Ichthyol. Explor. Freshwaters, Vol. 27, No. 4, pp. 347–354, 4 figs., 3 tabs., December 2016

Rehabilitation of *Xenocharax crassus* (Teleostei: Distichodontidae), a species endemic to the Congo basin in central Africa

Armel Ibala Zamba*,, Victor Mamonekene*,**, Emmanuel Vreven*** and Melanie L. J. Stiassny******

Xenocharax crassus Pellegrin, 1900, originally described from the Alima River (Congo basin, Republic of Congo) but synonymised with *X. spilurus* by Daget in 1960, is rehabilitated. *Xenocharax crassus*, a Congo basin endemic, is distinguished from *X. spilurus*, the latter found exclusively in basins of the Lower Guinean ichthyofaunal province, by the presence of a large black mark on the anterior part of the dorsal fin (versus absence), a small, round, black spot at the base of the caudal peduncle (versus a large ovoid spot covering the peduncle base), and a wider mouth (29–34 % HL vs. 24–29). For specimens of similar sizes, *X. crassus* has a shorter dorsal-adipose distance than *X. spilurus*. Furthermore, most *X. crassus* specimens have 6 supraneurals (frequency: 83 %) versus 7 (frequency: 79 %) in *X. spilurus*. With molecular data the species is readily distinguished from *X. spilurus* by 10 apomorphic, non-synonymous nucleotide transitions in the three sampled genetic markers (nd2, cyt-b, and myh6). A lectotype is designated for *X. spilurus*.

Xenocharax crassus Pellegrin, 1900, originellement décrit de la rivière Alima (Bassin du Congo, République du Congo), puis mis en synonymie avec *X. spilurus* par Daget en 1960, est réhabilité. *Xenocharax crassus*, endémique du bassin du Congo, se distingue de *X. spilurus*, rencontré exclusivement dans les bassins de la province ichtyofaunale de Basse Guinée, par la présence d'une large marque noire sur la partie antérieure de la nageoire dorsale (versus absence), d'un point noir à la base du pédoncule caudal (versus un large point ovoïde couvrant le pédoncule caudal) et par une bouche plus large (29–34 % HL vs. 24–29). Pour les spécimens de même taille, *X. crassus* a une distance dorsale-adipeuse plus courte que *X. spilurus*. La plupart des spécimens de *X. crassus* ont 6 supraneuraux (fréquence: 83 %) versus 7 (fréquence: 79 %) chez *X. spilurus*. Sur base des données moléculaires, les deux espèces se distinguent par 10 transitions apomorphiques, non-synonymes de nucléotide, ceci pour les trois marqueurs génétiques prélevés (nd2, cyt-b et myh6). Un lectotype est désigné pour *X. spilurus*.

* Ecole Nationale Supérieure d'Agronomie et de Foresterie, Université Marien Ngouabi, BP 69, Brazzaville, République du Congo. E-mail: ibalaszamba@yahoo.fr

** Institut de Recherche en Sciences Exactes et Naturelles, BP 2400, Brazzaville, République du Congo. E-mail: vito.mamonekene@gmail.com

*** Department of Vertebrates, Ichthyology, Royal Museum for Central Africa, Leuvensesteenweg 13, 3080 Tervuren, Belgium, and KU Leuven, Laboratory of Biodiversity and Evolutionary Genomics, Leuven, Belgium. E-mail: Emmanuel.vreven@africamuseum.be

**** Department of Ichthyology, Division of Vertebrate Zoology, American Museum of Natural History, New York, U.S.A. E-mail: mljs@amnh.org (corresponding author)

Introduction

The type species of the distichodontid genus *Xenocharax*, *X. spilurus*, was described by Günther in 1867. Günther's description was based on two syntypes (BMNH 1867.5.3.33–34) from "Gaboon". In 1900 Pellegrin described a second species, *X. crassus*, based on a single specimen (MNHN 1886-384) from "Leketi (Alima moyen)", a right bank affluent of the Congo River in the Republic of Congo (RC). According to Pellegrin (1900) the new species differed from *X. spilurus* in its stockier shape, greater interorbital width, posterior positioning of the dorsal fin, pelvic-fin insertion situated below the first dorsal-fin rays and not below the middle of the dorsal fin, and by the presence of a large black spot anteriorly on the dorsal fin. However Daget (1960) found that none of these features distinguish *X. crassus* from *X. spilurus* and, after examination of the holotype of *X. crassus*, concluded that all measurements fell within the range of *X. spilurus*. In addition, Daget (1960) found the typical black dorsal spot mentioned by Pellegrin (1900) in his original description of *X. crassus* also to be present in some young specimens identified as *X. spilurus* from Lake Tumba (Democratic Republic of Congo, DRC) and concluded that *X. crassus* was a junior synonym of *X. spilurus*. The genus has been considered monospecific since.

In a recent investigation of the relationships of citharinoid fishes Arroyave et al. (2013) confirmed Vari's (1979) placement of *Xenocharax* as the sister taxon to the remaining Distichodontidae. But unlike Vari who had relied solely on morphological data, Arroyave et al.'s (2013: figs. 4–5) molecular data suggested the presence of a second species within the genus. Concurrently, examination of numerous new collections from the DRC and RC indicated that *Xenocharax* specimens from the Congo basin were not attributable to *X. spilurus*. Following the results of Arroyave et al. (2013: 17), and in order to determine the taxonomic status of the nominal Congo basin species, *X. crassus*, we undertook a detailed morphological investigation and herein propose the rehabilitation of that species.

Material and methods

Most linear measurements follow Stiassny et al. (2007a) and were taken point to point except for caudal peduncle length, which was measured as the horizontal distance between the posterior border of anal and caudal-fin base. Mouth width was measured between the junction of contralateral maxillae and mandibles. Counts of lateral-line scales, dorsal and anal-fin rays follow Ibala Zamba et al. (2007). The following counts were taken on digital X-ray images: predorsal vertebrae, dorsal vertebrae, preanal vertebrae, anal vertebrae and supraneurals. Predorsal vertebrae are those in-between the Weberian complex and the first vertebra whose neural spine supports the first dorsal pterygiophore, i. e. the latter not included. Dorsal vertebrae are all vertebrae whose neural spine supports a dorsal pterygiophore. Preanal vertebrae are those in-between the Weberian complex and the first vertebra whose haemal spine supports the first anal pterygiophore, i.e. the latter not included. Anal vertebrae are counted from the first vertebra whose haemal spine supports the first anal up to the last vertebra, including the terminal caudal centrum. Additional specimens were cleared and double stained following Taylor & Van Dyke (1985). Abbreviations used throughout the text are: DRC, Democratic Republic of Congo; RC, Republic of Congo; SL, standard length; HL, head length; PC: Principal Component; and PCA, principal components analysis. Institutional abbreviations follow Sabaj Pérez (2014).

Sequence data employed are derived from a larger analysis (Arroyave et al., 2013), and three molecular markers, two mitochondrial (cyt-B and ND2) and one nuclear (myh6) totalling 2775 bp, were utilized in the current study. A likelihood analysis was conducted on the concatenated alignment partitioned into 3 gene regions with parameters unlinked under the GTR+I+G model in RAxML version 7.2.8 Black Box (Stamatakis, 2006) through the CIPRES Science Gateway V. 3.3 (Miller et al., 2010). Nodal support was estimated by means of the bootstrap character resampling method using 1000 pseudoreplicates.

Results

The best scoring Maximum Likelihood tree presented in Figure 1 provides strong support for the monophyly of *Xenocharax* and its placement as sister to the remaining Distichodontidae. Samples of *Xenocharax* from the Congo basin (*X. crassus*) are readily differentiated from those from the Lower Guinean ichthyofaunal province (*X. spilurus*) by

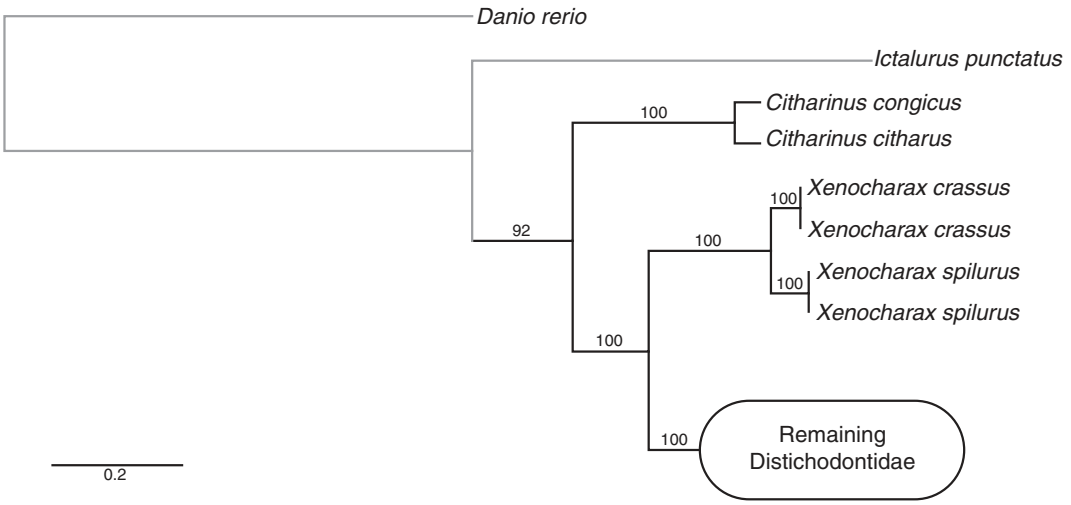

Fig. 1. Best scoring Maximum Likelihood tree based on a reduced otophysan nucleotide data set of Arroyave et al. (2013). Final ML score InL= –18967.752929.

ten apomorphic, non-synonymous nucleotide transitions in the three genes examined (Table 1). Most morphological variation appears dominated by dorsoventral compression, and by differences in mouth and fin placement (Fig. 2; Tables 1–3). Based on these, and additional morphological attributes noted below, we provide a redescription of *X. crassus* and formally resurrect it from synonomy with the type species of the genus, *X. spilurus*.

Xenocharax crassus Pellegrin, 1900
(Fig. 3a–b)

Holotype. MNHN 1886-0384, 164.1 mm SL; Republic of the Congo: Leketi (Alima moyen), Congo basin, ± 1°36'S 14°57'E; Mission de l'Ouest-Africain (M. de Brazza).

Additional material. AMNH 240388, 1, 82.9 mm SL; RC: Congo basin: Likouala-aux-herbes River, 1°12'N 17°24'E; V. Mamonekene, 2003. – AMNH 241661, 1, 70.3 mm SL; RC: Lékoli River, 0°36'N 14°57'E; V. Mamonekene, 2005. – AMNH 244554, 1, 106.4 mm SL; RC: Sangha River, 2°16'N 16°09'E; V. Mamonekene, 2006. – AMNH 245113, 1, 60.1 mm SL; RC: Sangha River, 2°16'N 16°09'E; V. Mamonekene, 2006. – AMNH 244556, 2, 106.2–108.4 mm SL; RC: Sangha River, 2°16'N 16°09'E; V. Mamonekene, 2006. – AMNH 245110, 2, 111.2–114.1 mm SL; RC: Lengoué River, 1°06'N 15°38'E; V. Mamonekene, Sep 2007. – AMNH 245111, 3, 94.9–103.2 mm SL; RC: Lengoué River, 1°06'N 15°38'E; V. Mamonekene, Sep 2007. – MRAC A4.046.P.1533–1535, 3, 74.6–98.9 mm SL; RC: Léfini Basin: lake Itsotso, 3°03'S 15°49'E; Mamonekene et al., 16 Sep 2004. – MRAC A8.020.P.0444–0445, 2, 98.4–120.2 mm; RC: Léfini basin: Louna River, 3°14'S 15°24'E; Vreven & Ibala Zamba, 1 Sep 2008. – MRAC A8.020.P.1349–1350, 2, 81.7–114.2 mm SL; RC: Léfini basin: Louna River, 3°14'S 15°24'E; Vreven & Ibala Zamba, 1 Sep 2008. – MRAC A8.020.P.1348, 1, 108.0 mm SL; RC: Lefini River, 2°59'S 15°11'E; A. Ibala Zamba, 1 Aug 2008. – MRAC A8.020.P.1342, 1, 100.1 mm SL; RC: Lefini River, 3°00'S 15°27'E; A. Ibala Zamba, 30 Mar 2008. – MRAC A7.031.P.0295, 1, 88.0 mm SL; RC: Lefini River, 2°59'S 15°11'E; Ibala Zamba & Vreven, 27 Sep 2007. – MRAC A7.031.P.2064–2066, 3, 112.6–138.3 mm SL; RC: small lake in Lefini basin, 3°01'S 15°16'E; Ibala Zamba & Vreven, 24 Sep 2007. – MRAC A7.031.P.0526, 1, 95.7 mm SL; RC: Lefini River, 3°01'S 15°14'E; A. Ibala Zamba & V. Vreven, 23 Sep 2007. – MRAC A8.020.P.0440–0443, 4, 59.0–61.7 mm SL; RC: Lefini River 2°56'S 16°09'E; Vreven & Ibala Zamba, 21 Aug 2008. – MRAC A8.020.P.1345–1346, 2, 74.8–99.4 mm SL; RC: Lefini River, 3°00'S 15°28'E; A. Ibala Zamba, 2 Apr 2008. – AMNH 241655, 1, 135.8 mm SL; DRC: Luilaka River, 2°30'S 21°21'E; Schelly & Monsembula, Jul 2006. – AMNH 242514, 1, 97.8 mm SL; DRC: Lac Ilungu, 1°33'S 18°38'E; Schelly et al., Aug 2007. – AMNH 249785, 1, 132.8 mm SL; DRC: Lomako River, 0°52'N 20°47'E; WFC personnel, Feb 2009. – MRAC 68940, 1, 79.6 mm SL; DRC: Nepoko River, ± 1°40'N 27°01'E, A. Henrion, 1946. – MRAC 179778, 1, 80.3 mm SL; DRC: Ubangi: Ngiri River, ± 2°17'N 19°15'E; P. Van Leynseele, 1970. – MRAC 105109–105117, 1/9, 92.5 mm SL; DRC: Tsuapa River, ± 0°14'S 20°50'E; R. Philippe, 2 Mar 1956. – MRAC 94903–94905, 1/3, 106.06 mm SL; DRC: Yackama: Congo River; ± 0°47'N 24°17'E, A. Gosse, Dec 1953. – MRAC

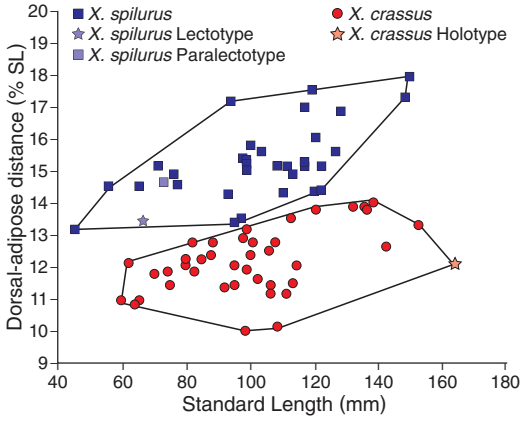

Fig. 2. Scatterplot of dorsal-adipose distance (% SL) against standard length (mm) for 34 specimens of *Xenocharax crassus* and 42 specimens of *X. spilurus*.

134213, 1, 88.1 mm SL; DRC: Lilanda River, ±0°48'N 24°17'E, J. P. Gosse, 8 Sep 1954. – MRAC 96595–96599, 5, 63.7–85.0 mm SL; DRC: Bokuma, 0°06'S 18°41'E; R. P. Lootens, 1954. – MRAC 94038–94055, 1, 65.3 mm SL; DRC: Coquilhatville, ±0°04'N 18°16'E; R. Philippe, 1954. – MRAC 778, 1, 152.7 mm SL; DRC: Kutu, ±2°44'S 18°08'E, P. Delhez, 1899. – MRAC 100732–100759, 11, 70.1–131.2 mm SL; DRC: Lake Tumba, ±0°48'S 18°03'E; G. Marlier, 29–30 Sep 1955. – MRAC 57757, 1, 190.1 mm SL; DRC: Lake Tumba, ±0°48'S 18°03'E; G. de Loneux, 1938. – MRAC 75-56-P-1289–290, 2, 147.4–167.3 mm SL; Cameroon: Boumba River, ±2°02'N 15°12'E; D. F. Thys van den Audenaerde, 21 Feb 1975. – MRAC 75-56-P-1320–322, 3, 103.5–153.3 mm SL; Cameroon: Boumba River, ±2°02'N 15°12'E; D. F. Thys van den Audenaerde, 22 Feb 1975. – MRAC 75-56-P-1362–366, 2, 98.0–168.3 mm SL; Cameroon: Boumba River, ±2°02'N 15°12'E; D. F. Thys van den Audenaerde, 20 Feb 1975.

Table 1. Non-synonymous nucleotide transitions diagnostic for *Xenocharax crassus* in two mitochondrial (nd2 and cyt-b) and one nuclear (myh 6) marker.

Gene fragment	Position	Transition
NADH dehydrogenase 2 (nd2)	175	A→G
	205	T→A
	223	A→G
	371	T→C
	599	T→C
	640	C→G
	653	C→T
cytochrome b (cyt-b)	71	C→A
	583	G→A
myosin-heavy polypeptide 6-cardiac muscle-alpha (myh6)	185	G→C

Differential diagnosis. *Xenocharax crassus* is distinguished from *X. spilurus* by the presence of a large black mark located anteriorly on the dorsal fin (versus absence); a small, round, black spot at the posterior half of the caudal peduncle and covering a total of 4 to 6 scales, ± 2 to 3 scales in horizontal and vertical direction alike (versus a large ovoid spot covering a total of about 35 to 46 scales, ± 8 to 10 scales in horizontal and vertical direction alike), and a wider mouth (29–34 % HL vs. 24–29). In addition, for the specimens of similar sizes, *X. crassus* has a shorter dorsal-adipose distance than *X. spilurus* (Fig. 2). Further, most *X. crassus* specimens have 6 supraneurals (frequency: 83 %) versus 7 (frequency: 79 %) in *X. spilurus*.

With molecular data the species is diagnosed by apomorphic, non-synonymous nucleotide transitions at ten sites for the three genetic markers sampled (nd2, cyt-b, and myh6; Table 1).

Description. A large, robust species. Maximum size examined 164.1 mm SL (male, holotype). Appearance generally as in Figures 3a–b. Comparative morphometrics and meristics of *X. crassus* and *X. spilurus* given in Tables 2 and 3. Body laterally compressed, relatively high, head length 28.0–33.2 % SL (mean 30.4), proportionally longer in smaller specimens. Interorbital width broad, but overlapping range of *X. spilurus*. Mouth terminal and wide. Premaxillae with two rows of short, stout, bicuspid teeth (32–38 in outer row); maxillae, each with 5–9 bicuspid teeth along anterodorsal margins and lower jaw with three rows of bicuspid teeth (31–37 in outer row). Dorsal-fin origin in advance of vertical through pelvic-fin insertion. Pelvic-fin origin below anterior half of dorsal-fin base approximately at level of 5th to 8th fin ray. Adipose scaled basally.

Coloration. In life (Fig. 3b), body generally greyish, darker dorsally over dorsal midline from head to caudal peduncle. Flanks with 11–14 faint vertical bars extending from upper to lower flanks only slightly below lateral line. In addition, flanks of some of specimens variously spotted with darkly pigmented scales randomly arrayed over lower flanks below lateral line. Small, round, black spot on posterior half of caudal peduncle at level of lateral line and covering a total of 4 to 6 scales (± 2 to 3 scales in horizontal and vertical direction alike). Dorsal fin dark with a large black mark anteriorly, extending over basal quarter to half of fin. Pectoral and pelvic fins translucent

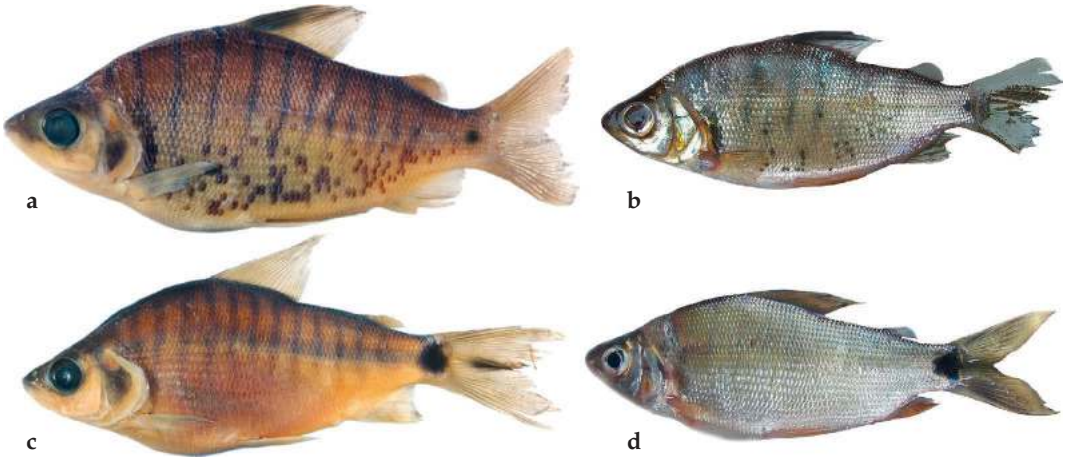

Fig. 3. a, *Xenocharax crassus*, AMNH 241655, 135.8 mm SL; Democratic Republic of Congo: Luilaka River, in preservation; **b,** immediately post-mortem; **c,** *X. spilurus*, AMNH 230316, 113.6 mm SL; Gabon: Ogowe basin: Lake Zile, in preservation; **d**, immediately post-mortem.

yellowish. Anal and caudal fins dark yellowish.

In preservation (Fig. 3a), head and body dark brown dorsally, becoming pale yellow ventrally. Opercle with large blackish blotch covering ventral region. Vertical black bands clearly visible on flanks. Ventral surface of head and body light yellowish-white. Small, round, black spot visible at base of caudal peduncle. Dorsal fin yellowish with dark patch anteriorly. Pectoral, pelvic, anal and caudal fins yellowish-white to transparent with faint brownish pigmentation along or in-between rays.

Distribution. *Xenocharax crassus* is known from localities in the Congo basin (Fig. 4). Few specimens have been collected in the Congo mainstream, and most are from large and middle-sized tributaries within the western part of the Congo basin in the Republic of Congo, and the Cuvette Central of the Democratic Republic of Congo. The species is absent from the lower Congo River (below Pool Malebo), from the main channel of the Congo River upstream of the Boyomo (Wagenia) near Kisangani, and from both the Kasai and Ubangui Rivers. Within its distribution area,

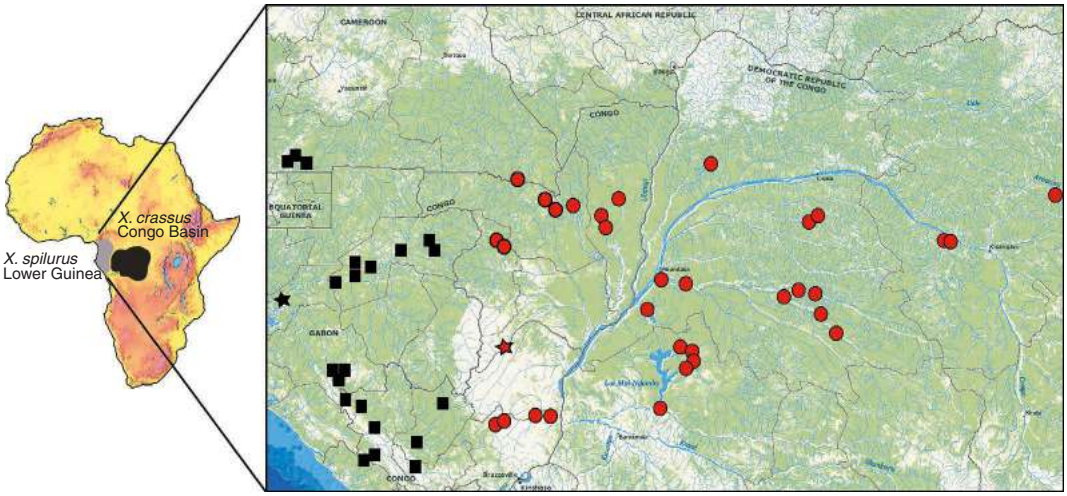

Fig. 4. Distribution of *Xenocharax* in central Africa; *X. spilurus* (■), *X. crassus* (●). ★, holotype of *X. crassus*; ★, lectotype *X. spilurus*.

X. crassus is found almost exclusively in forested tributaries or in savannah streams under dense gallery forest.

Discussion

Like Daget (1960), our observations confirm that the morphological features presented by Pellegrin (1900) to distinguish *X. crassus* from *X. spilurus* largely overlap (see Tables 2–3). Pellegrin (1900) also noted the presence of a large black mark on the anterior part of the dorsal fin, as characteristic for *X. crassus*. However, based on some young specimens identified as *X. spilurus* from Lake Tumba (MRAC 100732–100759) Daget (1960) stated that this feature did not serve to separate the two species. Daget (1960) seems to have relied on Poll's erroneous identification of these Lake Tumba specimens as *X. spilurus* and re-examination of the Lake Tumba specimens, as well as all other *Xenocharax* from the Congo basin, confirm that they are attributable to *X. crassus*.

The present morphological study of *Xenocharax* from throughout its known range in the Congo basin and the Lower Guinean ichthyofaunal province confirms the genetic findings of Arroyave et al. (2013) that specimens from the Congo basin are not attributable to *X. spilurus* and represent a different species. However, we note that although, at present, the upper Dja River is a right bank affluent of the Sangha River and therefore currently part of the Congo basin, before its capture by the Sangha it had been part of the Nyong River basin (Olivry, 1986), a coastal basin of the Lower Guinean ichthyofaunal province. Consequently, numerous typically lower Guinean species, such as *Parauchenoglanis guttatus* (Lönnberg, 1985) (Geerinckx et al., 2007), *Nannocharax intermedium* (Boulenger, 1903) (Vari, 2007), *Sarotherodon mvogoi* (Thys van den Audenaerde, 1965) (Stiassny et al., 2007b), *Mastacembelus marchei* Sauvage, 1879 (Vreven, 2007; Vreven & Stiassny, 2009) and *Hepsetus lineatus* (Pellegrin, 1926) (Decru et al., 2015), have been found in this part of the Congo basin. Unfortunately, *Xenocharax* is absent from all collections that we examined from this area, but we note that *X. crassus* has been found in the Boumba River, a downstream tributary of the Sangha. Based upon the distributional data

Table 2. Morphometric data for *Xenocharax spilurus* and *X. crassus*.

	X. spilurus						*X. crassus*				
	lectotype	paralectotype	all examined specimens				holotype	all examined specimens			
			min	max	n	mean		min	max	n	mean
Standard length (mm)	64.9	73.0	45.8	179.4	34	127.9	164.1	59.9	164.1	42	100.1
In percent standard length											
Head length	31.7	31.1	25.8	32.7	34	29.1	28.7	28.0	33.2	42	30.4
Predorsal distance	48.9	50.1	45.0	54.3	34	48.5	50.2	48.3	52.4	42	50.6
Prepectoral distance	30.9	31.9	25.0	33.6	34	28.5	28.2	26.1	32.3	42	29.4
Prepelvic distance	54.5	55.7	50.7	56.7	34	54.3	54.4	48.5	57.4	42	53.4
Preanal distance	76.2	76.5	74.7	80.7	34	77.9	84.5	74.8	84.5	42	78.6
Dorsal-fin base length	21.4	21.2	19.3	25.0	34	21.9	22.4	20.3	25.0	42	22.6
Anal-fin base length	14.6	14.0	10.6	14.6	34	12.8	12.8	11.7	15.4	42	14.1
Dorsal-adipose distance	13.4	14.6	13.2	17.9	34	15.2	12.1	10.0	14.1	42	12.2
Dorsal-fin length	32.9	33.0	28.8	34.8	33	31.9	23.4	23.4	35.7	32	30.7
Anal-fin length	19.9	21.8	15.3	21.8	33	18.2	14.0	13.6	20.6	36	17.6
Pectoral-fin length	19.3		18.4	21.6	33	20.0	17.0	17.0	20.8	41	18.7
Pelvic-fin length	22.0	22.2	19.6	23.5	34	21.5		17.6	22.7	39	20.0
Caudal peduncle length	12.6	12.0	11.7	14.3	34	12.8	10.1	10.0	13.6	42	11.9
Caudal peduncle depth	11.6	10.7	10.4	12.6	34	11.7	11.4	10.4	12.9	42	11.6
Body depth	34.0	35.1	30.2	42.5	34	38.0	44.3	34.3	44.7	41	40.5
In percent of head length											
Snout length	27	29	25	29	34	26.5	31	24	32	42	28.6
Eye diameter	32	32	27	38	34	32.3	31	29	41	42	34.1
Interorbital width	27	27	22	39	34	29.9	41	29	50	42	35.7
Mouth width	28	28	24	29	34	26.7	34	29	34	42	31.2

currently available we consider *X. spilurus* to be a strictly Lower Guinean endemic, with a distribution restricted to coastal basins of the Republic of Congo, Gabon and Cameroon (Fig. 4). All specimens of *Xenocharax* from the Congo basin conform to the holotype of *X. crassus* Pellegrin, 1900 and are considered assignable to that species, which is formally rehabilitated here.

Note on the syntypes of *Xenocharax spilurus*. The smallest of both *Xenocharax spilurus* syntypes (BMNH 1867.5.3.33, 64.9 mm SL), has been chosen as lectotype due to its better condition.

Comparative material. *X. spilurus*: AMNH 236475, 1, 128.3 mm SL; Cameroon: Nyabessan: Ntem River, 2°23'N 10°24'E; R. E. Brummett, Jun 2002. – AMNH 251707, 1, 94.3 mm SL; Cameroon: Ntem River, 2°18'N 11°18'E; Lamboj & Timelthaler, Feb 2007. – MRAC 73.18.P.892–893, 2, 148.2–149.7 mm SL; Cameroon: Ntem River, 2°21'N 10°35'E; D. Thys van den Audenaerde, 18 Mar 1973. – BMNH 1867.5.3.33, 1 herein designated as lectotype, 64.9 mm SL; Gaboon: Ogowe basin: Lake Zile, ±0°41'S 10°17'E. – BMNH 1867.5.3.34, 1 paralectotype, 73.0 mm SL; Gaboon: Ogowe basin: Lake Zile, ±0°41'S 10°17'E. – AMNH 230316, 2, 111.8–113.6 mm SL; Gabon: Ogowe River, 0°39'S 10°18'E; Sullivan & Arnegard, Jul 1999. – AMNH 230354, 1, 126.4 mm SL; Gabon: Ogowe River, 0°39'S 10°18'E; Sullivan et al., Jul 1999. – MRAC A0.048.P.2515–2526, 5/12, 98.0–122.2 mm SL; Gabon: Ogowe Ayem, 0°18'S 10°33'E; Mbega et al., 21 Jan 2000. – AMNH 230765, 1, 94.6 mm SL; Gabon: Ivindo River, 0°31'N 12°49'E; Hopkins & Lavoué, Jan 1998. – MRAC A1.090.P.0081, 1, 120.0 mm SL; Gabon: Toho River, 0°28'N 12°05'E; J. F. Gillet, 1 Sep 2001. – MRAC 99.055.P.0359, 1, 119.7 mm SL; Gabon: Nyanga River at Tchibanga, ±1°08'S 9°33'E; A. Kamdem Toham, 9 Oct 1998. – MRAC 99.090.P.0649, 1, 56.4 mm SL; Gabon: Louetsi River, 2°14'S 11°27'E; Obame, 5 Sep 1998. – MRAC 99.055.P.0358, 1, 99.1 mm SL; Gabon: Bendolo River, ±1°11'S 10°36'E; A. Kamdem Toham, 7 Nov 1998. – MRAC 99.090.P.0650, 1, 77.8 mm SL; Gabon: Ngounié River, 2°20'S 11°29'E; Sullivan et al., 14 Sep 1998. – AMNH 230287, 1, 76.4 mm SL; Gabon: Ogooue River, 0°40'S 10°20'E; Sullivan & Arnegard, Jul 1999. – MRAC A0.048.P.2473, 1, 110.6 mm SL; Gabon: Abanga River, ±0°17'S 10°29'E; Mbega et al., 22 Jan 2000. – AMNH 253876, 1, 45.8 mm SL; RC: Kouilou-Niari River, 4°04'S 12°89'E; V. Mamonekene, Oct 2010. – AMNH 253947, 1, 117.2 mm SL; RC: Kouilou-Niari River, 4°04'S 12°89'E; V. Mamonekene, Oct 2010. – AMNH 253910, 2, 65.4–97.0 mm SL; RC: Kouilou-Niari River, 4°04'S 12°89'E; V. Mamonekene, Oct 2010. – MRAC A5.036.P.0584, 1, 71.2 mm SL; RC: Polo: Ogowe River, 2°42'S 11°40'E; Mamonekene et al., 11 Aug 2005. – MRAC A7.31.P.2063, 1, 116.8 mm SL; RC: Kouilou-Niari River, 3°33'S 12°20'E; Vreven & Ibala Zamba, 8 Sep 2007. – MRAC A7.31.P.2712, 1, 121.8 mm SL; RC: Kouilou-Niari River, 3°33'S 12°20'E; Vreven & Ibala Zamba, 8 Sep 2007. – MRAC A7.31.P.2062, 1, 117.0 mm SL; RC: Nyanga River, 2°55'S 11°53'E; Vreven & Ibala Zamba, 31 Aug 2007. – MRAC A7.31.P.2067, 1, 108.5 mm SL; RC: Ngongo River, 2°39'S 11°36'E; Vreven & Ibala Zamba, 1 Sep 2007. – MRAC A7.31.P.2711, 1, 120.4 mm SL; RC: Ngongo River, 2°39'S 11°36'E; Vreven & Ibala Zamba, 2 Sep 2007.

Acknowledgements

We thank Jos Snoeks (MRAC; KU Leuven) for constructive comments on a previous draft of this manuscript; James Maclaine (BMNH) and Patrice Pruvost, Romain

Table 3. Meristic data for *Xenocharax spilurus* and *X. crassus*. Gill rakers on first arch given between brackets represent the total number.

	X. spilurus						*X. crassus*				
	lecto-type	para-lectotype	all examined specimens				holo-type	all examined specimens			
			min	max	n	mode		min	max	n	mode
Gill rakers on first arch	10/1/7 (18)	10/1/7 (18)	10/1/7 (18)	13/1/10 (24)	34	10/1/8 (19)	12/1/9 (22)	9/1/6 (16)	12/1/9 (22)	42	11/1/8 (20)
Lateral line scales	65	66	62	76	34	69	76	65	76	42	70
Scales above the lateral line	13	13	11	16	34	13	12	12	14	42	13
Caudal peduncle scales	21	21	21	27	34	24	23	23	25	42	24
Dorsal-fin rays	19	19	17	21	34	19	18	18	22	42	20
Anal-fin rays	15	15	12	15	34	13	15	13	15	42	14
Predorsal vertebrae	5	6	5	8	34	6	7	5	7	42	5
Dorsal vertebrae	12	12	10	13	34	12	11	11	13	42	12
Anal vertebrae	18	18	17	19	34	18	18	17	19	42	18
Preanal vertebrae	20	22	20	23	34	22	22	20	22	42	21
Supraneural	7	7	6	8	34	7	6	5	7	41	6

Causse, Zora Gabsi and Claude Ferrara (MNHN) for the loan of type specimens under their care; and Miguel Parrent (MRAC) and Barbara Brown, Radford Arrindell, and Lowell Flanders (AMNH) for help with the specimens housed in the collections under their care. Finally, our thanks to Jairo Arroyave (AMNH) for his help with phylogenetic analyses, and convivial company in the field. Fieldwork (2005–2009) of AIZ was undertaken as part of the projects "Appui au laboratoire de biologie des populations de l'Université Marien Ngouabi de Brazzaville pour l'étude de la biodiversité et la conservation des poissons d'eaux douces du Congo-Brazzaville" and "Interdisciplinary support of the sustainable management of forests and fish populations of the Congo Basin: reinforcement of ERAIFT" (2005–2010) financed by MRAC through a framework agreement with the Belgian Development Cooperation (DGD). Fieldwork by EV was supported by both the Belgian Leopold III-Fonds voor Natuuronderzoek en Natuurbehoud as well as the Stichting tot Bevordering van het Wetenschappelijk Onderzoek in Afrika. A study visit of AIZ to was provided by the African Biodiversity Information Centre (ABIC) 2013 grant program; a study visit of VM and AIZ to AMNH in 2014 was provided by the Axelrod Research Curatorship (MLJS) and another study visit of VM and AIZ to MRAC in 2015 has been supported by the Mbisa Congo project (2013–2018), a framework agreement project of MRAC.

Literature cited

Arroyave, J., J. S. S. Denton & M. L. J. Stiassny. 2013. Are characiform fishes Gondwanan in origin? Insights from a time-scaled molecular phylogeny of the Citharinoidei (Ostariophysi: Characiformes). PLoS ONE, 8 (10): e77269.

Daget, J. 1960. Le genre *Xenocharax* (Poissons Characiformes). Revue de Zoologie et de Botanique Africaines, 61: 35–48.

Decru, E., J. Snoeks & E. Vreven. 2015. Taxonomic evaluation of the *Hepsetus* from the Congo basin with the revalidation of *H. microlepis* (Teleostei: Hepsetidae). Ichthyological Exploration of Freshwaters, 26: 273–287.

Geerinckx, T., L. Risch, E. J. Vreven, D. Adriaens & G. G. Teugels. 2007. Claroteidae. Pp. 586–630 in: M. L. J. Stiassny, G. G. Teugels & C. D. Hopkins (eds.), Poissons d'eaux douces et saumâtres de basse Guinée. Tome 1. Collection Faune Tropicale 42. IRD, Paris, MNHN, Paris and MRAC, Tervuren.

Günther, A. 1867. New fishes from the Gaboon and Gold Coast. Annals and Magazine of Natural History, Series 3, 20: 110–117.

Ibala Zamba, A., G. De Boeck, V. Mamonekene & E. Vreven. 2007. Rehabilitation of *Bryconaethiops yseuxi* Boulenger, 1899 (Characiformes: Alestidae) from the Congo River basin, Africa. Journal of Natural History, 41: 1213–1226.

Miller, M., W. Pfeiffer & T. Schwartz. 2010. Creating the CIPRES Science Gateway for inference of large phylogenetic trees. Pp. 1–8 in: Gateway Computing Environments Workshop (GCE). Available from: www.phylo.org/sub_sections/portal/sc2010_paper.pdf

Olivry, J. C. 1986. Fleuves et rivières du Cameroun. MESRES-ORSTOM. Coll. Monographies Hydrologiques 9. ORSTOM, Paris, 733 pp.

Pellegrin, J. 1900. Poissons nouveaux ou rares du Congo français. Bulletin du Muséum National d'Histoire Naturelle, 6: 177–182.

Sabaj Pérez, M. H. (ed.). 2014. Standard symbolic codes for institutional resource collections in herpetology and ichthyology: an online reference. Version 5.0 (22 September 2014). Available from: http://www.asih.org/

Stamatakis, A. 2006. RAxML-VI-HPC: maximum likelihood-base phylogenetic analyses with thousands of taxa and mixed models. Bioinformatics, 22: 2688–2690.

Stiassny, M. L. J., G. G. Teugels & C. D. Hopkins (eds). 2007a. The fresh and brackish water fishes of the lower Guinea, West-Central Africa. Vol. 1. IRD, Paris, MNHN, Paris & MRAC, Tervuren, 603 pp.

Stiassny, M. L. J., A. Lamboj, D. De Weirdt & G. G. Teugels. 2007b. Cichlidae. Pp. 303–309 in: M. L. J. Stiassny, G. G. Teugels. & C. D. Hopkins (eds.), Poissons d'eaux douces et saumâtres de basse Guinée. Tome 2. Collection Faune Tropicale 42. IRD, Paris, MNHN, Paris and MRAC, Tervuren.

Taylor, W. R & G. C. Van Dyke. 1985. Revised procedures for staining and clearing small fishes and other vertebrates for bone and cartilage study. Cybium, 9: 107–119.

Vari, R. P. 1979. Anatomy, relationships and classification of the families Citharinidae and Distichodontidae (Pisces, Characoidea). Bulletin of British Museum of Natural History, 36: 261–344.

— 2007. Distichodontidae. Pp. 412–465 in: M. L. J. Stiassny, G. G. Teugels. & C. D. Hopkins (eds.), Poissons d'eaux douces et saumâtres de basse Guinée. Tome 1. Collection Faune Tropicale 42. IRD, Paris, MNHN, Paris and MRAC, Tervuren.

Vreven, E. J. 2007. Mastacembelidae. Pp. 548–571 in: M. L. J. Stiassny, G. G. Teugels. & C. D. Hopkins (eds.), Poissons d'eaux douces et saumâtres de basse Guinée. Tome 2. Collection Faune Tropicale 42. IRD, Paris, MNHN, Paris and MRAC, Tervuren.

Vreven, E. J. & M. L. J. Stiassny. 2009. *Mastacembelus simbi*, a new dwarf spiny eel (Synbranchiformes, Mastacembelidae) from the lower Congo River. Ichthyological Exploration of Freshwaters, 20: 213–222.

Received 22 December 2015
Revised 7 June 2016
Accepted 4 August 2016