Record of *Anablepsoides christinae* (Huber, 1992) (Teleostei: Cyprinodontiformes) from the upper Beni river basin in Bolivia

Registro de *Anablepsoides christinae* (Huber, 1992) (Teleostei: Cyprinodontifornes) de la cuenca alta del río Beni en Bolivia

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The genus *Anablepsoides* Huber, 1992 is one of the 24 valid genera that compose the subfamily Rivulinae Myers, 1925, of the family Rivulidae Myers, 1925 (Fricke *et al*. 2022a), and currently comprises 61 species (Fricke *et al*. 2022b). Initially the species of this genus were included in *Ruvulus* Poey, 1860 until Costa (2011) elevated five of its subgenera to genus level, and proposed the tribe Melanorivulini Costa, 2011 to group four of them (*Anablepsoides*, *Atlantirivulus* Costa, 2008, *Cynodonichthys* Meek, 1904 and *Melanorivulus* Costa, 2006) into one clade. The proposal of Costa (2011) was not accepted without some controversy (Huber 2012) and skepticism as it is weakly supported (Costa 2011, Valdesalici & Schindler 2013, Loureiro & de Sá 2015, Loureiro *et al*. 2018) and does not accord with the results of some previous studies (Hrbek & Larson 1999, Murphy *et al*. 1999, Hrbek *et al*. 2004, Vermeulen & Hrbek 2005). However, more recent evidence supports the validity of the genus *Anablepsoides* and the tribe Melanorivulini (Costa *et al*. 2016, Amorim & Costa 2022).

Anablepsoides are small to medium-sized [30 to 120 mm standard length (SL)] non-annual rivulids (Costa 2011, Loureiro & de Sá 2015), which can be easily differentiated from other members of the subfamily Rivulinae by the presence of scales on the entire ventral section of the head (Costa 2011). They are distributed in the Amazon and Orinoco river basins, and coastal river drainages in northern and northeastern South America and the Lesser Antilles (Costa 2011, Loureiro *et al*. 2018, Amorim & Costa 2022). They inhabit the shallower parts of perennial lotic and lentic water bodies in forests and savannas from sea level up to 1000 m above sea level (Costa 2011, Valdesalici & Schindler 2011, Loureiro & de Sá 2015, Amorim & Costa 2022). Although members of this genus, unlike seasonal rivulids, depend on the presence of water during embryonic development, at least some species are known to exhibit adaptations that allow them to stay out of water for long periods (Turko & Wright 2015, Livingston *et al*. 2018, Espírito-Santo *et al*. 2019).

At infrageneric level and informally, based on coloration patterns and other visible morphological characteristics, *Anablepsoides* are divided into three species complexes (Huber 1992 in Costa 2010, Costa *et al*. 2013, Amorim & Costa 2022), although the differences in some cases are subtle (Huber 1999, Valdesalici & Schindler 2011). From a biogeographic perspective, the *A. urophthalmus* complex comprises species from the middle and lower Amazon basin, the Orinoco basin and coastal rivers drainages; the *A. limoncochae* complex groups species from western Amazonia; and the *A. ornatus* complex brings together species from central Amazonia (Costa *et al*. 2013, Amorim & Costa 2022). However, these species complexes could not be confirmed based on molecular analysis by Amorim & Costa (2022), who identified only two main clades within the genus. The first, called clade α, corresponds to the species of the *A. urophthalmus* complex; while the second, called clade β, mostly includes the species inhabiting the upper and middle Amazon basin, belonging to the *A. ornatus* and *A. limoncochae* complexes.

To date, three species of *Anablesoides* have been recorded in Bolivia (Valdesalici & Gil 2019) and all were described from material collected in the country. While *A. beniensis* (Myers, 1927) has a relatively wide distribution in the central basin of the Madeira river in Bolivia and Brazil (Costa 2006), the other two – *A. chapare* Valdesalici & Gil, 2017 and *A. bibosi* Valdesalici & Gil, 2019 – are only known from their type localities in the pre-Andean upper Chapare river basin in Cochabamba Department (Valdesalici & Gil 2017, 2019).

Here, the first record of *Anablepsoides christinae* (Huber, 1992) from Bolivia is presented, based on material deposited at the Museo de Historia Natural Noel Kempff Mercado (MHNNKM), Santa Cruz Department. It is a species of the *A. limoncochae* complex belonging to clade β *sensu* Amorim & Costa (2022), that until now was thought to be endemic to the Madre de Dios river basin in the Peruvian Amazon (Ortega 2016).

MATERIALS AND METHODS

A set of five specimens (MNKP-4887) deposited in the ichthyological collection of the MHNNKM, and previously identified only to family level (Rivulidae), was examined. Two juveniles were excluded because of their small size (SL < 20 mm) and from the remaining specimens (two males and one female) morphological characteristics were reviewed, and morphometric and meristic values were recorded. Taxonomic identification was carried out following diagnostics for species of the *Anablepsoides limoncochae* complex (Huber 1992, Staeck 1994, Costa 2006, Valdesalici & Schindler 2011, 2013, Nielsen *et al*. 2016, Valdesalici & Gil 2017, 2019). Morphometric and meristic values were taken according to Costa (1995) and measurements were obtained with a digital Vernier caliper with ± 0,01 mm accuracy. For the nomenclature of the cephalic scale pattern, the proposal of Hoedeman (1958) was followed. The morphometric and meristic values obtained were compared with those indicated in the original description of *Anablepsoides christinae* (Huber, 1992). The nomenclature of hydrologic units (HU) using Pfafstetter classification is according to Lehner & Grill (2013)

and the names of water bodies and basins follow SUNIT (2007), when available. The geographical location of the collection locality was taken from the legal norm for the creation of the Madidi National Park and Integrated Management Natural Area (PNANMI Madidi; D.S. No. 24123 of September 1995).

Examined material: MNKP-4887, 5 ind., 2 males 33,5 – 41,3 mm SL, 1 female 40,1 mm SL & 2 juveniles < 20 mm SL; Bolivia, La Paz Department, Abel Iturralde Province, PNAMI [*sic*] Madidi, Campamento Alto Madidi, 25/VIII/2004, Col. I.

RESULTS

Anablepsoides christinae (Huber, 1992)

Body cylindrical fusiform, slightly compressed in posterior section; dorsal and ventral profile slightly convex from head to the insertion of dorsal and anal fins, respectively, from where it continues with concave curvature to the base of caudal fin; greatest body depth at posterior half between pectoral and ventral fins, greatest body width at the insertion of pectoral fins. Head wider than high; with obtuse snout and upper mouth; eyes forward and large. Unpaired and pectoral fins rounded; oval-shaped caudal fin; origin of dorsal fin above base of 8th to 9th anal fin rays. Scales large and cycloid, all over body and head, including ventral section of head and basal section of caudal fin, but absent at base of other fins; flank scales with contact organs at section between pectoral fins and just before dorsal fin origin; frontal cephalic scales E patterned.

Figure 1. *Anablepsoides christinae* (MNKP 4887). A) Male, 33,47 mm SL; B) Female, 40,07 mm SL. © Foto: H.A. Drawert

Coloration in alcohol of body in males pale brown background with six dark longitudinal stripes, thicker than interspaces at humeral section becoming narrower posteriorly and reducing to three stripes noticeably thinner than interspaces at caudal peduncle; dorsal section with less pale background and dark spots distributed asymmetrically on both flanks so that, in dorsal view, they form a zigzag pattern, but do not come together at dorsal profile line; anterior ventral section, from height of the insertion of pectoral fins to the base of ventral fins, with lighter background coloration and without dark markings. Head with snout and infra- and postorbital section darker, operculum with inferoposterior section paler than the rest of head and with dark opercular spot in the region of angulus superior. Paired fins whitish without dark markings; anal and dorsal fin with thin dark stripe on distal edge, also dorsal fin with slightly darker posterior basal section and dark longitudinal stripe at inferomedial section; caudal fin darker than the others, without conspicuous dark markings. Coloration in alcohol of female similar to males, but without longitudinal stripes on flanks and with characteristic peduncular spot between upper base of caudal fin and caudal peduncle; anal fin at posterior basal section with dark spots without pattern, dorsal fin with darker basal and distal section; and caudal fin with dark spots forming an incospicuous reticulate pattern in medial and dorsal sections.

The morphological characteristics described above are consistent with those indicated for *Anablepsoides christinae* and the values of morphometric measurements and meristic counts mostly overlap (Table 1). Likewise, the diagnostic characters established allow the identification of the revised specimens as belonging to the indicated species. According to label, the reviewed specimens (MNKP 4887) were collected in La Paz Department, Abel Iturralde Province, locality PNAMI [*sic*] Madidi "Campamento Alto Madidi". This collection locality data is corrected and complemented with the following: PNANMI Madidi, Campamento Alto Madidi (13°37'30" S, 68°45'00" W), 250 m of elevation; Beni river basin, Madidi river sub-basin (Pfaffstetter hydrologic unit 62266569).

FINAL CONSIDERATIONS

Seegers (1988), in the description of *Rivulus bolivianus*, a species synonymized with *Anablepsoides beniensis* by Costa (2006), mentions the presence in Bolivia of an undescribed species of the *A. limoncochae* complex. It is possible that this is the first reference to the presence of *A. christinae* in the country, although the species was only described by Huber in 1992; but it could be *A. chapare* or *A. bibosi* described more recently by Valdesalici & Gil (2017, 2019), or an as yet species undescribed.

The possible presence of a species of *Anablepsoides* in the Acre river basin (Pando department), cited as *Rivulus* aff. *christinae*, is mentioned by Valdesalici & Gil (2017). However, these authors indicate that the identity of the species needs to be confirmed by new collections as it is based on reports from an internet page and a specimen preserved in poor condition ("unfortunately faded") held in a private collection.

Table 1. Morphometric and meristic values of *Anablepsoides christinae*.

	MNKP 4887			Type material[1]	
	Male 1	Male 2	Female	Max	Min
Morphometric measures					
Standard length (mm)	41,3	33,47	40,07	61,4	-
	Percents of standard length				
Body depth	18,98	20,41	19,34	23	19
Caudal peduncle depth	14,87	15,06	17,64	-	-
Pre-dorsal length	78,21	75,11	75,87	83	79
Pre-pelvic length	50,27	50,13	49,14	55	53
Dorsal-fin base length	9,37	10,76	8,54	-	-
Anal-fin base length	19,69	17,63	15,47	-	-
Caudal-fin length	22,54	28,65	23,18	-	-
Pectoral-fin length	17,48	17,15	14,13	21,5	20
Pelvic-fin length	8,86	8,37	5,17	-	-
Head length	23,41	26,44	24,88	29	26
	Percents of head length				
Head depth	64,12	55,37	57,17	-	-
Head width	76,22	69,38	73,02	-	-
Snout length	33,82	35,25	30,79	-	-
Eye diameter	37,85	37,97	37,41	-	-
Meristic counts					
	Number of scales				
Longitudinal series	41	42	44	41	38
Transverse series	10	11	10	10,1[2]	9,5
Circumpeduncular rows	21	20	20	-	-
	Number of rays				
Pectoral fin	14	15	14	-	-
Pelvic fin	7	8	6	-	-
Dorsal fin	7	8	8	9	7
Anal fin	13	13	11	14	13
Caudal fin	23	22	23	-	-

1: Values from Huber (1992), except 2: from Huber (1999).

Consequently, these references are insufficient to confirm the presence of *A. christinae* or another species of the genus in addition to the three so far recorded from Bolivia, since in none of the cases is there any reference to voucher specimens. The present publication, at least partially, fills these information gaps by confirming the record of *A. christinae* based on the examination of valid voucher specimens. The possibility of the presence of other species of the genus in Bolivian territory, mainly in the Acre river basin, cannot ruled out.

Type specimens of *Anablepsoides christinae* were collected at Lake Tupac Amaru, upper Madre de Dios river basin, near Puerto Maldonado in Tambopata Province of Madre de Dios Department, Peru (Huber 1992). Other localities of occurrence reported by Staeck (1994), Valdesalici & Schindler (2011) and Ortega (2016) are also in the upper Madre de Dios river basin (HU 622664), always at 200 to 250 m above sea level. The specimens from Bolivia, were collected at the same altitude (250 m above sea level according to Google Earth and ESRI World Topo) but in the upper basin of the Beni river (HU 622665) near the "Campamento Alto Madidi". This locality is on the Madidi river less than 15 km in straight line from the watershed between the Madre de Dios and Beni river basins (Figure 2). Although both basins converge near Riberalta in the north of Beni Department, Bolivia, more than 400 km in a straight line downstream, the presence of *A. christinae* in the upper basin of the Beni river can be explained by the amphibious lifestyle of the members of this genus (Turko & Wright 2015, Livingston *et al*. 2018, Espírito-Santo *et al*. 2019) that allows them to cross watersheds dividing uplands. In addition, confirmation of the presence of *A. christinae* in the Beni river basin extends the known distribution range to the species to this basin, which implies the potential extension of its range, particularly in Bolivia.

The description of *Anablepsoides christinae* does not include values for all morphometric and meristic characters proposed by Costa (1995), as not all values are known for female individuals. The specimens examined for this work show slightly lower values in morphometric measurements, compared with the values presented by Huber (1992, 1999), possibly due to their smaller size and less advanced ontogenetic stage. On the other hand, all meristic counts coincide with those indicated for *A. christinae*; except one specimen examined has an additional scale in the longitudinal series, compared to the maximum value indicated by Huber (1992).

ACKNOWLEDGEMENTS

We are grateful to Luzmila Arroyo, Kathia Rivero, Karina Osinaga, and other colleagues at the MHNNKM, and especially to Carlos Ergueta, for their constant support. We also want to thank Sebastián Serra, Thomas Litz and Wolfgang Staeck for sharing information with us, without their support this paper would had significant gaps. Furthermore, we would like to express our gratitude to “the guys” of the Killifish Foundation for their encouragement and support.

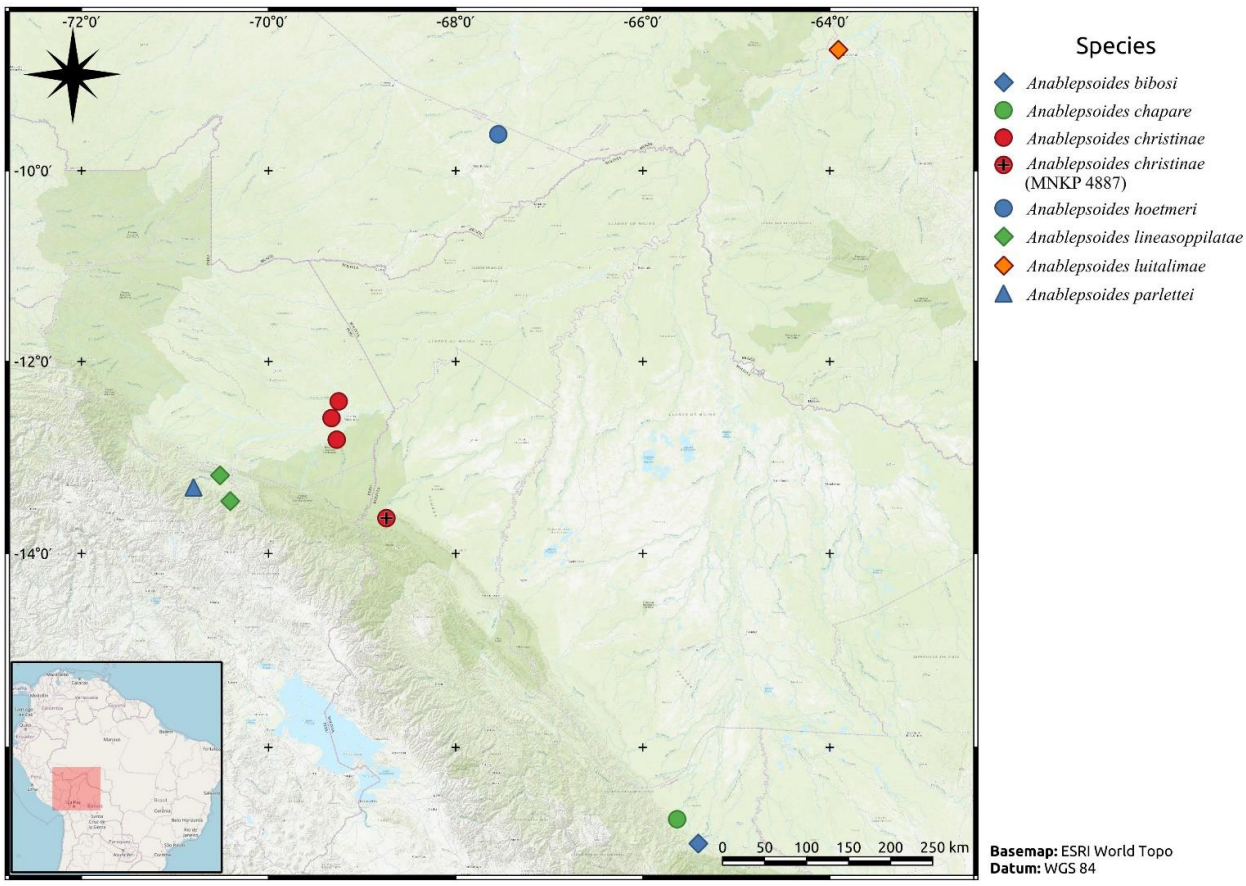

Figure 2. Occurrence localities of species of the *Anablepsoides limoncochae* complex in the southwest Amazon basin (Sources: Huber 1992, Staeck 1994, Valdesalici & Schindler 2011, 2013, Nielsen *et al*. 2016, Valdesalici & Gil 2017, 2019)

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Manuscrito recibido en agosto 2022
Manejado por Erika Cuéllar
Aceptado en febrero de 2023