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Congochromis, a New Cichlid Genus (Teleostei: Cichlidae) from Central Africa, with the Description of a New Species from the Upper Congo River, Democratic Republic of Congo

MELANIE L. J. STIASSNY[1] AND ULRICH K. SCHLIEWEN[2]

ABSTRACT

Congochromis, a new cichlid genus, is described on the basis of a suite of anatomical features of the cephalic laterosensory system, infraorbital series, oral dentition, and squamation. As recognized herein, *Congochromis* comprises three species formerly included in the genus *Nanochromis* (*N. squamiceps*, *N. dimidiatus*, and *N. sabinae*) and a new species from the vicinity of Kisangani (Stanleyville) on the upper Congo River. Diagnostic features for *Congochromis* and *Nanochromis* s.str. are provided. *Congochromis pugnatus,* n.sp. is diagnosed by the possession of a distinctive pattern of hypural fusion, a strongly inclined lower jaw, and an expanded cheek musculature.

INTRODUCTION

The increased rate of species discovery and description in the Congolese cichlid genus *Nanochromis* Pellegrin (see Lamboj, 2005; Schliewen and Stiassny, 2006; Lamboj and Schelly, 2006) is typical of a growing documentation of the high levels of species diversity among freshwater fishes in the Congo River basin (Schelly and Stiassny, 2004; Stiassny and Schaefer, 2005; Schliewen and Schäfer, 2006; Stiassny et al., 2006; Tshibwabwa et al., 2006). As species discovery rates increase, a concomitant understanding of phylogenetic relationships is necessary to provide a framework for investigation of the mechanisms and processes underlying contemporary aquatic diversity. To date, eleven *Nanochromis* species have been described, and a number of additional taxa are awaiting

[1] Division of Vertebrate Zoology, Department of Ichthyology, American Museum of Natural History, (mljs@amnh.org).
[2] Department of Ichthyology, Bavarian State Collection of Zoology, Münchhausenstr. 21, D-81247 München, Germany (schliewen@zsm.mwn).

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formal description (Schliewen and Stiassny, 2006, personal obs.; Lamboj, in litt.). In a recent study, Schliewen and Stiassny (2006) discussed the presence of two informally named groups within *Nanochromis*: a *nudiceps* group and a *squamiceps* group. Both groups are diagnosable on the basis of derived anatomical features, and herein we restrict the genus *Nanochromis* s.str. to include the type species *N. nudiceps* (Boulenger, 1899) and seven congeners: *N. consortus* Roberts and Stewart, 1976, *N. minor* Roberts and Stewart, 1976, *N. parilus* Roberts and Stewart, 1976, *N. splendens* Roberts and Stewart, 1976, *N. teugelsi* Lamboj and Schelly, 2006, *N. transvestitus* Stewart and Roberts, 1984, and *N. wickleri* Schliewen and Stiassny, 2006. The species of the *squamiceps* group are herein formally recognized as members of the new genus, *Congochromis*, with *C. squamiceps* (Boulenger, 1902) as the type species, along with *C. dimidiatus* (Pellegrin, 1900), *C. sabinae* (Lamboj, 2005), and a new species from the vicinity of Kisangani on the upper Congo River described herein.

MATERIALS AND METHODS

Counts and morphometric measurements follow Barel et al. (1977), with the following exceptions: predorsal length is measured as the distance between the dorsal fin origin and snout tip. Preanal length is measured as the distance between the anal fin origin and snout tip. Depth of the head is measured from the top of the head at midorbit to the ventral edge of the interopercle. Measurements were recorded to the nearest 0.1 mm using digital or dial calipers. Vertebral counts exclude the terminal, hypural-bearing vertebra, and vertebral and fin spine/ray counts and measurements were obtained from radiographs or cleared-and-stained skeletal preparations. The terminal dorsal and anal soft fin rays are counted as single elements, even if branched and split to the fin base when the element is associated with a single supporting pterygiophore. Gill raker counts correspond to the lower limb of the first arch and include the raker in the angle of the arch marking the transition from ceratobranchial to epibranchial.

Comparative material comprised formalin-fixed specimens stored in 70–75% ethanol, nonformalin-fixed specimens stored in 70–95% ethanol, and specimens cleared and stained for bone and cartilage using a modified protocol based on Taylor and Van Dyke (1985). When sufficient material was available, multiple cleared-and-stained specimens were prepared and examined for each species. Institutional abbreviations follow Leviton et al. (1985). The following comparative materials have been included in the study (values after catalog number indicate number of specimens examined, and do not necessarily correspond to the total number of specimens in the lot; C&S indicates cleared-and-stained preparation; SL, standard length; HL, head length):

Benitochromis finleyi: AMNH 238254, 1 ex. C&S, Cameroon.

Benitochromis riomuniensis: CU 90064, 15 ex., Lobe River, Cameroon.

Chromidotilapia mamonekenei: AMNH 232367, 14 ex., 1 C&S, 27 km from Tchibanga, Gabon.

Chromidotilapia mrac: AMNH 229522, 5 ex., 1 C&S, Mikouma River, Moyen-Ogooué, Gabon.

Congochromis dimidiatus: MNHN 1892-0120, syntype, 1 ex., Bangui; MNHN 1892-0121, syntypes, 3 ex., Bangui; MNHN 1920-0194-6, 3 ex., Bangui; AMNH 8150, 3 ex., 1 C&S, Bangui River at Bangui.

Congochromis sabinae: AMNH 235651, paratype, 1 ex., Loubi River, Likouala River drainage; AMNH 235652, paratype, 1 ex., Loubi River, Likouala River drainage; AMNH 227666, 1 ex., Lossi Creek, Sangha River drainage; CU 88552, 1 ex., Mambili River, Likouala River drainage.

Congochromis squamiceps: BMNH 1902.4.14: 11, syntype, 1 ex., Lindi River, Upper Congo; IRSNB 13, syntype, 1 ex., Lindi River, Upper Congo; AMNH 225399, 1 ex., Kisangani (Stanleyville), Upper Congo.

Divandu albimarginatus: AMNH 232347, 4 ex., Onoy River at Bandi, Gabon.

Nanochromis consortus: AMNH 233375, 1 ex., Nziya, Congo River; AMNH 236667, 1 ex., Nziya, Congo River; MCZ 50552, paratypes, 5 ex., 1 C&S, mainstream Congo River, near Inga.

Nanochromis minor: AMNH 237660, 1 ex. C&S., 2 km upstream of Kinganga, Congo River; MCZ 50342, paratypes, 2 ex., mainstream Congo River, downstream from Kinganga.
Nanochromis nudiceps: MRAC 1045, lectotype, Kutu.
Nanochromis parilus: MCZ 50202, paratypes, 8 ex., 1 C&S, mainstream Congo River, near Wombe.
Nanochromis splendens: MCZ 50477, paratypes, 6 ex., 1 C&S, mainstream Congo River, near Inga.
Nanochromis transvestitus: ZSM 29705, 9 ex., 2 C&S, Lake Mai Ndombe, near Inongo.
Nanochromis teugelsi: AMNH 233374, paratype, 1 ex., Bandundu province, Bokoni village, Kasai River, estuary across river.
Nanochromis wickleri: AMNH 236666, paratype, 1 ex. C&S, Lake Mai Ndombe at Inongo; AMNH 236665, paratype, 1 ex., Lake Mai Ndombe at Inongo.
Nanochromis sp.: AMNH 233569, 1 ex., Bobongo Creek into Sangha, Central African Republic.
Parananochromis gabonicus: CU 80730, 1 ex. C&S, Minka Creek, 7 km south of Oyem, Gabon; AMNH 211142, 4 ex., Nye River, Woleu-Ntem, Gabon.
Parananochromis longirostris: AMNH 230708, 7 ex., 1 C&S, Ivindo River, Gabon.
Pelvicachromis humilis: AMNH 22238, 1 ex. C&S, River Moa, Sierra Leone.
Pelvicachromis taeniatus: AMNH 216147, 1 ex. C&S, no data; CU 90064, 10 ex., Lobe River, Cameroon.
Teleogramma brichardi: MCZ 48009, 1 ex. C&S, Congo River, rapids at Kinsuka.
Thysochromis ansorgii: AMNH 235828, 2 ex., Benin; AMNH 216147, 1 ex. C&S, no data.

Throughout this paper the phylogenetic species concept is adopted as a basis for species diagnosis. Congolese place names follow contemporary usage, and equivalent colonial-era place names previously utilized in the literature are given within brackets following their initial appearance in the body of the text.

PRINCIPAL COMPONENTS ANALYSIS

To investigate species boundaries between the morphologically similar members of *Congochromis*, we have performed an exploratory multivariate analysis of 16 log-transformed morphometric variables using a sheared principal components analysis (PCA) (Humphries et al., 1981; Bookstein et al., 1985). Principal components were factored from the covariance matrix of log-transformed variables. The PCA was conducted in *Sheared PCA*, a freeware program written for the Macintosh operating system by Norman Macleod and available for download at http://www.nhm.ac.uk/hosted_sites/paleonet/ftp/ftp.html.

GENERIC DIAGNOSES

In the following generic diagnoses and accompanying illustrations an asterisk precedes character numbers, and character states are indicated by superscript numerals. Based on outgroup comparison among other chromidotilapiines and related cichlid species the use of superscript "1" indicates the hypothesized derived state and superscript "0" the plesiomorphic state for each figured character.

Nanochromis Pellegrin, 1904

Type species: *Nanochromis nudiceps* (Boulenger, 1899) [Type locality: Kutu, Lake Leopold II, Zaire (Lake Mai Ndombe, Democratic Republic of Congo)].
Included species: *N. consortus* Roberts and Stewart, 1976, *N. minor* Roberts and Stewart, 1976, *N. parilus* Roberts and Stewart, 1976, *N. splendens* Roberts and Stewart, 1976, *N. teugelsi* Lamboj and Schelly, 2006, *N. transvestitus* Stewart and Roberts, 1984, and *N. wickleri* Schliewen and Stiassny, 2006.

Nanochromis is diagnosed by the following combination of apomorphic features: at least the posterior half of the upper lateral line contiguous with the dorsal-fin base; presence of an asquamate nape, cheek, and belly; absence of a supraneural bone; possession of extremely fine, closely spaced unicuspid teeth in upper and lower jaws (fig. 1, $*1^1$ vs. $*1^0$); presence of a horizontally oriented, elongate second infraorbital (fig. 1, $*2^1$ vs. $*2^0$).

Nanochromis shares with *Congochromis*, its putative sistergroup, the apomorphic features of an elevated lateral line that is at least partially contiguous with the dorsal fin (less extensively so in *Congochromis*), a characteristic reduction of the infraorbital series consisting of a single, elongate element behind the first infraorbital (preorbital) (figs. 1, 5A), and

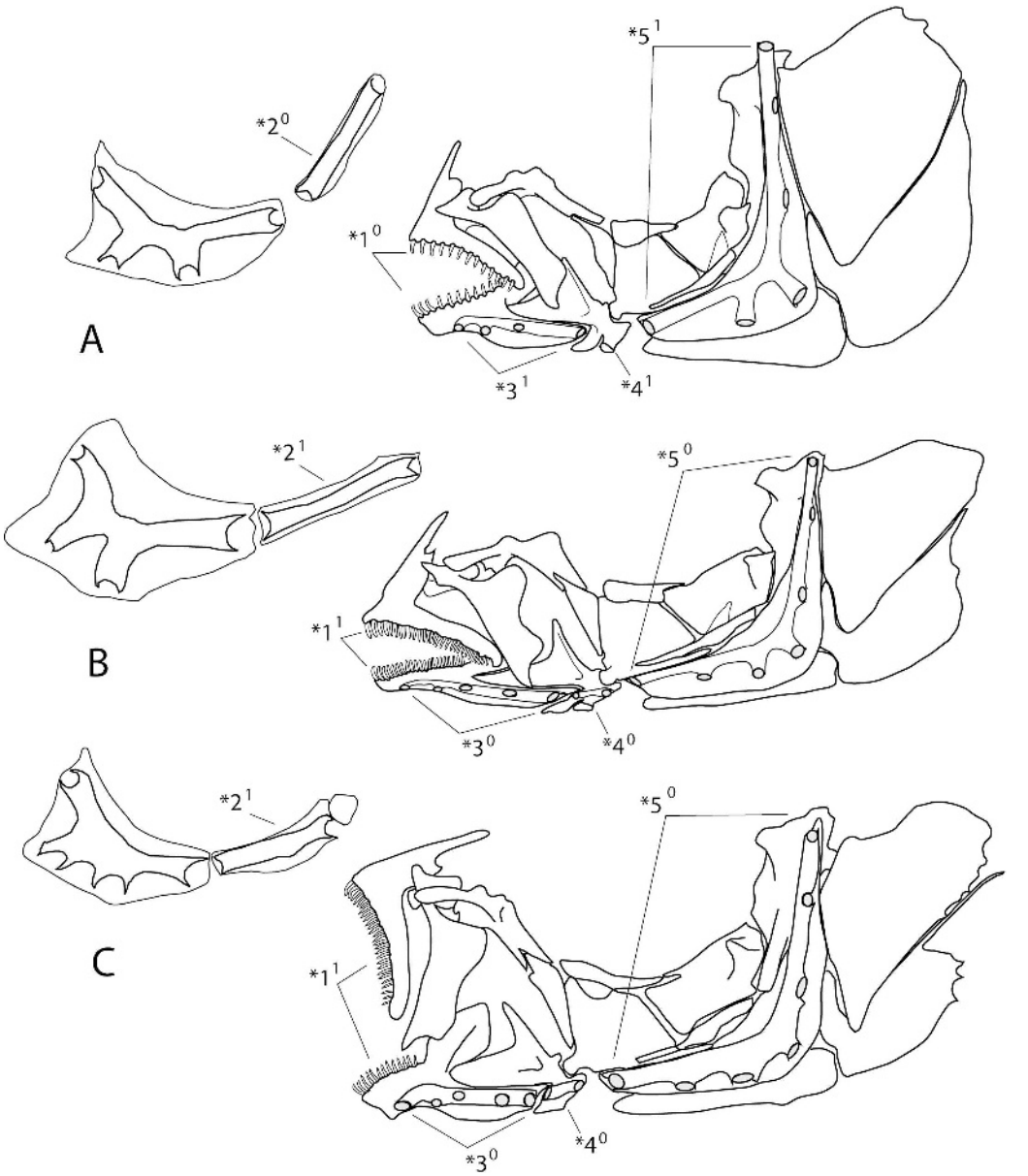

Fig. 1. Isolated infraorbital series, oral jaws, and suspensoria of **(A)** *Congochromis dimidiatus*, AMNH 8150, **(B)** *Nanochromis parilus*, MCZ 50202, and **(C)** *Nanochromis minor*, AMNH 237660.

an exoccipital contribution to the ventral articular surface of the pharyngeal apophysis.

Congochromis, new genus

Type species: *Congochromis squamiceps* (Boulenger, 1902) [Type locality: Lindi, Lindi River, Upper Congo, Zaire (Democratic Republic of Congo)].

Included species: *C. dimidiatus* (Pellegrin, 1900), *C. sabinae* (Lamboj, 2005), *C. pugnatus,* n.sp.

Congochromis is diagnosed by the following combination of apomorphic features: four pores in the dentary laterosensory canal (fig. 1, $*3^1$ vs. five pores, $*3^0$), absence of a laterosensory canal in the angulo-articular (fig. 1, $*4^1$ vs. $*4^0$), and six pores in the

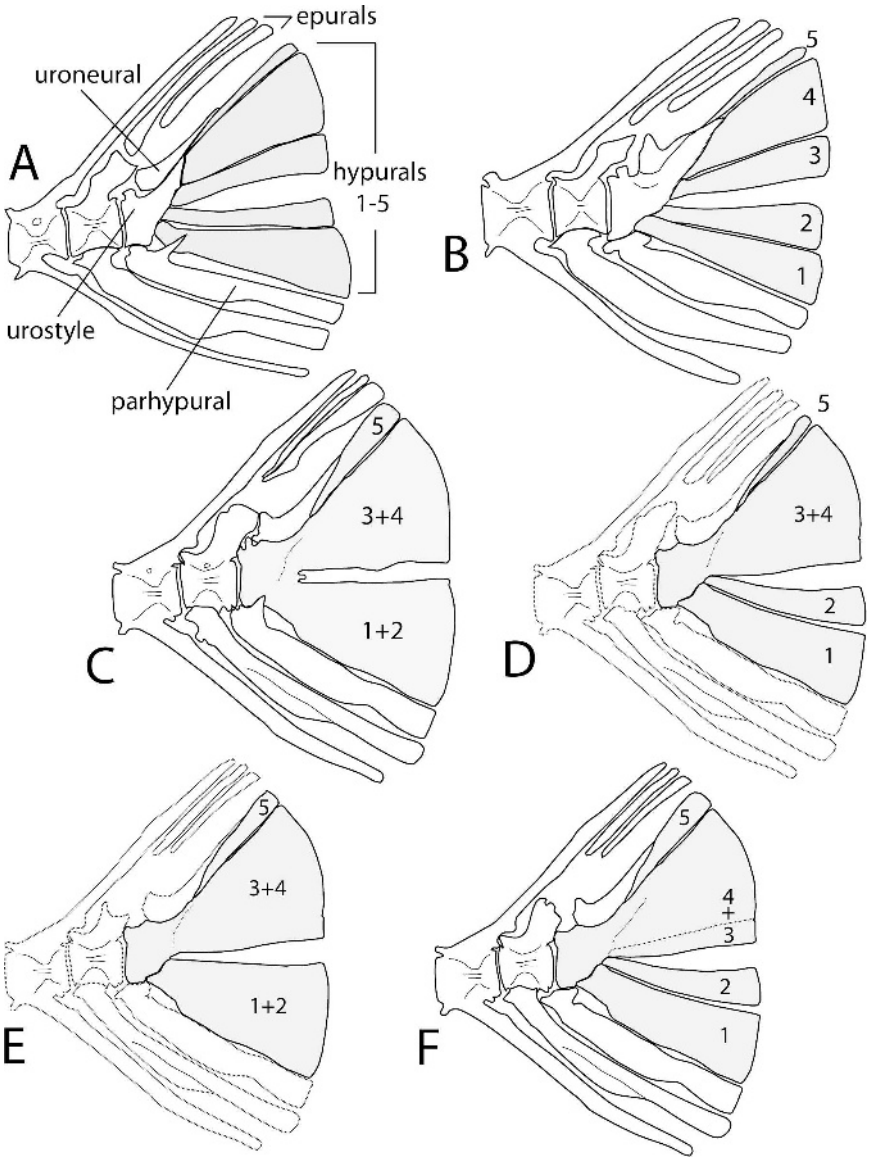

Fig. 2. Caudal fin skeleton of **(A)** *Parananochromis gabonicus* (CU 80730), **(B)** *Nanochromis parilus* (MCZ 50202), **(C)** *Congochromis pugnatus* (AMNH 237670), **(D)** *C. squamiceps* (recorded from a radiograph of IRSNB 13), **(E)** *C. sabinae* (recorded from radiographs of AMNH 235651-2), and **(F)** *C. dimidiatus* (AMNH 8150).

preopercle laterosensory canal (fig. 1, $*5^1$ vs. seven pores, $*5^0$).

The following combination of features distinguishes *Congochromis* from *Nanochromis*: only the last three to five pored scales of the upper lateral line are contiguous with the dorsal-fin base (vs. at least the posterior half of the upper lateral line contiguous); fully scaled nape, and partially scaled chest and cheek (vs. an asquamate nape, chest, and cheek); jaw teeth relatively robust unicuspids, not closely spaced (vs. extremely fine, closely spaced unicuspids); and the presence of a small, supraneural bone (vs. absence).

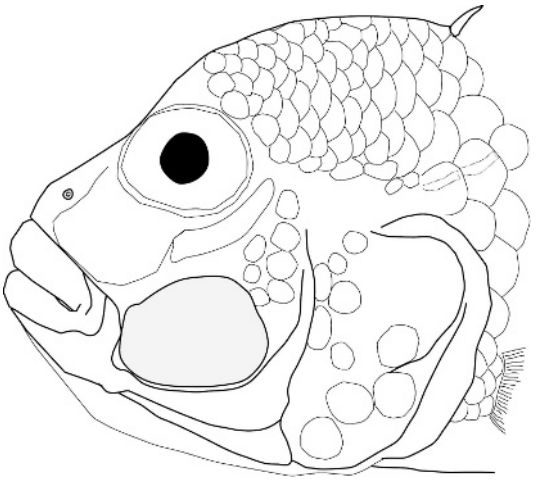

Fig. 3. Head squamation of *Congochromis pugnatus* (paratype, AMNH 237670); gray area on cheek indicates region of expanded adductor mandibulae musculature.

Congochromis pugnatus, new species

figures 3–5

HOLOTYPE: AMNH 6079, 48.2 mm SL, adult male, Democratic Republic of Congo, Kisangani (Stanleyville), H. Lang and J.P. Chapin, May 1915.

PARATYPES: Eight paratypes with same data as holotype: AMNH 237670, 2 ex., 1 C&S, 37.0–51.5 mm SL; FMNH 57121, 3 ex., 37.8–49.1 mm SL; MRAC 2006-45-P-1, 50.4 mm SL; ZSM 34981, 2 ex., 37.0–49.2 mm SL.

DIAGNOSIS: A *Congochromis* diagnosed by the possession of a compound urostyle + fused hypural plate (fig. 2C). Further differs from all congeners in possessing a strongly inclined lower jaw and expanded cheek musculature (fig. 3).

DESCRIPTION: Based on the holotype and eight paratypes. See table 1 for a summary of morphometric and meristic data for the new taxon and for comparative data on type specimens of all congeners. Morphological characteristics and general pigmentation pattern can be observed in figure 4, and of congeners in figure 6. A robust, relatively deep-bodied species (depth 29.3–35.5%, mean 31.7% SL). Greatest body depth at (males), or slightly behind (females), level of pelvic-fin insertion. Head short (length 31.2–33.2%, mean 32.1% SL) and deep (depth 21.2–25.1%, mean 23.1% HL). Cheek deep (depth 24.4–28.8%, mean 26.2% HL). Snout short and broad, jaws isognathous, with lower jaw strongly inclined and ventral section of adductor mandibulae muscle large and bulbous in anteroventral region of cheek (fig. 3). Lips well developed and fleshy, lower lip fold discontinuous at symphysis. Dorsal head profile straight to midorbit, bulbous to dorsal fin origin; markedly so in large males. Dorsal body profile curving gently downward along length of dorsal fin base to short, deep caudal peduncle. Ventral body profile more or less straight (males) or strongly convex (females).

Flanks covered with large, regularly imbricating, cycloid scales. A few deeply embedded, cycloid scales scattered over opercle and subopercle. Cheek with small round, cycloid scales restricted to one or two rows at dorsoposterior margin. Occipital region with numerous small, imbricating cycloid scales to level of midorbit. Small cycloid scales over pectoral-fin base, chest naked. Belly scales slightly smaller with a gradual transition in size; scales on ventral portion of belly and anal-genital region of same size as lateral belly scales. Upper lateral line originates behind occipital margin of opercle, ascends gradually to dorsal-fin base reaching highest point at level of 10th to 12th dorsal fin spine, continues with half an intervening scale or no intervening scale between lateral line and dorsal-fin base. Pored scales interspersed with more numerous nonpored scales along length of upper lateral line. Lower lateral line short, usually consisting of only two or three pored scales interspersed among nonpored scales. Upper lateral line separated from lower lateral line by two scales (excluding pored rows). Caudal-fin base with a single large pored scale medially (not included in longitudinal scale count) and numerous small scales over basal eighth of fin.

Dorsal fin with XVI–XVIII (mode XVII) spines and 6–9 (mode 8) rays. Anal fin with III spines and 5–6 (mode 6) soft rays. Dorsal-fin spines gradually increase in length to 14th or 15th spine, remaining spines of equal length. Soft dorsal and anal fins in males with tapering filamentous extensions reaching to

TABLE 1

Morphometric and Meristic Data for the Holotype and Eight Paratypes of *Congochromis pugnatus,* n.sp., Two Syntypes of *C. squamiceps*, Two Largest Syntypes of *C. dimidiatus*, and Two Paratypes of *C. sabinae*

Character	*Congochromis pugnatus,* n.sp.						*C. squamiceps*		*C. dimidiatus* MNHN		*C. sabinae* AMNH	
	Holotype	*N*	Mean	Min	Max	SD	IRSNB	BMNH				
							13	1902.4.14:11	92–120	92–121	235651	235652
SL	48.2	9		33.8	51.5		47.5	38.9	44.5	29.0	48.0	37.0
%SL												
Body depth	32.2	8	31.7	29.3	35.5	1.82	29.7	28.8	29.0	33.1	29.6	32.1
Head length	31.5	8	32.1	31.2	33.2	0.81	34.0	30.8	28.5	29.3	31.3	33.5
Cp length	40.0	8	43.8	36.0	51.7	5.75	35.8	-ve	52.7	44.7	47.3	40.3
Cp depth	45.0	8	49.3	45.0	57.2	4.11	42.6	-ve	53.5	51.8	52.0	46.8
Anal base	18.0	8	17.4	15.6	18.3	0.82	17.3	15.2	15.7	15.9	15.2	14.6
Dorsal base	65.4	8	62.7	60.4	65.4	1.71	64.0	57.1	61.8	61.4	60.4	63.2
Postorb. length	41.3	8	42.4	39.9	45.1	1.57	44.4	40.8	40.2	50.6	36.7	39.5
Predorsal	31.7	8	30.9	28.8	32.8	1.45	30.9	28.2	32.6	31.7	31.2	32.2
Preanal	71.6	8	68.6	57.4	72.5	4.79	70.3	67.8	75.1	70.0	58.1	75.4
%HL												
SnL	31.3	8	30.9	28.6	33.3	1.70	32.1	30.0	26.0	22.4	34.0	35.5
Head depth	25.1	8	23.1	21.2	25.1	1.41	22.5	-ve	19.6	17.0	21.7	18.9
Preorb, length	15.0	8	16.3	15.0	17.4	0.77	17.3	17.5	14.2	14.1	19.3	16.9
Lj length	38.8	8	38.7	34.5	41.2	2.27	40.7	37.5	36.2	34.1	39.3	31.5
Orbital width	30.6	8	28.5	26.9	30.6	1.26	27.1	29.2	29.1	24.7	32.0	31.5
Cheek depth	26.9	8	26.2	24.4	28.8	1.37	27.8	25.8	20.5	18.8	21.3	20.2
Counts												
Longitud. scales	25	26(1), 27(4), 28(3)					25		26	27	26	28
Dorsal spines	XVIII	XVI(2), XVII(4), XVIII(2)					XVIII	XVII	XVII	XVII	XVII	XVIII
Dorsal rays	8	6(1), 8(6), 9(1)					8	8	7	7	8	8
Anal rays	6	5(1), 6(7)					6	7	6	6	5	6
Gill rakers	9	8(1), 9(5), 10(2)					8	8	-ve	9	10	11
Vertebrae	27	26(7), 27(1)					26	27	25	25	24	25

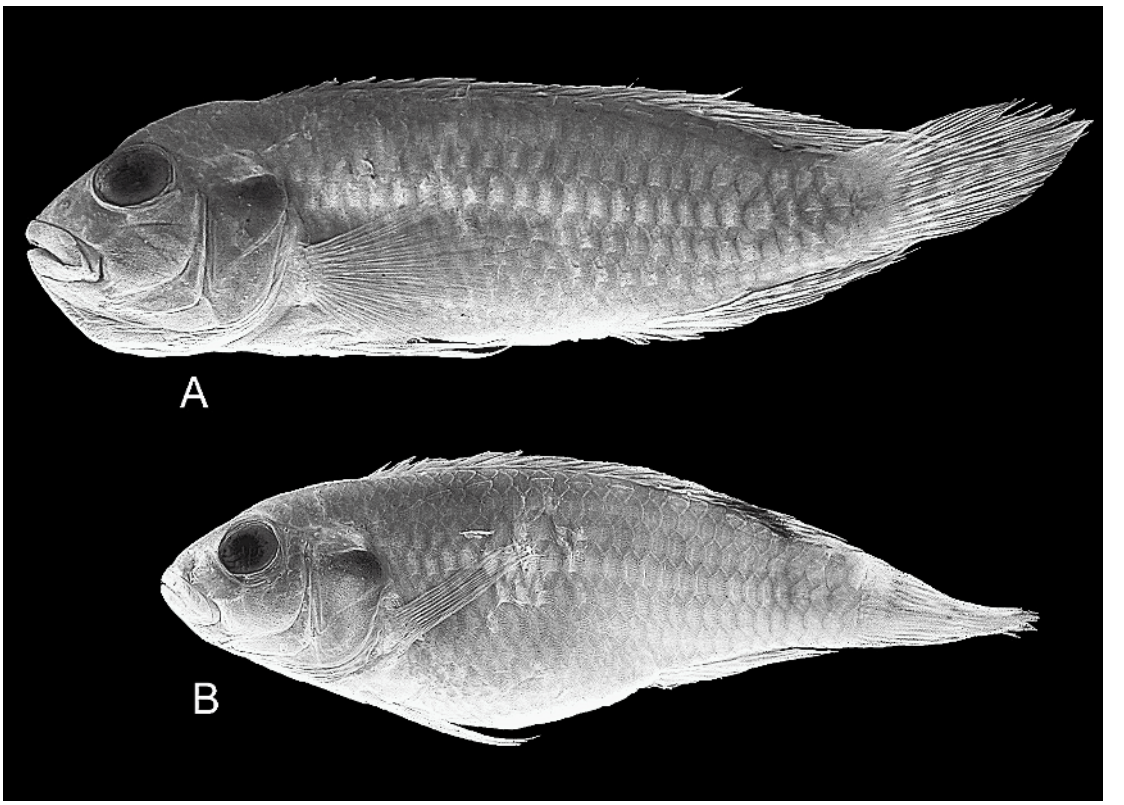

Fig. 4. *Congochromis pugnatus:* **(A)** AMNH 6079, holotype, male, 48.2 mm SL, Democratic Republic of Congo, Kisangani (Stanleyville), May 1915, H. Lang and J.P. Chapin; **(B)** AMNH 237670, paratype, female, 37.0 mm SL, same data as holotype.

basal third of caudal fin. In females soft dorsal and anal fins are pointed but not produced and do not reach base of caudal fin. Caudal fin rounded with 14 branched rays; appears lance-shaped, subacuminate when adducted. First pelvic fin ray longest in both sexes, reaching anal fin base in males, shorter in females. Pectoral fin rounded, reaching vertical approximately at midpoint of spinous dorsal fin.

Eight to 10 small gill rakers along outer row of lower limb of first gill arch (including larger more elongate raker in angle of arch) and three to five bulbous epibranchial rakers (fig. 5C). In common with most other chromidotilapiine cichlids, a prominent visorlike, hanging pharyngeal pad is developed on epibranchial 2, and no microbranchiospines are present on outer face of second, third, or fourth gill arches.

Outer row dentition on both premaxilla and dentary composed of relatively robust, recurved, unicuspid teeth (fig. 5B). Teeth are evenly spaced along each jaw, three or four symphysial teeth on dentary somewhat enlarged and procumbently implanted. Anteriorly in both jaws three to four short inner rows of recurved teeth taper to a single row posteriorly.

Lower pharyngeal jaw (fig. 5D) relatively gracile, with narrow horns and a short blunt keel. Dentigerous surface sparsely covered with bicuspid teeth. Posterior row teeth elongate, erect, closely spaced bicuspids with strongly hooked major cusp and smaller minor cusp. Anteriorly lower pharyngeal jaw teeth weakly erect, somewhat shouldered, robust, unicuspids.

Vertebrae column with a total of 26–27 (mode 26) vertebrae.

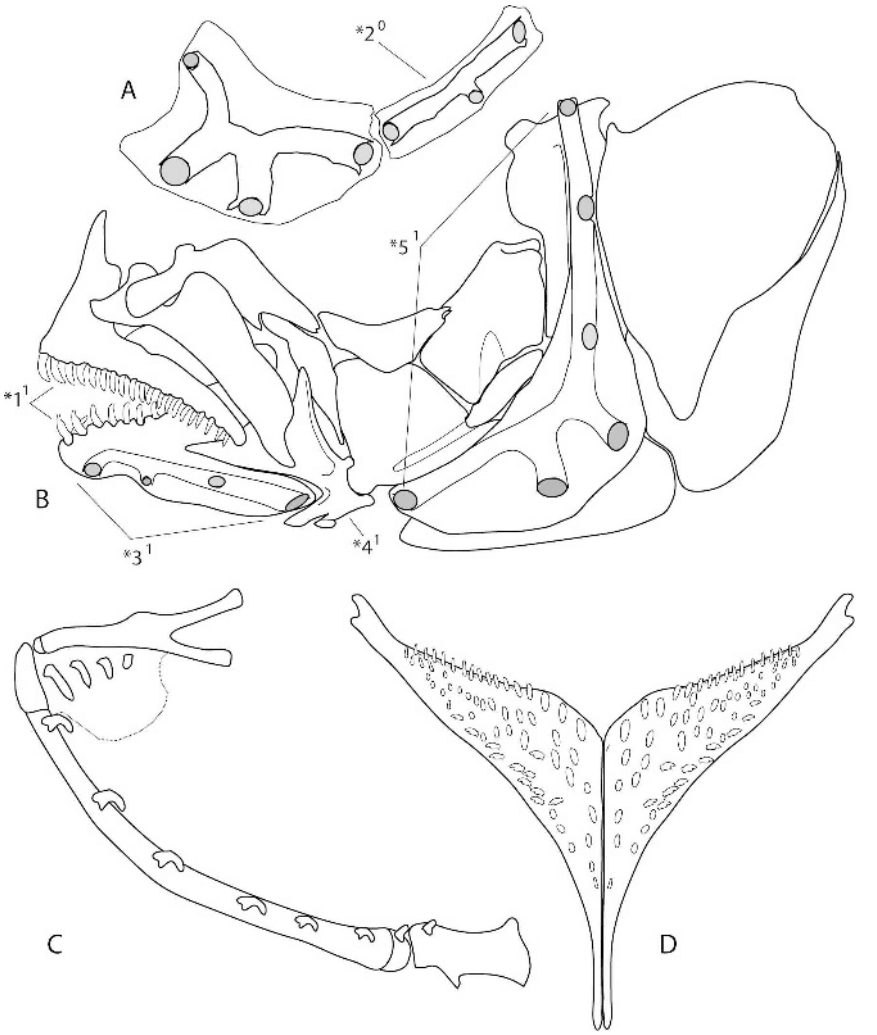

Fig. 5. *Congochromis pugnatus*, AMNH 237670, paratype, male, 51.5 mm SL: **(A)** infraorbital series, **(B)** suspensorium and jaws, **(C)** 1st gill arch, and **(D)** lower pharyngeal jaw.

Miscellaneous Osteology And Anatomy: In common with other *Congochromis*, the first infraorbital of *C. pugnatus* has four sensory canal pores and is followed by a single, elongate, dorsoposteriorly oriented infraorbital element (fig. 5A). Four pores perforate the laterosensory canal in the dentary, the anguloarticular lacks a canal, and six pores perforate the preopercular canal (fig. 5B). The pharyngeal apophysis has an extensive exoccipital contribution to the ventral articular surface of the apophysis.

Primitively in the caudal skeleton of chromidotilapiines the hypural plate is comprised of five separate hypural elements, each of which articulates with an autogenous terminal urostyle (e.g., fig. 2A, B). In *Congochromis* various patterns of hypural fusions are evident (e.g., fig. 2C–F), but uniquely in *C. pugnatus* hypurals 1+2 and 3+4 are fused into a single element, and the resultant compound hypural plate is fused with the urostyle (fig. 2C); this is the case even in the smallest specimens examined. By contrast, *C. sabinae* (fig. 2E), *C. squamiceps* (fig. 2D), and *C. dimidiatus* (fig. 2F) have hypurals 3+4 (or 3 and 4 in the case of *C. dimidiatus*) fused with the urostyle, but hypurals 1+2 (*C. sabinae*) or hypurals 1

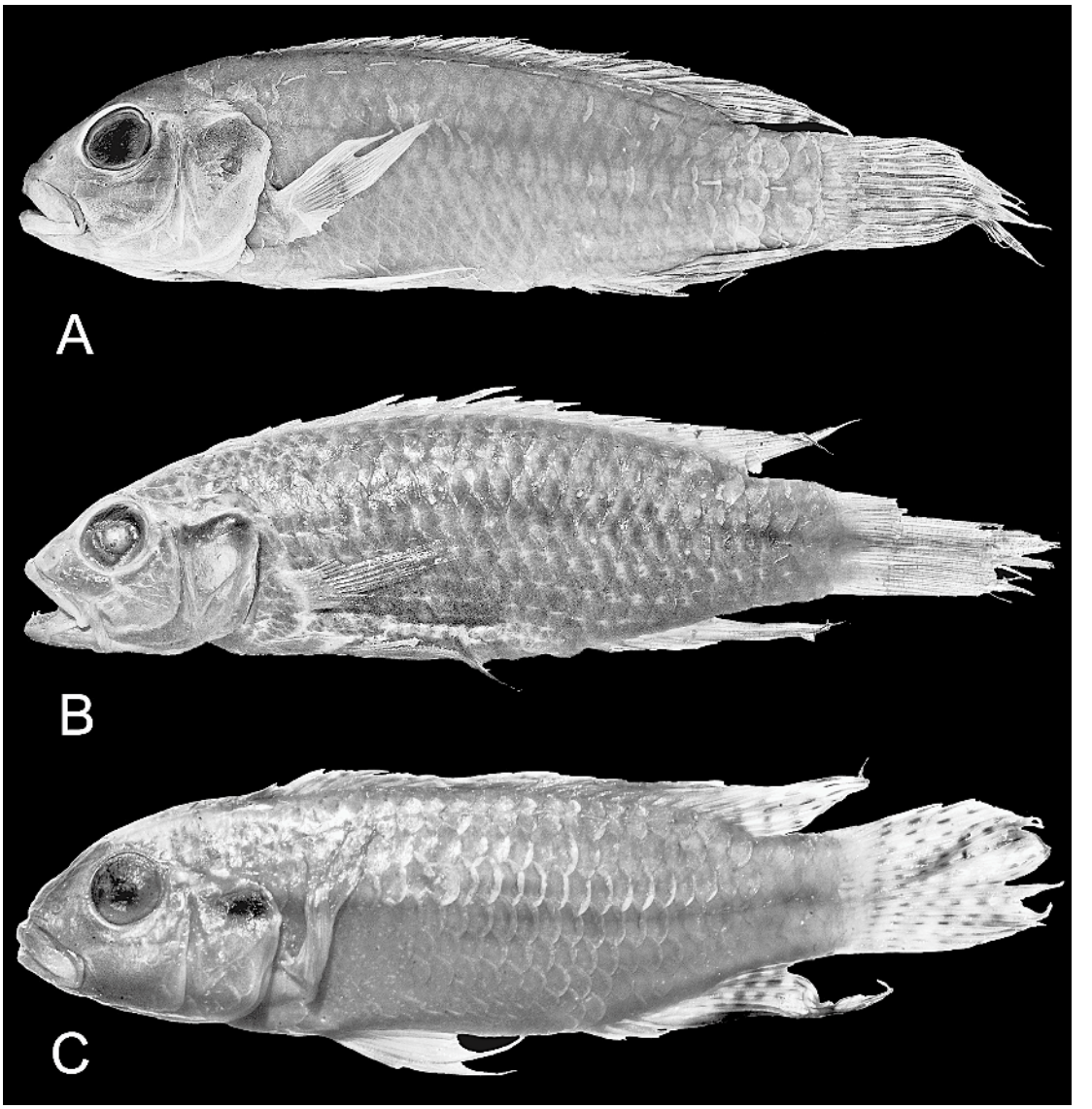

Fig. 6. **(A)** *Congochromis squamiceps*, IRSNB 13, syntype, male, 47.5 mm SL, Lindi River, Upper Congo, **(B)** *C. dimidiatus*, MNHN 1892-0120, syntype, male, 44.5 mm SL, Bangui, **(C)** *C. sabinae*, AMNH 235651, paratype, male, 48.0 mm SL, Loubi River, southwest of Makoua.

and 2 (*C. squamiceps* and *C. dimidiatus*) remain autogenous, even in the largest specimens available for study. In *C. pugnatus* the adductor mandibulae muscle is well developed, and in large individuals the anterioventral portion of the muscle complex is enlarged and voluminous, lending a characteristic bulge to the cheek (fig. 3).

COLORATION IN PRESERVATIVE (fig. 4): Ground color is more or less uniformly pale brown. Specimens have been in preservative for more than 90 years and pigmentation is faded; nonetheless, each flank scale has a narrow pigmented bar on its exposed posterior edge. Scale centers retain traces of a silvery iridescence, and this silvery iridescence is most

strongly marked midlaterally and over the bloated abdomen of female specimens. All specimens lack a clearly defined dark longitudinal band or series of midlateral blotches extending from the eye to the caudal peduncle (males) or end of the caudal fin (females), a pigmentation that is claimed to be characteristic of other *Congochromis* (Lamboj 2004); however, the absence of this feature may be an artifact of long-term preservation. Both males and females retain a heavily pigmented, scaleless opercular blotch. In males the soft dorsal, anal, and caudal fins are heavily maculate with alternating rows of light and dark maculae creating a striped patterning. In females these fins are hyaline and lack rows of maculae, and a single large black blotch is present in the soft dorsal fin (fig. 4B).

Coloration in Life: No data.

Geographical Distribution: Currently known only from the Upper Congo from a single collection from the vicinity of Kisangani (Stanleyville) in the Democratic Republic of Congo.

Habitat: The species is currently known only from historically collected specimens, and no record of habitat preference is provided by Nichols and Griscom, who reported only that the specimens were collected in 1915 during the AMNH Lang-Chapin Congo Expedition, in the vicinity Kisangani. The town of Kisangani lies between the Lindi River and the Congo mainstream, and as a result it is possible that Lang-Chapin specimens from "Kisangani" may refer to collections made in different rivers. *Congochromis pugnatus* and *C. squamiceps* may occur syntopically in the vicinity of Kisangani, as indicated by an individual of the latter species collected by Lang and Chapin (AMNH 225399) from the Kisangani locality, but this is unconfirmed at present.

Etymology: From the Latin *pugno*, meaning to contend or fight, in reference to the heavy-jawed, pugnacious aspect of the species.

DISCUSSION

As is evident from table 1 and figures 4 and 6, species of *Congochromis* are superficially very similar, and as a result problems persist in the identification of materials currently housed in museum collections (personal obs.). Most of these specimens have been collected more than 30 years ago, and precise information on locality, coloration, or behavior are often unavailable to aid in species assignment. In an effort to investigate species boundaries between the morphologically similar members of *Congochromis*, we performed an exploratory multivariate analysis of 16 log-transformed morphometric variables using a sheared PCA (Humphries et al., 1981; Bookstein et al., 1985). Because of the uncertainty of species identifications in museum collections, we have limited this analysis to include those members of the type series for each putative species for which we were able to obtain a full set of morphometric data. The resultant sample is too small to be of statistical significance; nonetheless, it is noteworthy that complete discrimination of a *C. pugnatus* + *C. squamiceps* cluster from *C. sabinae* and *C. dimidiatus* occurred along sheared PC2 (fig. 7 and table 2), while PC3 separates *C. sabinae* and *C. dimidiatus*. Sheared PC2 loaded heavily for preorbital length, caudal peduncle length, and length of anal base, and the variables that loaded most heavily for PC3 were cheek depth and caudal peduncle length (table 2). Based on these admittedly limited data, it appears that *C. pugnatus* and *C. squamiceps*, both from the

TABLE 2
Loadings of Morphometric Variables in Sheared Principal Components Analysis for Type Specimens of *Congochromis* spp. (fig. 7)

Variable	Sheared PC2	Sheared PC3
Standard length	0.105	0.066
Body depth	0.097	0.001
Head length	0.075	0.024
Head depth	0.195	−0.107
Snout length	−0.257	0.118
Preorbital length	−0.578	0.071
Lower jaw length	0.278	−0.104
Oribit diameter (horizontal)	−0.067	0.264
Postorbital length	0.216	−0.193
Cheek depth	0.099	−0.710
Caudal peduncle length	0.465	0.505
Caudal peduncle depth	0.170	0.196
Dorsal base	0.128	0.067
Anal base	0.312	−0.121
Predorsal length	0.109	0.101
Preanal length	0.089	0.045

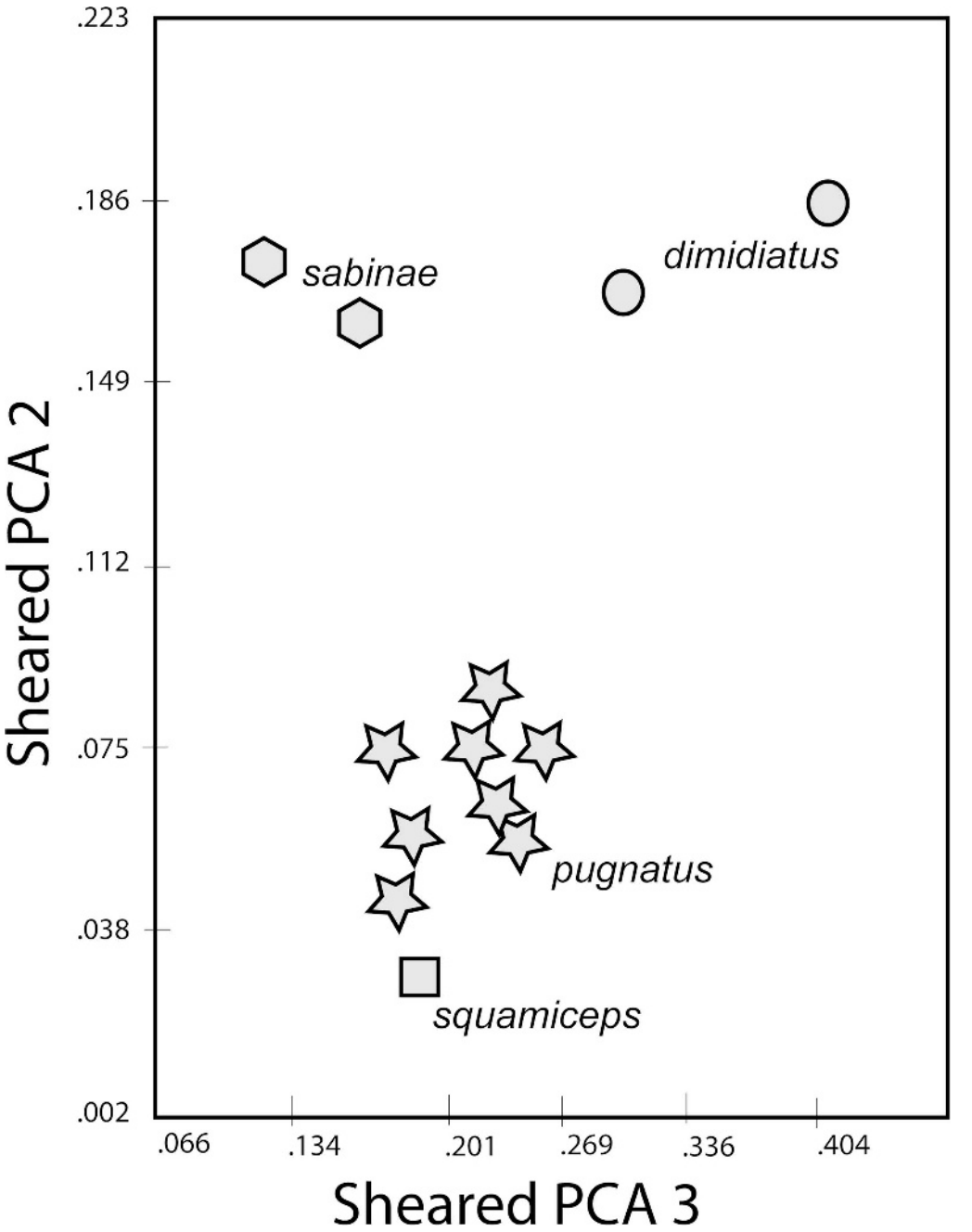

Fig. 7. Scatterplot of sheared second and third PC scores of 16 log-transformed morphometric variables the type series of *Congochromis pugnatus* (stars), syntype of *C. squamiceps* (square), paratypes of *C. sabinae* (hexagons), and syntypes of *C. dimidiatus* (circles) (see table 2 for axis loadings).

region around Kisangani in the upper Congo, are currently morphometrically indistinguishable. However, an ongoing radiograph-based analysis of body shape variation within and among chromidotilapiine species incorporating larger sample sizes suggests a greater resolving power (Schwarzer, in prep.), but with the limited material currently available we are unable to undertake such an analysis. Nonetheless, anatomically, *C. pugnatus* and *C. squamiceps* are readily separable on the basis of consistent hypural fusion pattern differences.

With the single exception of *C. sabinae*, with a range extending into the Liboumba River (Ogowe drainage) of Gabon, *Congochromis* and *Nanochromis* are restriced to the central Congo basin. A preliminary survey of extensive historical material housed in MRAC and AMNH and from recent collections in AMNH and ZMS suggests that *Nanochromis* s.str. is restricted to the lower Congo mainstream and Pool Malebo and to the shallow lakes Mai Ndombe and Tumba in the Cuvette Centrale (the ''saucer-shaped'' part of the central Congo basin), while species of *Congochromis* occur both in small rainforest streams (*C. sabinae*), as well as in larger rivers and lakes (*C. dimidiatus, C. pugnatus, C. squamiceps*). *Nanochromis* appears to be entirely absent in the Eastern Congo while, to date, no *Congochromis* is known from the lower Congo Rapids, Pool Malebo, or the Kasai drainage. In combination, this pattern suggests an allopatric origin of *Congochromis* and *Nanochromis*, as well as intrinsic ecological differences between members of the two closely related genera, and it highlights the importance of a fine-scaled analysis of distributional patterns within the Congo basin and the Cuvette centrale.

Although a preliminary analysis of both mitochondrial and nuclear DNA sequence data in chromidotilapiine cichlids supports the generic distinction of *Nanochromis* and *Congochromis* (Schliewen and Lamboj, unpubl.), the enigmatic eastern congolese *Chromidotilapia schoutedeni* (Poll and Thys van den Audenaerde, 1967) as well as the eburneo-ghanaen endemic *Limbochromis robertsi* (Thys van den Audenaerde and Loiselle, 1971) form a well-supported clade together with *Nanochromis* and *Congochromis*. This somewhat unanticipated result suggests that a further analysis, including morphological data from *C. schoutedeni* and *L. robertsi*, is desirable to resolve the phylogenetic intrarelationships of this group. Such an in-depth combined analysis is currently in progress.

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