Check List the journal of biodiversity data

NOTES ON GEOGRAPHIC DISTRIBUTION

Check List 14 (2): 387–392
https://doi.org/10.15560/14.2.387

PENSOFT

Expanding the geographical distribution of *Astyanax biotae* Castro & Vari, 2004 (Characiformes, Characidae), with comments on its conservation status

Carlos Alexandre Miranda Oliveira,[1] Anielly Galego de Oliveira,[1] Carla Simone Pavanelli[2]

1 Universidade Estadual de Maringá, Programa de Pós-Graduação em Ecologia de Ambientes Aquáticos Continentais, Av. Colombo, 5790, 87020-900 Maringá, PR, Brazil. **2** Universidade Estadual de Maringá, Departamento de Biologia, Programa de Pós-Graduação em Ecologia de Ambientes Aquáticos Continentais, Núcleo de Pesquisas em Limnologia, Ictiologia e Aquicultura (Nupélia), Av. Colombo, 5790, 87020-900 Maringá, PR, Brazil.
Corresponding author: Carlos Alexandre Miranda Oliveira, carlos.oliveira.itape@gmail.com.

Abstract

Astyanax biotae Castro & Vari, 2004 was only known from the type locality, a first-order stream from the lower Paranapanema River, a left bank tributary from the upper Paraná river basin. We report *A. biotae* from the Ivinhema River, rio do Peixe and other tributaries of Paranapanema River, expanding its distribution to both margins of the Paraná River. *Astyanax biotae* is zooplanktivorous and regarding its conservation status, can be classified as Least Concern.

Key words

Neotropics; Ivinhema River; rio do Peixe; Paranapanema River; South America.

Academic editor: Mariangeles Arce Hernandez | Received 20 July 2017 | Accepted 16 December 2017 | Published 23 March 2018

Citation: Oliveira CAM, de Oliveira AG, Pavanelli CS (2018) Expanding the geographical distribution of *Astyanax biotae* Castro & Vari, 2004 (Characiformes, Characidae), with comments on its conservation status. Check List 14 (2): 387–392. https://doi.org/10.15560/14.2.387

Introduction

The upper Paraná river basin, which comprises the region upstream of Itaipu Reservoir (Agostinho and Júlio Jr 1999, Graça and Pavanelli 2007), represents one of the best sampled rivers in Brazil (Castro et al. 2005, Graça and Pavanelli 2007, Langeani et al. 2007).

Among the hundreds of fish species that inhabit the upper Paraná River, there are 7 species of *Astyanax* Baird & Girard, 1854 (Lima et al. 2003, Graça and Pavanelli 2007, Langeani et al. 2007, Vari and Castro 2007, Garutti and Langeani 2009, Lucena and Soares 2016). *Astyanax* is one of the most diverse genera in the Characidae (Schmitter-Soto 2017). The genus is widely distributed in the Neotropics (Casciotta et al. 2005) and does not form a monophyletic clade (Mirande 2010, Rossini et al. 2016). The most encompassing taxonomic revision of *Astyanax* was made by Eigenmann (1910, 1917, 1921, 1927) who proposed the current definition of the genus. Following Eigenmann (1921), the genus is diagnosed by a combination of characters: 2 rows of premaxillary teeth, 5 teeth in the inner premaxillary series, lateral line complete, adipose fin present and caudal fin naked.

Astyanax biotae Castro & Vari, 2004 (Fig. 1) was described from a single locality, a first-order stream situated about 2.5 km from the mouth of the Paranapanema River, left bank of upper Paraná River. Thirteen years after its description, *A. biotae* is still only known from its type locality. The examination of *Astyanax* samples deposited at the DZSJRP (Departamento de Zoologia e

Figure 1. *Astyanax biotae*. **A.** MZUSP 79807, paratype, 42.5 mm SL, Paraná state, municipality of Diamante do Norte, córrego Água Mole, affluent of Paranapanema River, 22°38′31″ S, 052°48′59″ W. **B.** MZUEL 4529, topotype, 55.0 mm SL. **C.** NUP 15137, 44.1 mm SL, Mato Grosso do Sul state, municipality of Jateí, Peroba creek, affluent of Ivinhema River, 22°54′54″ S, 053°39′07″ W.

Table 1. Morphological data of *Astyanax biotae*. OD = original description, data from Castro and Vari (2004). Paratypes = 14; Topotypes = 7; New localities = 28 specimens analyzed.

Characters	OD	Paratypes	Topotypes	New localities
	Min–Max	Min–Max	Min–Max	Min–Max
Standard length (mm)	31.2–52.5	35.5–44.8	40.2–55.0	30.5–44.1
Morphometric				
Percentages of Standard Length				
Predorsal distance	50.4–56.9	50.7–52.7	50.1–54.2	50.5–56.5
Prepelvic distance	45.7–49.8	46.1–49.3	45.1–47.9	45.2–49.2
Prepectoral distance		27.7–28.8	26.8–28.5	26.8–30.6
Preanal distance	61.4–66.8	61.4–65.5	61.9–64.8	60.9–65.3
Body depth	34.7–41.8	35.2–41.1	35.4–41.3	35.1–41.9
Caudal peduncle depth	10.9–13.7	11.5–13.1	12.4–13.8	10.7–12.5
Caudal peduncle length	9.4–12.8	11.4–13.8	11.6–13.8	9.8–13.6
Dorsal-fin length	26.8–30.8	28.2–29.9	26.0–30.8	26.5–31.8
Pelvic-fin length	16.0–19.2	17.3–19.7	16.2–18.6	16.8–19.1
Pectoral-fin length	19.2–24.4	21.8–24.9	21.4–23.1	19.6–24.9
Anal-fin length		18.4–23.7	17.2–21.4	20.3–23.7
Length of anal–fin base	29.1–39.6	31.7–36.9	33.2–35.3	30.7–36.3
Head length	25.4–28.7	26.1–28.2	25.9–27.1	26.8–28.9
Distance from eye to dorsal fin		38.9–42.5	39.0–43.0	37.8–43.9
Distance from pectoral–fin origin to pelvic–fin origin		17.1–21.4	17.3–22.3	18.2–22.6
Distance from pelvic– to anal–fin origins		16.3–19.4	15.2–18.6	15.1–18.8
Percentages of Head Length				
Snout length	23.5–29.3	23.9–25.3	22.2–27.2	22.3–26.8
Upper jaw length		39.8–46.4	39.2–46.6	39.7–44.8
Orbital diameter	31.9–40.0	38.1–41.6	33.5–36.9	35.5–41.4
Interorbital distance	34.8–40.9	35.0–40.1	35.8–41.7	35.5–40.5
Meristic				
Humeral spots	2	2	2	2
Teeth of external series/maxilla	4/1	4–5/1–2	3–4/1	3–5/1–2
Dentary massive teeth	4	4–5	4–5	4–5
Symphyseal tooth cusps	4	4–5	4–5	4–5
2nd and 3rd teeth cusps of internal series	5	4–5	4–5	4–5
Maxilla cusps	3–5	3–5	3–5	3–5
Lateral line scales	32–35	32–35	33–35	32–35
Series of scales above/under lateral line	6–7/4–5	6–7/4–5	6–7/5	6–7/5
Predorsal scales	10–14	10–12	10–11	10–13
Circumpeduncular scales	13–15	13–14	12–14	13–15
Scales covering base of anal fin		10–14	9–15	9–18
Dorsal-fin rays	ii, 9	ii, 9	ii, 9	ii. 9
Pectoral-fin rays	i, 10–12	i, 10–12	i, 11–12	i. 11–13
Pelvic-fin rays	i, 6–7	i, 6–7	i, 7	i. 6–7
Anal-fin rays	ii–iv, 22–26	iii–iv, 22–26	iii–iv, 22–26	iii–v. 21–26
Gill-rakers on upper/lower branch	6/11	6–8/10–11	6–7/10–12	6–8/10–12
Color				
Humeral spots	Vertical	Vertical	Vertical	Vertical
Lateral body stripe	Inconspicuous	Inconspicuous	Inconspicuous	Inconspicuous

Botânica da Universidade Júlio de Mesquita Filho, São José do Rio Preto, Brazil) and NUP (Coleção Ictiológica do Núcleo de Pesquisas em Limnologia, Ictiologia e Aquicultura, Maringá, Brazil) fish collections previously identified as *Astyanax* sp. resulted in the first record of *A. biotae* in additional tributaries of right and left banks of the rio Paraná.

Methods

Counts and measurements were taken following Fink and Weitzman (1974) and Menezes and Weitzman (1990), except for number of scales series below the lateral line, which follows Bertaco and Lucena (2006). Additional measurements include: (1) the distance from pectoral- to pelvic-fin origins; (2) the distance from pelvic- to anal-fin origins. Measurements were taken point-to-point using a digital caliper to the nearest 0.1 mm, on the left side of the fish. All measurements are expressed as percentages of SL, except those subunits of the head, which are expressed as percentages of head length (HL). In Table 1, proportions were rounded to 0.1%.

The comparative diagnosis for the following species

was based on the morphological data taken from literature: *Astyanax aramburui* Protogino, Miquelarena & Lopes, 2006, *A. latens* Mirande, Aguilera & Azpelicueta, 2004, *A. tupi* Azpelicueta, Mirande, Almirón & Casciotta, 2003 and *A. saguazu* Casciotta, Almirón & Azpelicueta, 2003 (from their original descriptions); *A. correntinus* (Holmberg, 1891) and *A. pelegrini* Eigenmann, 1907 (from Mirande et al. 2006); *A. erythropterus* (Holmberg, 1891) (from Soneira et al. 2010); *A. stenohalinus* Messner, 1962 (from Almirón et al. 2010).

Abbreviations of ichthyological collections are: DZSJRP (Departamento de Zoologia e Botânica, São Paulo State University, São José do Rio Preto, São Paulo, Brazil); MZUEL (Museu de Zoologia, Universidade Estadual de Londrina, Londrina, Brazil); MZUSP (Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil); NUP, and USNM (National Museum of Natural History, Smithsonian Institution, Washington, DC, USA).

Stomachs of 10 *A. biotae* were analyzed by the volumetric method (Hyslop 1980). The identification of the organisms was done under a stereoscopic microscope, and with the help of literature for the lowest possible taxonomic level.

Results

Materials examined. Brazil, upper Paraná River drainage.

Type specimens: MZUSP 79807, 4 of 10, 35.5–44.8 mm SL, Paraná state, municipality of Diamante do Norte, córrego Água Mole, tributary of Paranapanema River, 22°38′31″ S, 052°48′59″ W, 7 Aug. 2000, R.M.C. Castro et al. USNM 373492, 10 of 15, 43.8–52.0 mm SL, same data.

Topotypes: MZUEL 4529, 7 of 23, 40.2–55.0 mm SL, 11 Dec 2008, F.C. Jerep, E.S. Silva & A. Souza.

New localities: DZSJRP 7510, 5 of 18, 30.5–38.1 mm SL, Mato-Grosso do Sul state, municipality of Angélica, córrego da Égua, tributary of Ivinhema River, 22°10′30″ S, 053°50′10″ W, 22 Apr. 2005, H.F. Chaves & L.G.G. Silveira. DZSJRP 13285, 6 of 7, 21.0–39.5 mm SL, São Paulo state, municipality of Planalto do Sul, stream tributary of Córrego da Lagoa next the urban perimeter, tributary of Paraná River, 22°18′05″ S, 52°14′05″ W, 30 Oct. 2011, A.R. Manzotti & G.H. Baviera. DZSJRP 14336, 5 of 5, 33.6–38.0 mm SL, São Paulo state, municipality of Planalto do Sul, stream tributary of Córrego da Lagoa next the urban perimeter, tributary of Paraná River, 22°18′06″ S, 52°14′16″ W, 30 Oct. 2011, A.R. Manzotti & G.H. Baviera. DZSJRP 14384, 1 of 1, 27.7 mm SL, São Paulo state, municipality of Estrela do Norte, stream Água da Divisa at Alvorada farm, tributary of Rebojo stream, rio Paranapanema sub-basin, 22°33′33″ S, 51°43′09″ W, 25 Sept. 2011, A.R. Manzotti & G.H. Baviera. DZSJRP 16455, 1 of 1, 34.3 mm SL, São Paulo state, municipality of Dracena, Prado stream, rio do Peixe sub-basin, 21°38′59″ S, 51°32′36″ W, M. Tassoni Filho, 14 Dec. 2011. NUP 15137, 10 of 18, 35.6–44.1 mm SL, Mato Grosso do Sul state, municipality of Jateí, Peroba creek at Parque Estadual das Várzeas do Rio Ivinhema (PEVRI), affluent of rio Ivinhema, 22°54′54″ S, 53°39′07″ W, 15 Nov. 2012, A.G. Oliveira.

Identification. *Astyanax biotae* (Table 1) differs from all congeners inhabiting La Plata River basin, except *A. latens* (Bermejo River); *A. aramburui*, *A. correntinus*, *A. erythropterus*, *A. pelegrini* and *A. tupi* (lower Paraná–Paraguay River); *A. stenohalinus* and *A. saguazu* (Uruguay River) by having the terminus of the dorsal-fin base situated along the vertical through branched anal-fin rays (vs through unbranched anal-fin rays or anterior to anal-fin origin). *Astyanax biotae*, by having 32–35 lateral line scales, differs from *A. aramburui* (vs 38–42), *A. correntinus* (vs 39–42), *A. erythropterus* (vs 49–54), *A. latens* (vs 37–38), *A. pelegrini* (vs 46–52), *A. saguazu* (vs 37–39) and *A. stenohalinus* (vs 37–39). From *A. tupi*, it differs by having 17–21 gill-rakers (vs 24–25). *Astyanax biotae* is not assigned to any *Astyanax* species complex currently recognized for the genus. The following characters distinguish *A. biotae* from *Astyanax* species complexes: presence of a vertically elongate black humeral blotch (vs humeral blotch horizontally elongate, oval-shaped in *A. bimaculatus* species complex, see Garutti and Langeani 2009); presence of 22–26 anal-fin rays (vs 25 or more in *A. fasciatus* species complex, see Melo and Buckup 2006 and vs 13 to 23 in *A. scabripinnis* species complex, see Bertaco and Lucena 2006).

Discussion

The discovery of *A. biotae* in 2004 was a result of the extensive fauna study implemented by the Program BIOTA/FAPESP through the thematic project "Fish diversity of the headwaters and streams of the upper Paraná river system in the state of São Paulo, Brazil". Castro and Vari (2004) described *A. biotae* solely based on material from the lower Paranapanema River, its type locality. The type locality of *A. biotae* is a first order creek surrounded by a narrow area of native vegetation. For that reason, Castro and Vari (2004) suggested that the species may be at risk of extinction since the area was threatened by several anthropogenic activities (e.g. deforestation, extensive use of fertilizers and pesticides in agricultural practices). Here we report that *A. biotae* also occurs in São Paulo state (rio do Peixe basin, and tributaries of lower Paranapanema River and Paraná River, all left bank of upper Paraná River) and Mato Grosso do Sul state (Ivinhema River basin, right bank of upper Paraná River) (Fig. 2).

Even though the known geographic distribution of *A. biotae* is still restricted to a relatively small area in the upper Paraná drainage and most sites are threatened by anthropogenic activities, no threats were detected in rio Ivinhema at Parque Estadual das Várzeas do Rio Ivinhema (PEVRI) (Fig. 3). Therefore, *A. biotae* can be classified as Least Concern, according to the International Union for Conservation of Nature criteria (IUCN 2017).

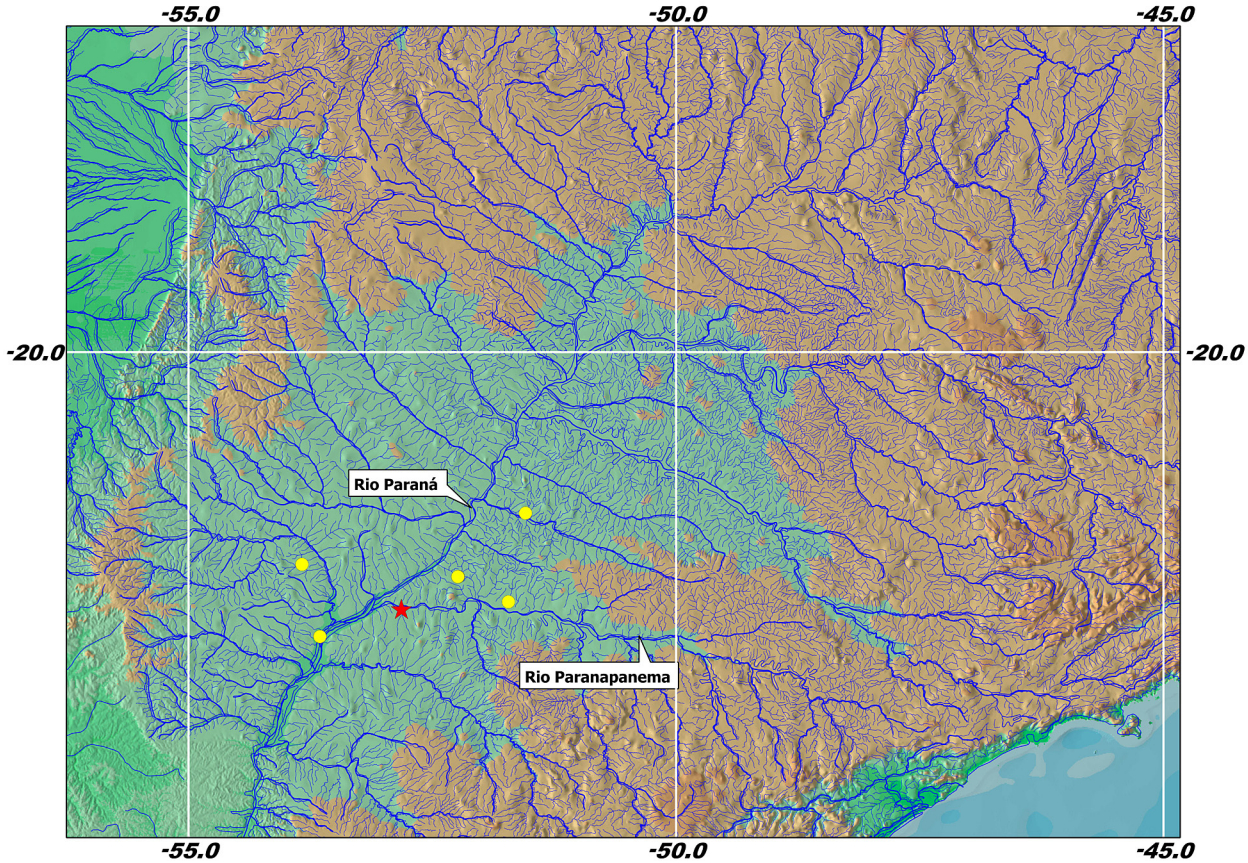

Figure 2. Map of Central Brazil showing the records of *Astyanax biotae*. Red star indicates the type locality and yellow dots new records for the species.

Figure 3. Brazil, Mato Grosso do Sul state, municipality of Jateí, Peroba creek at Parque Estadual das Várzeas do Rio Ivinhema (PEVRI), affluent of Ivinhema River, 22°54′54″ S, 053°39′07″ W, locality of collection of *Astyanax biotae*.

The feeding habits for the specimens from rio Ivinhema were also determined. *Astyanax biotae* can be considered zooplanktivorous, as more than 80% of its diet was composed by microcrustaceans, mainly Copepoda. The other items consumed were chironomid larvae, ephemeropteran naiads, and fruits.

Acknowledgements

We are grateful to Gabriel Deprá (Universidade Estadual de Maringá, UEM) for taking all the pictures and Francisco Langeani (DZSJRP), Fernando Jerep, José Birindeli, and Oscar Shibatta (MZUEL), Alessio Datovo, Mario de Pinna, and Osvaldo Oyakawa (MZUSP), Jeff Clayton, Lynne Parenti, Sandra Raredon, and Richard Vari (USNM), for assistance during visits to their institutions or for loaning material used in this study. The Núcleo de Pesquisas em Limnologia, Ictiologia e Aquicultura (Nupélia) of the Universidade Estadual de Maringá (UEM) provided logistical support. This work is part of the first author's (CAMO) post-doctorate supported by CAPES scholarship. AGO is supported by CAPES-PROEX. CSP author has been supported by grants from the CNPq (Process # 308946/2012-0).

Authors' Contributions

CAMO and CSP made the taxonomic study, AGO made the diet and reproductive analyzes and CAMO wrote the text.

References

Agostinho AA, Júlio Jr HF (1999) Peixes da bacia do Alto rio Paraná. In: Lowe-McConnell RH (Ed.) Estudos ecológicos de comunidades de peixes tropicais, EDUSP, São Paulo, 374–400.

Almirón AE, Casciotta JR, Azpelicueta MM, Loureiro M (2010) Redescription of *Astyanax stenohalinus* Messner, 1962 (Characiformes: Characidae), a poorly known species from Argentina and Uruguay. Zootaxa 2434: 60–68.

Azpelicueta MM, Mirande JM, Almirón AE, Casciotta JR (2003) A new species of *Astyanax* (Characiformes, Characidae) from Paraná River basin in Argentina. Revista del Museo de La Plata 15 (166): 1–12.

Bertaco VA, Lucena CAS (2006) Two new species of *Astyanax* (Ostariophysi: Characiformes: Characidae) from eastern Brazil, with a synopsis of the *Astyanax scabripinnis* species complex. Neotropical Ichthyology 4 (1): 53–60. https://doi.org/10.1590/S1679-62252006000100004

Casciotta JR, Almirón AE, Azpelicueta MM (2005) *Astyanax pampa* (Characiformes, Characidae), a new species from the southernmost boundary of the Brazilian subregion, Argentina. Revue suisse de Zoologie 112 (2): 401–408.

Castro RMC, Vari RP (2004) *Astyanax biotae*, a new species of stream fish from the rio Paranapanema basin, upper rio Paraná system, southeastern Brazil (Ostariophysi: Characiformes: Characidae). Proceedings of the Biological Society of Washington 117: 330–338.

Casciotta JR, Almirón AE, Azpelicueta MM (2003) A new species of *Astyanax* from río Uruguay basin, Argentina (Characiformes: Characidae). Ichthyological Exploration of Freshwaters 14 (4): 329–334.

Castro RMC, Casatti L, Santos HF, Vari RP, Melo ALA, Martins LSF, Abreu TX, Benine RC, Gibran FZ, Ribeiro AC, Bockmann FA, Carvalho M, Pelição GZ, Ferreira KM, Stopiglia R, Akama A (2005) Structure and composition of the stream ichthyofauna of four tributary rivers of the upper rio Paraná basin, Brazil. Ichthyological Explorations of Freshwaters 16 (3): 193–214.

Eigenmann CH (1910) Catalogue of fresh-water fishes of tropical and south temperate America. Reports of the Princeton University Expedition to Patagonia 1896–1899 3 (4): 375–511.

Eigenmann CH (1917) The American Characidae. Part 1. Memoirs of Museum of Comparative Zoology 43: 1–102, 16 pls.

Eigenmann CH (1921) The American Characidae. Part 3. Memoirs of the Museum of Comparative Zoology, 43: 208–310, 28 pls.

Eigenmann CH (1927) The American Characidae. Part 4. Memoirs of the Museum of Comparative Zoology, 43: 311–428, 24 pls.

Fink WL, Weitzman SH (1974) The so-called cheirodont in fishes of Central America with description of two new species (Pisces, Characidae). Smithsonian Contributions to Zoology 172: 1–46. https://doi.org/10.5479/si.00810282.172

Garutti V, Langeani F (2009) Redescription of *Astyanax goyacensis* Eigenmann, 1908 (Ostariophysi: Characiformes: Characidae). Neotropical Ichthyology 7: 371–376. https://doi.org/10.1590/S1679-62252009000300003h

Graça, WJ, Pavanelli CS (2007) Peixes da Planície de Inundação do Alto Rio Paraná e Áreas Adjacentes. EDUEM, Maringá, 241 pp.

Hyslop EJ (1980) Stomach contents analysis–a review of methods and their application. Journal of Fish Biology 17: 411–429. https://doi.org/10.1111/j.1095-8649.1980.tb02775.x

IUCN Standards and Petitions Subcommittee (2017) Guidelines for using the IUCN Red List Categories and Criteria. Version 13, updated March 2017. IUCN Standards and Petitions Subcommittee. http://cmsdocs.s3.amazonaws.com/RedListGuidelines.pdf. Accessed on: 2017-9-19.

Langeani F, Castro RMC, Oyakawa OT, Shibatta OA, Pavanelli CS, Casatti L (2007) Diversidade da ictiofauna do alto rio Paraná: composição atual e perspectivas futuras. Biota Neotropica 7 (3): 1–17. https://doi.org/10.1590/S1676-06032007000300020

Lima FCT, Malabarba LR, Buckup PA, Pezzi da Silva JF, Vari RP, Harold A, Benine R, Oyakawa OT, Pavanelli CS, Menezes NA, Lucena CAS, Malabarba MCSL, Lucena ZMS, Reis RE, Langeani F, Casatti L, Bertaco VA, Moreira C., Lucinda PHF (2003) Genera Incertae Sedis in Characidae. In: Reis, RE, Kullander SO, Ferraris Jr CJ (Eds) Check List of the Freshwater Fishes of South and Central America. EDIPUCRS, Porto Alegre, 106–169.

Lucena CAS, Soares HG (2016) Review of species of the *Astyanax bimaculatus* "caudal peduncle spot" subgroup sensu Garutti & Langeani (Characiformes, Characidae) from the rio La Plata and rio São Francisco drainages and coastal systems of southern Brazil and Uruguay. Zootaxa 4072 (1): 101–125. https://doi.org/10.11646/zootaxa.4072.1.5h

Melo FAG, Buckup PA (2006) *Astyanax henseli*, a new name for *Tetragonopterus aeneus* Hensel, 1870 from southern Brazil (Teleostei: Characiformes). Neotropical Ichthyology 4(1): 45–52. http://doi.org/10.1590/S1679-62252006000100003h

Menezes NA, Weitzman SH (1990) Two new species of *Mimagoniates* (Teleostei: Characidae: Glandulocaudinae), their phylogeny and biogeography and a key to the glandulocaudin fishes of Brazil and Paraguay. Proceedings of the Biological Society of Washington 103: 380–426.

Mirande JM (2010) Phylogeny of the family Characidae (Teleostei: Characiformes): from characters to taxonomy. Neotropical Ichthyology 8 (3): 385–568. http://doi.org/10.1590/S1679-62252010000300001

Mirande JM, Aguilera G, Azpelicueta MM (2004) A new species of *Astyanax* (Characiformes, Characidae) from the upper río Bermejo basin, Salta, Argentina. Revue Suisse de Zoologie 111(1): 213–223. https://doi.org/10.5962/bhl.part.80235

Mirande JM, Azpelicueta MM, Aguilera G (2006) Redescription of *Astyanax correntinus* (Holmberg, 1891) (Teleostei: Characiformes: Characidae), more than one hundred years from original description. Zoologische Abhandlungen 55: 9–15.

Protogino LC, Miquelarena AM, López H (2006) A new species of *Astyanax* (Teleostei, Characiformes, Characidae), with breeding tubercles, from the Paraná and Uruguay river basins. Zootaxa 1297: 1–16.

Rossini BC, Oliveira CAM, Melo FAG, Bertaco VA, Astarloa JMD, Rosso JJ, Foresti F, Oliveira C (2016) Highlighting *Astyanax* Species Diversity through DNA Barcoding. PloS ONE 11 (12): 1–20. https://doi.org/10.1590/S1679-62252009000400003h

Schmitter-Soto JJ (2017) A revision of *Astyanax* (Characiformes: Characidae) in Central and North America, with the description of nine new species. Journal of Natural History 51: 1331–1424. https://doi.org/10.1080/00222933.2017.1324050h

Soneira P, Casciotta JR, Almirón AE, Ciotek L, Giorgis P (2010) Redescription of *Astyanax erythropterus* (Holmberg, 1891) (Teleostei: Characiformes: Characidae) from La Plata basin in Argentina. Neotropical Ichthyology 8 (4): 779–785. https://doi.org/10.1590/S1679-62252010005000009

Vari RP, Castro RMC (2007) New species of *Astyanax* (Ostariophysi: Characiformes: Characidae) from the upper rio Parana system, Brazil. Copeia 2007 (1): 150–162. https://doi.org/10.1643/0045--8511(2007)7[150:NSOAOC]2.0.CO;2