, it has been reported from other places, including other cisandine sites.[6,20,21] 2) the supposed diagnostic characters are found in several other species 3) a very wide distribution was proposed, and 4) there is great morphological disparity among the type specimens of *H. jelskii* not mentioned in the description. There are similar problems with the two lots of specimens from the Huambo River used to describe *H. huambonicus*[2] (currently in the Natural History Museum in Vienna, NMW).

In this study, we reviewed the available specimens, including types of *H. jelskii* and *H. huambonicus*, to provide a better diagnosis of each. We designate a lectotype for *H. jelskii*, to establish a definite type locality. We also analyze and identify patterns of diversity concerning non-type material from the Amazon River basin and include the description of five new species.

Specimens examined

Acronyms for museums and collections follow Sabaj.[22] Information on specimens listed is presented as follows: species or taxon name, country, locality, coordinates (if available), museum acronym and catalog number, collection date; number of specimens, and standard length range (Table 1). The analysis of the type specimens of *H. jelskii* did not include lot NMW 57546, since it is a curimatid. Each specimen in the type series of *H. jelskii* identified as *Hemibrycon* was numbered individually, with the lot number followed by the corresponding specimen number (for example, NMW 57547.3), because the type series includes fish of different shapes and character states that indicate that they are probably from different places. Below we describe the differences. The type series of *H. jelskii*[1] and *H. huambonicus*[2] were examined using digitized images of material preserved in alcohol and available radiographs.

Methodology

Comparative material

Specimens from the Madeira and Ucayali basins, tributaries of the Amazon River, were identified using original descriptions and keys.[4,6,19] For both species (*H. jelskii* and *H. huambonicus*), morphometric characters were obtained (Figure 1A & 1B), following Vari and Siebert.[23] Measurements were made point to point with a Mitutoyo electronic caliper under a stereoscope (Zeiss Stemi DV4 32Z) taking the following into account: The end of the vertebral column was verified with the help of a dissection needle in specimens

preserved in alcohol and the case of the types by comparison of the photographs of the specimen with its respective radiograph. Characters were expressed as percentages of standard length (SL) or head length. Fin rays were examined for the presence or absence of bony spines to determine sex and taxonomic identity traits. The morphometric analysis was performed using the IMAGE J OPEN SOFTWARE, based on available images of *Hemibrycon jelskii* (25 syntypes); National Museum of Vienna (NMW) provided photographs, radiographs, or specimen loans of material under their care, these images were carefully made, each positioned in the same way, to allow undistorted digital measurements, and 330 specimens from the Amazon basin identified as *H. jelskii* by Bertaco and Malabarba.[6] Images of fish from the Amazon were made with a Nikon 3100 digital camera on photographic support, using the macro lens option to acquire images without deformations in the margins.[15] Morphological landmarks were digitized using the TPSDIG2 program.[24] A comparative analysis was carried out between the type series and the populations of Peru and Bolivia, using 25 type I and II landmarks (Table 2), which generally describe body variation and include landmarks related to pigmentation in the humeral region based on Roman-Valencia et al.[25] (Table 3 and 4). In the analyses, the following standards were used: the height of each configuration was estimated at the 'centroid height' (CH),[26] the effects of translation, scale, and rotation were removed from the set of configurations through an orthogonal of generalized least squares, (Procrustes (GPA).[27] All setups were scaled to CH=1 (tpsSmall).[28] A matrix of procrustes coordinates was obtained using the overlay method of the tps program. In the MORPHO J program, the comparison was made with canonical variables and with Principal Component Analysis (PCA). Osteological characters were observed in specimens cleared and stained using the protocol of Taylor and Van Dyke.[29] Data for species reported from the Amazon River Basin such as: *Hemibrycon beni* Pearson 1924, *H. divisorensis* Bertaco, Malabarba, Hidalgo and Ortega,[18] *H. helleri* Eigenmann,[19] *H. inambari* Bertaco and Malabarba,[6] *H. mikrostictos* Bertaco and Malabarba 2010,[6] *H. surinamensis* Géry 1962, *Hemibrycon taeniurus*[11] and *Hemibrycon tridens* Eigenmann[4] were used to contrast with the diagnosis of *H. jelskii* were taken from Bertaco and Malabarba.[6] For comparative purposes, data for *H. coxeyi* Fowler 1943, *H. orcesi* Böhlke,[9] *H. pautensis* Román-Valencia, Ruiz-C. and Barriga Salazar[8] and *H. polyodon*[12] are also included.

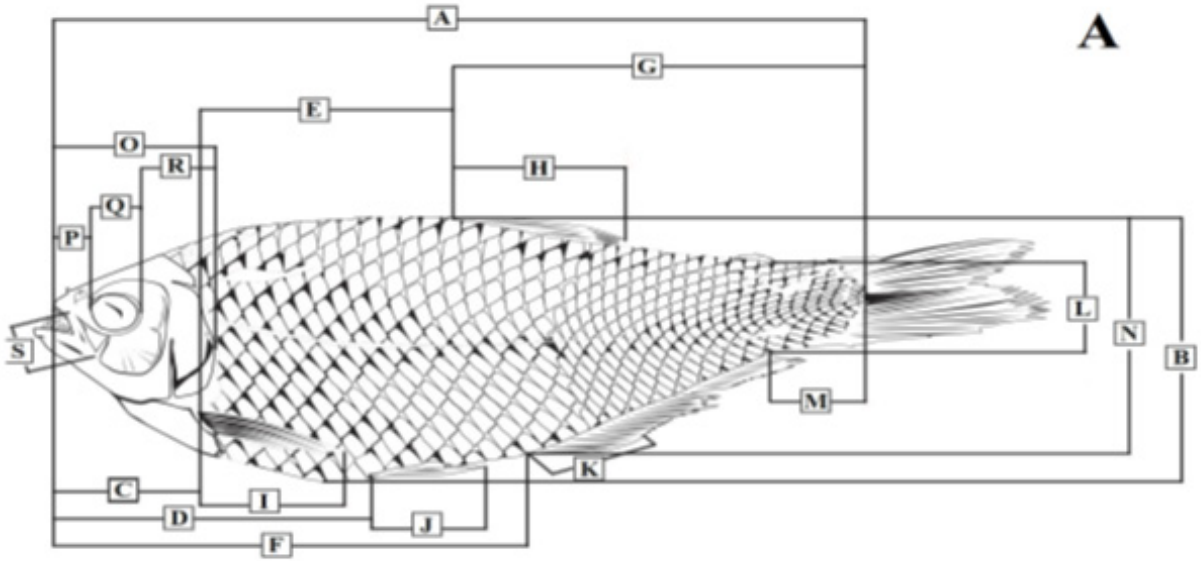

Figure 1A Morphometric data of *Hemibrycon* species from Amazon Basin sites given tables 3-4. **A.** Standard length; **B.** Body depth; **C.** Snout – pectoral-fin distance; **D.** Snout – pelvic-fin distance; **E.** Dorsal - pectoral fin distance; **F.** Snout – anal fin distance; **G.** Dorsal fin - hypural distance; **H.** Dorsal-fin length; **I.** Pectoral-fin length; **J.** Pelvic-fin length; **K.** Anal-fin length; **L.** Caudal-peduncle depth; **M.** Caudal-peduncle length; **N.** Dorsal-anal fin distance; **O.** Head length; **P.** Snout length; **Q.** Orbital diameter; **R.** Postorbital length; **S.** Maxilla length.

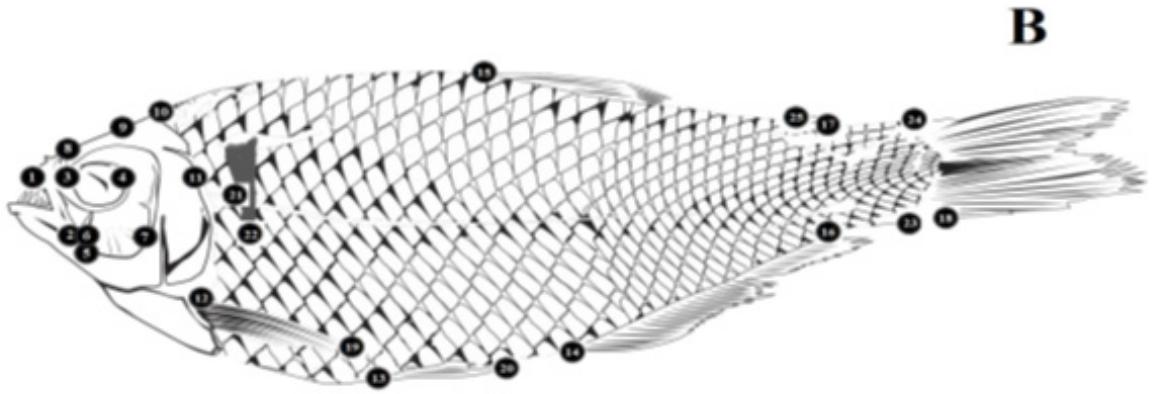

Figure 1B Identification of the landmarks used in the morphogeometric analysis of the *Hemibrycon* species recorded in the Amazon and reported in Table 2.

Citation: Ruiz-C RI, Román-Valencia C, Bastidas AM, et al. Redescription of *Hemibrycon jelskii*, with comments on *H. huambonicus*, and description of five new species from the Amazon River basin (Characiformes: Characidae: Stevardiinae). *J Aquac Mar Biol.* 2023;12(3):215–232. DOI: 10.15406/jamb.2023.12.00377

Table 2 Morphological landmarks included in the geometric morphometry analysis from *Hemibrycon jelskii and Hemibrycon* sp. 2 and *Hemibrycon* sp. 3 from Huambo. L, Landmark number

L Character	L	Character
1. Ventral border of upper lip	13.	Dorsal region of pelvic fin origin
2. Posteroventral border of the maxilla	14.	Anal fin origin
3. Anterior edge of the orbit relative to L1	15.	Dorsal fin origin
4. Posterior edge of the orbit relative to L1	16.	Posterior end of anal fin
5. Anterior end of the square	17.	Vertical of posterior end of anal fin above caudal peduncle
6. Anterior border of the third infraorbital relative to L2	18.	Origin of first procurrent ray from lower lobe of caudal fin
7. Posterior border of the third infraorbital relative to L2	19.	Posterior end of pectoral fin
8. Anterior dorsal edge vertical to L3	20.	Posterior end of pelvic fin
9. Dorsal posterior edge vertical to L4	21.	Anterior edge of the humeral spot above the lateral line
10. Posterior end of supraoccipital spine	22.	Most ventral end of humeral spot
11. Posterior end of operculum horizontal with L1, 3 and 4	23.	Posterior ventral end of caudal peduncle
12. Ventral end of pectoral fin origin	24.	Origin of first procurrent ray from upper lobe of caudal fin
	25.	Origin of the adipose fin

Results

Our study identified only 18 individuals, of the 28 type specimens, as carriers of characters that match those used to describe *Hemibrycon jelskii*[1] (Figure 2): NMW 57553.3., NMW 57547.2, NMW 57547.3, NMW 57547.4, NMW 57547.5, NMW 57548.1, NMW 57548.2, NMW 57549, NMW 57550.2, NMW 57553.2, NMW 57554.1, NMW 57554.2, NMW 57554.3, NMW 57554.4, NMW 57554.5, NMW 57555.1, NMW 57555.2 and NMW 57557.

The other ten specimens have a variety of as yet undescribed forms that are different from what we recognize here as true *H. jelskii*. Lot NMW 57546 (3 specimens), are *Cyphocharax* sp. (Curimatidae). The other seven lots, although belonging to *Hemibrycon*, show morphological variability that is here proposed as three different species of *Hemibrycon*, that we have differentiated as follows: *Hemibrycon* sp.1 (NMW 57550.1, NMW 57551.1, NMW 57551.2, NMW 57551.4, NMW 57553.1, Figure 2B), *Hemibrycon* sp. 2 (NMW 57547.1, Figure 2C) *Hemibrycon* sp. 3 (NMW 57551.2, Figure 2D), none of which can be identified as true *H. jelskii*. An analysis of divergence between the type specimens explained 92.6 % of the disparity from a discriminant analysis of traditional morphometric data (Figure 3A) and 80.5 % from an analysis of canonical variables of geometric morphometric data (Figure 3B). The latter allowed establishing deformation axes generated among true *Hemibrycon jelskii* and the other three forms differentiated above (Figure 4), which describe the effect of an increase in body depth found for *H. jelskii* females (Landmarks 13 -15 and 19-20), the posterior dorsal prolongation of the skull from the supraoccipital spine (milestone 31), associated with the development of the prominent spine present in *H. jelskii* females and *Hemibrycon* sp. 1 and *Hemibrycon* sp. 3; development of the posterior dorsal part of the second infraorbital (landmarks 8 and 9) in *Hemibrycon* sp. 2; and the projection of the anterior edge of the third infraorbital (Landmarks 10, 11 and 12) with respect to the anterior end of the quadrate (Landmarks 18) (Figure 4; Table 4 and 5). The specimens identified here as true *Hemibrycon jelskii* are different from the populations previously recognized as *Hemibrycon jelskii* by Bertaco and Malabarba,[6] from the Ucayali, Madre de Dios, Urubamba, and Mamoré River basins, which have different, undescribed body shapes. Based on the discriminant analysis of traditional measurements (Figure 5), the first two components explained 82.74% of their disparity; while the analysis of canonical variables from morphogeometric data made it possible to establish the deformation axes between these populations and *H. jelskii*, indicating that the greatest disparity is associated with characters of the skull and maxilla (Figure 6).

Table 5 Length regression of snout (H) and maxilla (Mx) of Amazon *Hemibrycon* species

T-test parameters	Length H	Length Mx
Given mean	0	0
Sample mean	14.6	4.7
95% comf. Interv	14.4	4.7
Difference	14.6	4.7
95% comf. Interv	14.4	4.7
t	148.8	159.9
p	0	0

Citation: Ruiz-C RI, Román-Valencia C, Bastidas AM, et al. Redescription of *Hemibrycon jelskii*, with comments on *H. huambonicus*, and description of five new species from the Amazon River basin (Characiformes: Characidae: Stevardiinae). *J Aquac Mar Biol.* 2023;12(3):215–232. DOI: 10.15406/jamb.2023.12.00377

Figure 2 A. *Hemibrycon jelskii* NMW 57553.3. Lectotype from Monterico, Huambo, Peru.

B. *Hemibrycon* sp. 1 from the original type series of *H. jelskii*: female (NMW 57551.1).

C. *Hemibrycon* sp. 2 from the original type series of *H. jelskii*: female (NMW 57547.1).

D. *Hemibrycon* sp. 3 from the original type series of *H. jelskii*: female (NMW 57551.2). For all scale bar =1 cm.

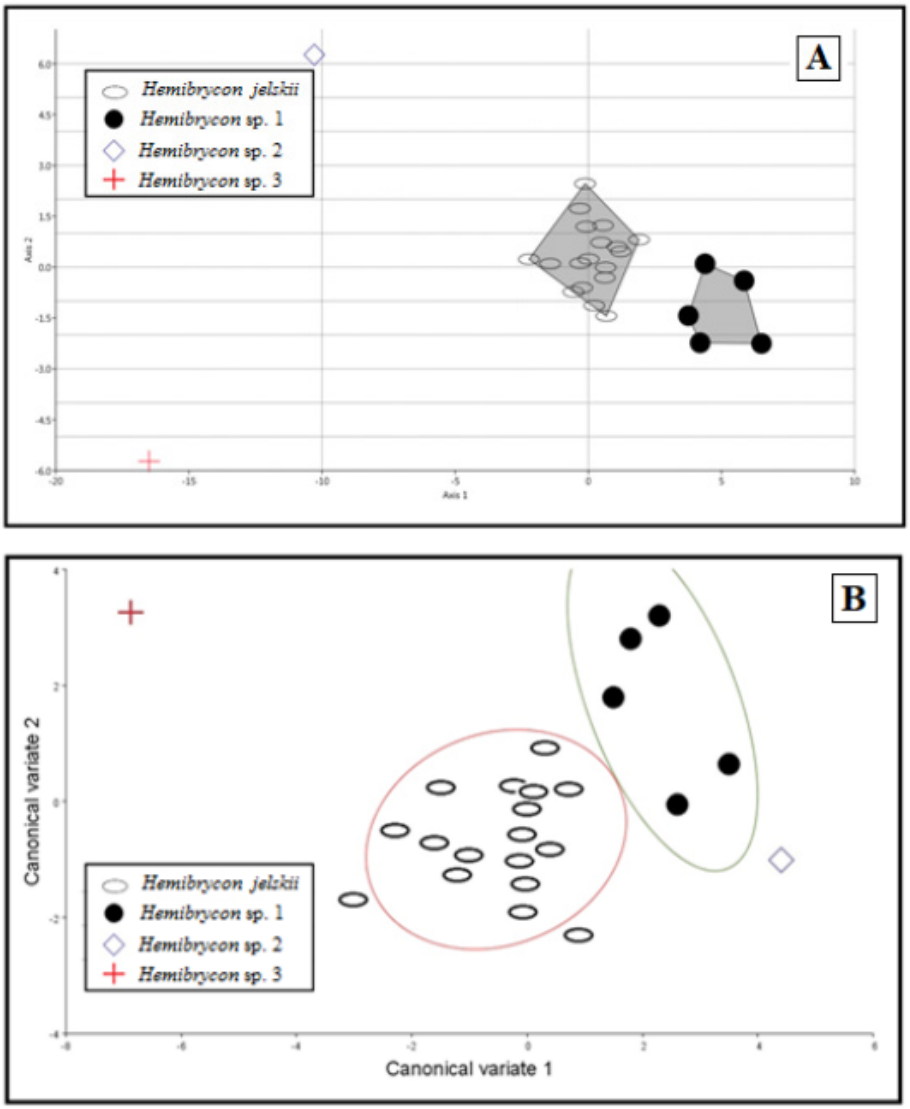

Figure 3 Morphological analysis of syntypes of *H. jelskii.*

A. Principal component analysis from traditional characters.

B. Representation of canonical variable analysis from morphogeometric data.

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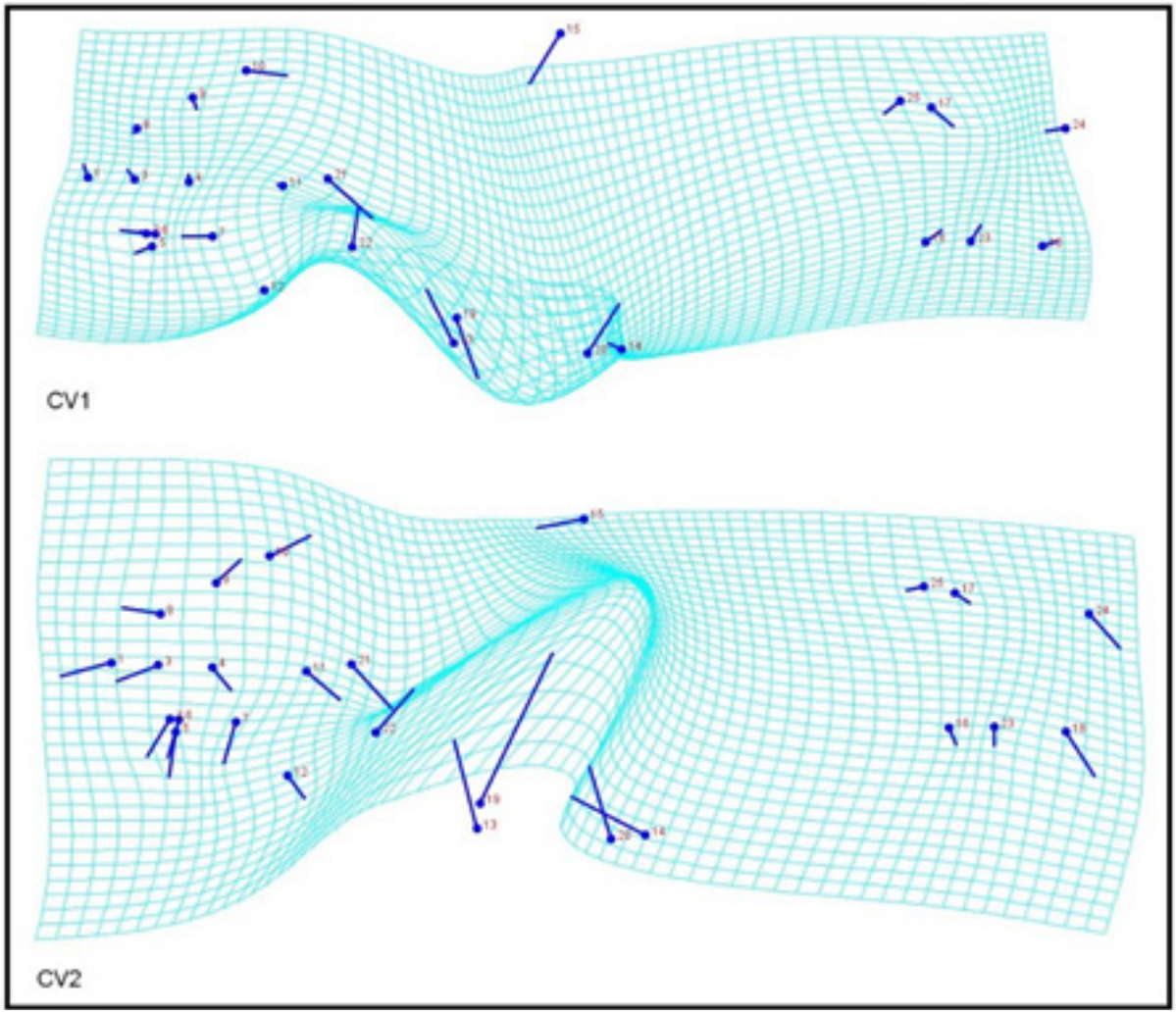

Figure 4 Deformation axes (VC1 and VC2), and deformation axis of *H. jelskii* original type series.

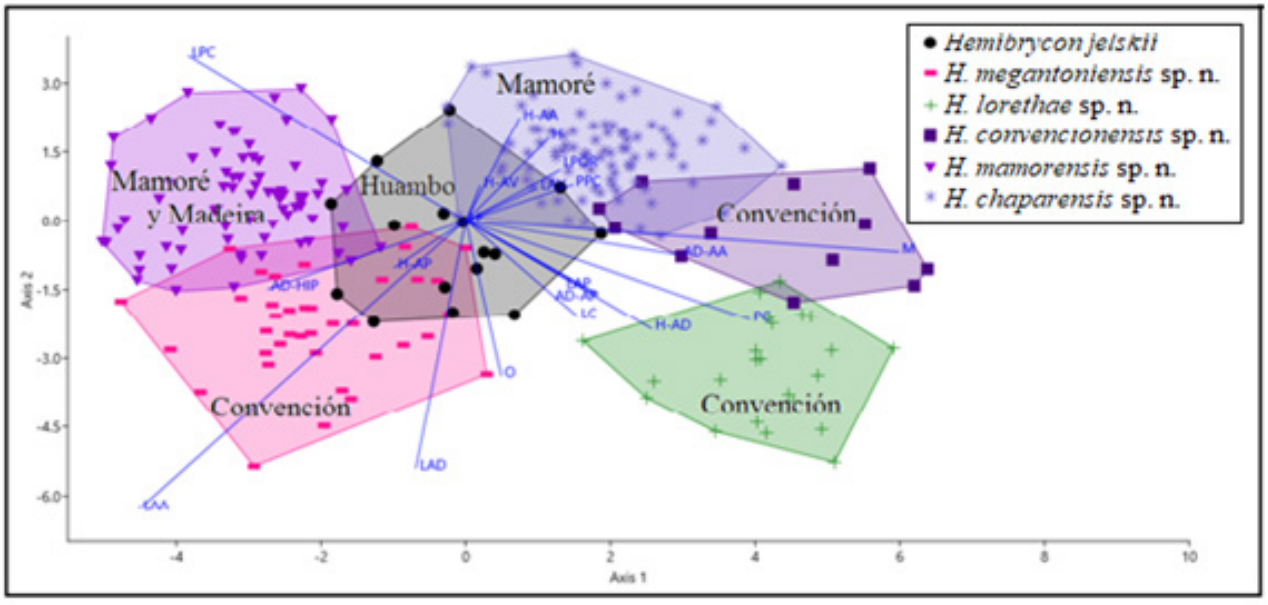

Figure 5 Discriminant analysis of type series of *H. jelskii* from the Huambo River, Pacific versant, compared with Amazonian populations from the Mamoré, Ucayali and Madeira River drainages previously identified as *H. jelskii* (Bertaco et al., 2010). The first two eigenvalues explain 83% of total variation.

Citation: Ruiz-C RI, Román-Valencia C, Bastidas AM, et al. Redescription of *Hemibrycon jelskii*, with comments on *H. huambonicus*, and description of five new species from the Amazon River basin (Characiformes: Characidae: Stevardiinae). *J Aquac Mar Biol.* 2023;12(3):215–232. DOI: 10.15406/jamb.2023.12.00377

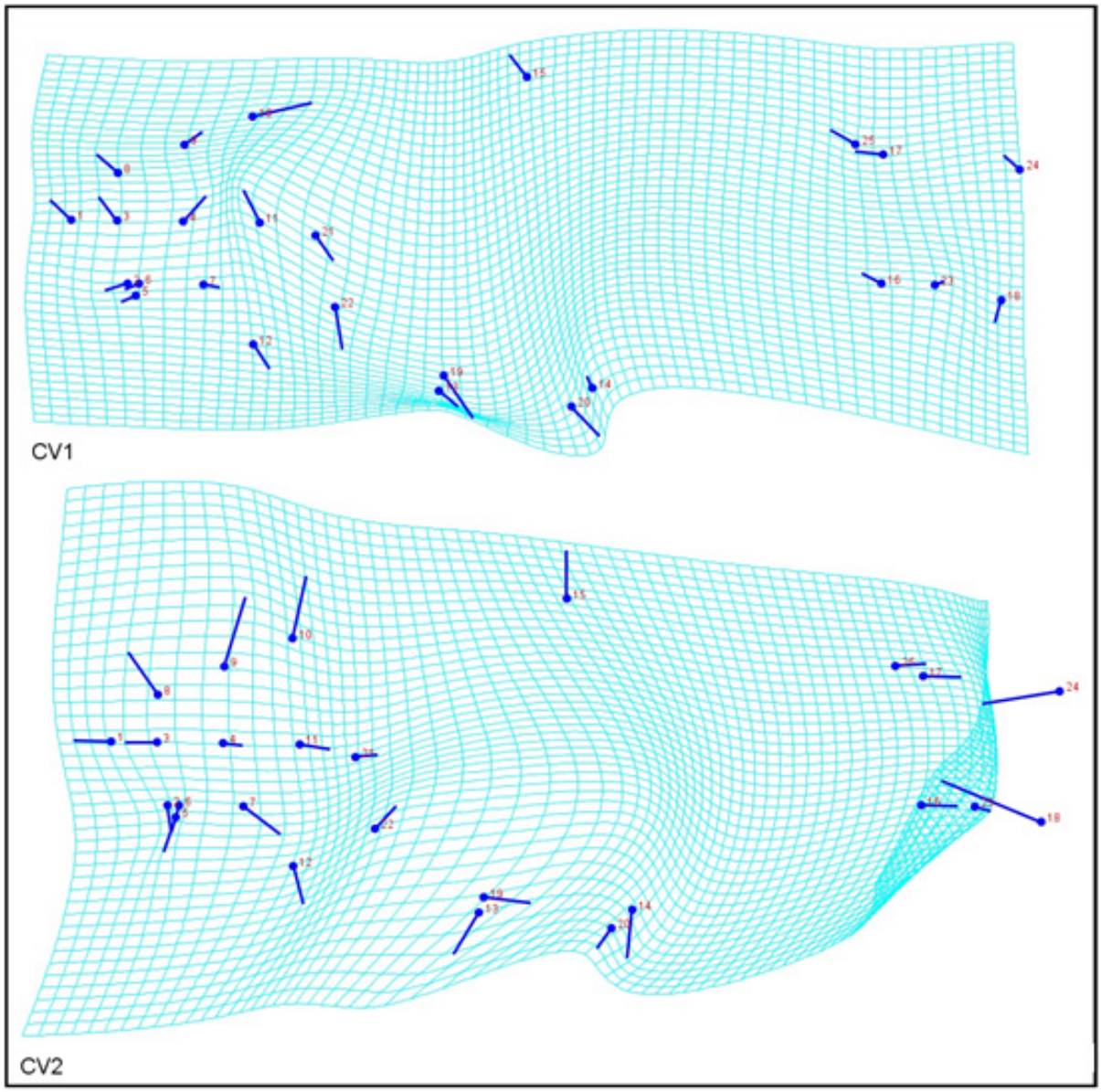

Figure 6 Deformation axes described by the analysis of canonical variables, axes of VC1 and VC2 present among the *H. jelskii* syntypes with respect to the Amazon populations.

In addition, morphological differences were observed in the type series of *Hemibrycon huambonicus*, made up of three individuals in two lots: NMW 57530 and NMW 57531. Only lot NMW 57531 was included in the redescription by Bertaco and Malabarba.[6] The two lots of the type series differ in the distances from the snout to the anal fin 41.9% (vs. 45.8%), the length of the dorsal fin 57.1% (vs. 61.2%), the depth of the caudal peduncle 14.5% (vs. 12.7%), orbital diameter 27.3% (vs. 34.4%) and postorbital distance 56.0% (vs. 43.7%) (Table 3).

Hemibrycon jelskii[1]

(Figure 2A-8, Table 3 and 5)

Lectotype: NMW 57553.3. Río Huambo, Monterico, Pacific versant, Peru.

Paralectotypes: NMW 57547.2, NMW 57547.3, NMW 57547.4, NMW 57547.5, NMW 57548.1, NMW 57548.2, NMW 57549, NMW 57550.2, NMW 57553.2, NMW 57554.1, NMW 57554.2, NMW 57554.3, NMW 57554.4, NMW 57554.5, NMW 57555.1, NMW 57555.2, NMW 57557. These specimens were collected by Professor Jelskii from the Pacific versant of Peru and designated by Steindachner as type material of *H. jelskii*.

Diagnosis

Hemibrycon jelskii is distinguished from the other seven specimens included in the original type series as *Hemibrycon* and identified here as follows: from *Hemibrycon* sp.1 (NMW 57550.1, NMW 57551.1, NMW 57551.3, NMW 57551.4, NMW 57553.1, Figure 2B) by having contact along the entire edge of the third infraorbital with the quadrate (vs. posterior part of the ventral edge of the third infraorbital without contact with the quadrate, Figure 7); in having a wide ventral half of the maxilla with a blunt and pointed tip (vs. maxilla with a thin ventral margin relative to the middle part of the maxilla). *Hemibrycon jelskii* is also distinguished from *Hemibrycon* sp.1 by having a small cleithrum that does not cover the origin of the first simple ray of

the pectoral fin vs. a large cleithrum covering the origin of the first simple ray of the pectoral fin (Figure 7). Females of *H. jelskii* are distinguished from females recognized as *Hemibrycon* sp.1 by having short pectoral fins that do not reach the pelvic fin insertion vs. long pectoral fins that reach the pelvic fin insertion, and having pelvic fins that do not reach the anal fin insertion vs. pelvic fins long reaching anal fin insertion (Figure 8). *H. jelskii* can be distinguished from the specimen identified as *Hemibrycon* sp.2 (NMW 57547.1, Figure 2C) by the predorsal distance 48.5% - 53.4% (vs. 55.4%); by prepelvic distance 38.1% - 54.7% (vs. 37.8%); by the distance of the dorsal fin to the origin of the pectoral fin 37.3% - 43.3% (vs. 43.9%); by the dorsal fin - hypural distance 52.1% - 57.1% (vs. 49.4%), by the length of the dorsal fin 19.7% - 25.8% (vs. 18.8%), by having contact along the entire margin of the third infraorbital with the quadrate (vs. ventral edge of the third infraorbital without contact with the quadrate), by the shape of the cleithrum that is wide and arched (vs. narrow and elongated) and by having the ventral tip of the maxilla more elongated, exceeding the ventral edge of the second infraorbital (vs. does not exceed the ventral edge of the second infraorbital), for having a broad humeral spot that covers three to four scales at the level of the lateral-line canal (vs. narrow spot that covers only one scale at the level of the lateral-line canal, Figure 7). *H. jelskii* are distinguished from *Hemibrycon* sp.3 (NMW 57551.2, Figure 2D) by having the posterior edge of the second infraorbital transverse, not overlapping the third infraorbital (opposite the posterior dorsal edge of the arcuate, overlapping the third infraorbital, Figure 7). It is also distinguished from the three *Hemibrycon* specimens included in the original type series by the shape of the anterior end of the anal fin, which is convex in *H. jelskii* and straight in the others (Figure 8).

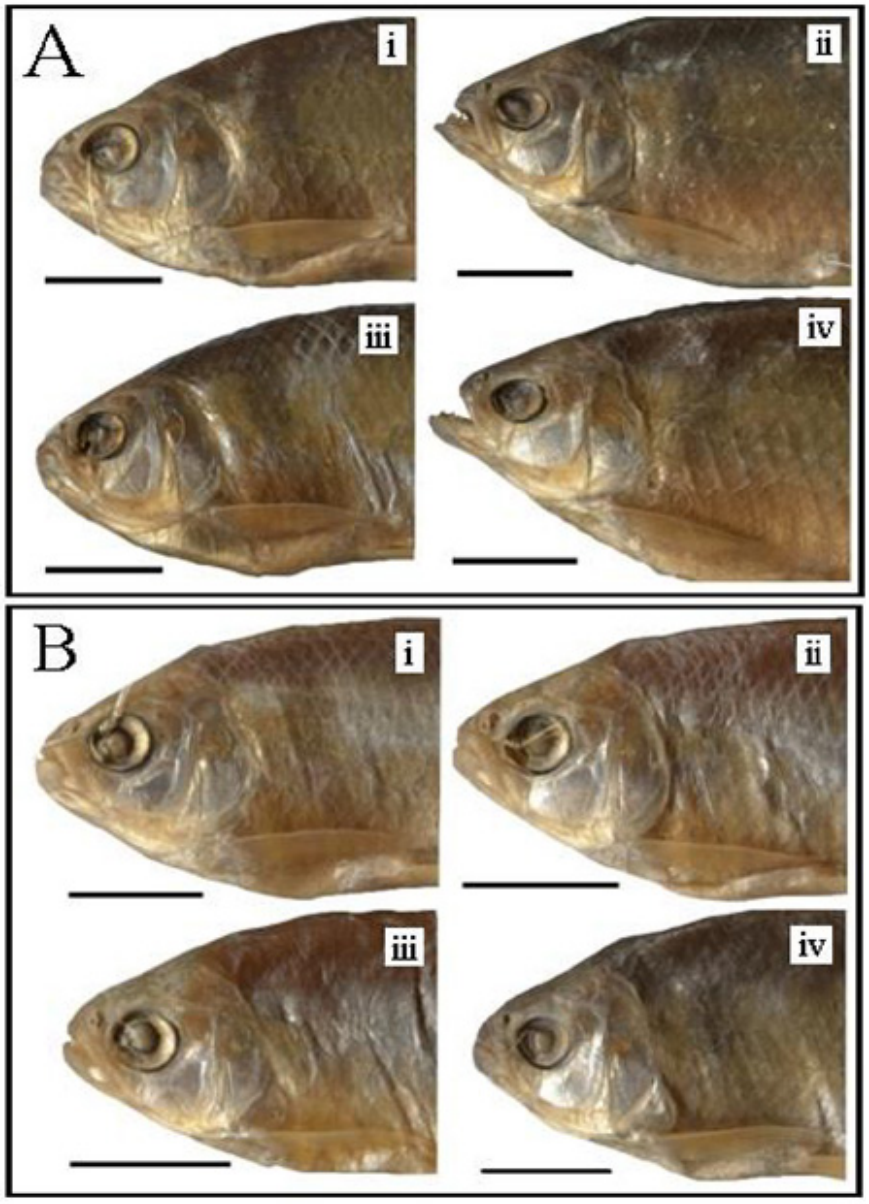

Figure 7 Skull, humeral region, and pectoral fin of *Hemibrycon jelskii* type series individuals.

A. *H. jelskii,* i. NMW 57553.3 male, ii. NMW 57555.1, female; iii. NMW 57550.2, male; iv. NMW 57549, female.

B. *Hemibrycon* sp.1, i. NMW 57551.1 male, ii. NMW 57551.3, female; iii. NMW 57551.4, male; IV. NMW 57553.1, female. For all scale bar =1 cm.

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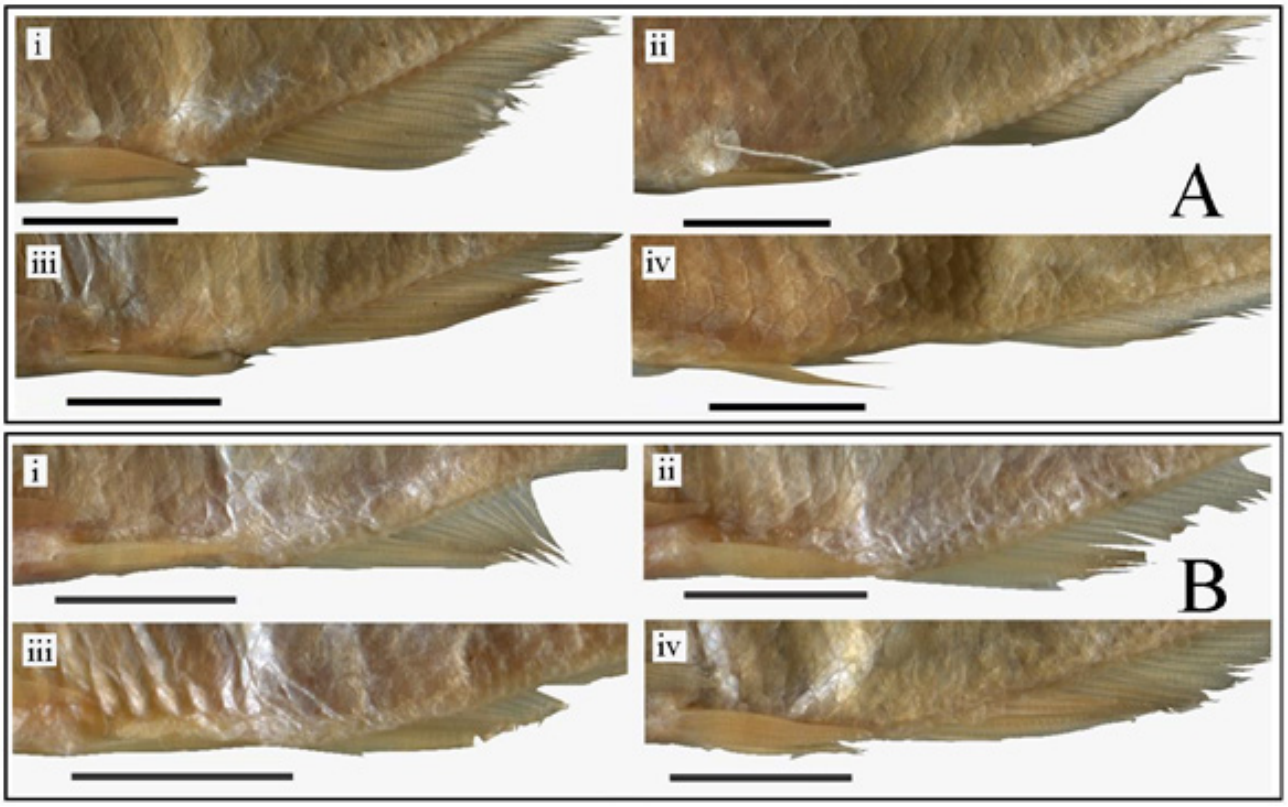

Figure 8 Pelvic and anal fin of *Hemibrycon jelskii* type series individuals.

A. i. NMW 57553.3, male; ii. NMW 57555.1, female; iii. NMW 57550.2, male; iv. NMW 57549, female.

B. *Hemibrycon* sp.1. i. NMW 57551.1, male; ii. NMW 57551.3, female; iii. NMW 57551.4, male; IV. NMW 57553.1, female. For all scale bar =1 cm.

H. jelskii differs from its congeners as follows: from *H. beni*, by having more branched anal-fin rays 26-29 (vs. 15-19); from *H. coxeyi* by having a deeper body: body depth 30.6-38.3% (vs. 28.4%), by prepectoral distance 19.4-23.8% (vs. 18.2%), by dorsal-pectoral distance 38.2-43.3% (vs. 36.5%), by dorsal-fin length 19.7-25.8% (vs. 10.05%), pectoral-fin length 18.4-23.2% (vs. 17.7%), anal-fin length 12.2-17.1% (vs. 10.07%), caudal peduncle depth 12.1-14.0% (vs. 10.6%), dorsal-anal distance 31.0-36.7 (vs. 29.09%); from *H. divisorensis* by prepectoral distance 19.4-23.8% (vs. 23.6-26.0%), by caudal peduncle depth 12.1-14.0% (vs.10.7-12.2%), and by absence of pigment on the caudal peduncle. *Hemibrycon jelskii* is distinguished from its congeners as follows: from: *H. helleri, H. metae* and *H. guejarensis* Román-Valencia, Ruiz-C. & Taphorn[30] by having more anal-fin rays 26-29 (vs. 19-23); from *H. huambonicus* by having fewer lateral-line scales 39-43 (vs. 44-48); from *H. inambari* by having more anal-fin rays 26-29 (vs. 22-26), shorter anal fin length 12.2-17.1% (vs. 28.0-34.4%) and for having the adipose fin inserted anterior to a vertical through the last anal-fin ray (vs. in front of adipose fin located vertically through insertion of last anal-fin rays); in addition to having more vertebrae (precaudal vertebrae 17, caudal vertebrae 23, total vertebrae 40 (vs. precaudal vertebrae 18-19; caudal vertebrae 21-22; total vertebrae 39-41). from *H. mikrostiktos* for having more scales below the lateral line 6-8 (vs. 3-4), from *H. orcesi* by predorsal distance 48.5-52.6% (vs. 53.8-57.3%), prepectoral distance 19.4-23.8% (vs. 26.2-28.1%), and pelvic-fin length 12.2-14.0% (vs. 15.3-16.6%), from *H. pautensis* by dorsal - anal distance 31.0-36.7% (vs. 28.9-31.6%) and eye diameter 27.0-32.2% (vs. 39.5-44.0%), from *H. polyodon* for having fewer scales between the lateral line canal and the pelvic-fin origin 4 (vs. 6), and by the number of simple dorsal-fin rays iii (vs. ii), from *H. surinamensis* by prepectoral distance 19.4-23.8 % (vs. 23.2-25.1%), from *H. taeniurus* by caudal peduncle depth 12.1-14.0% (vs. 10.8-12.9%) and from *H. tridens* by body depth 30.6 -38.3% (vs. 23, 6%), depth of the caudal peduncle 12.1-14.0% (vs. 7.7%), caudal peduncle length 11.3-15.9% (vs. 19.1%) and pelvic-fin length 12.2-14.8% (vs. 18.2%).

Description

Mouth terminal, Body compressed its greatest depth anterior to dorsal-fin origin. The dorsal and ventral margins of the caudal peduncle are not straight. Ventral profile convex from gill isthmus to pelvic-fin insertion and from there straight to anal-fin origin. Lateral line scales 39-43, scales between lateral line and dorsal-fin origin 7-9, scales between lateral line and anal-fin origin 6-8, scales between lateral line and pelvic-fin insertions 6-7. Dorsal fin rays ii, 8, first simple ray about half the length of the second simple ray. The distal margin of the dorsal fin is slightly convex. Origin of adipose fin anterior to insertion of last anal-fin ray. Anal-fin rays iv-v, 26-29. Caudal fin with 10-9 main rays; dorsal lobe with 12 procurrent rays and ventral lobe with 10 procurrent rays. Total 39 vertebrae, including 4 fused vertebrae in Weberian apparatus: 17 precaudal vertebrae, last pleural rib not centrally fused, and last two precaudal vertebrae modified as transitional mode, no true pleural ribs; 23 caudal vertebrae, including urostyle. Caudal skeleton with seven hypurals.

Distribution

Hemibrycon jelskii is found only in the Huambo River basin of the Pacific versant of Peru.

Pigmentation in alcohol

Lateral body surface with a silver band that extends from the humeral region to the base of the caudal peduncle, without a reticulated pattern. Dorsal area of the head and body is chestnut brown, the sides of the skull and ventral surface of the body light brown, silver operculum, and infraorbital area. The humeral spot is formed by two layers of pigment; the first layer is formed by melanophores with a lower concentration and with surface distribution, narrow, covers four series of scales above the lateral-line canal and two to three below it; horizontally humeral spot covers two to three vertical series of scales at lateral line canal level. The second layer of pigment is formed by melanophores with greater concentration and deep distribution; the second configuration has dark concentration, highlighted concerning the first layer of pigments, distributed above the lateral line canal. In addition, this deep layer of pigments is crossed by a canal that originates at the same point sensory lateral canal and extends in a transversal manner on a series of scales above the sensory lateral canal. The caudal spot on the central axis of the caudal peduncle does not extend anterior to vertical through the adipose-fin origin and extends in the shape of a nail over mid-caudal rays, but it does not cover caudal lobes. Pectoral, pelvic, dorsal, and anal fins are hyaline; distal tips of anal-fin rays are dark.

Sexual dimorphism

Males have small hooks present on anal and pelvic-fin rays. The dorsal profile of the head is slightly sigmoid in females vs. the pre-dorsal region extends as a continuous arch from head to dorsal-fin origin in males.

Comments

Hemibrycon jelskii differs from the Amazon Basin populations previously identified as *H. jelskii*, which are here identified as new species. Besides the differences mentioned in the diagnoses of the new species, a regression analysis detected differences based on maxillary length and head length among the analyzed species (slope: 0.47985 and intercept -2.2159, Figure 9A), as well as maxillary length and body depth (slope: 0.22864 and intercept 0.26429 Figure 9B). In these analyses, values for *H. jelskii* are higher than those obtained for two species described from the Mamoré and Ucayali River drainages, but lower for three other species from those same drainages that are described as new below.

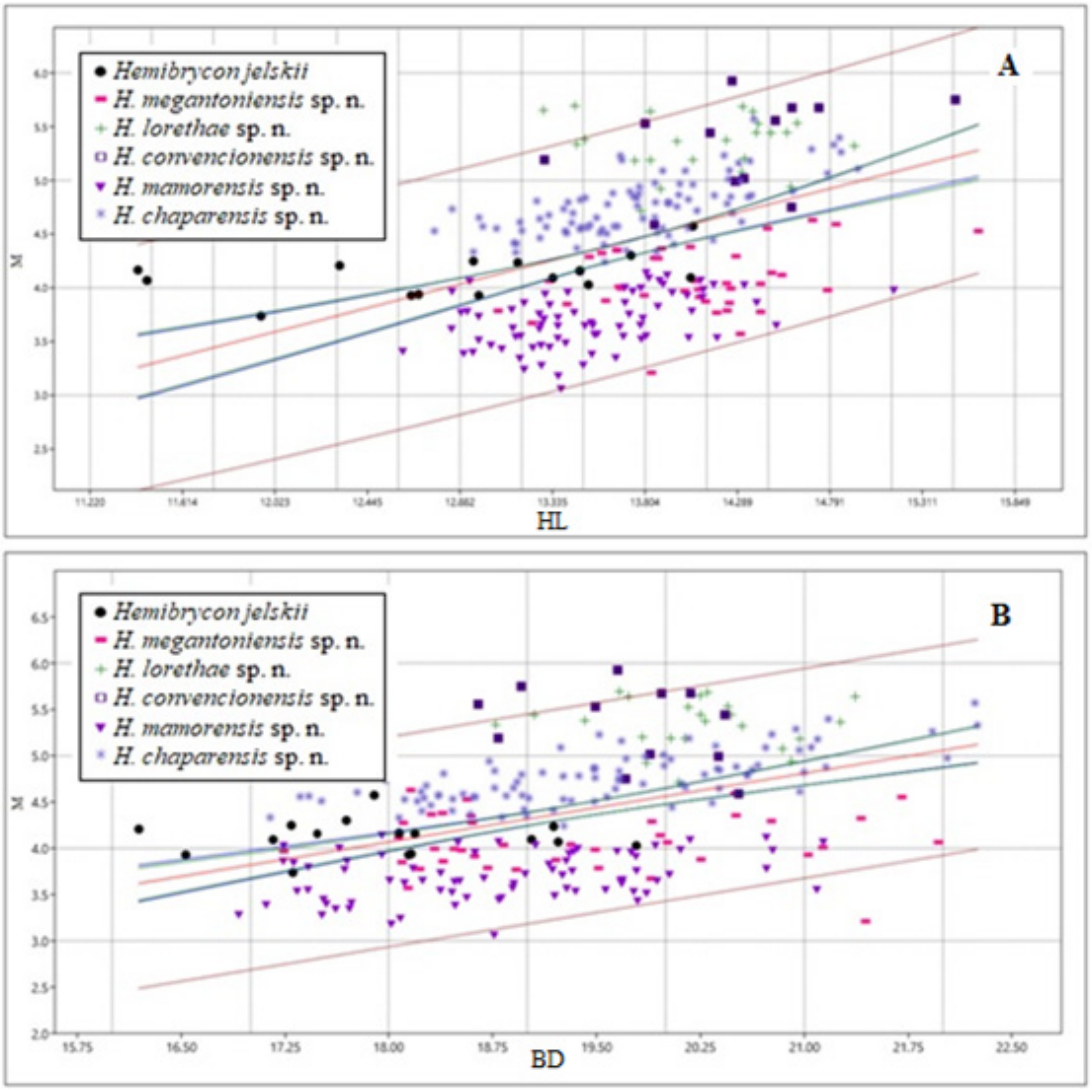

Figure 9 A. Head length distribution in *Hemibrycon* species from Amazon River basin.

B. Body depth distribution in *Hemibrycon* species from Amazon River basin.

Citation: Ruiz-C RI, Román-Valencia C, Bastidas AM, et al. Redescription of *Hemibrycon jelskii*, with comments on *H. huambonicus*, and description of five new species from the Amazon River basin (Characiformes: Characidae: Stevardiinae). *J Aquac Mar Biol.* 2023;12(3):215–232. DOI: 10.15406/jamb.2023.12.00377

Hemibrycon megantoniensis n. sp. (Figure 10, Table 4)

lsid:zoobank.org:pub:40AD34DC-D929-4942-97E1-8CBDF611D11C

Holotype: MUSM 37001, 73.8 mm SL, Perú, Cusco, La Convención, Megantoni, Río Parotori, Quebrada Piriabindeni, Col. Roberto Quispe, 28 May 2009. 18 L -12.020699/-73.064395.

Paratypes: Perú: Cusco, La Convención, Megantoni, Urubamba, MUSM 36070 (20), 24.36-79.87mm SL, Río Parotori, Río Poyiriari. Col. Roberto Quispe, 20 May 2009, 18 L -12.179018/-73.089707;MUSM 37002, (2, C&S), 53.83-59.90 mm SL, Río Parotori, Río Poyiriari. Col. Roberto Quispe, 20 May 2009, 18 L -12.179018/-73.089707; MUSM 36092, (1), 89.3 mm SL, Río Mantelo. Col. Roberto Quispe. 18 L -12.528547/-73.085503; MUSM 36056, (3), 44.9 -79.3 mm, Río Bajo Urubamba, Quebrada Parotori, Col. Roberto Quispe, 21 May 2009, 18 L -12.219824/-73.089707; MUSM 15878 (7), 50.0-73.6 mm, (2C&S), 39.1-51.5,Ucayali, Padre Abad, Aguaytía, Quebrada Rashaya, Col. H. Ortega & M Hidalgo, 17 May 1997, 09°03´19”S/75°29´57”O; MUSM 37003 (2,C& S) ,39.67-52.30 mm, Ucayali, Padre Abad, Aguaytía, Quebrada Rashaya, Col. H. Ortega & M Hidalgo, 17 May 1997, 09°03´19”S/75°29´57”O; MUSM 35492 (10), 32.2-57.4 mm, Ucayali, Atalaja, Sepahua, Quebrada Lazano, tributario del Río Mishahua, 18L 72118478756971.

Figure 10 *Hemibrycon megantoniensis* n. sp. Holotype. MUSM 37001, 73.8 mm SL, Peru, Cusco, La Convención, Megantoni, Río Parotori, Quebrada Piriabindeni, Col. Roberto Quispe, 28 May. 2009. 18 L -12.020699/-73.064395. Scale bar = 1 cm.

Diagnosis

Hemibrycon megantoniensis n. sp. differs from *H. jelskii* by head length in standard length (23.3-26.7% vs. 18.5-23.8%); by having a long pectoral fin that extends beyond the origin of the pelvic fin (versus a short pectoral fin that does not reach the origin of the pelvic fin); in having the posterior ventral edge of the third infraorbital in contact with the preoperculum (vs. posterior ventral edge of third infraorbital not in contact with preoperculum). The humeral spot of *H. megantoniensis* n. sp. covers 2-3 vertical rows of scales above the lateral line (versus 4 vertical rows of scales). *H. megantoniensis* n. sp. differs from *H. polyodon* in having a broader second pigment layer pattern in the humeral spot (versus the second pigment layer pattern of the humeral spot extends beyond the first layer, giving it a narrow and vertically elongated shape that extends below the lateral line to a horizontal aligned with the lower edge of the operculum). It is distinguished from *H. coxeyi* by body depth 30.1-39.2% (vs. 28.43%), prepectoral distance 22.9-26.2% (vs. 18.2%), and prepelvic distance 40 .8-45.7% (vs. 36.8%). It differs from *H. beni, H. helleri,* and *H. tridens* by having more anal-fin rays 26-28 (vs. 15-19 in *H. beni*, 19-23 in *H. helleri* and 17 in *H. tridens*). It differs from *H. inambari* by the length of the anal fin 14.4-19.6% (versus 28.0-34.4%). It differs from *H. divisorensis* by the absence of an asymmetrical spot covering the area from the base of the caudal fin to a vertical through the last anal-fin rays (vs. asymmetric spot present on the caudal peduncle). It is distinguished from *H. mikrostiktos* by the predorsal distance 47.6-52.3% (vs. 52.1-55.2%) and by having the vertical humeral spot crossed ventrally by the lateral line (vs. humeral circular and located above the lateral line). It is distinguished from *H. orcesi* by the preanal distance 53.6-58.0% (vs. 59.1-66.9%), by having more lateral-line scales 40-44 (vs. 34-36). It is distinguished from *H. pautensis* by the length of the caudal peduncle 11.9-15.1% (vs. 8.07-11.7%), and by head length 23.5-26.7% (vs. 19.14-21.46%). It differs from *H. surinamensis* by the length of the pelvic fin 12.4-15.7% (vs. 15.2-17.6%), and by the absence of an asymmetric spot on the caudal peduncle (vs. asymmetric spot on caudal peduncle present). It is distinguished from *H. taeniurus* by a head length of 23.3-26.7% (vs. 21.0-23.6%) and by having pigmentation on the caudal peduncle (vs. caudal peduncle without pigmentation).

Description

Mouth terminal, Body compressed with greatest depth anterior to dorsal-fin origin. Dorsal profile of the head is straight in males and females; the predorsal profile extends as a continuous shallow arc from the posterior tip of the supraoccipital spine to the dorsal-fin origin. Dorsal and ventral margins of caudal peduncle straight. Ventral profile nearly straight between mandible and pectoral-fin insertions, from there, arched to pelvic-fin insertions, then straight to anal-fin origin. Lateral line scales 40-44, scales between lateral line and dorsal-fin origin 8-9, scales between lateral line and anal-fin origin 6-7, scales between lateral line and dorsal-fin origin. Pelvic-fin rays 6-7. Dorsal-fin rays ii, 7-8, i, first simple ray about half the length of the second simple ray. The distal margin of the dorsal fin is slightly convex. Adipose-fin origin is anterior to the insertion of the last anal-fin ray. Anal fin rays iii-iv, 25-28. Caudal fin with 10-9 main rays; dorsal lobe with 5 procurrent rays and ventral lobe with 4 procurrent rays. Total vertebrae 40, including 4 fused in Weberian apparatus: 17 precaudal vertebrae, last pleural rib not centrally fused, and last two precaudal vertebrae modified as transitional mode, no true pleural ribs; 23 caudal vertebrae, including urostyle. Caudal skeleton with seven hypurals.

Sexual dimorphism

Hooks were observed on the anal and pelvic-fin rays of males.

Etymology

Hemibrycon megantoniensis n. sp. It bears the new name of the Peruvian district, Megantoni, of Cusco where the type series was collected.

Distribution

This species occurs in the Río Quispe drainage, a tributary of the upper Urubam River, and Lazano creek, tributary Mishahua River Ucayali River, Peru.

Pigmentation in alcohol

The lateral surface body has a silvery band extending from behind the operculum through the humeral region to the base of the caudal peduncle, without a reticulated pattern. Dorsal area of the head and body is brownish, the sides of the skull and ventral surface of the body light brown, operculum, and infraorbital area silver. The humeral spot is formed by two layers of pigment; the first layer is formed by melanophores of lighter concentration and superficial distribution, narrow, and covers four series of scales above the lateral line canal and two to three below. The second layer of pigment is formed by melanophores with greater concentration and deeper distribution; the second configuration has a dark concentration of melanophores, standing out from the first layer of pigments, covering the lateral line. This deep layer of pigments is crossed by a secondary lateral-fine canal originating at the same point as the main lateral-line canal and extending transversely over a series of scales above the lateral line. The caudal spot on the central axis of the caudal peduncle, does not extend anterior to the vertical through adipose-fin origin fin, and extends as a horizontal bar over middle caudal rays, but does not cover caudal lobes. Pectoral, pelvic, dorsal, and anal fins are hyaline; the distal tips of anal fin rays are dark.

Sexual dimorphism

Males have spines on their anal and pelvic fins. The pelvic-fin spines differed between the Loreto-Ucayali site (9-15 spines) and the La Convención-Cusco site (16-18 spines). The pelvic-fin spines are denser and about equally spaced proximally but fewer and more widely separated distally. The spines were only observed on the branched pelvic-fin rays, the first pelvic-fin ray is simple in this species. Anal-fin ray hooks varied similarly with 6-9 at the Loreto-Ucayali site and 12-13 at the La Convención-Cusco site. In the Loreto-Ucayali population, the first simple ray and the first 13 branched anal-fin rays had spines. In specimens from the La Convención-Cusco population, the spines are fewer on the third to the seventh branched anal-fin rays. The spines on the anal fin are less prominent than those on the pelvic fins and are absent from the pectoral, dorsal, and caudal fins.

Hemibrycon lorethae n. sp.

(Figure 11, Table 4)

lsid:zoobank.org:pub:40AD34DC-D929-4942-97E1-8CBDF611D11C

Holotype: MUSM 15901, 64.8 mm, Perú, Loreto, Ucayali, Rashajosa A., Quebrada Norte, -12.61762, -72.59957. 16 May 1997.

Paratypes: Peru: MUSM 36110 (17), 73.8 mm SL, Perú, Cusco, La Convención, Megantoni, Río Parotori, Quebrada Piriabindeni, Col. Roberto Quispe, 28 May 2009. 18 L -12.020699/-73.064395; MUSM 15901, (14) 54.9-74.9 mm, Loreto, Ucayali, Rashajosa A., Quebrada Norte, -12.61762, -72.59957. 16 May 1997.

Figure 11 *Hemibrycon lorethae*,n. sp. Holotype**,** MUSM 15901, 64.8 mm, SL Peru, Loreto, Ucayali, Rashajosa A., Quebrada Norte. 16 May 1997. Scale bar =1 cm.

Diagnosis

Hemibrycon lorethae n. sp. differs from *H. jelskii* by head length 23.1-28.3% (vs. 18.5-23.8%); by pectoral-fin length, the tips of which extend beyond the pelvic fin insertions (vs. pectoral fins short, their tips not reaching the pelvic fin insertions); by having the posterior ventral margin of third infraorbital in contact with the preoperculum; (vs. third infraorbital not in contact with the preoperculum). *Hemibrycon lorethae* n. sp. differs from *H. beni* and *H. helleri* by having more anal-fin rays 24-29 (vs.15-19 *H. beni*, 19-23 *H. helleri*). *Hemibrycon lorethae* n. sp. differs from *H. coxeyi* by body depth 31.0-39.2% (vs. 28.4%); predorsal distance 49.9-53.2% (vs. 49.8%), prepectoral length 21.9-25.1% (vs. 18.2%), prepelvic length 41.0-44.7% (vs. 36.8%), dorsal-fin length 22.7-28.5% (vs. 10.05%), head length 23.1-28.3% (vs. 21.7%) and eye diameter 30.8-36.9% (vs. 27.9%). *Hemibrycon lorethae* sp n. differs from *H. mikrostiktos* by caudal peduncle length 9.67-13.3% (vs. 13.6-19.3%) and by having a vertically elongated humeral spot that extends below the lateral line (vs. humeral spot circular and located above the lateral line). *Hemibrycon lorethae* n. sp. differs from *H. inambari* by anal-fin length 13.9-20.5 % (vs. 28.0-34.4 %), and from *H. surinamensis* and *H. divisorensis* because it lacks an asymmetric spot that covers base of caudal-fin rays that extends forward to a vertical through the last anal-fin rays. It differs from *H. orcesi* by prepelvic distance 41.0-44.7% (vs. 44.5-51.3%) and by having a conspicuous spot on the caudal peduncle (vs. absent). *Hemibrycon lorethae* n. sp. differs from *H. pautensis* by body depth 31.0-39.2% (vs. 28.0-30.8%), head length 23.1-28.3% (19.1-21.4%) and eye diameter 30.8-36.9% (vs. 39.5-44.0%). *Hemibrycon lorethae* n. sp. differs from *H. polyodon* by the shape of the humeral spot which is broad and located on the lateral line (vs. humeral spot uniformly narrow, and extending below the lateral line. It differs from n. sp. *H taeniurus* for having a spot on the caudal peduncle (vs. absent), and from *H. tridens* by having a deeper body 31.0-39.2% (vs. 23.6%), a deeper caudal peduncle 11.0-14, 0 (vs. 7.7%) and caudal peduncle length 9.67-13.3% (vs. 19.1%) *Hemibrycon lorethae* n. sp. differs from *H. megantoniensis* sp n. by the length of the maxilla 34.1-42.7 (vs. 23.4-31.9).

Description

Mouth terminal, Body compressed with greatest depth anterior to dorsal-fin origin; predorsal profile extended in a continuous arc from head to dorsal-fin origin. Dorsal and ventral margins of caudal peduncle straight. Ventral profile convex between gill isthmus and pelvic-fin insertion, from there straight to anal-fin origin. Lateral line scales 40-43, scales between lateral line and dorsal-fin origin 8, scales between lateral line and anal-fin origin 5-6, scales between lateral line and fin pelvic-fin insertions 5-6. Dorsal-fin rays ii, 7, i, first simple ray about half the length of the second simple ray. The distal margin of the dorsal fin is slightly convex. Adipose-fin origin is anterior to the insertion of the last anal-fin ray. Anal-fin rays iii-iv, 24-28. Caudal fin with 10-9 main rays; dorsal lobe with 5 procurrent rays and ventral lobe with 4. Total 39 vertebrae, including 4 fused vertebrae of Weberian apparatus: 17 precaudal vertebrae, last pleural rib not centrally fused, and last two precaudal vertebrae modified as transitional mode, no true pleural ribs; 23 caudal vertebrae, including urostyle. Caudal skeleton with seven hypurals.

Etymology

This species is named in homage to the late Mrs. Constanza Loreth Fajardo Calderon, sister of the first author, and used as a noun in apposition.

Distribution

Hemibrycon lorethae n. sp. occurs in the Ucayali River drainage, Loreto department and the Río Quispe drainage (upper Urubamba) Peru.

Pigmentation in alcohol

Lateral body surface with the silver band that extends from behind the opercle crossing the humeral region to the base of the caudal peduncle, without a reticulated pattern. Dorsal area of the head and body is chestnut brown, the sides of the skull and ventral surface of the body light brown, silver operculum, and infraorbital area. The humeral spot is formed by two layers of pigment; the first layer is formed by melanophores with a lower concentration and with surface distribution, narrow, covers four series of scales above the lateral-line canal and two to three below it; horizontally humeral spot covers two to three vertical series of scales at lateral line canal level. A second layer of pigment, formed by melanophores with greater concentration and deep distribution; the second configuration has dark concentration, highlighted concerning first layer of pigments, distributed above the lateral line canal. In addition, this deep layer of pigments is crossed by a canal that originates at the same point sensory lateral canal and extends in a transversal manner on a series of scales above the sensory lateral canal. The caudal spot on the central axis of the caudal peduncle, does not extend anterior to vertical through the adipose-fin origin and extends in the shape of the horizontal bar over mid-caudal rays, but it does not cover caudal lobes. Pectoral, pelvic, dorsal, and anal fins are hyaline; distal tips of anal-fin rays are dark.

Sexual dimorphism

Sexual dimorphism was observed in pectoral-fin length, which is longer in males, reaching or surpassing pelvic-fin insertions; female's dorsal head profiles are slightly sigmoid but a continuous arc in males. Males have hooks on anal and pelvic-fin rays; 18-21 hooks on the pelvic fin, present from the base of the ray, with less distance between them in the proximal part but hook separation increasing as size decreases distally; 8-12 hooks on the first 10-11 branched rays and also on the first simple anal-fin ray. The hooks are less prominent on the anal fin than on the pelvic fin. Hooks are absent from pectoral and dorsal-fin rays.

Hemibrycon convencionensis n. sp.

(Figure12, Table 4)

lsid:zoobank.org:pub:40AD34DC-D929-4942-97E1-8CBDF611D11C

Holotype: MUSM 37005, 73.8 mm SL, Perú, Cusco, La Convención, Megantoni, Río Parotori, Quebrada Piriabindeni, Col. Roberto Quispe, 28 May 2009. 18 L -12.020699/-73.064395.

Paratypes: MUSM 36110 (14), 26.8-72.0 mm SL, Perú, Cusco, La Convención, Megantoni, Río Parotori, Quebrada Piriabindeni, Col. Roberto Quispe, 28 May 2009. 18 L -12.020699/-73.064395.

Figure 12 *Hemibrycon convencionensis* n. sp. Holotype MUSM 37005,73.8 mmSL Peru, Cusco, La Convención, Echarate, Río Parotori, Quebrada Piriabindeni, 28 May 2009. Scale bar =1 cm.

Diagnosis

Hemibrycon convencionensis n. sp. differs from *H. jelskii* by head length 25.1-28.9 (vs. 18.5-23.8%); postorbital length 42.5-48.9 (vs. 49.0-59.4%); and in having the posterior ventral edge of the third infraorbital in contact with the preoperculum (vs. posterior ventral edge of third infraorbital not in contact with preoperculum). It differs from *H. beni* and *H. helleri* by having more anal-fin rays: 23-27 (vs. 15-19 *H. beni*, 19-23 *H. helleri*). It is distinguished from *H. inambari* by anal-fin length 14.5 to 17.5% (vs. 28.0 to 34.4%). It differs from *H. surinamensis* and *H. divisorensis* by the absence of an asymmetrical spot that covers the base of the caudal-fin rays and that extends forward to a vertical through the posterior anal-fin rays. It differs from

H. coxeyi in prepectoral distance 22.6-26.1% (vs. 18.2%), prepelvic distance 42.4-47.2% (vs. 36.8%) and head length 25 .1-28.9% (vs. 21.7%). From *H. mikrostiktos* it differs in predorsal distance 48.8-52.9% (vs. 52.1-55.2%) and head length 25.1-28.9% (vs. 23.7-25.8%). *Hemibrycon convencionensis* n. sp. differs from *H. orcesi* in having fewer lateral-line scales 34-36 (vs. 40-44) and more branched anal-fin rays, 25 (vs. 17-18). From *H. pautensis* it differs in prepelvic distance 42.4-47.2% (vs. 38.0-42.9%), head length 25.1-28.9% (vs. 19.14-21.46%), eye diameter 29.0-37.5% (vs. 39.5-44.0%) and postorbital length 42.5-48.9% (vs. 34.3-40.8%). It differs from *H. polyodon* in having a broad humeral spot located above the lateral line (vs. narrow humeral spot that extends across and below the lateral line). It differs from *H. tridens* in prepelvic distance 42.4-47.2% (vs. 39.5%), body depth 29.8-34.9% (vs. 23.6%), caudal peduncle depth 10 0.3-13.9% (vs. 7.7%), caudal peduncle length 10.6-14.2% (vs. 19.1%) and head length 25.1-28.9% (vs. 23.4%). *Hemibrycon convencionensis n. sp.* differs from *H. taeniurus* by a head length 25.1-28.9% (vs. 22.9-24.7%) and by having a spot on the caudal peduncle (vs. no spot). It differs from *Hemibrycon megantoniensis* n. sp. by maxillary length 33.0-41.7% (vs. 23.4-31.9%); by the shape of the humeral spot which is wider above the lateral line (covering 4-5 scales) (versus humeral spot narrow above the lateral line which covers only 3 scales); in having the pelvic-fin rays from the most proximal branched ray to the most distal simple ray with the tip ending in a transverse angle (vs. those rays with the tips forming a straight line) (observed in all individuals examined); in having two scales between the operculum and the humeral spot (versus four scales between the operculum and the humeral spot). It differs from *Hemibrycon lorethae* n. sp. in having the anterior anal-fin rays covered by small scales for one-third or less of their length (versus small scales covering one-half or more of the length of the anterior anal-fin rays); and in having a sigmoid vs. straight dorsal skull profile in *Hemibrycon lorethae*.

Description

Mouth terminal, Body compressed, its greatest depth is anterior to dorsal-fin origin; dorsal and ventral margins of caudal peduncle not straight. Ventral profile convex between gill isthmus and pelvic insertion, then straight to anal-fin origin. The pectoral fin in adults is not as long as the pelvic fin; tips of pelvic fins reach the anal-fin origin in immature, but not in adults. Lateral line scales 40-44, scales between lateral line and dorsal fin origin 8-9, scales between lateral line and anal fin origin 5-7, scales between lateral line and pelvic-fin insertions 5-6. Dorsal fin rays ii, 6-7, I; first simple ray about half the length of the second simple ray. The distal margin of the dorsal fin is slightly convex. Origin of adipose fin anterior to insertion of last anal-fin ray. Anal-fin rays iii-iv, 24-28. Caudal-fin with 10-9 main rays; dorsal lobe with 5 procurrent rays and ventral lobe with 4. Total vertebrae 40, including 4 fused in Weberian apparatus; 17 precaudal vertebrae, last pleural rib not centrally fused, and last two precaudal vertebrae modified as transitional mode, no true pleural ribs; 23 caudal vertebrae, including the urostyle. Caudal skeleton with seven hypurals.

Etymology

Hemibrycon convencionensis n. sp. is named for Convención Province, Peru, where the type series was collected.

Distribution

This species *Hemibrycon convencionensis* n. sp. has been found only in the Río Quispe drainage, upper Urubamba River drainage, Peru.

Pigmentation in alcohol

Lateral body surface with a silver band that extends from behind the opercle crossing the humeral region to the base of the caudal peduncle, without a reticulated pattern. Dorsal area of the head and body is chestnut brown, the sides of the skull and ventral surface of the body light brown, silver operculum, and infraorbital area. The humeral spot is formed by two layers of pigment; the first layer is formed by melanophores with a lower concentration and with surface distribution, narrow, and covers four series of scales above the lateral-line canal and two to three below it; horizontally humeral spot covers two to three vertical series of scales at lateral line canal level. The second layer of pigment is formed by melanophores with greater concentration and deep distribution; the second configuration has dark concentration, highlighted concerning first layer of pigments, distributed above the lateral line canal. In addition, this deep layer of pigments is crossed by a canal that originates at the same point sensory lateral canal and extends in a transversal manner on a series of scales above the sensory lateral canal. The caudal spot on the central axis of the caudal peduncle, does not extend anterior to vertical through the adipose-fin origin and extends in the shape of the horizontal bar over mid-caudal rays, but it does not cover caudal lobes. Pectoral, pelvic, dorsal, and anal fins are hyaline; distal tips of anal-fin rays are dark.

Sexual dimorphism

No sexual dimorphism was observed, and no hooks were found on the fins.

Hemibrycon mamorensis n. sp.

(Figure 13, Table 4)

lsid:zoobank.org:pub:40AD34DC-D929-4942-97E1-8CBDF611D11C

Holotype: Bolivia: UMSS 1545, 65.7 mm SL, Bolivia, Colonia San Carlos, Amazon River basin/Mamoré; Isiboro/Chipiriri, 16° 52’ 31.7» S; 65° 22‘ 1.8“ W, 15 May 2006.

Paratypes: UMSS 09300, (5), 43.4-66.7 mm SL, Rio Bulo Bulo-Caripuyo, Amazon River Basin/Mamoré-Ichilo/Bulo Bulo, 17° 17’ 57.4» S ; 64° 26’ 25.7” W, 06 Nov. 2008; UMSS 09319, (9), 37.5-64.1 mm SL, Río Izozog-San Salvador, Amazon River Basin/Mamoré; Ichilo/Izozog, 17° 15’ 44.9» S ; 64° 32’ 53.7” W, 08 Nov. 2008; UMSS 09320, 45.05-64.13mm SL, Río Izozog-San Salvador, Amazon River Basin/Mamoré; Ichilo/Izozog, 17° 15’ 44.9» S ; 64° 32’ 53.7” W, 08 Nov. 2008;UMSS 9255, (16), 38.4-61.3 mm SL, Santa Rosa, Afluente Rio Eñe, Amazon River Basin/Mamoré; Ichilo/Chapare, 17° 4’ 50.9» S;65° 13’ 21.4” W; UMSS 09321, (3, C&S),51.85-60.55 mm SL, Santa Rosa, afluente Rio Eñe, Amazon River Basin/Mamoré; Ichilo/Chapare, 17° 4’ 50.9» S;65° 13’ 21.4” W; UMSS 03238, (19), 50.3-70.2 mm SL, Villa Samual San Juan, Amazon River basin/Mamoré; Isiboro/Chipiriri, 16° 53’ 4.1» S ; 65° 20’ 49.6” W, 18 May 2006; UMSS XX, (2 ,C&S), 51.70-53.98 mm SL, Villa Samual San Juan, Amazon River basin/Mamoré; Isiboro/Chipiriri, 16° 53’ 4.1» S ; 65° 20’ 49.6” W, 18 May 2006; UMSS 05416 (7), 50.0-69.3 mm SL, Colonia San Carlos, Amazon River basin/Mamoré; Isiboro/Chipiriri, 16° 51’ 21.9» S ; 65° 19’ 45” W; UMSS 03337, (3), 38.8-56.3 mm SL, Predio Domingo Murillo, Amazon River basin/Mamoré; Isiboro/Chipiriri, 16° 49’ 55.5» S ; 65° 21’ 59.6” W, 11 Jul. 2006; UMSS 01888, (6), 51.7- 78.2 mm SL, Bolivia, Amazonas, Santa Fé, Amazon River basin/Mamoré; Isiboro/Chipiriri, 16° 48’ 10.8» S ; 65° 18’ 30.4” W, 16 May 2007; UMSS 05290. (2), 52.7-64.3 mm SL, Colonia San Carlos, Amazon River basin/Mamoré; Isiboro/Chipiriri. 16° 50’ 40.2» S; 65° 18’ 58.5” W, 05 Aug. 2005; UMSS 04652, (3), 39.7-

47.0 mm SL, Villa Gral. Barrientos, Amazon River basin/Mamoré, Isiboro/Chipiriri. 16° 49' 38.9» S ; 65° 22' 2.7" W, 02 Aug. 2004; UMSS 03751, (6), 29.7-61.4 mm SL, Rancho 4 Esquinas, Amazon River basin/Mamoré, Isiboro/Chipiriri, 16° 51' 3.1» S ; 65° 21' 49.9" W, 08 Oct. 2004; UMSS 03827 (15), 52.2-73.0 mm SL, Rio Colonia Senda Bayer, Amazon River basin/Mamoré; Isiboro/Chipiriri, 16° 51' 4.9» S ; 65° 21' 40.6" W, 26 Oct. 2004; UMSS 00856, (3), 32.2-64.56 mm SLRio Ibuelo, Amazon River basin/Mamore, Ichilo/Chapare, 15 Oct. 2004; 09870, (15), 56.97-70.81 mm SL, Arroyo Tucupi, Tucupi, Amazon River basin/Beni, Madera Cotacales, 5 Nov. 2009.

Figure 13 *Hemibrycon mamorensis* n. sp. Bolivia: UMSS 1545, 65.7 mm SL, Bolivia, Colonia San Carlos, Amazon River basin/Mamoré; Isiboro/Chipiriri, 16° 52' 31.7" S - 65° 22' 1.8" W, 15 May 2006. Scale bar =1 cm.

Diagnosis

Hemibrycon mamorensis n. sp. differs from *H. jelskii* in having the postero-ventral margin of the third infraorbital in contact with the preoperculum (vs. not in contact). It differs from *H. coxeyi* by prepectoral distance 22.0-26.5% (vs. 18.2%), prepelvic distance 40.1-47.5% (vs. 36.8%), dorsal-fin length 21.2-25.8% (vs. 10.1%); anal-fin length 12.6-18.7% (vs. 10.1%), caudal peduncle depth 11.0-13.4% (vs. 10.7%); and head length 23.1-25.8% (vs. 21.8%). It differs from *H. beni* and *H. helleri* in having more anal-fin rays 23-28 (vs. 15-19, 19-23 respectively). It differs from *H. inambari* by snout length 23.8-28.7% (vs. 18.5-23.6%). It differs from *H. surinamensis* and *H. divisorensis* by the absence of an asymmetrical spot that covers the base of the caudal fin rays and extends anterior to the insertion of the last anal-fin rays. *H. mamorensis* n. sp. differs from *H. orcesi* by eye diameter 26.58-35.6% (vs. 36.4-48.6%). It differs from *H. mikrostiktos* by snout length 23.8-28.7 % (vs. 19.3-22.9%), by having more branched anal-fin rays 27-28 (vs. 18-20), and by having vertically elongated humeral spot that ventrally crosses the lateral line (vs. humeral spot circular, located above the lateral line). It differs from *H. pautensis* by head length 23.1-25.8% (vs. 19.1-21.4%), eye diameter 26.5-35.6% (vs. 39 0.5-44.1%), and postorbital length 42.3-53.5% (vs. 34.3-40.8%). It differs from *H. polyodon* mainly in the configuration of the humeral spot. In *Hemibrycon mamorensis* n. sp. that spot is broad dorsally above the lateral line and narrow below the lateral line (versus humeral spot uniformly narrow above and below the lateral line). It differs from *H. taeniurus* in having chevron-shaped markings along the sides (vs. without chevrons). It differs from *H. tridens* by body depth 28.6-40.2% (vs. 23.6%); caudal peduncle depth 11.0-13.4% (vs. 7.7%), caudal peduncle length 11.2-15.9% (vs. 19.1%), pelvic-fin length 13.6 -16.7% (vs. 18.2%) and snout length 23.8-28.7% (vs. 22.0%). It differs from *Hemibrycon megantoniensis* n. sp. by maxillary length 31.3-38.6% (vs. 23.4-31.9%); in having the pelvic-fin tips blunt (vs. pointed). It differs from *Hemibrycon lorethae* n. sp. in having a hump posterior to the supraoccipital spine (vs. without a hump*). H. mamorensis* n. sp. differs from all congeners in having fuzzy chevron markings along the lateral stripe down the sides (vs. no chevrons along lateral stripe) except *Hemibrycon chaparensis* n. sp which has darker chevrons and differs in maxillary length 31.3-38.6% (vs. 23.0-31.7%).

Description

Mouth terminal, Body compressed. The greatest body depth is anterior to dorsal-fin origin. The dorsal profile of the head is slightly sigmoid in females, a continuous arc in males; the predorsal region extends as a continuous arc from head to dorsal-fin origin. The dorsal and ventral margins of the caudal peduncle are not straight. Ventral profile convex between the gill isthmus and the pelvic insertion, and from there straight to the anal fin origin. The length of the pectoral fin in adults is no longer than the length of the pelvic fin, and the tips of the pelvic fins in adults do not reach origin of the anal fin origin as they do in immature individuals. Lateral line scales 40-44, scales between lateral line and dorsal fin origin 8-9, scales between lateral line and anal fin origin 5-7, and scales between lateral line and dorsal fin insertions. Pelvic fin 5-6. Dorsal fin rays ii, 6-7, i, first simple ray about half the length of the second simple ray. Distal margin of the dorsal fin is slightly convex. Origin of the adipose fin anterior to the insertion of the last ray of the anal fin. Anal fin rays iii-iv, 24-28. The tail fin with 10-9 main rays; dorsal lobe with 5 procurrent rays and ventral lobe with 4 procurrent rays. Total 40 vertebrae, including 4 fused vertebrae in the Weberian apparatus: 17 precaudal vertebrae, last pleural rib not centrally fused, and last two precaudal vertebrae modified as transitional mode, no true pleural ribs; 23 caudal vertebrae, including the urostyle. Caudal skeleton with seven hypurals.

Sexual dimorphism

No sexual dimorphism was observed, and no hooks were found on the fins.

Etymology

Hemibrycon mamorensis n. sp. is named after the Río Mamoré where the type series was collected.

Distribution

Hemibrycon mamorensis n. sp. occurs in the Mamore River drainage of the upper Amazon basin in Bolivia.

Pigmentation in alcohol

Lateral body surface with a silver band that extends from behind the opercle crossing the humeral region to the base of the caudal

peduncle, without a reticulated pattern. Dorsal area of the head and body is chestnut brown, the sides of the skull and ventral surface of the body light brown, silver operculum, and infraorbital area. The humeral spot is formed by two layers of pigment; the first layer is formed by melanophores with a lower concentration and with surface distribution, narrow, and covers four series of scales above the lateral-line canal and two to three below it; horizontally humeral spot covers two to three vertical series of scales at lateral line canal level. The second layer of pigment is formed by melanophores with greater concentration and deep distribution; the second configuration has dark concentration, highlighted concerning first layer of pigments, distributed above the lateral line canal. In addition, this deep layer of pigments is crossed by a canal that originates at the same point sensory lateral canal and extends in a transversal manner on a series of scales above the sensory lateral canal. It also has a series of chevron-shaped markings formed by dark lines along the myosepta between myotomes that extend from the dorsal region of the coelomic cavity to the caudal peduncle; pigmented muscle septa that form chevrons that do not match the rows of scales. Chevrons without distal extensions in both juvenile and adult specimens. The caudal spot on the central axis of the caudal peduncle, does not extend anterior to vertical through the adipose-fin origin and extends in the shape of the horizontal bar over mid-caudal rays, but it does not cover caudal lobes. Pectoral, pelvic, dorsal, and anal fins are hyaline; distal tips of anal-fin rays are dark.

Sexual dimorphism

Sexual dimorphism was observed in the length of pectoral fins, longer in males, as they reach and/or surpass the origin of the pelvic fin, sexual dimorphism associated with hooks on anal and pelvic fin rays is observed, the distribution of hooks on fins varying from 14-21 in pelvic fin present from the base of ray, they have less distance between them in the proximal part, in the distal part of ray distance between hooks increases as the size of hooks decreases, 9-12 in anal fin; less prominent than pelvic fin; hooks absent on pectoral and dorsal-fin rays.

Hemibrycon chaparensis n. sp.

(Figure 14, Table 4)

lsid:zoobank.org:pub:40AD34DC-D929-4942-97E1-8CBDF611D11C

Holotype: UMSS 09323, 58.5 mm SL, Bolivia, Río San Rafael-Muyurina, Amazon River basin/Mamoré; Chapare/San Mateo. 17° 3' 58.7» S; 65° 29' 14.4" W, 29 Oct. 2008.

Paratypes: UMSS 9197, (4), 50.1-73.2 mm SL, Bolivia, Afluente del Espíritu Santo, Cuevitas, Amazon River basin/Mamoré; Chapare/Espíritu Santo, 17° 0' 11.5" S; 65° 34' 59.2" W, 31 Oct. 2008; UMSS 9234, (8), 49.5-57.0 mm SL, Bolivia, Río San Rafael-Muyurina, Amazon River basin/Mamoré; Chapare/San Mateo. 17° 3' 58.7" S; 65° 29' 14.4" W, 29 Oct. 2008; UMSS 5257, (33), 33.1-73.3 mm SL, Bolivia, Rio de Villa, Amazon River basin/Mamoré; Isiboro/Chipiriri,14 Sept.2008; UMSS 09326, (3, C&S), 46.17-65.73 mm SL, Bolivia, Rio de Villa, Amazon River basin/Mamoré; Isiboro/Chipiriri,14 Sept.2008; UMSS 03469, (13), 29.0-77.2 mm SL, Bolivia, Amazonas/Mamoré; Isiboro/Chipiriri; -16.866677 S; 65.390682W, ZubietaJ., Moya N. De Merona, 09 Jul 2006; UMSS 09328, 54.32-60.92 mm SL, Bolivia, Amazonas/Mamoré; Isiboro/Chipiriri; -16.866677 S; 65.390682W, ZubietaJ., Moya N. De Merona, 09 Jul 2006.

Figure 14 *Hemibrycon chaparensis* n. sp. Holotype: UMSS 09323, 58.5 mm SL, Bolivia, Río San Rafael-Muyurina, Amazon River basin/Mamoré; Chapare/San Mateo. 17° 3' 58.7» S - 65° 29' 14.4" W, 29 Oct. 2008. Scale bar =1 cm.

Diagnosis

Hemibrycon chaparensis n. sp. differs from *H. jelskii* in having the posteroventral margin of the third infraorbital in contact with the preoperculum (vs. not in contact). It differs from *H. beni*, *H. helleri* and similar species by having more anal-fin rays: 23-28 (vs. 15-19, 19-23 respectively). It differs from *H. inambari* by the length of the anal fin 13.6-20.5% (vs. 28.0-34.4%). It differs from *H. surinamensis* and *H. divisorensis* in lacking an asymmetrical spot at the base of the caudal fin that extends anteriorly to above the last rays of the anal fin. It differs from *H. coxeyi* by prepectoral distance 21.5-27.9% (vs. 18.2%), prepelvic distance 39.9-46.1% (vs. 36.8%), dorsal-fin length 21.9-26.1% (vs. 10.1%), pectoral-fin 19,2-23,6% (vs. 17,7%), anal fin length 13.6 -20.5% (vs. 10.1%), head length 22.3-26.4% (21.76%) and jaw length 23.0-31.7% (34.58%). It differs from *H. mikrostiktos* by the number of branched anal-fin rays 24-26 (vs. 18-21). It differs from *H. orcesi* by eye diameter 27.5-36.8% (vs. 36.35-48.56%). It differs from *H. pautensis* by caudal-peduncle length 11.0-16.8% (versus 8.0-11.7%). It differs from *H. polyodon* and *H. taeniurus* by having chevron-shaped markings along the lateral stripe (vs. no chevrons on the sides). *H. chaparensis* n. sp. differs from *H. tridens* by body depth 28.7-38.3% (vs. 23.6%); caudal-peduncle depth 10.3-13.6% (vs. 7.7%) and caudal-peduncle length 11.0-16.8% (vs. 19.1%). It differs from *Hemibrycon megantoniensis* n. sp., *H. lorethae* n. sp., *H. convencionensis* n. sp. and *H. mamorensis* n. sp. by maxillary length 23.0-31.7% (vs. 34.1-42.7%; 33.0-41.7%; 31.3-38.6 respectively).

Description

Mouth terminal, Body compressed, greatest body depth anterior to dorsal-fin origin; sexually dimorphic hooks present on anal and pelvic-fin rays; dorsal profile of head slightly sigmoid in females, continuous arc in males, predorsal region extended as a continuous arc from the head to dorsal-fin origin. The dorsal and ventral margins

of the caudal peduncle are not straight. Ventral profile convex from gill isthmus to pelvic insertion, then straight to anal-fin origin. Lateral line scales 40-44, scales between lateral line and dorsal fin origin 8-9, scales between lateral line and anal fin origin 5-7, scales between lateral line and pelvic-fin insertions 5-6. Dorsal fin rays ii, 6-7, i, first simple ray about half the length of the second simple ray. The distal margin of the dorsal fin is slightly convex. Origin of adipose fin anterior to insertion of last anal-fin ray. Anal fin rays iii-iv, 24-28. Caudal fin with 10-9 main rays; dorsal lobe with five procurrent rays and ventral lobe with four rays. Total vertebrae 40, including four fused vertebrae in Weberian apparatus: 17 precaudal vertebrae, last pleural rib not centrally fused, and last two precaudal vertebrae modified as transitional mode, no true pleural ribs; 23 caudal vertebrae, including urostyle. Caudal skeleton with seven hypurals.

Sexual dimorphism

No sexual dimorphism was observed, and no hooks were found on the fins.

Etymology

Hemibrycon chaparensis is named for the Chaparé region, where the type series was collected.

Distribution

Hemibrycon chaparensis n. sp. occurs in the Mamore and Madeira River drainages, upper Amazon, Bolivia.

Pigmentation in alcohol

Lateral body surface with a silver band that extends from behind opercle crossing the humeral region to the base of the caudal peduncle, without a reticulated pattern. Dorsal area of the head and body chestnut brown, sides of skull and ventral surface of body light brown, silver operculum and infraorbital area. Humeral spot formed by two layers of pigment; first layer formed by melanophores with lower concentration and with surface distribution, narrow, covers four series of scales above lateral-line canal and two to three below it; horizontally humeral spot covers two to three vertical series of scales at lateral line canal level. Second layer of pigment, formed by melanophores with greater concentration and deep distribution; second configuration has dark concentration, highlighted with respect to first layer of pigments, distributed above lateral line canal. In addition, this deep layer of pigments is crossed by canal that originates at same point sensory lateral canal and which extends in transversal manner on series of scales above sensory lateral canal. Caudal spot on central axis of caudal peduncle, does not extend anterior to vertical through adipose-fin origin, and extends in shape of horizontal bar over mid-caudal rays, but it does not cover caudal lobes. Pectoral, pelvic, dorsal, and anal fins hyaline; distal tips of anal-fin rays dark.

Sexual dimorphism

Sexual dimorphism was observed in length of pectoral fins, longer in males, they reach and / or surpass the origin of the pelvic fin, males have hooks on anal and pelvic fin rays, their distribution varying, with 18-21 on pelvic fin rays, closer together proximally, farther apart and smaller near ray tips, 12-14 on anal fin; less prominent than those on pelvic fin; hooks absent on pectoral and dorsal-fin rays.

Discussion

Hemibrycon jelskii[1] was described using fish specimens tank-grown by Professor Konstanty Jelskii,[1] so the location of origin of the type material is uncertain. There are however, documentary records in the Vienna Zoological Museum of the professor's expeditions to the Huambo River basin. Steindachner[1] reported this species as high Andean. In light of the morphological disparity discovered in this work among the Amazonian populations and the four different morphotypes present in the type specimens (*Hemibrycon* sp.1, *Hemibrycon* sp.2, *Hemibrycon* sp. 3 and *Hemibrycon* sp. 4, we conclude that these came from different places. Pigmentation characters have been useful in the determination and differentiation of taxa, such as *Bryconamericus* and *Astyanax*[25,30,31] and *Serrasalmus*.[32] For *Hemibrycon* species, Bertaco and Malabarba[6] highlighted the importance of the size of the humeral spot (measured by how many series of horizontal scales the spot covered) in the differentiation of cisandine *Hemibrycon* species. A humeral spot covering 7-9 scale was a diagnostic character given by those authors to separate *H. helleri* and *H. jelskii* from most other cisandine species in the genus, that have only 4-6. However, this character was not described for the type specimens from Monterico, Peru, nor for the specimens they examined from the Amazon River basin.[6] With the description of *Hemibrycon jelskii* Steindachner,[1] the "site of Monterico in Peru" was designated as the type locality; however, the simplicity of this description creates ambiguity in the interpretation of the geographic location of the site and, consequently, different hypotheses have been proposed: Taczanowski[33] stated that the *H. jelskii* specimens collected in Monterico were from a site three days to the east of Huanta (Ayacucho) in the San Miguel River; there are also differing reports of the altitudes: 825 masl[34] and 827 masl[35] for the collection site, but Stephens and Taylor[29] proposed that these locations are too low for the San Miguel River and the site probably located at the coordinates: 12°28' S-73°54' W, in the department of Ayacucho, Peru. Bertaco and Malabarba[6] affirm that the basin or river closest to this place is the Apurímac River, belonging to the Ucayali River basin and not the Remac River near Lima on the Pacific slope, as reported by Lima et al. (130).[21]

The most recent interpretation corresponds to Frick et al.,[3] who locates the type locality in the department of Huánuco, Peru, Monterico and Río Huambo. In Peru, different places known as Monterico have been found, in the departments of Cajamarca, Junín, Lima, Cusco, Huánuco, Apurímac and Amazonas.[36] Given the different interpretations given above we surmise that the type locality of *H. jelskii* is possibly located in the western, Pacific coastal drainages of Peru and not, as has been assumed, in the Amazon River Basin. This could explain the evident differences we found among the *Hemibrycon* specimens examined here from the Amazon Basin and the available *H. jelskii* syntypes. In addition, regarding the location of the site reported as the type locality of *Hemibrycon jelskii*, Steindachner's original article[1] had four sections, one of which deals with fish from the Amazon River basin, but another that treats fishes from high Andes mountains of Peru. We believe this lends more credence to the idea that the type series was not collected in the Amazon Basin.

Our review of *H. huambonicus* type material (Steindachner: MNW 57530. NMW 57531)[2] revealed that they were supposedly designated after the description had already been published, in 1884 and 1883, respectively.[2] However, the reason for this discrepancy is unknown, as the data matches that of the type material and the jar is marked as a type in the inventory catalog. The dates on the labels may be the date of acquisition by the museum, and not when they were collected or examined by Steindachner (Palandacic 2018, curator of the National Museum of Vienna NMW [personal communication to C. Román-Valencia 08/05/2018]).[30] Additionally, the type material includes various collection dates.[37] So we surmise that the type material used to describe *H. huambonicus*[2] corresponds to specimens from the Huambo River (material currently deposited in the Vienna museum).

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Conflicts of interest

The authors do not have any conflicts of interest.

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