Description of *Apistogramma allpahuayo* sp. n., a new dwarf cichlid species (Teleostei: Perciformes: Geophaginae) from in and around the Reserva Nacional Allpahuayo Mishana, Loreto, Peru *

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> Abstract

A new species of *Apistogramma* is described from Peru, based on a total of 51 specimens collected in small forest brooks in and around the Reserva Nacional Allpahuayo Mishana in the drainage of the Nanay river basin about 30 kilometres southwest of Iquitos, Departamento Loreto (approximately 73° 25' W/03° 59' S). *Apistogramma allpahuayo* sp. n. is distinguished from all other *Apistogramma* species by the combination of black w-shape marking on lower jaw, (in adult males) lyrate caudal fin, massive jaws and hypertrophied orange lips, distinct roundish caudal-peduncle spot clearly separated from lateral band ending at vertical bar 7, serrated dorsal fin with conspicuous extensions of first membranes, and proportions of dorsal-fin spines differing from those otherwise typical within genus. *Apistogramma allpahuayo* sp. n. is thought to be a representative of the *Apistogramma cacatuoides* complex within the *Apistogramma cacatuoides* lineage.

> Resumen

Una nueva especie de *Apistogramma* es descrita para Perú, a partir de un total de 51 muestras colectadas en pequeñas quebradas en el Reserva Nacional Allpahuayo Mishana en la cuenca del río Nanay, a unos 30 kilómetros al suroeste de Iquitos, Departamento de Loreto (aproximadamente 73°25´W/03°59´S). *Apistogramma allpahuayo* sp. n. se distingue de todas las otras especies de *Apistogramma* por la combinación de una marca negra en forma de w en la mandíbula inferior, – en los

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machos adultos – aleta caudal tiene la forma de una lira, mandíbulas fuertes y labios hipertrofiados de color naranja, un pedúnculo caudal distintamente redondo y claramente separado de las bandas laterales que acaban con la banda vertical 7, una aleta dorsal dentada con llamativas extensiones de las primeras membranas, y proporciones de las espinas dorsales que difieren de las condiciones típicas del género. Se considera que *Apistogramma allpahuayo* sp. n. es un representante del complejo *Apistogramma-cacatuoides* dentro del lineaje *A. cacatuoides*.

> Kurzfassung

Eine neue *Apistogramma*-Art wird auf Basis von 51 Exemplaren beschrieben, die aus kleinen Waldbächen im Bereich des Reserva Nacional Allpahuayo Mishana im Einzugsgebiet des Rio Nanay etwa 30 Kilometer südwestlich von Iquitos, Departamento Loreto, Peru (etwa 73° 25' W/03° 59' S) stammen. *Apistogramma allpahuayo* sp. n. ist von allen anderen *Apistogramma*-Arten durch die Kombination von schwarzem w-förmigem Unterkieferzeichnungsmuster, bei adulten Männchen zweizipfeliger Schwanzflosse, massigem Unterkiefer und hypertrophen orange gefärbten Lippen, deutlichem vor dem abgesetzten runden Schwanzwurzelfleck im siebten Querband endendem Lateralband, gesägter Rückenflosse mit starken Verlängerungen der vorderen Flossenhäute und von den sonst in der Gattung typischen Verhältnissen abweichenden Längenproportionen der Dorsalstacheln unterschieden. *Apistogramma allpahuayo* sp. n. ist ein Vertreter des *Apistogramma-cacatuoides*-Komplexes innerhalb der *Apistogramma-cacatuoides*-Linie.

> Key words

Biodiversity, endemism, ecology, freshwater, Neotropics, new taxa, protected area, Rio Nanay System, systematic.

Introduction

During the years 2010 and 2011 members of the Laboratoire Mixte International (LMI) had the opportunity to carry out ecological research on several aquatic habitats in Peru, and to collect a variety of freshwater fishes. Amongst these were several small cichlid species of the Neotropical genus *Apistogramma* Regan, some of them currently unknown to science. One of these species had been regularly imported from Peru for the aquarium hobby since at least 1995, and misidentified as *Apistogramma juruensis* Kullander, 1986 by Römer & Soares (1995) and Römer (1996). Nevertheless, the species has been used in several scientific studies since then (e.g. Engelking *et al*. 2010; Römer 2000, 2001; Römer & Beisenherz 2005). Since around 2008 the numbers of imported specimens have unexpectedly dropped significantly in spite of continuing interest in this species. As with most other forms within the genus, there are no existing reports on the field biology of this species. We have now been able to collect sufficient material for ichthyological, behavioural, and genetic studies of this species from at least seven different sites in and around the protected Reserva Nacional Allpahuayo Mishana south of Iquitos, and hence present the formal description of the 81st species of the genus *Apistogramma* in this paper.

Methods

Methods for counts and measurements are as detailed in Römer (2006), Römer & Hahn (2008), and Römer *et al*. (2003, 2004, 2006, 2011) except where otherwise stated. GPS locality data were taken using a GPSmap 76 CSx (Garmin Int. Inc., Lenexa, USA). Preservation of all specimens followed the "low temperature preservation protocol" (LTPP) described in detail by Römer & Hahn (2008). Fish were preserved in the laboratory after observation as detailed in Römer *et al*. (2011). Fresh material collected in 2010 and 2011 was stored in > 90% ethanol. The description of preserved specimens is based on the holotype, supplemented by study of all paratypes. Some specimens had to be cleaned by the "brushing" procedure described in detail in Römer *et al*. (2011).

As we are basically following the morphological/genetic-cluster concept (M/GC) for species delimitation (*cf*. Sites & Marshall, 2004; also Davis & Nixon, 1992; Wiens & Servedio, 2000), comparative statistical analysis of all data was performed using the PC program Statistica 6.0 for Windows (StatSoft Inc., Tulsa, USA). DNA samples were taken and stored following Römer *et al*. (2010, 2011), but stored under LMI working numbers differing from the final deposition numbers of voucher specimens. These storage numbers are given in the raw data tables. Voucher specimens were stored in the following collections: California Academy of Sciences (CAS), Museum für Tierkunde Dresden (MTD) fish collection (MTD F), Museo de Historia Natural at Universidad Nacional Mayor de San Marcos (MUSM); abbreviations as given in Sabaj Pérez (2010). Photographs of all specimens were taken under conditions described by Römer

et al. (2011). Gill rakers and pharyngeal elements have been excluded from this study, as these form part of further investigations in progress.

The description is based on inspection of preserved type specimens, on photographs of types taken immediately, three weeks, and five months after preservation, as well as on photographs of live type material taken in the Instituto de Investigaciones de la Amazonia Peruana (IIAP) in Iquitos shortly before preservation. In addition, some specimens collected outside the Reserva Nacional Allpahuao Mishana were exported to Germany for behavioural observation in the aquarium. Several photographs of the species presented here have already been published in Römer (2000) and are used here to supplement part of the reference material in this study. Reasons for giving precise descriptions of live coloration in *Apistogramma* species have been explained at length by Römer (2000, 2006) and Römer *et al*. (2003, 2004, 2006). As detailed descriptions of live coloration have already been published by Römer & Soares (1995, 1996) and Römer (2001), and the species has also been extensively portrayed hitherto by various other authors (Koslowski, 2003; Mayland & Bork, 1997; Staeck, 2003; Stawikowski, 2005; Warzel, 1998), information given in this paper will be restricted to highlighting diagnostic elements of live coloration. Photographic illustrations will also be restricted to showing typical patterns of specimens mainly from the type series or type location.

In the material section we partially follow Zarske (2011) and for the first time explicitly nominate "authorised specimens" for some species. Zarske suggested that such specimens might be called "authorised subtypes", but as this material has no type status at all, the second term "subtypes" should not be used in order to avoid any potential confusion regarding their taxonomic status, and especially to avoid their being mistaken for part of the type material. These authorised specimens should, at best, be regarded as topotypical and collected more recently than the type material. They should also be in comparatively good condition and identified by one or more of the original describers or other specialist authorities as belonging to the systematic group in question (= "authorised"). The rationale of this procedure is that authorised specimens may be used as reference material, issued on loan for further studies by other researchers, instead of the type material. The loan policy of the owner institutions for such authorised specimens could be far less restrictive than the norm of protecting type material from the risk of destruction during loan and/or transportation. The use of authorised specimens would give researchers the opportunity of obtaining necessary information on a particular species on the one hand, while effectively protecting the original type material on the other.

Apistogramma allpahuayo sp. n.

Type material: 51 specimens.

Holotype (fig. 1): MUSM 40593, male, 37.2 mm SL, collected in a small nameless *cocha* (lake) with a small affluent *quebrada* (brook) approximately 29 km south of Iquitos, about 2 km west of the *carretera* (road) from Iquitos to Nauta, Reserva Nacional Allpahuayo Mishana, Loreto, Peru [field station F10-P-2011-R; position 03° 59' 11.1" S / 73° 25' 51.4" W], August 10th 2011, by Roger Mori jr., Roger Mori sr., Joscha Beninde, Fabrice Duponchelle, François Kervarec, and Uwe Römer.

Paratypes (figs. 2–3) (50 specimens): CAS 233867, 1 male, 28.6 mm SL; MTD F 32650, 1 male, 21.7 mm SL; MUSM 41821, 1 male, 32.5 mm, 2 females, 24.6–28.0 mm SL; collection data as given for the holotype. MTD F32645, 2 females, 23.4–25.4 mm SL; MUSM 40592, 2 males, 27.5–30.1 mm SL, 1 female, 23.0 mm SL; MUSM 41814, 1 female, 26.0 mm SL; collected in a nameless isolated *cocha*, about 0.1 to 0.2 ha, close to a small fast flowing *quebrada*, about 2 km west of the road from Iquitos to Nauta, Reserva Nacional Allpahuayo Mishana, Loreto, Peru [field station F-11-P-2011-R; position 03° 51' 20.9" S / 73° 25' 56.4" W], August 10th 2011, by Roger Mori jr., Roger Mori sr., Joscha Beninde, Fabrice Duponchelle, François Kervarec, and Uwe Römer. MTD F 32646, 2 females, 26.6–29.2 mm SL; MUSM 40591, 2 males, 25.6–37.3 mm SL; MUSM 41812, 2 females, 24.7–25.9 mm SL; collected in the stagnant water of a swamp with small *quebrada* (brook), about 2 km west of the *carretera* from Iquitos to Nauta, Reserva Nacional Allpahuayo Mishana, Loreto, Peru [field station F-13-P-2011-R; position 03° 58' 51.0" S / 73° 25' 20.9" W], August 10th 2011, by Roger Mori jr., Roger Mori sr., Joscha Beninde, Fabrice Duponchelle, François Kervarec, and Uwe Römer. CAS 233865, 1male, 34.6 mm SL, 2 females, 24.9–28.7 mm SL, 1 unsexed, 23.2 mm SL; CAS 233866, 2 males, 29.5–31.7 mm SL, 1 female, 25.1 mm SL, 1 unsexed, 22.3 mm SL; MTD F 32693, 3 males, 25.7–37.7 mm SL, 2 females, 21.9–30.2 mm SL; MTD F 32694, 3 males, 28.1–34.3 mm SL, 1 female 24.4 mm SL; MTD F 32695, topotype, 1 male 38.2 mm SL; MTD F 32696, 3 males, 32.7–36.1 mm SL; MUSM 41818, 3 males, 29.1–34.5 mm, 3 females, 24.7–27.8 mm SL; MUSM 42057, 2 males, 30.6–32.9 mm SL, 3 females, 24.0–28.5 mm SL; MUSM 42058, 1 female, 27.3 mm SL; May 15th 2010, collected in a small *quebrada* (brook) close to the *carretera* (road) from Iquitos to Nauta, close to the boundary of the Reserva Nacional Allpahuayo Mishana, Loreto, Peru [close to field station F13-P-2011-R; position 03° 58' 51.10" S / 73° 25' 21.10" W], November 2010 by Roger Mori sr.

Comparative material: *Apistogramma allpahuayo* sp. n. (40 non-type specimens): Collection UR, commercial import from Peru in 2001, exporter O.A.F.A., Iquitos, preserved February 2002 to January 2003; 30 specimens of both sexes, still alive, observed in the aquarium, to be deposited in collections of IIAP, FMNH, and MUSM, collected in a dammed *quebrada* (brook) on a private cattle and buffalo ranch east of the *carretera* (road) from Iquitos to Nauta at about km 29 [field station F22-P-2011-R; position 03° 59' 32.S / 73° 25' 19. W], August 30th 2011 by Roger Mori jr., Roger Mori sr., Fabrice Duponchelle, and Uwe Römer. *Apistogramma arua* Römer & Warzel, 1998 (10 specimens): type series; MTD F 32697, 2 males, 28.3–45.4 mm SL, 1 female, 29.8 mm SL; MTD F 32699, 1 male, 38.5 mm SL, 1 female, 27.6 mm SL, MUSM 42059, 2 males, 35.5–44.5 mm SL, authorised specimens, collected September 2006 at type locality, M. Sugino. *Apistogramma barlowi* Römer & Hahn, 2008: type series. *Apistogramma cacatuoides* Hoedeman, 1951 (26 specimens): CAS 233868, 2 males, 27.3–33.8 mm SL, 2 females, 20.7–24.7 mm

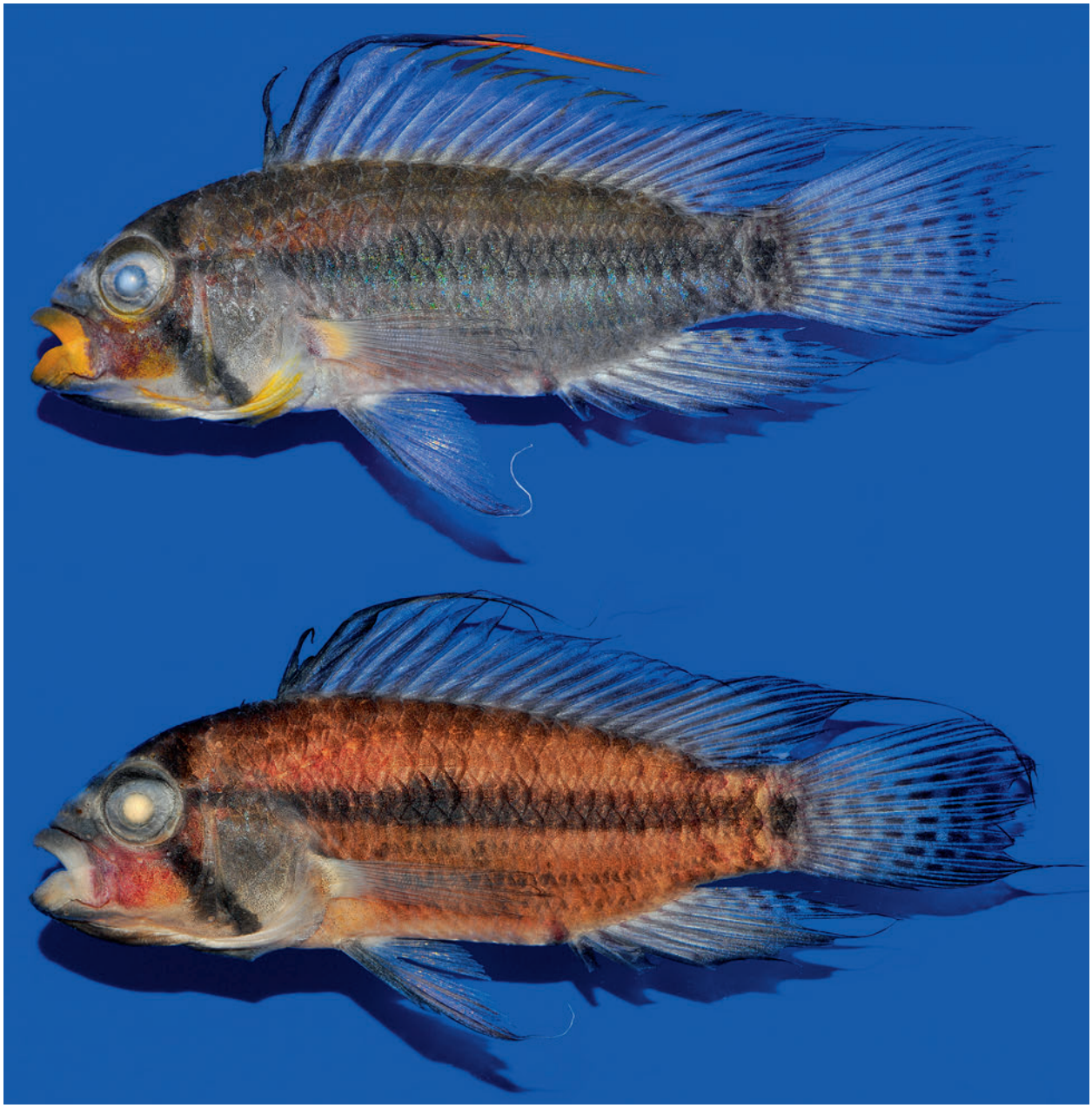

Fig. 1. *Apistogramma allpahuayo* sp. n., holotype, MUSM 40593, male, 37.2 mm SL, blue morph (BM). **Top**: three weeks after preservation; **bottom**: five months after preservation. All figures: U. Römer.

SL; MTD F 32647, 3 males, 27.8–35.0 mm SL, 1 female, 22.0 mm SL; MTD F 32648, 3 males, 22.9–32.4 mm SL, 1 female, 27.5 mm SL; MTD F 32649, 1 male, 23.7 mm SL, 2 females, 27.6–28,6 mm SL; MUSM 41815, 1 male, 28.8 mm SL, 3 females, 21.8–27.1 mm SL; MUSM 41816, 2 males, 26.2–31.3 mm SL, 2 females, 23.1–24.6 mm SL; MUSM 41817, 1 male, 29.9 mm SL, 1 female, 25.4 mm SL; collected in a palm swamp approximately 7.9 km south of Iquitos, east of and near to the *carretera* (road) from Iquitos to Nauta, a few hundred meters upstream of a large fishpond, Departamento Loreto, Peru (field station F-19-P-2011-R: position 03° 50'25.9" S / 73° 19'51.5" W), August 19th 2011, by Roger Mori jr., Roger Mori sr., Joscha Beninde, François Kervarec, and Uwe Römer. MTD F 32654, 1 male, 43.9 mm SL, collected in shallow parts of a wide, deep *quebrada* (brook) about 0.3 km east of the *carretera* (road) from Iquitos to Nauta, near Puente Pintuyaco, approx. 42 km south of Iquitos, Loreto, Peru (field station F18-P-2011-R; position 04° 05'56.2" S / 73° 27'12.8" W), August 12th 2011, by Roger Mori jr., Roger Mori sr., Joscha Beninde, Fabrice Duponchelle, François Kervarec, and Uwe Römer *Apistogramma huascar* Römer et al., 2006: type series. *Apistogramma luelingi* Kullander, 1976 (36 specimens): MUSM 21393, 11 specimens, 15.3–39.2 mm SL, Pozo Pedro, CICRA, Aguajal, Cca. R. Los Amigos, Manu, Madre de Dios, Perú (12°33´61.1 S / 70°06´59.3 W), December 05th 2003, by M. Hidalgo. MUSM 22163, 25 specimens, 11.3–39.7 mm SL; Aguajal Trigoso, Aguajal bajo Madre de Dios, Cca. del Rio Madre de Dios, Tambopata, Madre de Dios, Perú (19 L 0514976 / 8622696 // 200 m.), February 2nd 2004, by M. Hidalgo et al.. *Apistogramma martini* Römer et al., 2003: type series. *Apistogramma pantalone* Römer et al., 2006: type series. Other material as listed in Römer (1994, 1997, 2006), Römer & Hahn (2008), Römer & Warzel (1997), and Römer *et al.* (2003, 2004, 2006, 2011).

Fig. 2. *Apistogramma allpahuayo* sp. n., paratype, MUSM 40591, male, 37.3 mm SL, yellow morph (YM), three weeks after preservation.

Fig. 3. *Apistogramma allpahuayo* sp. n., paratype females: **top**: 1. MUSM 42058, 27.3 mm SL, three weeks after preservation; **bottom**: MUSM 41814, 26.0 mm SL, five months after preservation.

Diagnosis. *Apistogramma allpahuayo* sp. n. is a medium size (males up to 40 mm, females to 31 mm SL), moderately high-backed, laterally compressed, slightly elongate *Apistogramma* species with rather robust head and jaws, exhibiting pronounced sexual size dimorphism and sexual dichromatism. Reduction in number of head pores typical for species related to *Apistogramma cacatuoides* with only 3 infra-orbital pores. The species can be distinguished from all other *Apistogramma* species known to date on the basis of the combination of the following characters: Habitus overall most similar to *Apistogramma cacatuoides*. Adult mature specimens of both sexes with typical black pattern on lower frontal part of head, covering caudal edge of lower lip and central part of tissue between arches of lower jaws, often producing striking w-shaped pattern; distinct caudal-peduncle spot usually round, exceptionally about square, covering central quarter to third of caudal peduncle, clearly separated from broad lateral band ending on vertical bar 7. Lateral band easily one scale wide, slightly wider in central part. Adult males with hypertrophied bright yellow, in some cases orange lips, red to pink cheek; three indistinct narrow abdominal stripes. Most males with violet anal spot; males with (usually) slightly asymmetric lyrate caudal fin (upper lobe longer than lower), with up to nine vertical lines of faint, bluish hyaline spots on central three quarters; caudal fin truncate and frequently speckled in females. Dorsal fin serrated with prolonged lappets in anterior half, in adult males for entire length of fin; pointed lappets of dorsal spines 2 to 4 (rarely 5) more than twice the length of spines with either black or red tips to lappets 3 to 4 (rarely 5) in old males; length pattern of spines in dorsal fin unique within genus with one of spines 3 to 5 longest; ventral fins in males with irregular black and yellow or orange spot pattern. Females in brooding coloration with either continuous lateral band from posterior edge of orbital to seventh vertical bar, or lateral spot where vertical bar 3 crosses lateral band; membranes of (at least) first five dorsal spines pointed, narrow black cheek stripe, and narrow continuous dark brown to blackish stripe on dorsum.

Description

Morphological characters: (n = 51; 21.7 to 39.3 mm SL) For biometric data see tables 1–3, 6 & 7, for morphometric data see table 4.

Habitus (figs. 1–7, 9, 12–14)**:** Possibly strongly reminiscent of *Apistogramma cacatuoides* (figs. 8 & 15) on first sight, but clearly distinguishable. Body moderately elongate in small males and females and (especially in larger specimens) moderately deep (32.3 to 37.5 % SL, mean 34.9 % SL, std. dev. 1.13), strongly compressed laterally, about twice as deep as wide, head moderately long (34.0 to 40.0 % SL, mean 36.3 % SL, std. dev. 1.30), these proportions creating moderately robust appearance. Statistically significant meristic differences in morphometrics between sexes restricted to size. Adult males usually up to 25 % larger than females. With increasing size relative proportions change: values for head length, pre-dorsal length, pre-anal length, diameter of eye, pelvic spine length, and length of last anal spine are reduced relative to SL, values for body depth, snout length, cheek depth, pre-orbital depth, inter-orbital width, upper and lower jaw length, caudal peduncle length, length of dorsal- and anal-fin base, and length of last dorsal spine are increased. Upper head profile regularly convex from edge of upper lip to base of first dorsal spine, thereafter upper contour of body to distal end of dorsal-fin base nearly straight; degree of curvature slightly increasing with size of specimen; in largest males upper head profile with slight indentation above caudal edge of eye, giving slightly humped impression; lower head profile slightly and regularly convex in adult males, only slightly curved to almost straight from edge of lower lip to posterior margin of gill cover in medium-size and small specimens. Mouth terminal, large, lips with hypertrophied folds; jaws impressively stout, maxillary extending approximately to vertical below anterior margin of pupil; lower jaw massive but comparatively short (about 10.7–17.8 % SL, mean 14.5 % SL, n = 50); cheek completely scaled, scale pattern at first sight comparable to that given for *Apistogramma cacatuoides* in Kullander (1986, fig. 51), but scales on average slightly larger; 5 dentary and 3 infraorbital pores; gill covers completely scaled. Ventral fins [V I.4 (n = 1), V I.5 (n = 49)] pointed, slightly prolonged in smaller individuals, extending to posterior base of caudal fin in adult males. Pectoral fins [11 (n = 3), 12 (n = 48)] rounded, extending to above base of first or second anal-fin spine in adult males, to anal opening to base of first anal-fin spine in females. Dorsal fin [D. XIV.6.i (n = 2), XIV.7 (n = 7), XIV.7.i (n = 1), XV.5.ii (n = 1), XV.6 (n = 6), XV.6.i (n = 6), XV.7 (n = 23), XVI.5.i (n = 1), XVI.6 (n = 2), XVI.7 (n = 1)], spines increasing in length from D1 to D5, decreasing to spine D11, and rest of spines about as long as spine D11, except last spine usually slightly longer than two spines before it, third, fourth, or fifth dorsal spine normally longest; in males dorsal membranes pointed, in small specimens slightly, in large ones significantly prolonged past tips of spines; in adult males extensions of membranes from D2 to D4 up to about twice as long as related spines, from D5 to D7 membranes as long as spines; from D8 to final spine about 30 to 50 %

Table 1. Summarised biometric data of *Apistogramma allpahuayo* sp. n. type specimens (data given in mm).

		***Apistogramma allpahuayo* sp. n.** (all)					**males**					**females**					**abbreviations**
	HT	**(n)**	**mean**	**min.**	**max.**	**st.dev.**	**(n)**	**mean**	**min.**	**max.**	**st.dev.**	**(n)**	**mean**	**min.**	**max.**	**st.dev.**	HT = Holotype / PT = Paratype
SL	37.2	51	29.0	21.7	39.3	4.77	26	32.2	21.7	39.3	4.40	23	25.9	21.9	30.2	2.11	standard length
TL	50.1	51	39.1	29.4	54.0	6.83	26	43.7	29.6	54.0	6.34	23	34.7	29.4	41.4	3.05	total length
TLS	53.0	51	39.7	29.4	56.3	7.24	26	44.5	30.3	56.3	6.57	23	35.0	29.4	42.4	3.06	total length plus streamer
HL	13.5	51	10.5	7.5	14.5	1.82	26	11.8	8.2	14.5	1.69	23	9.3	7.5	11.1	0.86	head length
HD	11.0	51	8.3	6.3	12.0	1.47	26	9.3	6.3	12.0	1.39	23	7.4	6.2	8.8	0.64	head depth
BD	12.7	51	10.1	7.5	14.2	1.65	26	11.1	7.5	14.2	1.57	23	9.1	7.6	11.0	0.84	body depth
HW	6.9	51	5.4	3.8	7.8	0.94	26	6.0	4.2	7.8	0.89	23	4.9	3.8	5.9	0.51	head width
PDL	14.1	51	10.9	7.8	15.6	1.80	26	12.0	8.3	15.6	1.71	23	9.7	7.8	11.4	0.87	pre-dorsal length
TDL	33.6	51	26.3	19.2	36.1	4.33	26	29.2	19.7	36.1	4.01	23	23.6	19.2	28.0	2.09	trans-dorsal length
PVL	15.5	51	11.8	8.6	16.4	2.15	26	13.3	9.8	16.4	1.91	23	10.3	8.6	12.5	1.00	pre-pelvic length
PAL	26.8	51	20.5	15.4	28.4	3.35	26	22.8	16.4	28.4	2.98	23	18.4	15.4	21.8	1.69	pre-anal length
TAL	33.1	51	25.8	19.0	35.4	4.23	26	28.7	19.7	35.4	3.82	23	23.1	19.0	27.4	2.02	trans-anal length
Eye	4.1	51	3.6	1.8	4.8	0.53	26	3.9	3.1	4.8	0.46	23	3.3	2.9	3.8	0.27	eye diameter
SNL	3.8	51	2.4	1.2	4.3	0.78	26	2.9	1.7	4.3	0.72	23	1.9	1.2	2.6	0.36	snout length
CHD	3.6	51	2.5	1.6	4.7	0.77	26	3.0	1.8	4.7	0.74	23	2.0	1.6	2.7	0.32	cheek depth
POD	1.0	51	0.8	0.3	1.3	0.21	26	0.9	0.3	1.3	0.22	23	0.7	0.4	0.9	0.13	pre-orbital depth
IOW	3.2	51	2.5	1.7	4.0	0.52	26	2.8	1.7	4.0	0.52	23	2.2	1.7	2.7	0.29	inter-orbital width
UJL	4.2	51	3.2	1.8	5.5	0.91	26	3.7	2.1	5.5	0.91	23	2.6	2.0	3.5	0.38	upper jaw length
LJL	6.2	51	4.2	2.5	6.7	1.03	26	4.9	3.1	6.7	1.06	23	3.7	3.0	4.6	0.39	lower jaw length
CPD	5.4	51	4.4	3.2	6.0	0.77	26	4.9	3.2	6.0	0.69	23	3.9	3.2	4.9	0.39	caudal peduncle depth
CPL	3.9	51	3.1	1.9	5.3	0.78	26	3.5	2.1	5.3	0.85	23	2.7	2.0	3.3	0.31	caudal peduncle length
DFB	21.3	51	16.9	12.1	23.2	2.85	26	18.7	12.3	23.2	2.70	23	15.2	12.1	18.1	1.37	dorsal fin base length
AFB	7.2	51	5.8	4.1	8.2	1.06	26	6.5	4.1	8.2	1.00	23	5.1	4.2	5.9	0.47	anal fin base length
PecL	12.2	51	8.7	5.8	12.9	1.77	26	9.8	6.0	12.9	1.67	23	7.7	5.9	8.9	0.84	pectoral fin length
PelL	15.3	51	9.2	5.3	15.3	2.54	26	10.7	6.4	15.3	2.51	23	7.5	5.3	10.3	1.23	pelvic fin length
PelSL	5.2	51	4.2	2.7	5.5	0.67	26	4.5	3.2	5.5	0.63	23	3.8	2.7	4.8	0.56	pelvic fin spine length
LDS	6.9	51	4.7	3.1	7.2	1.10	26	5.4	3.4	7.2	1.00	23	4.0	3.1	5.6	0.57	last dorsal spine length
LAS	6.4	51	4.9	3.6	6.8	0.79	26	5.4	3.9	6.8	0.73	23	4.4	3.6	5.3	0.40	last anal spine length

of length of spine; in females tips of lappets from D1 to D4 or D5 clearly pointed, others usually rectangular, in some cases rounded, extensions of lappets beyond spines always less than 10 % of spine length; in adult males soft dorsal fin noticeably pointed, 2nd and / or 3rd ray longest, extending to last third of caudal fin, significantly past posterior margin of caudal fin in largest males. Anal fin [A. III.5 (n = 2), III.6 (n = 38), III.7 (n = 11)] pointed in males and larger females, soft portion extending to central part, exceptionally to posterior margin of caudal fin; rounded in smaller females and males, extending to centre of first third of caudal fin. Caudal fin with 14 (n = 1), 15 (n = 2), or 16 (n = 48) principal soft rays; in males of about 30 mm SL or larger lyrate; in most males slightly asymmetric, upper lobe fairly regularly (~60 % of specimens) longer than lower, reverse asymmetry less frequent (~30 % of specimens), lobes of about equal length in remainder; caudal rays V4 and D4 clearly prolonged relative to remaining rays (approx. 5 % to more than 10 % of SL), intervening rays significantly shorter, decreasing in length from D3 to V2, V3 about as long as D2, forming more or less serrated straight distal edge, outer rays decreasing rapidly in length; caudal truncate in large females (> 25 mm SL), exceptionally with short pointed tip in position of upper filamentous extension in male, rounded in small specimens; in both sexes first tenth to fifth scaled, scale pattern irregular. Caudal peduncle in all specimens deeper than long, growth allometry of caudal-peduncle depth in slight, of length in strict linear, correlation with SL (range ~107 % to ~240 %, mean 175 %, n = 51). Squamation as given for *Apistogramma martini* Römer *et al*., 2003, scales in median longitudinal row 20 (n = 5), 21 (n = 38), or 22 (n = 8); upper lateral line canals 8–16 (mean 12.5, standard deviation 1.8, n = 50), medium lateral line 0–3 canals (mean 0.6, standard deviation 1.0, n = 50), lower lateral line canals 0–8 (mean 4.0, std. dev. 2.10, n = 50); 16 scales around caudal peduncle (n = 48), cycloid scales on caudal-fin base, rest of fin usually unscaled, only in very large males scattered scales on basal 15 % of fin. Jaw teeth unicuspid caniniform, only slightly recurved (nearly straight) in basal two thirds, distal third recurved; embedded in yellow to pink fleshy skin tissue leaving cream white distal third uncovered; two comparatively regular series in

Table 2. Summarised biometric data of *Apistogramma allpahuayo* sp. n. type specimens (data given as % of SL; SL given in mm).

		***Apistogramma allpahuayo* sp. n.** (all)					**males**					**females**					**abbreviations**
	HT	**(n)**	**mean**	**min.**	**max.**	**st.dev.**	**(n)**	**mean**	**min.**	**max.**	**st.dev.**	**(n)**	**mean**	**min.**	**max.**	**st.dev.**	HT = Holotype / PT = Paratype
SL	37.2	51	29.0	21.7	39.3	4.77	26	32.2	21.7	39.3	4.40	23	25.9	21.9	30.2	2.11	standard length
TL	134.5	51	134.8	128.6	139.4	2.42	26	135.6	131.9	139.4	2.16	23	133.8	128.6	137.2	2.48	total length
TLS	142.4	51	136.5	128.6	145.7	3.59	26	138.1	131.9	145.7	3.67	23	134.7	128.6	140.3	2.75	total length plus streamer
HL	36.3	51	36.3	34.0	40.0	1.28	26	36.5	34.6	39.6	1.07	23	36.0	34.0	38.1	1.28	head length
HD	29.6	51	28.7	26.0	31.1	1.12	26	28.8	26.0	30.8	1.14	23	28.4	26.7	31.1	1.13	head depth
BD	34.0	51	34.8	32.3	37.5	1.19	26	34.6	32.3	37.5	1.26	23	35.0	33.1	36.7	1.14	body depth
HW	18.5	51	18.7	16.8	20.8	0.70	26	18.6	17.7	19.9	0.56	23	18.7	16.8	20.8	0.84	head width
PDL	37.8	51	37.5	35.4	40.1	1.13	26	37.4	36.0	39.8	0.93	23	37.5	35.4	39.9	1.24	pre-dorsal length
TDL	90.1	51	90.8	87.9	93.9	1.35	26	90.6	88.2	92.9	1.12	23	90.8	87.9	93.9	1.56	trans-dorsal length
PVL	41.7	51	40.6	37.8	45.3	1.61	26	41.2	38.7	45.3	1.56	23	39.8	37.8	42.5	1.26	pre-pelvic length
PAL	79.0	51	77.9	73.6	83.0	1.61	26	77.9	73.6	83.0	1.80	23	77.9	74.6	80.6	1.44	pre-anal length
TAL	88.9	51	89.1	85.4	93.0	1.52	26	89.1	86.2	92.0	1.38	23	89.2	85.4	93.0	1.71	trans-anal length
Eye	11.1	51	12.4	8.0	14.1	0.98	26	12.1	11.0	14.1	0.76	23	12.8	11.8	13.8	0.53	eye diameter
SNL	10.3	51	8.2	5.5	11.5	1.45	26	9.0	6.7	11.5	1.25	23	7.2	5.5	8.9	1.05	snout length
CHD	9.8	51	8.5	6.8	11.9	1.23	26	9.2	7.6	11.9	1.19	23	7.8	6.8	8.9	0.68	cheek depth
POD	2.7	51	2.7	1.4	4.3	0.47	26	2.8	1.4	4.3	0.50	23	2.6	1.8	3.7	0.45	pre-orbital depth
IOW	8.6	51	8.5	6.9	10.2	0.68	26	8.6	7.5	10.2	0.62	23	8.5	6.9	10.0	0.77	inter-orbital width
UJL	11.3	51	10.8	7.9	14.7	1.58	26	11.5	9.1	14.6	1.71	23	10.1	8.4	11.7	0.94	upper jaw length
LJL	16.6	51	14.5	10.7	17.8	1.46	26	15.0	10.7	17.8	1.59	23	14.1	11.3	15.5	0.99	lower jaw length
CPD	14.4	51	15.3	14.2	16.4	0.59	26	15.4	14.4	16.2	0.58	23	15.2	14.2	16.4	0.59	caudal peduncle depth
CPL	10.5	51	10.6	6.5	13.8	1.47	26	10.9	6.5	13.8	1.68	23	10.4	7.2	12.5	1.18	caudal peduncle length
DFB	57.3	51	58.3	54.4	61.6	1.67	26	58.2	54.4	61.6	1.95	23	58.5	55.4	60.6	1.31	dorsal fin base length
AFB	19.3	51	19.9	17.5	23.0	1.08	26	20.1	18.5	23.0	1.12	23	19.7	17.5	21.6	1.03	anal fin base length
PecL	32.7	51	29.9	25.2	33.7	2.14	26	30.4	25.5	33.7	2.02	23	29.5	25.3	33.4	2.05	pectoral fin length
PelL	41.0	51	31.3	21.2	41.8	5.11	26	33.2	21.2	41.8	5.20	23	29.1	23.8	39.5	4.28	pelvic fin length
PelSL	13.9	51	14.5	11.1	17.7	1.35	26	14.1	12.5	16.0	0.86	23	14.8	11.1	17.7	1.52	pelvic fin spine length
LDS	18.5	51	16.1	10.7	20.0	1.66	26	16.8	12.7	20.0	1.52	23	15.3	10.7	18.6	1.51	last dorsal spine length
LAS	17.3	51	16.9	14.0	19.9	1.11	26	16.8	14.0	18.7	1.21	23	16.9	15.2	19.9	1.05	last anal spine length

both jaws, but series across anterior part of lower jaw irregular in largest specimens; in most larger specimens tendency to form irregular third series.

Coloration of preserved specimens:

[after 3 weeks or 5 months (recent material) in 90 % ethanol, or 8 to 10 years (old material) in 75% ethanol] (figs. 1–3, & 11)

Recent material: At least two basic and distinct colour phenotypes clearly detectable in freshly preserved male material; these will be termed blue morph (BM) and yellow morph (YM), referring to the dominant colour. Occasionally intermediate or aberrant colour morphs may occur (*cf*. Mayland & Bork, 1997; Römer, 2000). In both morphs basic colour of upper half of body predominantly greyish to brownish (males) or grey to yellowish (females), in both sexes darker on three dorsal-most scale rows, more intense in females; in males lower half of body either yellowish (YM) or greyish (BM); several males also reddish brown or with violet sheen on anterior part of back from upper edge of gill cover to a line below about 8th to 10th dorsal spine; posterior margins of body scales with dark grey (rarely blackish) edgings. Lips of large males overall yellow to orange, with duskier, rarely black anterior part and red to violet outer edges of upper fold of lip, in mature females lips yellowish with grey edges. Lower jaw blackish, depending on mood before preservation occasionally dark grey, unscaled parts of cheeks, chin, and lateral parts of branchiostegal membranes basically yellow, in upper half with slightly greyish tone in YM males; chin and lateral parts of branchiostegal membranes basically creamy white to light grey with very small black dots, generally in upper half with slightly greyish blue tone in BM males; in most females slightly yellowish. Breast between bases of pectoral fins, ventral fins, and posterior part of branchiostegal membranes greyish with small black dots (under microscope) or with small yellow to orange spots in males, overall white with few black chromatophores close to pectoral base in all females examined. Mid-ventral region pale greyish in males, whitish or yellow in females; males with dark grey to violet anal spot, absent in females. Pectoral-fin base proximally grey, closer to fin either whitish, pale yellow, or pale orange in males, porce-

lain white to (rarely) pale yellow in females. Interorbital stripe about half as wide as pupil, postorbital area covered by blackish triangular spot. Operculum in males more or less uniform light grey, without spot- or line-markings, darker on upper parts (BM), or dark grey on upper parts with rest yellow to light orange (YM), usually brown (recent material) or grey (old material) in females, usually no contrast with sub-operculum. Cheek in males yellow or orange, anterior half frequently wine red to pink; cheek stripe black, roughly as wide as pupil, wider at lower edge in transition zone between pre-operculum and operculum, usually about one third wider in males than in females, beginning between foramen 1 and including foramen 2 of posterior orbital of suborbital series (for terminology see Kullander, 1987), when complete running backwards in straight line between or frequently including lateral canal foramina (LCF) 10 and 11 across posterior half of cheek to lower posterior margin of preoperculum and to posterior tip of interoperculum, but in some specimens distinct fragments restricted to cheek and preoperculum, distal edge blunt, not pointed. Snout stripe straight, about half to 2/3 as wide as cheek stripe, only slightly wider on occlusal than on buccal end of snout. Upper head and nape from interorbital to dorsum below first dorsal spine blackish in both sexes, more intense in females, in some specimens dark blackish brown. Frontal part of head from interorbital to lips either light grey (most males), or same colour as adjacent upper head and nape (most females). Dorsal spots only diffuse, covering row of scales basal below dorsal fin in larger specimens, absent in several specimens. Some small specimens with faint dark brown stripe following dorsal-fin base. Dorsal fin without any dark spots on base of membranes. Iris dark, blackish grey, in recent material with golden yellow lower outer rim. Seven vertical bars, hardly visible in few specimens, not divided, in males restricted to upper half of body, interspaces narrow (width about less than 1/3 of bars), only partially visible in larger specimens, more frequent in females than in males. Several specimens with three more or less distinct continuous abdominal stripes composed of rows of dark grey to black triangular dashes, each single dash covering one fifth to less than one quarter of height of each scale, first (upper) stripe on lower edge of L-0-row scales and upper edge of L-1-row scales, second (middle) on lower edge of L-1-row and top edge of L-2-row, third (lower) on lower edge of L-2-row and upper edge of L-3-row; upper stripe continuous from immediately behind pectoral base to vertical above second anal-fin spine, middle to above caudal edge of anal fin, lower from about anterior edge of 2nd vertical bar to caudalmost third of anal-fin base (fig. 11). In females spots extremely small, forming narrow stripes in positions of basal edges of abdominal stripes of males. In several specimens no stripes detectable. Lateral band virtually straight, one scale high in anterior third, covering L+1 scale row and upper third or (less frequently) upper half of L scale row, about one and a half scales wide posterior to vertical bar 2 and lateral spot, stretching from posterior edge of orbital to 7th vertical bar on caudal peduncle, always clearly separated from caudal spot. No distinct separate lateral spot in large males, but in some smaller male and female specimens significantly darker area where lateral band intersects vertical bar 3, giving impression of longitudinal-oval lateral spot; exceptionally in few larger females second but smaller darkened area where lateral band intersects vertical bar 4, giving impression of second indistinct lateral spot. In some specimens pigmentation more intense in position of lateral spot on vertical bar 3. Distinct single black caudal-peduncle spot, more or less regularly round to (exceptionally) slightly oval, covering about one third to half of height of caudal peduncle. All unpaired fins in BM males overall hyaline blue to whitish blue, dusky grey on tips of membranes, grey along spines as well as soft rays; remainder of membranes of dorsal, anal, and caudal fins mostly greyish; YM males similar except dorsal fin with narrow yellow stripe along base, and anal fin with overall yellow to orange replacing hyaline or whitish blue parts. Scaled portion of caudal-fin base slightly darker than rest of fin. Under microscope all fins with regular dense pattern of small round light greyish chromatophores. Males with up to seven (nine in live specimens!) vertical rows of dusky horizontal oval spots on caudal fin. Central part of pectoral hyaline whitish, rest transparent, with rows of close-packed regular small spots of greyish pigment along fin rays, mostly absent on membranes. Ventral fin with dark grey to black spine, membranes bluish white in most male specimens (BM), in some greyish with irregular pattern of black and yellow spots (YM), in all females with black zone covering up to first three membranes; holotype and some other large males with red distal quarter of membranes 3 and 4 (nearly faded after 5 months of preservation); in females all non-blackish parts of fin porcelain white. Anal fin in adult males with narrow, in mature females with broader blackish outer margin from base of first spine to tip of longest soft ray, absent in most immature specimens; soft portion of anal (and exceptionally dorsal) fin with inconspicuous rows of hyaline spots in large specimens. Coloration of dorsal fin overall whitish to light grey, spines hyaline bluish white, no black markings, only inconspicuous dark pigmentation on membranes along anterior side of spines and – more intense – of soft rays; in females basal fifth to quarter of each membrane whitish with grey pigmentation; first two spines and membranes of dorsal fin in most males dark grey to light blackish, in females same area plus basal

Table 3. Biometric data taken from *Apistogramma allpahuayo* sp. n. type specimens (given in mm; for abbreviations see tables 1 & 4).

Coll. No.	Status	DNA-No.	Sex	SL	TL	TLS	HL	HD	BD	HW	PDL	TDL	PPL	PAL	TAL	Eye	SNL	CHD	POD	IOW	UJL	LJL	CPD	CPL	DFB	AFB	PecL	PelL	PelSL	LDS	LAS
MTD F 32694	PT	301319	m	39.3	54.0	56.3	14.5	12.0	14.2	7.8	15.6	36.1	16.2	28.4	35.4	4.8	3.9	4.7	1.2	4.0	4.9	6.7	6.0	5.3	23.2	8.2	12.9	12.7	5.5	7.2	6.1
MTD F 32695	**TPT**	301320	m	38.2	52.2	53.0	14.1	10.8	13.1	7.1	14.7	34.4	15.7	26.9	33.7	4.2	4.3	3.7	1.0	3.3	5.5	6.3	5.9	4.0	21.8	7.8	10.4	14.1	4.8	6.0	5.8
MTD F 32692	PT	301309	m	37.7	52.3	53.9	13.7	10.6	13.5	7.0	13.9	34.0	15.0	26.2	33.4	4.4	3.3	4.5	1.2	3.5	4.0	6.7	5.8	5.0	22.4	7.2	12.2	10.9	5.4	6.2	5.5
MUSM 40591	PT	301954	m	37.3	51.4	51.4	14.1	11.1	12.1	7.0	14.0	33.6	16.4	26.9	33.3	4.4	3.6	4.1	1.2	3.1	5.1	5.9	5.7	5.2	21.3	7.4	12.6	13.9	5.1	6.8	6.4
MUSM 40593	**HT**	301948	m	37.2	50.1	53.0	13.5	11.0	12.7	6.9	14.1	33.6	15.5	26.8	33.1	4.1	3.8	3.6	1.0	3.2	4.2	6.2	5.4	3.9	21.3	7.2	12.2	15.3	5.2	6.9	6.4
MTD F 32696	PT	UR.101.2044	m	36.1	49.3	49.8	13.4	10.9	12.3	7.2	13.5	32.2	16.2	25.2	31.9	4.2	4.0	3.2	1.2	3.3	5.3	5.9	5.6	4.1	19.7	7.3	10.9	14.1	5.2	7.2	6.8
MTD F 32693	PT	301329	m	35.0	48.7	49.9	12.7	9.9	12.4	6.6	13.1	32.1	14.0	24.1	31.4	4.4	3.6	3.4	1.0	3.1	3.5	5.7	5.2	4.3	21.0	8.0	10.6	13.8	4.7	5.0	5.3
MTD F 32696	PT	UR.101.2043	m	34.8	48.3	48.9	12.8	9.8	11.1	6.3	12.8	31.2	13.9	23.9	29.8	4.3	2.8	2.9	0.9	2.9	5.1	5.7	5.5	3.6	20.9	6.9	9.6	11.6	4.8	6.5	5.5
CAS 233865	PT	301310	m	34.6	47.4	50.5	12.6	9.9	12.1	6.3	12.6	31.4	14.4	24.2	30.3	4.1	3.2	3.1	0.9	3.1	3.5	4.8	5.5	4.2	20.7	6.7	11.5	12.4	5.1	6.3	6.0
MUSM 41818	PT	301311	m	34.5	47.5	48.8	13.1	9.8	12.6	6.5	12.9	31.8	13.9	23.9	30.6	4.4	3.4	3.4	0.9	3.1	3.2	5.2	5.3	4.2	21.0	7.5	8.8	10.3	4.9	5.4	5.6
MUSM 41818	PT	301321	m	33.4	44.1	44.1	12.0	9.3	11.1	6.2	12.1	30.4	13.8	23.5	29.6	3.8	3.3	3.1	1.2	2.9	4.0	4.8	5.2	3.0	19.0	6.2	10.1	12.4	4.4	5.1	5.5
MUSM 42057	PT	301330	m	32.9	44.5	44.5	11.9	9.6	11.7	6.1	12.2	30.6	13.5	23.2	29.9	3.8	3.2	2.9	0.8	2.9	3.9	4.6	5.0	2.1	20.1	7.2	10.7	10.4	4.8	5.6	5.7
MTD F 32696	PT	UR.101.2045	m	32.7	43.4	44.1	11.6	9.1	10.6	6.1	12.0	28.8	13.3	21.9	28.2	3.9	2.7	3.0	0.8	2.8	4.6	5.4	5.3	3.1	18.5	6.5	10.7	10.0	4.7	5.5	5.8
MUSM 41821	PT	301949	m	32.5	43.3	43.3	11.5	9.2	11.3	6.2	12.1	29.3	13.6	23.1	28.8	3.6	2.6	2.7	0.8	3.0	3.5	4.1	4.7	3.8	18.7	6.5	10.1	12.9	5.0	5.5	5.7
MTD F 32694	PT	301331	m	32.3	44.2	44.8	11.7	9.3	11.3	6.0	11.8	29.2	13.3	22.8	29.0	4.3	3.7	3.4	0.9	2.8	3.4	4.6	4.7	3.8	18.3	6.5	9.6	9.7	4.0	4.1	4.5
CAS 233866	PT	301323	m	31.7	43.6	43.5	12.5	9.4	11.0	5.7	12.6	29.1	13.3	22.4	28.4	3.7	2.9	3.1	0.9	2.6	4.1	5.0	5.1	2.9	17.8	6.5	9.8	9.5	4.9	5.7	5.9
MUSM 42057	PT	301332	m	30.6	40.9	41.8	11.4	9.4	10.8	5.8	11.0	27.6	12.5	21.7	27.5	3.6	2.6	2.8	0.8	2.7	3.7	4.5	4.8	3.0	18.1	6.4	9.7	8.3	4.2	5.1	5.1
MTD F 32693	PT	301322	f	30.2	41.4	42.4	11.1	8.4	11.0	5.7	11.4	28.0	12.5	21.8	27.4	3.7	2.4	2.7	0.8	2.7	3.5	4.6	4.9	3.3	18.1	5.9	8.8	10.3	4.8	5.6	5.4
MUSM 40592	PT	301942	m	30.1	40.8	41.1	10.7	8.9	10.7	5.7	11.4	27.6	12.8	22.2	27.6	3.8	2.9	2.6	1.3	2.5	2.7	3.2	4.9	3.6	18.2	5.8	9.2	6.4	3.9	5.2	5.5
CAS 233866	PT	301334	m	29.5	39.7	40.4	10.4	9.1	11.1	5.5	10.8	27.3	11.7	20.8	27.1	3.5	2.0	2.9	0.8	2.8	3.3	4.3	4.6	2.6	18.2	6.7	8.9	8.4	4.2	5.0	5.3
MTD F 32646	PT	301956	f	29.3	39.2	39.2	10.9	8.2	10.0	5.4	10.9	26.5	12.4	21.4	26.0	3.8	2.6	2.5	0.8	2.5	3.4	4.2	4.4	2.7	17.1	5.8	8.9	7.0	4.6	4.9	4.7
MUSM 41818	PT	301333	m	29.1	39.5	40.9	10.5	7.8	10.0	5.2	10.7	26.6	11.8	20.8	25.9	3.6	2.6	2.5	0.7	2.5	3.6	4.4	4.3	3.4	17.4	5.6	9.1	12.2	4.2	4.9	5.1
CAS 233865	PT	301327	f	28.7	37.5	37.5	9.9	8.0	10.1	5.2	10.8	25.6	11.2	20.5	25.0	3.4	2.3	2.1	0.8	2.4	2.9	3.6	4.1	2.9	16.0	5.1	7.9	7.1	3.9	3.1	4.4
CAS 233867	PT	301950	m	28.6	38.0	38.0	9.9	8.4	10.0	5.1	10.8	25.5	12.0	20.7	25.5	3.6	2.4	2.2	0.7	2.2	3.0	4.6	4.5	3.4	16.1	5.6	8.0	11.2	4.6	5.0	4.9
MUSM 42057	PT	301314	f	28.5	39.0	39.0	10.6	8.9	10.4	5.9	10.8	26.4	11.4	20.5	25.6	3.7	1.9	2.4	0.8	2.5	3.1	4.2	4.7	2.7	17.1	5.5	8.2	8.1	4.8	4.5	4.7
MTD F 32694	PT	301312	m	28.1	37.9	37.9	10.3	8.1	9.8	5.4	10.6	25.3	10.9	19.7	25.1	3.3	2.2	2.3	0.7	2.6	2.9	4.2	4.5	2.8	16.2	5.9	8.4	8.5	4.0	4.3	4.8
MUSM 41821	PT	301952	f	28.0	37.6	37.6	9.6	7.6	10.3	5.3	10.1	25.3	11.4	20.2	25.0	3.8	1.8	2.5	0.7	2.1	2.4	4.0	4.3	3.2	16.5	5.5	7.1	7.4	3.9	4.0	4.4
MUSM 41818	PT	301315	f	27.8	36.4	36.4	9.7	7.7	9.2	5.2	10.3	25.0	11.0	19.8	25.3	3.5	2.1	2.2	0.7	2.5	2.9	3.6	4.1	2.0	16.1	5.4	8.0	8.0	3.8	4.0	4.2
MUSM 40592	PT	301943	m	27.5	37.2	38.5	10.1	7.8	9.5	5.0	10.2	24.7	10.8	19.7	24.5	3.6	2.0	2.1	0.8	2.1	2.7	3.7	4.4	3.1	15.9	5.4	8.2	8.0	3.9	4.8	4.7
MUSM 42058	PT	301313	f	27.3	36.7	36.7	9.9	7.7	9.5	4.9	10.2	24.5	10.7	18.9	23.9	3.5	1.5	2.3	0.6	2.2	2.3	4.2	4.1	2.9	16.1	5.4	8.6	8.0	4.3	4.4	4.8
MTD F 32646	PT	301958	f	26.6	35.6	35.6	9.6	7.5	9.0	5.1	10.0	24.3	10.6	18.6	23.4	3.6	1.6	2.1	0.7	2.5	2.8	3.9	3.9	2.9	16.0	5.1	8.6	8.7	3.8	4.0	4.8
MUSM 42057	PT	301328	f	26.5	35.8	35.8	9.6	7.8	9.6	5.0	10.4	24.9	10.4	19.1	23.8	3.1	2.3	2.3	0.9	2.6	2.9	3.8	4.1	2.8	15.0	5.1	7.9	7.1	4.5	4.3	4.4
MUSM 32694	PT	301337	f	26.2	35.9	35.9	10.0	7.4	9.3	5.0	10.3	24.2	10.2	18.7	23.2	3.5	2.4	1.8	0.8	2.4	2.7	3.0	3.9	2.1	15.6	5.4	8.2	6.9	3.6	4.0	4.6
MUSM 41814	PT	301944	f	26.0	35.6	36.1	9.3	7.4	9.2	4.8	9.3	23.7	10.6	18.4	23.2	3.3	1.9	2.1	0.7	2.2	2.5	3.5	4.2	3.0	15.8	5.4	8.7	10.3	3.8	3.8	4.3
MUSM 41812	PT	301957	f	25.9	33.5	33.5	9.6	7.5	9.1	5.0	9.9	23.9	11.0	18.6	23.6	3.6	2.0	2.1	0.6	2.2	2.8	3.8	4.1	2.8	15.2	5.2	8.4	7.9	4.0	4.5	4.6

Table 3 continued.

Coll. No.	Status	DNA-No.	Sex	SL	TL	TLS	HL	HD	BD	HW	PDL	TDL	PPL	PAL	TAL	Eye	SNL	CHD	POD	IOW	UJL	LJL	CPD	CPL	DFB	AFB	PecL	PelL	PelSL	LDS	LAS
MTD F 32693	PT	301325	m	25.7	34.2	34.2	8.9	7.3	8.6	4.5	9.8	23.1	10.3	18.2	22.8	3.1	2.2	2.0	0.7	2.0	2.9	3.4	3.7	2.4	14.0	4.9	7.5	7.8	3.3	4.0	4.0
MUSM 40591	PT	301955	m	25.6	33.7	33.7	9.5	6.6	8.7	4.8	9.4	23.0	10.3	18.1	22.8	3.3	1.9	2.1	0.7	2.0	2.6	3.5	3.9	2.7	15.0	5.0	7.7	7.0	3.6	4.4	4.4
MTD F 32645	PT	301945	f	25.4	33.8	33.8	9.0	7.0	8.9	4.7	9.2	22.8	9.7	17.9	22.5	3.1	1.7	2.0	0.5	1.8	2.5	3.6	4.0	2.9	14.7	5.1	7.2	6.4	3.4	3.9	4.1
CAS 233866	PT	301316	f	25.1	33.5	33.5	9.0	7.0	8.7	4.8	9.6	22.9	10.0	17.4	22.9	3.3	2.0	2.0	0.8	2.4	2.6	3.7	3.8	2.8	14.8	5.4	6.9	6.1	4.4	3.7	4.6
CAS 233866	PT	301317	f	24.9	33.5	33.5	8.8	7.4	8.7	4.9	9.2	22.4	9.4	17.2	22.2	3.2	1.5	1.9	0.9	2.0	2.2	3.7	3.9	2.2	14.7	4.9	7.7	9.2	3.8	4.0	4.2
MUSM 41812	PT	301959	f	24.7	32.9	32.9	8.8	7.0	8.6	4.9	9.8	22.7	9.9	17.4	23.0	3.2	1.5	1.9	0.7	2.2	2.7	3.7	3.6	2.6	14.4	5.2	8.0	6.9	3.8	3.9	4.2
MUSM 41818	PT	301324	f	24.7	33.8	33.8	9.3	7.6	9.0	4.5	9.9	23.1	9.7	17.4	22.2	3.1	2.0	1.9	0.8	2.0	2.8	3.5	3.9	2.6	14.5	5.3	6.9	6.5	3.5	4.2	4.9
MUSM 41821	PT	301953	f	24.6	33.1	33.1	8.8	6.6	8.1	4.4	9.0	21.9	9.5	17.1	21.4	3.1	1.5	1.7	0.6	1.7	2.5	3.1	3.5	2.6	14.3	4.6	7.1	7.6	4.0	3.8	4.3
MTD F 32694	PT	301336	f	24.4	33.1	33.1	8.3	7.0	8.7	4.1	9.1	21.8	9.6	17.2	22.1	3.0	1.8	1.7	0.6	2.0	2.5	3.4	3.6	2.6	14.4	5.0	7.4	7.3	2.7	3.3	3.9
MUSM 42057	PT	301318	f	24.0	31.5	31.5	8.3	6.6	8.1	4.4	8.5	21.3	9.2	16.3	20.5	3.1	1.6	1.6	0.5	1.9	2.5	3.5	3.6	2.5	14.3	4.2	6.5	6.6	3.6	3.5	4.0
MTD F 32645	PT	301946	f	23.4	30.9	32.4	8.7	6.9	8.2	4.3	8.8	21.2	9.6	16.5	20.6	3.1	1.6	1.7	0.4	2.1	2.0	3.5	3.5	2.9	13.4	4.4	6.8	6.6	3.6	3.7	4.0
CAS 233865	PT	301335	?	23.2	31.5	31.5	8.5	6.7	8.0	4.2	8.9	21.5	8.9	16.1	20.3	3.1	1.8	1.6	0.6	1.9	1.8	2.5	3.3	2.4	13.7	4.7	5.8	6.9	4.0	3.5	4.1
MUSM 40592	PT	301947	f	23.0	29.6	29.6	8.8	6.2	7.6	4.3	8.7	20.8	9.4	16.7	20.6	3.1	1.7	1.7	0.6	2.0	2.2	3.1	3.5	2.6	13.3	4.5	6.5	8.3	3.2	3.2	3.9
CAS 233866	PT	301326	?	22.3	30.1	30.1	8.9	6.4	7.9	4.4	8.9	20.5	9.5	16.0	20.1	1.8	1.8	1.6	0.6	1.9	2.3	3.1	3.5	1.9	12.5	4.7	6.4	8.0	3.9	3.9	3.9
MTD F 32693	PT	301338	f	21.9	29.4	29.4	7.5	6.4	8.0	3.8	7.8	19.2	8.6	15.4	19.0	2.9	1.2	1.6	0.5	1.8	2.2	3.2	3.2	2.4	12.1	4.2	5.9	5.4	2.7	3.4	3.6
MTD F 32650	PT	301951	m	21.7	29.7	29.7	8.2	6.3	7.5	4.2	8.3	19.7	9.8	16.4	19.7	3.1	1.7	1.8	0.3	1.7	2.1	3.1	3.2	2.6	12.3	4.1	6.0	7.8	3.2	3.4	3.9

half of third membrane, rarely whole third and lower half of fourth membrane black. Scales on body in males bluish grey to brownish with slightly darker edges on upper half of body, less clearly differentiated on lower half; in females lowest two rows of scales on body above anal fin with lighter grey edges.

Red and blue elements of coloration significantly faded to completely absent after 4 months, even in recent material (figs. 1 & 3), with no difference in intensity compared to older (non type) material preserved about nine years earlier. Some basic diagnostic colour elements such as bright yellow to orange lips of males no longer visible, but black pattern even clearer and more pronounced than in material photographed three weeks after preservation (fig. 1). Overall body coloration of males altered to more brownish tone, coloration of fins not modified in BM specimens, faded in YM specimens, but spot pattern on ventral fins of males still visible; originally yellow parts of lips and branchiostegal membrane porcelain white, originally bluish grey parts now light grey, pectoral base porcelain white instead of light orange. Variability of colour modification higher in female types than in males, but black w-shape pattern on chin unmistakable. In general body coloration more faded pale yellowish brown or beige contrasting with black pattern, lips greyish, cheeks brownish, operculum creamy white to grey, snout and interorbital region grey, eye greyish white with darker zone in upper quarter (fig. 3).

Coloration of live specimens (figs. 4–7, 9, 12–14): Information and photographic illustrations will be restricted to important diagnostic elements, for numerous supplementary photographs of live specimens see Römer (2000), Römer & Soares (1995, 1996).

Live coloration of adult male *Apistogramma allpahuayo* sp. n. is – depending on mood – highly variable and unique within the genus. Apart from the black w-shape chin marking already described for preserved specimens, the most striking and unique colour pattern of displaying or highly aggressive male *Apistogramma allpahuayo* sp. n. is silvery white lateral band covering parts of L-0 and L-1 scale rows, dorsal and caudal fin overall wine red to violet, dorsum, ventral side of body, and head below lower edge of orbital yellow (fig. 9), head from upper lip to above centre of eye milky bluish grey to dark grey (BM), or beige brownish (YM) (figs. 4–5, 7, & 9). Lips intense yellow to orange on edges, extending more or less to the central part, degree of yellow or orange progressive depending on age. In males whitish tips of teeth contrasting with pink to red tissue in which they are embedded (visible in frontal photographs only) (fig. 18). Ventral fins of BM males uniform light blue to greenish (figs. 4–5, 7), males of YM with pattern of dark spots on blue and yellow ventral fins (figs. 6 & 9). Anal fin of

Table 4. Meristric data taken from *Apistogramma allpahuayo* sp. n. type specimens (SL given in mm; for abbreviations see last column of table).

Coll.No.	Status	DNA-No.	Sex	SL	DF (h)	DF (s)	DF (n)	AF (h)	AF (s)	PF (h)	PF (s)	PecF	CF	LRS	
MTD F 32694	PT	301319	m	39.3	15	6	0	3	6	1	5	12	16	20	
MTD F 32695	TPT	301320	m	38.2	15	7	0	3	7	1	5	12	16	21	**abbreviations**
MTD F 32692	PT	301309	m	37.7	15	6	0	3	6	1	5	12	16	21	
MUSM 40591	PT	301954	m	37.3	15	7	0	3	6	1	5	12	16	21	**DF** = dorsal fin
MUSM 40593	HT	301948	m	37.2	14	7	1	3	7	1	5	11	14	21	
MTD F 32696	PT	UR.101.2044	m	36.1	14	7	0	3	6	1	5	12	16	21	**AF** = anal fin
MTD F 32693	PT	301329	m	35.0	15	7	0	3	7	1	5	12	15	21	
MTD F 32696	PT	UR.101.2043	m	34.8	15	7	0	3	6	1	5	12	16	21	**PF** = pelvic fin
CAS 233865	PT	301310	m	34.6	15	7	0	3	6	1	5	12	16	21	
MUSM 41818	PT	301311	m	34.5	15	6	0	3	6	1	5	12	16	20	**PecF** = pectoral fin
MUSM 41818	PT	301321	m	33.4	15	7	0	3	6	1	4	12	16	21	
MUSM 42057	PT	301330	m	32.9	15	7	0	3	7	1	5	11	16	21	**CF** = caudal fin
MTD F 32696	PT	UR.101.2045	m	32.7	15	7	0	3	6	1	5	12	16	21	
MUSM 41821	PT	301949	m	32.5	15	6	1	3	6	1	5	12	16	21	**(h)** = hard rays (spines)
MTD F 32694	PT	301331	m	32.3	15	7	0	3	5	1	5	12	16	21	
CAS 233866	PT	301323	m	31.7	14	6	1	3	6	1	5	12	16	21	**(s)** = soft rays
MUSM 42057	PT	301332	m	30.6	15	7	0	3	7	1	5	12	16	21	
MTD F 32693	PT	301322	f	30.2	15	7	0	3	6	1	5	12	16	22	**(i)** = minor soft rays
MUSM 40592	PT	301942	m	30.1	16	5	1	3	7	1	5	12	16	21	
CAS 233866	PT	301334	m	29.5	15	7	0	3	7	1	5	12	16	21	
MTD F 32646	PT	301956	f	29.3	15	7	0	3	6	1	5	12	16	21	
MUSM 41818	PT	301333	m	29.1	15	7	0	3	6	1	5	12	15	21	
CAS 233865	PT	301327	f	28.7	14	7	0	3	6	1	5	12	16	22	
CAS 233867	PT	301950	m	28.6	14	7	0	3	6	1	5	12	16	21	**DNA-No.:**
MUSM 42057	PT	301314	f	28.5	15	6	0	3	6	1	5	12	16	21	storage number of
MTD F 32694	PT	301312	m	28.1	14	7	0	3	7	1	5	12	16	21	DNA-sample
MUSM 41821	PT	301952	f	28.0	15	7	0	3	6	1	5	12	16	21	
MUSM 41818	PT	301315	f	27.8	15	7	0	3	7	1	5	12	16	21	
MUSM 40592	PT	301943	m	27.5	14	7	1	3	6	1	5	12	16	21	
MUSM 42058	PT	301313	f	27.3	15	6	1	3	6	1	5	12	16	21	
MTD F 32646	PT	301958	f	26.6	15	6	1	3	6	1	5	12	16	20	
MUSM 42057	PT	301328	f	26.5	14	7	0	3	6	1	5	12	16	21	
MUSM 32694	PT	301337	f	26.2	15	6	1	3	6	1	5	12	16	21	
MUSM 41814	PT	301944	f	26.0	15	5	2	3	6	1	5	12	16	21	
MUSM 41812	PT	301957	f	25.9	15	7	0	3	7	1	5	12	16	20	
MTD F 32693	PT	301325	m	25.7	15	7	0	3	6	1	5	12	16	21	
MUSM 40591	PT	301955	m	25.6	15	7	0	3	6	1	5	12	16	21	
MTD F 32645	PT	301945	f	25.4	15	6	1	3	6	1	5	12	16	22	
CAS 233866	PT	301316	f	25.1	15	7	0	3	6	1	5	12	16	21	
CAS 233866	PT	301317	f	24.9	15	6	1	3	6	1	5	12	16	21	
MUSM 41812	PT	301959	f	24.7	15	7	0	3	7	1	5	11	16	21	
MUSM 41818	PT	301324	f	24.7	14	7	0	3	6	1	5	12	16	21	
MUSM 41821	PT	301953	f	24.6	16	6	0	3	6	1	5	12	16	22	
MTD F 32694	PT	301336	f	24.4	15	6	0	3	6	1	5	12	16	21	
MUSM 42057	PT	301318	f	24.0	16	6	0	3	6	1	5	12	16	22	
MTD F 32645	PT	301946	f	23.4	14	6	1	3	6	1	5	12	16	21	
CAS 233865	PT	301335	?	23.2	15	7	0	3	6	1	5	12	16	21	
MUSM 40592	PT	301947	f	23.0	15	7	0	3	6	1	5	12	16	22	
CAS 233866	PT	301326	?	22.3	14	7	0	3	6	1	5	12	16	20	
MTD F 32693	PT	301338	f	21.9	16	7	0	3	6	1	5	12	16	22	
MTD F 32650	PT	301951	m	21.7	15	6	0	3	5	1	5	12	16	21	

males either overall light blue (BM) or green to yellow (YM). First two dorsal membranes black, remainder whitish blue (BM) or with violet tinge (YM), no other black in dorsal fin; some males with red tips to dorsal membranes three to five (*cf.* Römer, 2000). In females first three dorsal-fin membranes completely and distal third of remainder black (fig. 12), in early brooding stages black may be reduced to first two membranes

Fig. 4. *Apistogramma allpahuayo* sp. n., non-type, male, YM, not preserved, live coloration shortly after capture, dominant, slightly aggressive with typical black lateral pattern and speckled ventral fins.

Fig. 5. *Apistogramma allpahuayo* sp. n., non-type, male, BM, not preserved, live coloration shortly after capture, dominant, slightly aggressive with typical black lateral pattern and unspeckled ventral fins.

Fig. 6. *Apistogramma allpahuayo* sp. n., non-type, male, YM, not preserved, live coloration shortly after capture, yawning, coloration typical for subdominant aggressive specimens.

and distal part of third (figs. 13 & 14). Mature females with yellowish to light brown body and inconspicuous vertical bars on flanks, more intense dorsally (fig. 12), with intervals between bars less than 30 % of bar width. Lateral band in both sexes sometimes replaced or covered by mostly round mid-lateral spot at intersection with third vertical bar (figs. 5, 12–13). Brooding females lemon yellow with white chest, variable black cheek stripe, first three to four (rarely five) dorsal membranes black, ventral fins at least partially black (figs. 13–14), and body with either a) broad lateral band running from immediately behind orbital to vertical bar 7, clearly separated from caudal spot (fig. 14), or b) partially faded but visible lateral band clearly separated from caudal spot and distinct lateral spot (fig. 13), or c) caudal spot combined with lateral spot, or d) without any black pattern (*cf.* Römer 2000). No mid-ventral stripe or pectoral spot in both sexes. Dominant males with abdominal stripes: three, only exceptionally four longitudinal series of black dots on flanks below lateral band (fig. 7), shape of dots as described for *Apistogramma cacatuoides* (fig. 8), and therefore clearly differing from pattern known from *A. juruensis* Kullander, 1986.

Systematic relationships: *Apistogramma allpahuayo* sp. n. is apparently a member of the *Apistogramma cacatuoides* lineage (nomenclature following Römer, 2006) and most closely related to *Apistogramma cacatuoides* itself. In particular the overall similarities in the shape of body and fins, and the basic coloration of body and fins, leave no doubt that this taxon must be regarded as a sibling species of the well-known *Apistogramma cacatuoides* from the same region in Peru. Detailed analysis of relationships within the genus is in progress and will be published in due course.

Etymology: The species name *allpahuayo* is a noun in apposition and refers to the type locality. The holotype and most of the paratypes were collected in a small brook feeding the Quebrada Allpahuayo within the Reserva Nacional Allpahuayo Mishana. This rainforest reserve, sited between kilometres 23 and 31.5 west of the road from Iquitos to Nauta, covers an area of approximately 58000 ha (Ministerio del Ambiente, 2011).

Distribution and Ecology: In spite of the fact that the species has been known for nearly two decades, the first precise locality data on the Peruvian *Apistogramma allpahuayo* sp. n. are published here. The type locality of *Apistogramma allpahuayo* sp. n. (figs. 16 & 17), is a small *quebrada* within the Reserva Nacional Allpahuayo Mishana, which is sited about 25 km south-west of Iquitos. According to our studies,

Fig. 7. *Apistogramma allpahuayo* sp. n., non-type, male, BM, not preserved, live coloration shortly after capture, collected at type locality, with typical abdominal stripes and lateral band separated from caudal spot, dominant, neutral mood.

Fig 8. For comparison: *Apistogramma cacatuoides* Hoedeman, male, not preserved, live coloration shortly after capture, field station F19-P-2011-R, with typical abdominal stripes and lateral band continuing onto caudal base, dominant, neutral mood.

Fig. 9. *Apistogramma allpahuayo* sp. n., non-type, male, YM, not preserved, live coloration shortly after capture, typical colour pattern during highly aggressive lateral threat.

Fig. 10. For comparison: *Apistogramma cacatuoides* sp. n., male, not preserved, live coloration shortly after capture, same location as fig. 8, typical colour pattern during highly aggressive lateral threat.

Fig. 11. Abdominal stripe pattern of male *Apistogramma allpahuayo* sp. n. (**a**) and *A. cacatuoides* (**b**), for details see text.

the distribution of the species is restricted mainly to small rivers and streams west of the *carretera* (road) from Iquitos to Nauta and within the borders of the nature reserve. The species inhabits most, but not all of the small black water *quebradas* of this area. On the basis of current knowledge the species appears to be endemic to the Rio Nanay system. On the basis of our field studies outside the reserve, populations of *Apistogramma allpahuayo* sp. n. are known from only two, perhaps three locations in a single *quebrada* outside the Reserva Nacional Allpahuayo Mishana. Only a few single specimens have been found at other collection sites. We do, however, have evidence that the species may in fact be slightly more widespread than currently known. Information covering another collection site in the Rio Nanay system, including photographs of voucher specimens of both sexes resembling the species described herein, has been sent by P. Willink (in lit. September 25th 2006) to the senior author. But the corresponding voucher specimens

Fig. 12. *Apistogramma allpahuayo* sp. n., non-type, female, not preserved, live coloration shortly after capture, mature, dominant, neutral mood, typical black pattern of non-brooding specimens.

Fig. 13. *Apistogramma allpahuayo* sp. n. non-type, female, not preserved, live coloration after 4 weeks in the aquarium, dominant, typical brood-care coloration shortly after spawning.

Fig. 14. *Apistogramma allpahuayo* sp. n. non-type, female, not preserved, live coloration in the aquarium, dominant, typical aggressive brood-care pattern while caring for larvae, with lateral band separated from caudal spot and dorsal spots merging into dorsal band.

Fig. 15. For comparison: *Apistogramma cacatuoides*, female, not preserved, live coloration in the aquarium, dominant, typical aggressive brood-care pattern while caring for larvae, with lateral band continuing onto caudal-fin base and dorsal region lacking spot or band pattern.

had still not been catalogued in the MUSM and/or the FMNH collections when UR reviewed the MUSM collection in July 2011, and thus were not available during our work on this paper. On the basis of the above, plus information from local professional fishermen, reference material collected by ourselves, and material that we have been able to inspect in various collections, the new species has apparently been found nowhere outside the Peruvian Department of Loreto.

Geologically speaking, the range of *Apistogramma allpahuayo* sp. n. is situated at the north-eastern edge of the Iquitos palaeoarch. In this comparatively hilly area different streams are isolated from one another by geomorphological structures. Even brooks that are only a short distance from each other and not part of the same system are strictly isolated from one another, as there are no inundation zones like the *varzea* of the central Amazonian rain forest, in this area. This situation may be making a fundamental contribution to the high diversity of species and their comparatively restricted distribution ranges in this part of the Peruvian Amazon.

All collection sites except one were situated within more or less dense forest. The brooks in which *Apistogramma allpahuayo* sp. n. was caught mostly contained black water, while some were slightly influenced by white water. In one case the water was light in colour and translucent. Water conditions measured at the various collection sites were as given in table 5. The oxygen levels measured in all locations were low to extremely low, as is typical of many tropical waters characterised by rotting plant matter that form the typical habitat of most *Apistogramma* species (Römer, 2000, 2001, 2006). Such oxygen levels usually cause physiological stress to aquatic organisms unless they are adapted to such extreme conditions. As a lack of oxygen may restrict access for fish in general to certain areas in their natural range, the implication is that

Table 5. Data on water conditions taken from eight collection sites of *Apistogramma allpahuayo* sp. n. in the area in and around the Reserva Nacional Allpahuayo Mishana. For methodology of measurements see text. Detailed descriptions of locations to be published elsewhere.

field station	GPS-position	date	time	water-type	T [°C]	pH	O_2 [mg/l]	µS [cm]
F7-P-2011-R	03° 58′ 37 S / 73° 25′ 17 W	2011.08.04	09.05 am	black (+ white)	24.7	5.1	0.87	118
F10-P-2011-R	03° 59′ 11 S / 73° 25′ 51 W	2011.08.10	09.25 am	black	24.5	5.5	0.39	93
F10-P-2011-R	03° 59′ 11 S / 73° 25′ 51 W	2011.08.10	09.45 am	"	25.0	5.6	0.37	83
F11-P-2011-R	03° 51′ 20 S / 73° 25′ 56 W	2011.08.10	11.48 am	black (+ white)	28.5	5.7	2.10	81
F12-P-2011-R	03° 51′ 20 S / 73° 25′ 56 W	2011.08.10	12.59 pm	branco	25.5	7.4	2.20	23
F13-P-2011-R	03° 58′ 51 S / 73° 25′ 20 W	2011.08.10	01.59 pm	clear (+ white)	26.7	5.5	2.24	78
F13-P-2011-R	03° 58′ 51 S / 73° 25′ 20 W	2011.08.10	02.41 pm	"	26.8	5.6	1.52	87
F22-P-2011-R	03° 59′ 32 S / 73° 25′ 19 W	2011.08.30	01.10 pm	black	26.9	5.2	1.35	110
F23-P-2011-R	03° 57′ 38 S / 73° 24′ 37 W	2011.08.30	01.31 pm	clear (+ white)	28.6	5.2	2.26	102
F24-P-2011-R	03° 54′ 59 S / 73° 21′ 46 W	2011.08.30	03.05 pm	clear	25.7	4.6	1.72	142

there may be advantages for adapted species such as *Apistogramma*. For example, they may have access to areas where abundances of large predators are low and possibly interspecific competition is lacking and which thus constitute safe territory for breeding. In fact we have repeatedly observed *Apistogramma* females of different species in areas with extremely low oxygen levels (< 1 mg/l), obviously caring for eggs, larvae, and even more obviously small fry. These observations suggest adaptation of the *Apistogramma* species in question to extremely low oxygen levels as discussed above. The acidic pH levels in the habitat of *Apistogramma allpahuayo* sp. n. (values of about 5) are usually typical for clear- and blackwater habitats. But in one brook (F12-P-2011-R) the pH level was unexpectedly high at 7.4, which may have been the result of white water influencing the *quebrada*. Here only a single specimen was collected, and this was in comparatively bad condition, indicating suboptimal water conditions for this species.

Our observations in the habitats of *Apistogramma allpahuayo* sp. n. revealed that the water level may vary considerably after rainfall. After heavy rainfall on August 4th 2011 we observed water levels rapidly rising by about 20 cm compared to normal levels six days later. In all habitats investigated the sandy bottoms of streams were covered with a scattering of fallen leaves, twigs, branches, fallen trees, and a sometimes thick layer of fine brownish detritus. Submerged plants – with the exception of some algae – were not seen. The following fish species were collected together with *Apistogramma allpahuayo* sp. n. during our 2011 field work: several specimens of *Aequidens* sp., *Cichlasoma* sp., *Crenicichla* sp. (*cf. saxatilis* group), *Laetacara flavilabris* (Cope, 1870), *Laetacara* sp., *Carnegiella* cf. *myersi* Fernandez-Yepez, 1950, *Crenuchus spilurus* Günther, 1863, *Hoplias* sp. (*malabaricus*?), *Hyphessobrycon* sp., *Pyrrhulina* sp., *Thoracocharax* cf. *securis* (Filippi, 1853), *Hoplosternum* spp. (2), *Gymnotus* spp. (3), and an *Atinga* species, probably *Synbranchus marmoratus* Bloch, 1795. Nevertheless, data on distribution and ecology still need amplification by further studies.

Biology: At present there are no detailed field reports available on the biology of *Apistogramma allpahuayo* sp. n., but it has been observed intensively during different preliminary ethological studies in the aquarium. Most of the basic results of aquarium studies on social behaviour and reproduction have been made available in work already published, although in most of these publications, especially those of Beisenherz & Römer (2003), Engelking *et al*. (2010), Römer (2000, 2001, 2006), Römer & Beisenherz (2005), and Römer & Soares (1995, 1996), data for *Apistogramma allpahuayo* sp. n. are erroneously given as being for *Apistogramma juruensis*.

This is, essentially, the result of the misidentification of specimens imported to the USA in 1995 without precise locality data. Not until a few years later was it first brought to light that these fish were imported from northern Peru and not from the mainly Brazilian system of the Rio Juruá as originally thought. Subsequently the fish described here as *Apistogramma allpahuayo* sp. n. was discussed under the provisional names "Schwarzkinn-/black-chin-*Apistogramma*" and "Pucallpa" by other authors (Koslowski, 2002, Linke & Staeck, 2006; Staeck, 2003; Stawikowski, 2005; Warzel, 1998).

Apistogramma allpahuayo sp. n. appears to be a typical polygamous representative of the genus, in which serial monogamy has not yet been observed. The species has repeatedly been bred successfully in captivity. In this regard the highly ritualised aggressive behaviour of males is particularly worthy of mention: As in all other related species within the *Apistogramma cacatuoides* complex, males of *Apistogramma allpahuayo* sp. n. threaten one another

Table 6. Morphological traits of *Apistogramma allpahuayo* sp. n. and other species related to *Apistogramma cacatuoides*. Diagnostic features highlighted in pink.

	***allpahuayo* sp. n.**	***cacatuoides***	***luelingi***	***juruensis***	***huascar***	**sp. ("Jurua")**
black chin pattern						
wide W-shape spot	×					
narrow vertical supra lip stripe		×		×	×	
missing			×		×	×
lateral band						
ends on vertical bar 7	×			×		
continuous to caudal base		×	×		×	×
abdominal stripes						
half as wide as interspaces	×					
wider than interspaces		×	×	×		
missing					×	×
colour of lips in aggression						
orange	×					
yellow	×		×		×	
grey		×	×	×	×	×
blue		×		×	×	×
dorsal fin						
last spine longest		×	×	×	×	×
without spots in soft portion	×			×	×	×
with red and/or black spots in soft portion		×	×			
black spots along fin base					×	
ventral fins						
with variable black spots	×					
without spots		×	×	×	×	×
caudal fin						
spots missing	×			×	×	×
red stripe pattern missing	×			×		
with red and/or black spots		×	×			
upper lobe with red stripe pattern		×	×		×	×

with their mouths wide open. Interestingly, during this frontal threat their teeth form a striking contrast with the overall yellow to orange coloration of the outer mouth area, as well as with the whitish inner mouth area, perhaps stressing the potential fighting ability of a given male. This provides a wide potential for interpretation against the background of mate choice behaviour and sexual selection. *Apistogramma allpahuayo* sp. n. is the only species of the genus in which functional sex change has been unequivocally recorded: Pretor (pers. comm. to UR 2005/2006) kept a functional adult female with typical sexual traits, which successfully reproduced repeatedly before its mate died. After this loss it grew rapidly to normal male size, expressing clear and typical male colours and sex-linked morphological traits. The only fry remaining in the aquarium grew up into a mature female within the approximately six months that followed. Pretor was then surprised to observe this specimen spawning successfully with what was originally its mother. During the whole process of sex change several photographs of the specimen in question were taken by Pretor and the senior author to document the changes in habitus. After its second successful spawning as a functional male, the sex-changed specimen was preserved, and its gonads fixed for further investigation by H. Greven (Düsseldorf University, Germany). The results of this morphological examination of the gonads of the functionally sex-changed specimen will be published elsewhere.

For detailed descriptions of aquarium biology see Römer (2000), Römer & Soares (1995, 1996); for more specialised information resulting from experiments on female mate choice, see Engelking et al. (2010), Römer (2000, 2001), Römer & Beisenherz (2005), Römer & Soares (1996).

Table 7. Summarised biometric data of *Apistogramma allpahuayo* sp. n. type specimens, and comparative material of *A. cacatuoides* and *A. luelingi* (data given in mm). For collection data see text.

		***Apistogramma allpahuayo* sp. n.**					***Apistogramma cacatuoides***					***Apistogramma luelingi***					**abbreviations**
	HT	**(n)**	**mean**	**min.**	**max.**	**st.dev.**	**(n)**	**mean**	**min.**	**max.**	**st.dev.**	**(n)**	**mean**	**min.**	**max.**	**st.dev.**	HT = Holotype / PT = Paratype
SL	37.2	50	28.9	21.7	39.3	4.75	22	28.3	22.0	43.9	4.96	29	30.3	12.2	43.3	7.49	standard length
TL	50.1	50	39.0	29.4	54.0	6.78	18	38.0	29.3	60.0	7.00	29	41.3	19.5	61.8	10.39	total length
TLS	53.0	50	39.5	29.4	56.3	7.19	15	39.4	30.1	63.9	8.67	29	42.7	19.5	63.5	11.89	total length plus streamer
HL	13.5	50	10.5	7.5	14.5	1.81	22	10.3	8.0	15.2	1.79	28	11.0	6.9	15.2	2.27	head length
HD	11.0	50	8.3	6.3	12.0	1.47	22	8.0	6.3	12.0	1.34	28	9.0	5.2	12.9	2.11	head depth
BD	12.7	50	10.1	7.5	14.2	1.66	22	10.3	7.5	15.2	1.74	28	11.8	7.0	17.3	2.75	body depth
HW	6.9	50	5.4	3.8	7.8	0.94	22	5.2	4.0	7.7	0.79	28	5.9	3.6	8.1	1.28	head width
PDL	14.1	50	10.8	7.8	15.6	1.80	22	10.2	7.9	15.0	1.64	28	11.4	7.0	16.1	2.45	pre-dorsal length
TDL	33.6	50	26.2	19.2	36.1	4.32	22	25.7	20.2	39.7	4.40	28	28.2	16.5	39.1	6.14	trans-dorsal length
PVL	15.5	50	11.7	8.6	16.4	2.15	22	11.2	9.0	16.1	1.78	28	12.9	7.3	18.4	2.94	pre-pelvic length
PAL	26.8	50	20.5	15.4	28.4	3.35	22	19.7	15.7	29.4	3.25	28	21.7	12.6	30.4	4.75	pre-anal length
TAL	33.1	50	25.8	19.0	35.4	4.23	22	25.00	19.7	37.7	4.12	28	27.7	15.9	38.8	6.11	trans-anal length
Eye	4.1	50	3.6	1.8	4.8	0.53	22	3.6	2.8	4.8	0.52	28	3.9	2.5	5.1	0.72	eye diameter
SNL	3.8	50	2.4	1.2	4.3	0.79	22	1.9	1.1	3.6	0.63	28	2.5	1.3	4.0	0.71	snout length
CHD	3.6	50	2.5	1.6	4.7	0.77	22	2.3	1.4	3.6	0.50	27	2.6	1.6	4.6	0.78	cheek depth
POD	1.0	50	0.8	0.3	1.3	0.21	22	0.7	0.4	1.3	0.22	27	1.0	0.5	1.6	0.27	pre-orbital depth
IOW	3.2	50	2.5	1.7	4.0	0.52	22	2.7	1.9	4.0	0.49	28	2.7	1.5	4.0	0.64	inter-orbital width
UJL	4.2	50	3.1	1.8	5.5	0.88	22	3.0	1.9	6.0	0.83	28	3.2	1.4	5.4	1.01	upper jaw length
LJL	6.2	50	4.2	2.5	6.7	1.02	22	4.2	2.9	6.7	0.88	28	4.4	2.5	6.3	0.97	lower jaw length
CPD	5.4	50	4.4	3.2	6.0	0.76	22	4.4	3.2	7.0	0.81	28	5.0	2.6	7.5	1.23	caudal peduncle depth
CPL	3.9	50	3.1	1.9	5.3	0.79	22	3.4	2.5	5.8	0.73	28	3.4	1.6	5.0	0.89	caudal peduncle length
DFB	21.3	50	16.8	12.1	23.2	2.82	22	17.0	13.2	27.0	3.07	27	18.9	10.4	26.0	4.11	dorsal fin base length
AFB	7.2	50	5.8	4.1	8.2	1.05	22	5.8	4.4	9.8	1.34	28	6.6	3.8	9.3	1.48	anal fin base length
PecL	12.2	50	8.7	5.8	12.9	1.78	20	8.2	4.1	13.1	1.98	27	9.5	5.0	14.4	2.45	pectoral fin length
PelL	15.3	50	9.1	5.3	15.3	2.54	22	10.1	6.0	20.5	3.24	27	11.3	5.7	19.9	4.07	pelvic fin length
PelSL	5.2	50	4.2	2.7	5.5	0.67	22	4.3	3.3	5.8	0.61	27	4.8	3.0	7.0	1.00	pelvic fin spine length
LDS	6.9	50	4.7	3.1	7.2	1.08	21	4.6	3.2	7.9	1.15	26	5.3	2.9	8.9	1.54	last dorsal spine length
LAS	6.4	50	4.9	3.6	6.8	0.79	21	4.7	3.3	6.8	0.84	26	5.4	2.8	8.3	1.31	last anal spine length

Discussion: Ortega & Vari (1986) list seven (including one potentially invalid taxon), and Ortega *et al*. (2010) 14 species of *Apistogramma* for the territory of Peru (based on published taxonomic data up to 2004). In the meantime intensive research activities in the cis-Andean area of the country have brought several new taxa to light (compare Ortega *et al.* 2012). *Apistogramma allpahuayo* sp. n. is the 21st species of the genus formally described from Peru. The species is sexually highly dimorphic and cannot be mistaken for any other *Apistogramma* species except *Apistogramma cacatuoides* and a few species closely related to that species. In fact *Apistogramma allpahuayo* sp. n. is most similar to *Apistogramma cacatuoides*, *A. juruensis*, *A. luelingi*, *A. salpinction* Kullander & Vari, 2005 (from the Brazilian Trombetas system), and an as yet undescribed species (from the upper course of the Brazilian Rio Juruá) provisionally called *Apistogramma* sp. "Juruá". *Apistogramma allpahuayo* sp. n. is unequivocally distinguished from all these species, which share the same overall morphology, by the unique black w-pattern on the lower jaw (fig. 18), which is absent in *A. cacatuoides*, *A. luelingi*, and *A.* sp. "Juruá" (table 6). Some *Apistogramma cacatuoides* of both sexes may exhibit a dark blue-grey to grey stripe along the lower lip, but this line is never extended in a caudal direction. According to the description given by Kullander (1986), some *Apistogramma juruensis* may have a similar lip stripe, but usually a little broader than in *A. cacatuoides*, and a completely different shape compared to that in *Apistogramma allpahuayo* sp. n.. To date no such colour pattern has been reported in *Apistogramma* sp. "Juruá"; instead the lower lip of the latter species is a uniform light grey, bluish grey, pale yellow, or (rarely) creamy white. This also applies to other species from Peru, for example *Apistogramma barlowi*, *A. martini*, *A. pantalone*, and *A. payaminonis* Kullander, 1986, which in addition are clearly differentiated by their overall different appearance. Only highly aggressive males of *Apistogramma arua* may occasionally exhibit a similar black pattern on the lower side of the mouth, but in such fish the entire branchiostegal membrane

Table 8. Summarised biometric data of *Apistogramma allpahuayo* sp. n. type specimens, and comparative material of *A. cacatuoides* and *A. luelingi* (data given as % of SL; SL given in mm). For collection data see text.

		***Apistogramma allpahuayo* sp. n.**					***Apistogramma cacatuoides***					***Apistogramma luelingi***					**abbreviations**
	HT	**(n)**	**mean**	**min.**	**max.**	**st.dev.**	**(n)**	**mean**	**min.**	**max.**	**st.dev.**	**(n)**	**mean**	**min.**	**max.**	**st.dev.**	HT = Holotype / PT = Paratype
SL	37.2	50	28.9	21.7	39.3	4.75	22	28.3	22.0	43.9	4.96	29	30.3	12.2	43.3	7.49	standard length
TL	134.5	50	134.7	128.6	139.4	2.36	18	130.2	124.0	136.9	4.05	29	135.9	131.2	142.8	2.66	total length
TLS	142.4	50	136.4	128.6	145.7	3.58	15	134.8	125.9	145.6	5.08	29	140.1	131.2	172.9	9.74	total length plus streamer
HL	36.3	50	36.3	34.0	40.0	1.300	22	36.2	34.5	38.8	1.48	28	35.9	32.2	39.0	1.87	head length
HD	29.6	50	28.7	26.0	31.1	1.13	22	28.5	27.0	29.9	0.78	28	29.0	26.7	31.1	1.28	head depth
BD	34.0	50	34.9	32.3	37.5	1.13	22	36.2	34.2	38.1	1.19	28	38.2	34.9	41.8	2.06	body depth
HW	18.5	50	18.7	16.8	20.8	0.70	22	18.6	16.2	19.8	0.78	28	19.2	17.3	21.3	1.15	head width
PDL	37.8	50	37.5	35.4	40.1	1.13	22	36.0	34.3	38.1	1.19	28	37.2	34.4	39.6	1.57	pre-dorsal length
TDL	90.1	50	90.8	87.9	93.9	1.36	22	90.9	87.0	95.6	1.83	28	91.4	87.5	98.7	2.44	trans-dorsal length
PVL	41.7	50	40.6	37.8	45.3	1.62	22	39.6	36.8	42.0	1.20	28	41.6	38.1	45.7	1.82	pre-pelvic length
PAL	79.0	50	77.9	73.6	83.0	1.60	22	76.8	73.1	79.9	1.81	28	77.3	73.9	80.9	1.75	pre-anal length
TAL	88.9	50	89.2	85.4	93.0	1.46	22	88.8	85.7	90.6	1.44	28	89.7	86.1	94.7	2.13	trans-anal length
Eye	11.1	50	12.4	8.0	14.1	0.99	22	12.9	10.9	14.4	0.85	28	12.8	11.6	14.4	0.84	eye diameter
SNL	10.3	50	8.2	5.5	11.5	1.47	22	6.5	4.6	9.0	1.31	28	8.0	5.4	10.4	1.18	snout length
CHD	9.8	50	8.5	6.8	11.9	1.24	22	8.2	6.4	9.1	0.67	27	8.3	6.5	11.6	1.29	cheek depth
POD	2.7	50	2.7	1.4	4.3	0.47	22	2.5	1.8	3.1	0.39	27	3.0	2.3	3.7	0.36	pre-orbital depth
IOW	8.6	50	8.5	6.9	10.2	0.69	22	9.5	8.4	11.0	0.62	28	8.8	7.5	10.1	0.79	inter-orbital width
UJL	11.3	50	10.7	7.9	14.6	1.49	22	10.4	7.8	13.7	1.21	28	10.1	7.2	13.6	1.59	upper jaw length
LJL	16.6	50	14.5	10.7	17.8	1.45	22	14.8	12.7	16.0	0.93	28	14.3	11.2	16.2	1.19	lower jaw length
CPD	14.4	50	15.3	14.2	16.4	0.59	22	15.4	13.5	16.7	0.76	28	16.1	14.7	18.4	1.00	caudal peduncle depth
CPL	10.5	50	10.7	6.5	13.8	1.48	22	11.9	9.8	14.0	1.06	28	10.9	9.1	12.8	1.09	caudal peduncle length
DFB	57.3	50	58.2	54.4	61.6	1.67	22	60.1	56.5	63.1	1.66	27	60.3	56.8	64.0	1.63	dorsal fin base length
AFB	19.3	50	19.9	17.5	23.0	1.09	22	20.5	18.5	32.6	2.83	28	21.6	19.0	24.8	1.53	anal fin base length
PecL	32.7	50	29.9	25.2	33.7	2.14	20	28.4	15.1	33.0	3.97	27	30.0	25.4	34.1	2.59	pectoral fin length
PelL	41.0	50	31.3	21.2	41.8	5.16	22	34.9	27.3	46.8	4.87	27	35.2	27.3	50.2	6.24	pelvic fin length
PelSL	13.9	50	14.5	11.1	17.7	1.36	22	15.2	12.8	16.8	1.06	27	15.4	11.9	19.7	1.74	pelvic fin spine length
LDS	18.5	50	16.1	10.7	20.0	1.64	21	16.1	12.3	19.7	1.78	26	16.3	13.6	20.7	1.85	last dorsal spine length
LAS	17.3	50	16.9	14.0	19.9	1.11	21	16.9	14.4	19.8	1.48	26	17.0	14.2	19.1	1.33	last anal spine length

usually appears black, and the overall colour pattern of this species as well as its habitus significantly differ from *Apistogramma allpahuayo* sp. n.

Apistogramma allpahuayo sp. n. is further distinguished from *A. cacatuoides* and *A. luelingi* by the greater extent of the lateral band in the latter two species (ending on vertical bar 7 versus extending onto basal part of caudal fin). Compared to *Apistogramma allpahuayo* sp. n., the lateral band in *Apistogramma* sp. "Juruá" appears wider, while the caudal spot is significantly smaller. In high aggression the black lateral band in *Apistogramma allpahuayo* sp. n. is replaced by a silvery white stripe, which is significantly wider than the original band and contrasts strikingly with the rest of the colour of the body (fig. 9). No such colour pattern has been reported in this context from any other species of the genus. Comparable, but far less expressed, silvery white colour elements have been reported only from *Apistogramma atahualpa* Römer, 1997 (Römer, 2000), which lives in the area north-east of the range of *Apistogramma allpahuayo* sp. n.. But in addition to having a rounded caudal fin, *Apistogramma atahualpa*, like *A. huascar* (lyrate caudal fin), exhibits a series of conspicuous black spots along the basal part of the dorsal fin, while no such spots have ever been recorded in the new species described here. Interestingly, *Apistogramma allpahuayo* sp. n. shares with *A. huascar* the coloration of the tissue in which the jaw teeth are embedded: both species exhibit red or orange fleshy tissue contrasting with the whitish teeth (Römer, 2006) (fig. 18). Both species also exhibit highly ritualised frontal threat behaviour during territorial fights as well as during mating display.

The abdominal marking of dotted lines on the flanks in *Apistogramma allpahuayo* sp. n. is also diagnostic. As the form of the dots appears to be as described for *Apistogramma cacatuoides*, this is clearly different from the pattern in *A. juruensis* (Kullander, 1986). Although the form of these dotted lines appears to be identical with that recorded for *Apistogramma cacatuoides*, they are only half as wide and generally far less intense in *Apistogramma allpahuayo* sp. n.,

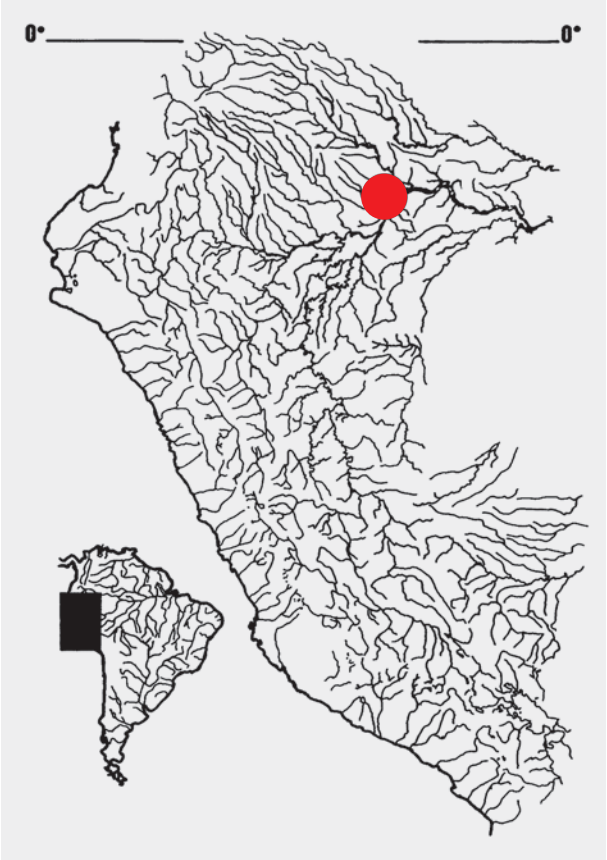

Fig. 16. Map of Peru showing distribution of *Apistogramma allpahuayo* sp. n., type locality indicated by red dot.

and hence are diagnostic for the latter species (figs. 1–3, 7–8, 10–11).

Perhaps less obviously, *Apistogramma allpahuayo* sp. n. may be distinguished from the species listed above by the different proportions of the dorsal fin spines. As in most other species of the genus, in *Apistogramma cacatuoides*, *A. luelingi*, and *A.* sp. "Juruá" the last dorsal spine is the longest. By contrast, in *Apistogramma allpahuayo* sp. n. one of spines three to five is usually the longest, with the length of the following spines decreasing to the third- or second-last, whilst the last is slightly longer than the two or three spines before it. This pattern, found in all specimens we have examined, is, as far as we know, unique within the genus *Apistogramma*.

Differences in the biometrics of *Apistogramma allpahuayo* sp. n. in comparison to *A. cacatuoides* and *A. luelingi* are generally not significant. But there are some tendencies that may be of some diagnostic value: in comparison to *Apistogramma allpahuayo* sp. n. the body is generally deeper in all *A. cacatuoides* and most *A. luelingi* (valid for specimens of all sizes) (fig. 19), the head wider in *A. cacatuoides*, the interorbital wider in *A. luelingi*, the snout shorter in *A. cacatuoides*, the caudal peduncle deeper in *A. cacatuoides*, the dorsal-fin base slightly longer in *A. cacatuoides* and *A. luelingi*, and the anal-fin base longer in *A. cacatuoides* (tables 7 & 8).

Differences in shape of fins and size between the sexes of *Apistogramma allpahuayo* sp. n. are diagnostic. Males have been recorded as showing a high degree of polychromatism in earlier observations (Römer, 2000; Römer & Soares, 1995, 1996), and this was confirmed during our current studies. Several different colour morphs have been identified (figs. 4–7, & 9; Mayland & Bork, 1997; Römer, 2000; Römer & Soares, 1995, 1996), but we have identified only two distinct morphs amongst our recent material, which may in fact reflect the limited number of specimens available. We have the strong impression that other colour morphs may represent intermediate stages between YM and BM individuals. At present it is not clear whether colour polymorphism in males is based on differences in diet, age, social status, or simply genetic factors, but it has been shown to have significant function during reproduction, as female *Apistogramma* in general are selective in mate choice (Beisenherz & Römer, 2003; Römer, 2001; Römer & Beisenherz, 2005, 2006; Ready *et al*., 2006). In *Apistogramma allpahuayo* sp. n. differences in coloration seem to be stable within the offspring of males of a particular morph. It may therefore be speculated that if genetic differentiation is the most probable background to polychromatism, female preference for certain mate colour morphs may be a decisive factor contributing to stabilisation of these morphs. Interestingly, differences in reproductive success have been observed during breeding experiments carried out on *Apistogramma allpahuayo* sp. n. (Römer, 2000; Römer & Soares 1996). Differences in reproductive success combined with selective mate choice by females might potentially trigger speciation via genetic stabilisation of male colour morphs in this species.

Conservation status

Owing to its ecology and endemic status within a comparatively small area, *Apistogramma allpahuayo* sp. n. may be considered potentially vulnerable, given the deforestation activities around Iquitos. It should therefore (like all other local endemics such as *Apistogramma eremnopyge* Ready & Kullander, 2004, *A. nijsseni* Kullander, 1979, *A. norberti* Staeck, 1991, and others) be placed on the lowest level (potentially vulnerable) of the red data list of the Peruvian (ichthyo) fauna. Fortunately the most important and effective step in the conservation of this commercially attractive species has already been taken by declaring the Allpahuayo Mishana area a protected nature

Fig. 17. View of the type habitat of *Apistogramma allpahuayo* sp. n. within the Reserva Nacional Allpahuayo Mishana, August 10th 2011, at about 9.30 a.m. local time.

Fig. 18. *Apistogramma allpahuayo* sp. n., non-type, male, YM, shortly after capture, not preserved, portrait showing typical w-shape pattern and teeth embedded in contrasting reddish tissue.

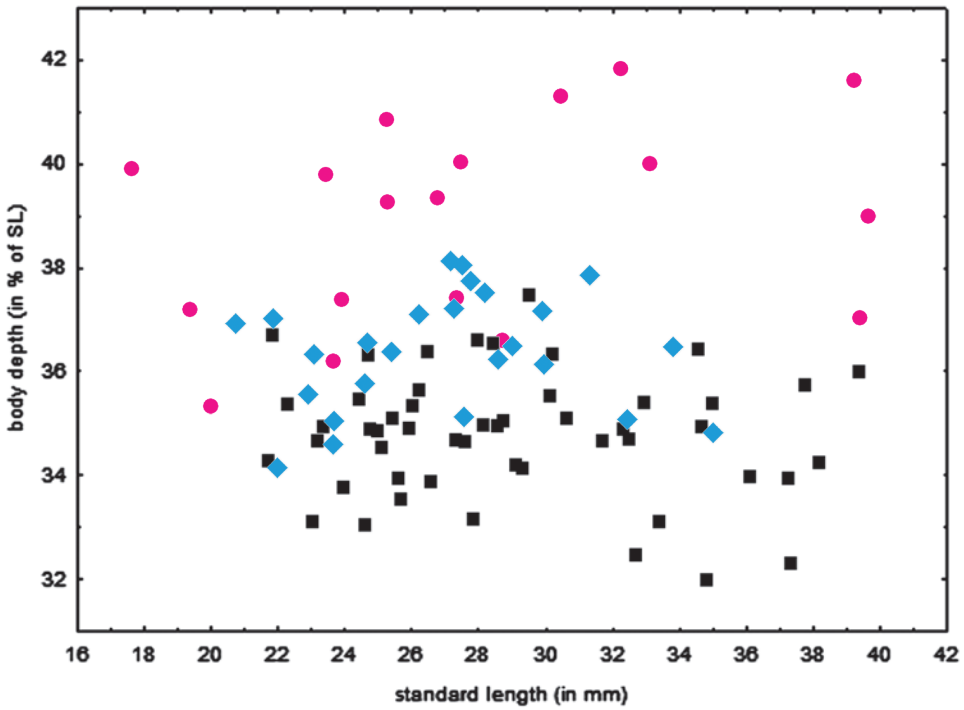

Fig. 19. Plot of relative depth of body versus SL of *Apistogramma allpahuayo* sp. n. (black squares) in comparison to its congeners *A. cacatuoides* (pink dots) and *A. luelingi* (blue diamonds).

reserve on January 15th 2004 (Decreto Supremo Nº 002-2004-AG), thus providing protection for a significant part of the species´ range. Within the limits of the Reserva Nacional Allpahuayo Mishana collection for scientific purposes is under clear restrictive regulation, and not permitted at all for commercial purposes.

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