

Taxonomic problems with the type material of *Heros autochthon* Günther, 1862 (Teleostei: Cichlidae)

Felipe Polivanov Ottoni¹ & Pedro Henrique Negreiros Bragança²

¹ Laboratório de Sistemática e Ecologia de Organismos Aquáticos, Centro de Ciências Agrárias e Ambientais, Universidade Federal do Maranhão. Campus de Chapadinha, BR-222, KM 04, S/N, Boa Vista, CEP 65500-000, Chapadinha, MA, Brazil. fpottoni@gmail.com

² South African Institute for Aquatic Biodiversity, Private Bag 1015, 6140 Grahamstown, South Africa. p.braganca@saiab.ac.za, pedrobra88@gmail.com

Abstract

Herein we provide detailed information from the Lectotype and Paralectotypes of *Heros autochthon*, and notice that is not possible to link this name to any putative *Australoheros* species, due to: the poor condition of the type material preservation, confusions related to the material storage, the little informative original description, and inaccurate data related to its type locality. Thus, after a careful investigation of the types, information present in the original description, information obtained from the BMNH fish curator, and comparison of this data with valid species of *Australoheros*, *Heros autochthon* should be considered a 'nomen dubium'. Our conclusions are based on the following reasons: i) the imprecise type locality (Brazil); ii) the original description little informative, not allowing distinguishing it from several species of *Australoheros*; iii) the colouration pattern of the specimens is faded, confirming information present in the original description, not being able to access this valuable source of information, especially for the taxonomy of *Australoheros*; and iv) it is not possible to distinguish *H. autochthon* from several species of *Australoheros*, based on the examination of its type series. At last, but not less relevant, is the lack of knowledge, and the many doubts and confusion related to the type series of *Heros autochthon*, such as: the possibility that the type series is mixed, given that the types were placed in two different jars; there are inconsistencies in the label; and distinct conditions of the preserved specimens are clearly seen. The difference in the preserved colouration information between types, as well as the impossibility of obtaining internal morphology information of the Lectotype through radiographs, supports the hypothesis that the type series may have been collected separately, and fixed in distinct preservative solutions.

keywords: *Australoheros*, Cichlinae, Heroini, 'nomen dubium', taxonomy

Resumo

Aqui fornecemos informações detalhadas do Lectótipo e Paralectótipos de *Heros autochthon*, e notamos que não é possível vincular esse nome a nenhuma espécie de *Australoheros* devido a: má condição de preservação do material tipo, confusões relacionadas ao armazenamento do material, a descrição original pouco informativa, e dados imprecisos relacionados à sua localidade de tipo. Assim, após uma cuidadosa investigação dos tipos, informações presentes na descrição original, informações obtidas com o curador de peixes do BMNH e comparação desses dados com espécies válidas de *Australoheros*, *Heros autochthon* deveria ser considerado um 'nomen dubium'. Nossas conclusões são baseadas nas seguintes razões: i) a localidade do tipo imprecisa (Brasil); ii) a descrição original é pouco informativa, não permitindo distinguir a espécie de muitas espécies de *Australoheros*; iii) o padrão de colorido dos exemplares está desbotado, confirmando a informação presente na descrição original, não permitindo o acesso a fontes valiosas de informação, especialmente para a taxonomia de *Australoheros*; e iv) não é possível distinguir *H. autochthon* de muitas das espécies de *Australoheros*, com base no exame da série tipo. Por fim, mas não menos relevante, é a falta de conhecimento e as muitas dúvidas e confusões relacionadas à série de tipo de *Heros autochthon*, tais como: a possibilidade de que a série tipo tenha sido misturada, já que os tipos foram alocados em dois frascos diferentes; existem inconsistências no rótulo; e a condições distinta de preservação dos exemplares é claramente observável. A diferença nas informações relacionadas a coloração preservada entre os tipos e a impossibilidade de se obter informações morfológicas internas do

Lectótipo, por meio de radiografias, suporta a hipótese de que a série tipo pode ter sido coletada separadamente, e fixada em soluções distintas de preservação.

palavras-chave: *Australoheros*, Cichlinae, Heroini, 'nomen dubium', taxonomia.

Introduction

Heros autochthon Günther, 1862 is a cichlid species described from "Brazil", based on four specimens, named a, b, c, and d in the original description, "presented" by Lord Stuart, without any additional information on its type locality and collector (Günther 1862; Říčan & Kullander 2003; Ottoni 2012). According to Říčan & Kullander (2003, p. 800):

"*Heros autochthon* was described by Günther (1862: 299) on the basis of four specimens from "Brazil," presented by Lord Stuart (apparently Charles Stuart (1779–1845), Ambassador to Brazil in 1825-1826), and it is most likely from Rio de Janeiro [city of Rio de Janeiro]".

There is, however, no strong and convincing evidence to consider the city of Rio de Janeiro as the type locality of this species. Considering that Brazil is a country of continental dimensions, any deduction that the type locality is in the city of Rio de Janeiro that is not based on a detailed itinerary or historical documents of Stuart's stay in Brazil should be taken as speculation without strong and convincing evidence. In addition, there is no evidence that Lord Stuart collected the material, but "presented" it. As a result, there is no precise information about the possible collector, and the material may have simply been collected by someone else, who donated the material to Lord Stuart. Therefore, the type material may have been collected anywhere in Brazil, or even in more than one location, and the City of Rio de Janeiro would be just the port from where the material was sent to Europe.

Kullander (2003) and Říčan & Kullander (2003, 2008), considered *H. autochthon* a synonym of *Australoheros facetus* (Jenyns, 1842) without examining the type specimens (figs. 1, 2, 3), and relying only on the original description which is incomplete and imprecise. It is important to emphasize that according to Kullander (2003, p. 623) the type material of *Heros autochthon* consists of four uncatalogued specimens from the Natural History Museum, London (BMNH), with type locality 'Brazil':

"*Heros autochthon* Günther, 1862: 299. Type locality: Brazil. Syntypes: (4)
?BMNH uncat. (1)."

The types, however, were only located, photographed and made available in the museum database in 2010 by the request of the first author of this paper. Radiographs, however, were not available at that time. Therefore, all the conclusions of Ottoni (2012) regarding *H. autochthon* relied only on external morphology, especially on colouration features. Ottoni (2012) considered *Heros autochthon* as not belonging to the genus *Australoheros* Říčan & Kullander, 2006 since the specimen with the better preserved colour pattern, which was designated Lectotype (BMNH 1961.7.7.6, fig. 1) in this same paper, apparently did not exhibit the interruptions in the mid-dorsal portion of trunk bars 6-7, which is one of the main diagnostic features of the genus (see Říčan & Kullander 2006; Ottoni 2012). Recently, Říčan et al. (2016) challenged Ottoni (2012) and considered *Heros autochthon* not only a member of *Australoheros*, but a valid species (*A. autochthon*) without presenting any justification.

This paper aims to evaluate the effectiveness of the information present in the original description of *Heros autochthon*, as well as the information obtained from the examination of the type material, including internal anatomy, that could only be accessed for the first time in the present study, allowing a more accurate taxonomic identification of this nominal taxon by its existing name-bearing type. To accomplish this, the present paper examined: the type material of *Heros autochthon*, its original description, literature information, and comparative material.

Material and Methods

Morphological inspection (colour pattern, general external morphology, meristics including both internal and external anatomy features) follow Ottoni (2018). Fin spines and rays counts, as well as, internal meristics were taken from radiographed specimens, except by these counts for the Lectotype, which were taken directly from the specimen. Unfortunately, probably due to negative effects of fixation and long-term preservation, X-rays images from the Lectotype could not reveal bone structures (see discussion).

The type series of *Heros autochthon* examined here is housed at the Natural History Museum, London: *Heros autochthon*: Lectotype: BMNH 1961.7.7.6 (fig. 1); Paralectotypes: BMNH 1961.7.7.2-4 (figs. 2, 3).

Comparative material

Comparative material related to *Australoheros* and other cichlid genera are listed in: Ottoni & Costa (2008); Ottoni et al. (2008, 2014, 2019), Ottoni & Cheffe (2009), Schindler et al. (2010), Ottoni (2010, 2012, 2013a,b, 2015), Ottoni & Schindler (2014), and Ottoni & Mattos (2015). Additional information on the colouration in life, internal anatomy and features of other species not included in the aforementioned papers were taken from Kullander (1986), Kullander & Nijssen (1989), and Řičan & Kullander (2003, 2006, 2008).

Results

Meristics of *Heros autochthon* type series is presented in table 1. Measurements were not included in the morphological inspection since the type material of *Heros autochthon* is old and not well preserved, what could have resulted in a change in the general profile of body and some structures. Unfortunately, the long-term preservation undesired effects are common in old preserved fish specimens. Colour pattern can be seen in figures 1a and 2. The colour pattern of the Lectotype is better preserved, however the colour pattern of Paralectotypes are faded, not allowing to observe the shape, number and the presence/absence of trunk bars, and the shape and presence/absence of spots (especially the caudal-fin base spot) and other markings.

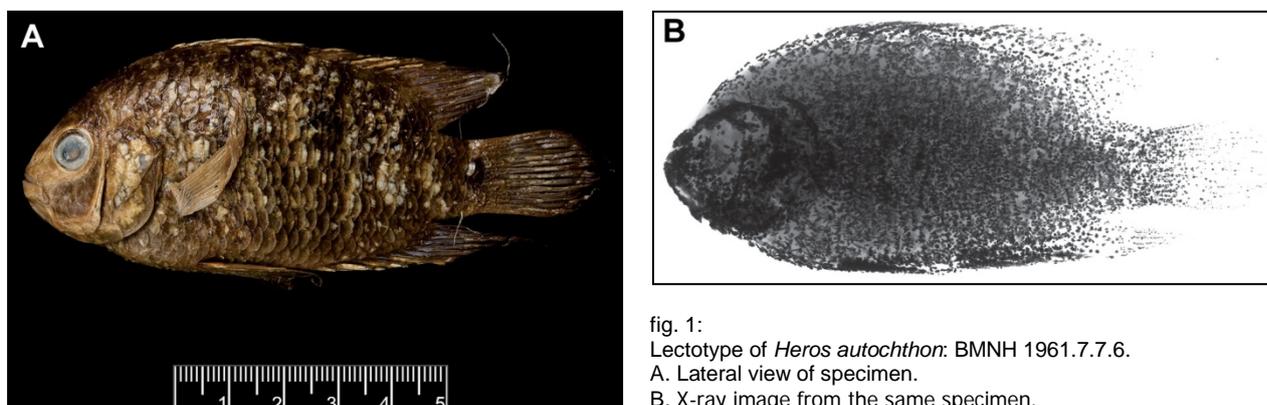


fig. 1:
Lectotype of *Heros autochthon*: BMNH 1961.7.7.6.
A. Lateral view of specimen.
B. X-ray image from the same specimen.

Discussion

Here, after examining *Heros autochthon*'s Lectotype and Paralectotypes, as well as its original description, we conclude that the type material and information included in the original description could not be used to accurately refer to the species identity, not allowing a precise taxonomic determination and identification. Our conclusions are based on the following four reasons:

(1) the type locality of *H. autochthon* is imprecise and doubtful (Brazil). Even if considering the city of Rio de Janeiro as its type locality, as argued by Řičan & Kullander (2003), Ottoni et al. (2019) revealed the existence of a series of distinct *Australoheros* lineages (species) occurring in the state of Rio de Janeiro and surroundings, but none known to occur in Rio de Janeiro city (see Ottoni & Costa 2008; Ottoni 2010, 2012, 2013a,b; Ottoni et al. 2008, 2019). Further, some of these species occur extremely close to each other, within less than 100 km distance in the same river catchment (see Ottoni et al. 2019, figs. 1 and 2); (2) the original description of *H. autochthon* is brief, with few information, making it difficult to correlate that name to any of the currently valid *Australoheros* species; (3) the original description itself states that the colour of the specimens were faded, not describing it with accuracy. Thus, the colour pattern description is brief and little informative consisting in about four lines of text, what is herein seen as critical given the importance of the colouration pattern as a useful/vital source of characters in the taxonomy of *Australoheros*, not only for diagnosing the genus and species, but also in delimiting species groups within the genus (see Řičan & Kullander 2003, 2006, 2008; Ottoni et al. 2011, 2014; Ottoni 2012, 2013a,b; Ottoni & Schindler 2014); and (4) it is not possible to distinguish *H. autochthon* from several species of *Australoheros* [e.g. *Australoheros facetus* (Jenyns, 1842) and several *Australoheros* species occurring in the costal river basins of eastern Brazil], based on the examination of its type series, since several features useful for the taxonomy of the genus rely on colouration pattern, both from preserved and life specimens (colour pattern of type material, especially Paralectotypes are not well preserved, and the life colouration is

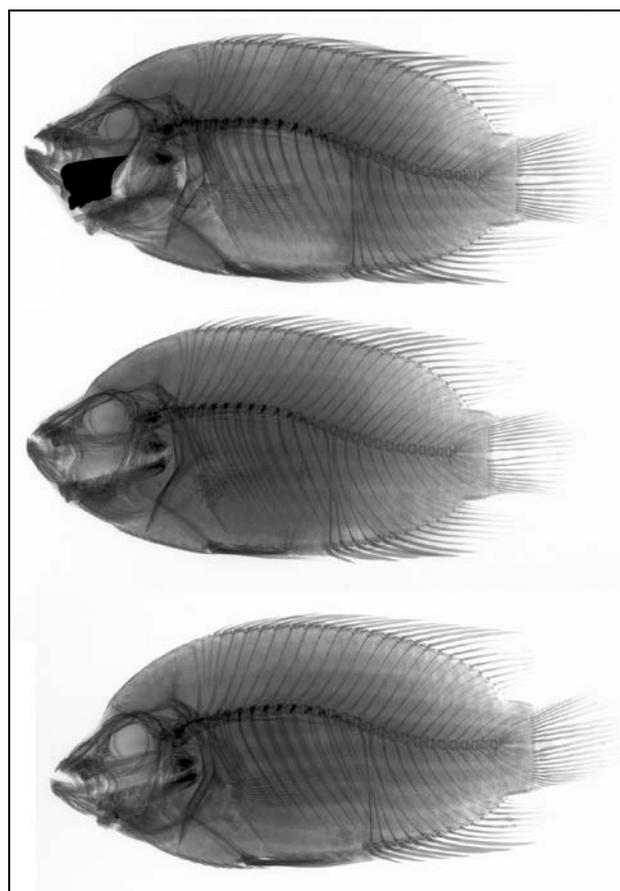


fig. 2 (left):
Paralectotypes of *Heros autochthon*: BMNH 1961.7.7.2-4,
lateral view.

fig. 3 (above):
X-ray images from the same specimens.

impossible to be accessed examining the type material), internal anatomy (impossible to be observed in the Lectotype), and molecular methods (impossible to be accessed using the type material) (see Řičan & Kullander 2003, 2006, 2008; Ottoni 2010, 2012, 2013a, b; Ottoni & Schindler 2014; Ottoni et al. 2011, 2014, 2019).

The designated Lectotype is the specimen possessing the somewhat better preserved colour pattern (fig.1a), while the colour pattern of the Paralectotypes is faded (fig. 2), but even in this specimen the colour pattern is not clear. Curiously, when examining the requested x-ray images of the type series, any skeleton information could be extracted from the Lectotype x-ray image, whereas some skeleton details could be observed in the Paralectotypes x-rays images. According to the curator, due to the way the Lectotype has been preserved, the x-ray image is in fact useless (see fig. 1b), making it impossible to obtain information related to the internal anatomy of the Lectotype. On the other hand, the x-ray images of the Paralectotypes allowed to access some information on internal anatomy (see fig. 3 and table 1).

Ottoni et al. (2019) published a comprehensive integrative taxonomy species delimitation study focusing in testing the limits between eastern Brazil *Australoheros* species, more specifically species distributed from the south of Bahia State, the northern most distribution for the genus, to southeastern Brazil, which comprises a high species diversity, including species occurring in the Rio de Janeiro State (Ottoni et al. 2019). When comparing *Heros autochthon* with all the valid species of *Australoheros* occurring in river drainages of the Rio de Janeiro State, it is not possible to distinguish it from most of these species, such as: *Australoheros austrani* Ottoni & Costa, 2008, *A. barbosa* Ottoni & Costa, 2008, *A. macacuensis* Ottoni & Costa, 2008, *A. macaensis* Ottoni & Costa, 2008, *A. montanus* Ottoni, 2012, and *A. robustus* Ottoni & Costa, 2008. The aforementioned species, on the other hand, are clearly distinguishable by both molecular and morphological data (see Ottoni & Costa 2008; Ottoni 2012, 2013a,b; Ottoni et al. 2019).

Analysing the type series of *Heros autochthon* besides the aforementioned difference in colouration seen between the Lectotype and Paralectotypes (the Paralectotypes with a much more faded colouration), probably due to fixation, the shape of snout is different, with the Lectotype presenting a much more rounded and a less dorsally depressed snout (figs. 1a, 2), as well as the skeleton of the Lectotype is poorly preserved when compared to the skeleton of the Paralectotypes (see figs. 1b, 3). These differences, however, could be an artefact of preservation. Depending on the concentration of formaldehyde and ethanol, and the way of preservation the colour can become faded, and the specimen may become susceptible to dehydration, changing the original shape of some structures, and even decalcifying bone structures. According to the curator of the fish collection of BMNH, James Maclaine (pers. obs):

“The specimens were in separate jars (BMNH 1961.7.7.2-4 in one jar, BMNH 1961.7.7.6 in another) but were stored together in our type collection, both labelled as ‘SYNTYPE’. However when examined it is clear that BMNH 1961.7.7.6 looks very different and the x-ray clearly shows that the preservation method was different too. There is also nothing on the label for BMNH 1961.7.7.6 other than the scientific name...”

“Regarding BMNH 1961.7.7.6, the x-ray is horrible. The x-ray result is interesting because it casts more doubt on BMNH 1961.7.7.6 being part of the original type series, it was obviously prepared in a completely different way!”

Therefore, it is highly possible that the Lectotype and the Paralectotypes have not been collected in the same location and/or the same date, since they were stored in separate jars, being fixed in different solutions (solutions with different concentration of formaldehyde or ethanol, for example). The better preservation of the Lectotype's colour pattern was the reason Ottoni (2012) has designated it as the Lectotype, since, as already mentioned above, the colour pattern is a useful/vital source of characters in the taxonomy of *Australoheros*, for diagnosing the genus and species, as well as, delimiting species groups within the genus. Another possible explanation that cannot be ignored is that the type series specimens could have been accidentally mixed, consisting in individuals from different collection sites, a fact not discarded by the curator of the fish collection of BMNH. James Maclaine (pers. obs):

“There is also nothing on the label for BMNH 1961.7.7.6 other than the scientific name, so there is not much evidence for type status there”.

These two possibilities mentioned above just highlight the lack of knowledge, the many doubts and confusion related to the type series of *Heros autochthon*. Information about its true identity and origin probably will never be recovered with certainty, reinforcing that for now the type material and information included in the original description cannot be used to accurately refer to the species identity, not allowing the taxonomic determination and identification with precision.

Conclusion

Given the current knowledge on the diversity and taxonomy of the genus *Australoheros*, especially concerning the species occurring in southeastern Brazil (see Ottoni et al. 2019), assuming that the type locality of *Heros autochthon* is in the city of Rio de Janeiro and trying to link that name to any putative lineage (species) of the genus is somewhat speculative and increases the confusion on the taxonomy of the group, and this practice should be avoided. The poorly preserved type series, and the impossibility to obtain colour in life and colour pattern information from the preserved types, turns any attempt in linking the name *H. autochthon* to any putative *Australoheros* species feeble. Considering the still unexpected successful extraction and amplification of reliable and not fragmented molecular characters from old and poorly preserved specimens that were firstly fixed in formaldehyde (in this case from the Lectotype, which is the specimen that bears the name of the species), and considering the many doubts and confusion related to the type series of *Heros autochthon*; in our opinion the name *H. autochthon* should be considered a ‘nomen dubium’.

Acknowledgements

We thank James Maclaine for providing photographs, x-ray images, and information on the type material of *Heros autochthon*, and an anonymous reviewer who contributed to the improvement of this article. This study was supported by the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Fundação de Amparo à Pesquisa e ao Desenvolvimento Científico e Tecnológico do Maranhão (FAPEMA), and the German Cichlid Society (DCG).

table 1. Meristic data of the *Heros autochthon* type series. Pc= procurrent rays.

	Original description	BMNH 1961.7.7.6 (examined material)	BMNH 1961.7.7.2-4 (examined material)		
Dorsal-fin spines	16	16	16	16	16
Dorsal-fin rays	10	10	apparently 10 (maybe 11)	apparently 10 (maybe 9)	apparently 9 (maybe one or more rays were lost)
Proximal radials on dorsal-fin base	-	-	25	apparently 24	apparently 25
Supra neurals	-	-	2	2	2
Anal-fin spines	7	7	7	7	7
Anal-fin rays	8	8	9	9	apparently 9 (maybe 8)
Proximal radials on anal-fin base	-	-	13	13	13
Caudal-fin rays	-	-	3Pc+8+8+3 Pc	3 Pc +8+8+3 Pc	3 Pc +8+8+3 Pc
Total vertebrae	-	-	26	26	26
Cheek scales rows	2 or 3	3	2 or 3	3	3

References

- Günther, A. (1862): Catalogue of the fishes in the British Museum. Catalogue of the Acanthopterygii, Pharyngognathi and Anacanthini in the collection of the British Museum. Vol. 4. Trustees of the British Museum, London. 534 pp.
- Kullander, S.O. (1986): Cichlid fishes of the Amazon River drainage of Peru. Swedish Museum of Natural History, Stockholm, 431 pp.
- Kullander, S.O. (2003): Family Cichlidae (Cichlids). pp. 605-654. In: Reis, R.E., S.O. Kullander & J.R. Ferraris (eds): Check list of the freshwater fishes of South and Central America. Porto Alegre, Edipucrs
- Kullander, S.O. & H. Nijssen (1989): The cichlids of Surinam: Teleostei, Labroidei. E.J. Brill, Leiden, The Netherlands. 256 p.
- Otoni, F.P. (2010): *Australoheros capixaba*, a new species of *Australoheros* from south-eastern Brazil (Labroidei: Cichlidae: Cichlasomatinae). Vertebrate Zoology 60 (1): 19-25
- Otoni, F.P. (2012): Three new species of *Australoheros* from southeastern Brazil, with taxonomic notes on *Chromys oblonga*, *Heros autochthon* and *H. jennynsii* (Teleostei: Labroidei: Cichlidae). Vertebrate Zoology 62 (1): 83-96
- Otoni, F.P. (2013a): *Australoheros sanguineus* sp.n. - a new cichlid species from the Rio Cubatão basin, southern Brazil (Cichlidae: Heroini). Vertebrate Zoology 63 (2): 161-169
- Otoni, F.P. (2013b): Life colouration of three *Australoheros* species from the rio Paraíba do Sul basin, southeastern Brazil (Teleostei: Labroidei: Cichlidae). Vertebrate Zoology 63 (1): 9-13
- Otoni, F.P. (2015): Evaluating the use of the anterior ceratohyal morphology to diagnose *Laetacara* Kullander, 1986, with comments on other cichlid genera (Cichlidae: Cichlasomatini). Vertebrate Zoology 65 (1): 57-64
- Otoni, F.P. (2018): Update of diagnoses, information on distribution, species, and key for identification of *Laetacara* species (Teleostei, Cichlidae, Cichlasomatini). Vertebrate Zoology 68 (1): 47-63
- Otoni, F.P., P.H.N. Bragança & I. Schindler (2014): Lebendfärbung und Habitat von *Australoheros tavaresi* (Teleostei: Cichlidae). DCG-informationen 45 (9): 196-199
- Otoni, F.P. & M.M. Cheffe (2009): A new species of *Australoheros* from the upper Rio das Antas, laguna dos Patos System, southern Brazil (Labroidei, Cichlidae, Cichlasomatinae). Spixiana 32 (1): 153-159
- Otoni, F.P. & W.J.E.M. Costa (2008): Taxonomic revision of the genus *Australoheros* Řičan & Kullander, 2006 (Teleostei: Cichlidae) with descriptions of nine new species from south-eastern Brazil. Vertebrate Zoology 58 (2): 207-232
- Otoni, F.P., A.Q. Lezama, M.L. Triques, E.N. Fragoso-Moura, C.C.T. Lucas & F.A.R. Barbosa (2011): *Australoheros perdi*, new species (Teleostei: Labroidei: Cichlidae) from the lacustrine region of the Doce river valley, southeastern Brazil, with biological informations. Vertebrate Zoology 61 (1): 137-145

- Otoni, F.P. & J.L.O. Mattos (2015): Phylogenetic position and re-description of the endangered cichlid *Nannacara hoehnei*, and description of a new genus from Brazilian Cerrado (Teleostei, Cichlidae, Cichlasomatini). *Vertebrate Zoology* 65 (1): 65-79
- Otoni, F.P., J.L.O. Mattos, A.M. Katz & P.H.N. Bragança (2019): Phylogeny and species delimitation based on molecular approaches on the species of the *Australoheros autrani* group (Teleostei, Cichlidae), with biogeographic comments. *Zoosystematics and Evolution* 95 (1): 49-64
- Otoni, F.P., O.T. Oyakawa & W.J.E.M. Costa (2008): A new species of the genus *Australoheros* from the rio Ribeira do Iguape basin, São Paulo, Brazil (Labroidei: Cichlidae: Cichlasomatinae). *Vertebrate Zoology* 58 (1): 75-81
- Otoni, F.P. & I. Schindler (2014): Zur Lebendfärbung zweier *Australoheros*-Arten aus Südost-Brasilien (Teleostei: Cichlidae). *DCG-informationen* 45 (5): 111-114
- Říčan, O. & S.O. Kullander (2003): "*Cichlasoma*" *scitulum*: A new species of Cichlid fish from the río de La Plata region in Argentina, Brazil, and Uruguay. *Copeia* 2003 (4): 794-802
- Říčan, O. & S.O. Kullander (2006): Character and tree-based delimitation of species in the "*Cichlasoma*" *facetum* group (Teleostei, Cichlidae) with the description of a new genus. *Journal of Zoological Systematics and Evolutionary Research* 44 (2): 136-152
- Říčan, O. & S.O. Kullander (2008): The *Australoheros* (Teleostei: Cichlidae) species of the Uruguay and Paraná River drainages. *Zootaxa* 1724 (1): 1-51
- Říčan, O., L. Piálek, K. Dragová & J. Novák (2016): Diversity and evolution of the Middle American cichlid fishes (Teleostei: Cichlidae) with revised classification. *Vertebrate Zoology* 66 (1): 1-102
- Schindler, I., F.P. Otoni & M.M. Cheffe (2010): *Heros acaroides* Hensel, 1870 - a valid species of *Australoheros* (Teleostei: Perciformes: Cichlidae) from the Patos-Mirim lagoon system, south Brazil. *Vertebrate Zoology* 60 (2): 139-146

recommended form for reference:

Otoni, F.P. & P.H.N. Bragança (2021):
Taxonomic problems with the type material of *Heros autochthon* Günther, 1862 (Teleostei: Cichlidae).
Ichthyological Contributions of PecesCriollos 74: 1-7
available as pdf-file at www.pecescrilloos.de since 17.Feb.2021