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Three new species of African suckermouth catfishes, genus *Chiloglanis* (Siluriformes: Mochokidae), from the lower Malagarasi and Luiche rivers of western Tanzania

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Abstract

Recent fieldwork and review of existing collections containing *Chiloglanis* specimens from the lower Malagarasi and Luiche rivers in western Tanzania has revealed three new species that are readily distinguished from described congeners by external features. Two of the species, *Chiloglanis igamba* **sp. nov**., and *Chiloglanis orthodontus* **sp. nov**. are restricted to the Malagarasi basin. The third species, *Chiloglanis kazumbei* **sp. nov.**, is more broadly distributed in both the Malagarasi and adjacent Luiche basin. A key to all described species within these two basins is presented, along with comments on the distribution and validity of nominal *Chiloglanis* species examined during this study.

Key words: valid species, *Chiloglanis micropogon* Poll 1952, *Chiloglanis pojeri* Poll 1944

Introduction

The genus *Chiloglanis* Peters 1868 is the second largest genus within the family Mochokidae, with approximately 46 valid species distributed throughout most of the tropical rivers of sub-Saharan Africa as well as the Nile River basin. *Chiloglanis* is also the type genus of the subfamily Chiloglanidinae (Riehl & Baensch 1991; Vigliotta 2008), which also includes *Atopochilus* Sauvage 1879, *Euchilichthys* Boulenger 1900, and *Atopodontus* Friel and Vigliotta 2008. Members of this subfamily are rheophilic taxa that are characterized by jaws and lips modified into a sucker or oral disc used for adhering to and feeding upon objects in fast flowing waters. Most species of the genus *Chiloglanis* are relatively small fishes (<100 mm SL), and are distinguished from other members of the subfamily by several features including: the absence of a free orbital margin; the absence of a mandibular sensory canal; and 1 or 2 rows of mandibular teeth bunched in a tight bouquet at the jaw symphysis, in a more loosely distributed curved row, or rarely a tight, relatively straight row (Fig. 1A–C; Friel & Vigliotta 2008: Fig. 3D–F respectively), as opposed to 3 or more straight, transverse rows of mandibular teeth in all other genera within the subfamily (Friel & Vigliotta 2008: Figs. 2 & 3A–C). Additional internal features that characterize *Chiloglanis* are provided in Friel and Vigliotta (2008) and Vigliotta (2008). Finally, adult males of some *Chiloglanis* species display prominent dimorphism of the caudal fin that is species specific and often useful for identification purposes (Figs. 2, 3 & 6).

Most *Chiloglanis* specimens collected from the Malagarasi River in western Tanzania (east of Lake Tanganyika) have previously been identified as species that were originally described from the upper Congo River basin in the Democratic Republic of the Congo (west of Lake Tanganyika). In an assessment of the Malagarasi ichthyofauna, De Vos *et al*. (2001) listed three species for the genus: *Chiloglanis* aff. *lufirae*, *Chiloglanis* aff. *lukugae* and one undescribed species. This is not surprising perhaps, because the Malagarasi is considered part of the Congo River basin, and was continuous with it prior to the opening of the rift that created Lake Tanganyika (Tiercelin & Mondeguer 1991). In fact, De Vos *et al*. (2001) estimated that about 15% of the Malagarasi fish fauna has a Congolese origin reflecting this ancient connection.

To investigate the true identity of *Chiloglanis* species from the Malagarasi, we examined all available collections from this basin, as well as samples from other basins bordering Lake Tanganyika. The majority of this mate-

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rial collected prior to 2001 is held at the Royal Museum for Central Africa (MRAC). The MRAC collection includes Malagarasi specimens examined by De Vos *et al*. (2001) that had been identified as *Chiloglanis* aff. *lufirae* Poll 1976, *Chiloglanis* aff. *lukugae* Poll 1944, *Chiloglanis somereni* Whitehead 1958, and an undescribed *Chiloglanis* sp. During our visit to MRAC, we also examined type specimens representing 26 nominal species of *Chiloglanis*, including several species described from other basins bordering Lake Tanganyika and beyond. Furthermore, we have examined photographs and radiographs of additional *Chiloglanis* type specimens deposited at other museums that have been made available via the All Catfish Species Inventory (ACSI) website at http://silurus.acnatsci.org/index.html.

Finally, the first author made new collections from the lower Malagarasi and Luiche rivers in 2004 and 2009 that provided large series of *Chiloglanis* specimens. This new material along with earlier collections confirmed the presence of several distinct species that are not conspecific with any described taxa. Three of the new species found in the lower Malagarasi are described here. A fourth undescribed species (tentatively labeled as *Chiloglanis* sp. "musasae" by De Vos) is known only from the upper Malagarasi basin in Burundi, and is still under study by MRAC researchers.

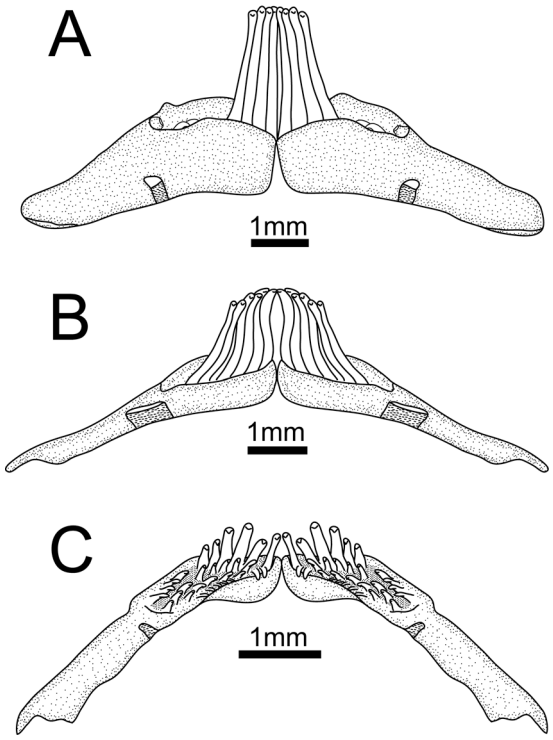

FIGURE 1. Dorsal view of the lower jaw and dentary dentition of three new *Chiloglanis* species. A. *Chiloglanis igamba* **sp. nov.**, CU 94005; B. *Chiloglanis kazumbei* **sp. nov.**, CU 90387; C. *Chiloglanis orthodontus* **sp. nov.**, CU 90755.

Material and methods

Measurements were taken to the nearest 0.1 mm with digital calipers or from scaled distances between landmark points recorded with the aid of a stereomicroscope equipped with a camera lucida. Skeletal features were studied using both radiographs and cleared and stained preparations. Gender of specimens was determined by external examination. As in most mochokids, males bear more elongate and acutely pointed genital papillae than similarly sized females; in addition, females possess a longitudinal invagination along the midline between the anus and urogenital papilla. Morphometric measurements, including subunits of the head and oral disc follow Friel and Vigliotta (2008: Fig. 1). Meristic count formulas (except for the dorsal fin) and terminology for premaxillary dentition generally follow the methods of Skelton and White (1990). Herein the dorsal-fin count includes the dorsal spinelet and is designated along with the dorsal spine by upper case Roman numerals. Institutional abbreviations follow Sabaj Pérez (2010). Abbreviations for specimen preparation are as follows: ALC, alcoholic specimen; and C&S, cleared and stained preparation.

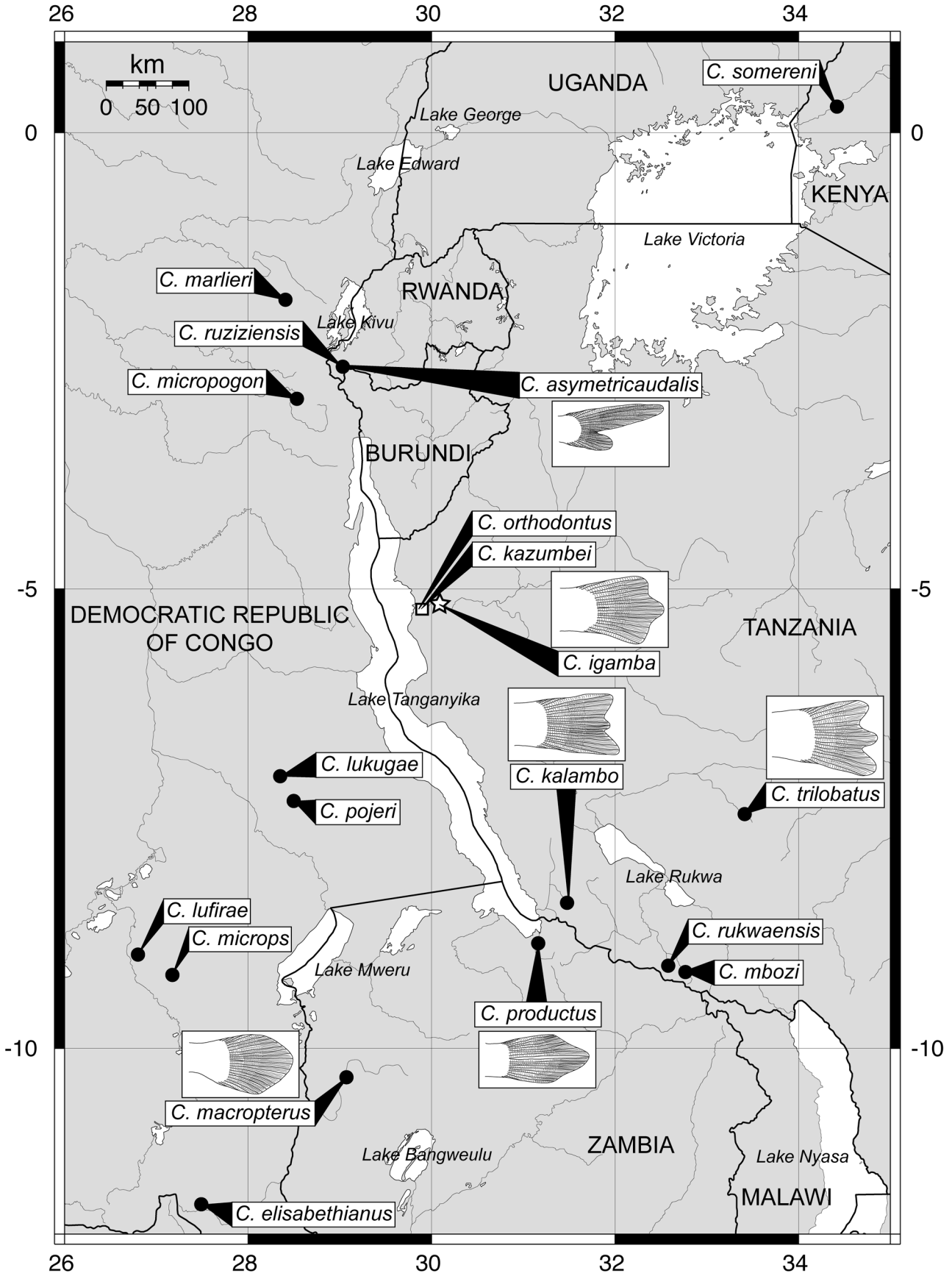

FIGURE 2. Map of the general area surrounding Lake Tanganyika showing the type localities of three new *Chiloglanis* species (white square & star) along with those of 16 additional *Chiloglanis* species previously described from the region (black circles). For those species displaying secondary sexual dimorphism of the caudal fin in adult males, a silhouette of the fin is illustrated.

***Chiloglanis igamba* sp. nov.**
(Figs. 1A & 3; Table 1)

Chiloglanis aff. *lufirae* — De Vos *et al*. 2001: 131.
Chiloglanis sp. "igamba" — Vigliotta 2008: 125.

Holotype. CU 90576, 1 male ALC, 64.6 mm SL; Tanzania, Kigoma Region, Malagarasi River at Lower Igamba Falls, 5.1802° S, 30.503° E; J.P. Friel & S. Loader, 9 October 2004.

Paratypes. AMNH 251401, 40 ALC, 27.2–61.8 mm SL; Tanzania, Kigoma Region, Malagarasi River at Lower Igamba Falls, 5.1800100° S, 30.0508300° E; J.P. Friel, P.B. McIntyre & R.C. Schelly, 5 August 2009. — CU 94005, 36 males ALC (8 measured for Table 1), 27.6–63.5 mm SL, 13 females ALC (6 measured for Table 1), 29.3–3.6 mm SL, 2 undetermined gender C&S; same collection data as holotype. — CU 95220, 41 ALC, 26.0–61.7 mm SL; same collection data as AMNH 251401. — MRAC 2010-006-P-1-5, 5 ALC, 30.8–56.8 mm SL; same collection data as AMNH 251401. — SAIAB 87163, 5 ALC, 30.9–56.2 mm SL; same collection data as AMNH 251401.

Non-type specimens. AMNH 251402, 10 ALC, 34.4–54.5 mm SL; Tanzania, Kigoma Region, Malagarasi River between Upper Igamba Fall and High Fall, 5.1785800° S, 30.0730600° E; J.P. Friel, P.B. McIntyre & R.C. Schelly, 6 August 2009. — AMNH 251403, 4 ALC, 33.7–60.4 mm SL; Tanzania, Kigoma Region, Malagarasi River at rapids ~8 km downriver of Igamba Falls, 5.1799300° S, 29.9803500° E; J.P. Friel, P.B. McIntyre & R.C. Schelly, 7 August 2009. — AMNH 251404, 4 ALC, 28.0–36.5 mm SL; Tanzania, Kigoma Region, Malagarasi River upriver ~12 km E of Uvinza, near village of Kanzibwe, 5.1398600° S, 30.4893200° E; J.P. Friel, P.B. McIntyre & R.C. Schelly, 10 August 2009. — AMNH 251405, 22 ALC, 24.3–47.0 mm SL; Tanzania, Kigoma Region, Malagarasi River downriver ~4 km W from Uvinza; near village of Nkwasa, 5.0979300° S, 30.3544900° E; J.P. Friel, P.B. McIntyre & R.C. Schelly, 11 August 2009. — AMNH 251406, 3 ALC, 32.3–47.6 mm SL; Tanzania, Kigoma Region, Malagarasi River near fork in road to village of Ngutu, 5.1156300° S, 30.2966800° E; J.P. Friel, P.B. McIntyre & R.C. Schelly, 12 August 2009. — AMNH 251407, 34 ALC, 27.6–56.0 mm SL; Tanzania, Kigoma Region, Malagarasi River within gorge, 5.2289500° S, 30.2240300° E; J.P. Friel, P.B. McIntyre & R.C. Schelly, 17 August 2009. — AMNH 251408, 3 ALC, 24.8–34.2 mm SL; Tanzania, Kigoma Region, Malagarasi River within gorge, 5.2028300° S, 30.1697500° E; J.P. Friel, P.B. McIntyre & R.C. Schelly, 18 August 2009. — CU 90410, 1 male ALC, 34.5 mm SL; Tanzania, Kigoma Region, small side channel of Malagarasi River at Uvinza, 5.1110000° S, 30.3932000° E; J.P. Friel, G. Kazumbe & S. Loader, 18 September 2004. — CU 90428, 1 male ALC, 31.3 mm SL, 1 female ALC, 37.1 mm SL; same collection data as holotype. — CU 90569, 9 male ALC, 22.1–3.9 mm SL, 8 female ALC, 24.1–30.2 mm SL; same collection data as CU 90410. — CU 90572, 1 male ALC, 32.1 mm SL; Tanzania, Kigoma Region, Malagarasi River at Igamba Falls, 5.1802000° S, 30.0505000° E; J.P. Friel & S. Loader, 17 September 2004. — CU 95221, 10 ALC, 28.9–36.1 mm SL; same collection data as AMNH 251402. — CU 95222, 4 ALC, 33.7–58.1 mm SL; same collection data as AMNH 251403. — CU 95223, 3 ALC, 29.0–51.8 mm SL; same collection data as AMNH 251404. — CU 95224, 22 ALC, 22.8–47.3 mm SL; same collection data as AMNH 251405. — CU 95225, 4 ALC, 29.5–55.1 mm SL; same collection data as AMNH 251406. — CU 95226, 35 ALC, 25.3–62.7 mm SL; same collection data as AMNH 251407. — CU 95227, 4 ALC, 25.7–36.0 mm SL; same collection data as AMNH 251408. — MRAC P 94068.0002–0006, 1 male ALC, 4 female ALC; Tanzania, Kigoma Region, Malagarasi River at the rapids near Uvinza salt mine, 5° 06' S, 30° 22' E; L. De Vos, 21 October 1994.

Diagnosis. *Chiloglanis igamba* is a sexually dimorphic species in which the caudal fin of adult males is relatively truncate, but with the middlemost rays moderately elongated (Figs. 2 & 3). Females and juvenile males of this species in contrast exhibit a gently forked caudal fin. Sexual dimorphism of the caudal fin is also apparent in several species of *Chiloglanis*, including the following from various tributaries flowing into Lake Tanganyika: *C. trilobatus*, *C. kalambo*, *C. productus* and *C. asymetricaudalis*. However, the particular shape of the caudal fin in *C. igamba* is unique among all congeners (Figs. 2 & 3; see also Fig. 5 in Ng & Bailey 2006 or Fig. 155 in Seegers 1996).

The most similar sexually dimorphic caudal fins are found in males of *C. trilobatus* and *C. kalambo*, where the middle most rays form a third lobe (Fig. 2). The trilobate caudal-fin shape in these species can be distinguished from the shape in *C. igamba* by the areas between upper, middle and lower lobes, which are notably recessed. In *C. igamba* these recessed areas are absent and a clearly trilobate shape is not evident. *Chiloglanis igamba* is further

distinguished from *C. trilobatus* and *C. kalambo* by a shorter adipose-fin base length (10.3–16.3% SL vs. 16.4–22.3% SL in *C. trilobatus* and 16.5–23.4% SL in *C. kalambo*); a shorter depth at dorsal fin insertion (14.5–18.4% SL vs. 20.0–24.0% SL in *C. trilobatus* and 18.2–23.5% SL in *C. kalambo*; taken to be equivalent to Seegers (1996) "body depth"); a shorter caudal peduncle depth (8.7–12.6% SL vs. 11.9–14.5% SL in *C. trilobatus* and 11.3–15.4% SL in *C. kalambo*); a longer snout length (20.3–26.2% SL, mean 23.0% SL vs. mean of 19.9% SL in *C. trilobatus* and mean of 18.4% SL in *C. kalambo*); a shorter maxillary barbel (5.0–7.5% SL, mean 6.1% SL vs. mean of 10.6% SL in *C. trilobatus* and mean of 9.3% SL in *C. kalambo*); a wider oral disc (20.4–26.8% SL, mean 24.5% SL vs. mean of 19.0% SL in *C. trilobatus* and mean of 19.7% SL in *C. kalambo*); a wider set of premaxillary tooth plates (15.6–19.8% SL, mean 17.9% SL vs. mean of 14.0% SL in *C. trilobatus* and mean of 13.7% SL in *C. kalambo*); 27–45 primary teeth on each premaxilla (vs. 18–31 in *C. trilobatus* and 7–21 in *C. kalambo*); 6 soft rays in the dorsal fin, rarely 5 (vs. 5 rays in *C. trilobatus* and *C. kalambo*).

Caudal-fin shape in males of *C. igamba* is also fairly similar to the shape found in males of *C. productus*. However, in *C. productus* all caudal-fin rays, especially the middle rays, are elongated and the fin is diamond shaped. (Fig. 2). *Chiloglanis igamba* is also easily distinguished from *C. productus* by its pigmentation, which consists of cream-colored splotches on a light brown background. In contrast, the pigmentation of *C. productus* is medium to dark brown with a pale midlateral stripe along the lateral line. *Chiloglanis igamba* is further distinguished from *C. productus* by a shorter pectoral spine (9.9–15.1% SL vs. 15.2–18.5% SL); a shorter pectoral-fin longest ray (15.2–18.8% SL vs. 19.1–23.9% SL); and a shorter adipose-fin base (10.3–16.3% SL vs. 22.5–26.2% SL).

Finally, in *Chiloglanis asymetricaudalis* the caudal fin of adult males is forked, but with an elongate upper lobe (Figs. 2 & 6). In addition to caudal fin shape, *Chiloglanis igamba* is easily distinguished from *C. asymetricaudalis* by a shorter pectoral spine (9.9–15.1% SL vs. 16.4–19.7% SL); a shorter dorsal spine (8.2–12.7% SL vs. 13.0–15.7% SL); a shorter anal fin (11.7–15.9% SL vs. 22.6–28.0% SL); a shorter caudal peduncle (15.0–17.7% SL vs. 18.4–20.9% SL); and a markedly different pigment pattern (Fig. 3 vs. Fig. 6).

Description. Dorsal, lateral and ventral views in Figure 3 illustrate body shape, form and position of fins and barbels. Morphometric and meristic data for holotype and 14 syntopic paratypes are summarized in Table 1.

TABLE 1. Summary of morphometric measurements and meristic counts for *Chiloglanis igamba* **sp. nov.** (N=15; holotype and 14 paratypes). Standard length expressed in mm. All other measurements expressed as % SL. Meristic data for holotype is identified by an asterisk, and the number of specimens with a particular value for fin rays, ribs and vertebrae is shown in parentheses.

MORPHOMETRICS	Holotype	Range	Mean±%SD
Standard length (mm)	64.6	30.0–64.6	
Head length	36.7	31.3–37.5	35.3±1.79
Head depth (maximum)	17.8	13.8–17.8	16.1±1.20
Body depth at anus	13.9	12.2–14.7	13.3±0.71
Occipital shield width (minimum)	4.0	2.8–4.9	3.7±0.59
Prepectoral length	33.9	27.3–34.4	31.6±2.01
Predorsal length	42.3	39.7–44.5	41.8±1.57
Prepelvic length	58.7	55.8–60.3	57.8±1.28
Preanal length	70.3	67.8–72.6	70.1±1.64
Eye diameter (horizontal)	3.9	3.9–5.5	4.9±0.46
Orbital interspace	10.1	7.9–11.4	9.3±0.92
Snout length	25.4	20.3–26.2	23.0±2.02
Premaxillary tooth-patch width	16.6	15.6–19.8	17.9±1.18
Premaxillary tooth-patch length	4.2	3.3–4.4	3.8±0.35
Mandibular tooth row width	3.3	1.8–4.4	2.7±0.67
Anterior nares interspace	5.1	4.4–5.7	5.1±0.40
Posterior nares interspace	5.3	4.5–5.5	5.0±0.29

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TABLE 1. (continued)

MORPHOMETRICS	Holotype	Range	Mean±%SD
Maxillary barbel length	5.4	5.0–7.5	6.1±0.64
Medial mandibular barbel length	0.9	0.9–3.0	1.5±0.49
Lateral mandibular barbel length	2.0	1.1–3.5	2.8±0.60
Mouth width	11.9	10.7–14.1	12.1±1.08
Oral disc width	24.5	20.4–26.8	24.5±1.55
Oral disc length	22.4	19.3–23.8	21.3±1.38
Upper lip length	6.5	4.7–6.5	5.4±0.56
Lower lip length	9.9	8.7–11.6	10.0±0.71
Pectoral-spine length	11.8	9.9–15.1	11.9±1.43
Pectoral-fin length	17.0	15.2–18.8	16.8±1.22
Width at pectoral-fin insertion	26.3	25.2–28.1	26.6±0.86
Length of postcleithral process	7.1	6.8–9.1	7.6±0.69
Pelvic-fin length	13.9	11.2–15.8	13.8±1.09
Depth at dorsal-fin insertion	17.5	14.5–18.4	16.8±1.24
Dorsal-spine length	10.5	8.2–12.7	10.2±1.30
Dorsal-fin length (longest ray)	14.4	12.4–16.6	14.4±1.14
Dorsal-fin base length	10.7	10.2–12.2	11.4±0.61
Dorsal fin to adipose-fin length	23.7	20.5–25.2	22.8±1.53
Adipose-fin base length	13.0	10.3–16.3	13.7±1.63
Adipose fin to caudal-peduncle length	15.9	13.7–17.3	15.6±0.94
Adipose-fin height	2.0	2.0–4.0	3.2±0.51
Anal-fin length (longest ray)	13.8	11.7–15.9	14.2±1.17
Anal-fin base length	12.8	11.0–15.0	13.0±1.25
Lower caudal-fin lobe length	21.4	20.4–24.2	21.9±1.04
Upper caudal-fin lobe length	22.9	21.3–26.0	23.2±1.40
Caudal-peduncle depth (maximum)	11.9	8.7–12.6	10.7±1.18
Caudal-peduncle length	16.7	15.0–17.7	16.4±0.84
MERISTICS			
Mandibular tooth rows	1 or 2*		
Mandibular tooth count (total)	8–16*		
Mandibular tooth count (functional anterior row)	7–8*		
Mandibular tooth count (posterior replacement row)	0–8*		
Primary premaxillary teeth (total)	57–89; 63*		
Secondary premaxillary teeth (total)	20–40		
Tertiary premaxillary teeth (total)	8–16		
Pectoral-fin count	I, 8*(11); I, 9(4)		
Pelvic-fin count	i, 6*(15)		
Dorsal-fin count	II, 5 (2); II, 6*(13)		
Anal-fin count	iii, 6(1); iii, 7*(12); iii, 8(2)		
Caudal-fin count	i, 7, 8, i*(15)		
Pleural rib count (pairs)	7*(11); 8(4)		
Total vertebral count	33*(15)		

FIGURE 3. Dorsal, lateral and ventral views of *Chiloglanis igamba* **sp. nov.**, holotype, CU 90576, Tanzania, Kigoma Region, Malagarasi River at Lower Igamba Falls. Photo by T.R. Vigliotta. Scale bar equals 1 cm.

Moderately sized *Chiloglanis* species, maximum standard length <70 mm. Body roughly cylindrical, depressed anteriorly and compressed posteriorly. Predorsal profile convex; postdorsal body sloping gently ventrally. Preanal profile horizontal. Anus and urogenital opening located at vertical though origin of adipose fin. Skin with numerous small unculiferous tubercles, especially towards head and along dorsal midline. Lateral line complete and mid-lateral along side of body.

Head depressed and broad, snout margin rounded when viewed dorsally. Gill opening restricted to lateral aspect of head from level of base of pectoral spine to level of middle of eye. Gill membranes broadly united to, and attached across isthmus, supported by 5 or 6 branchiostegal rays. Bony elements of skull roof lack any superficial ornamentation. Skin covering skull roof with numerous small, round unculiferous tubercles. Occipital-nuchal shield small, not visible through skin dorsally.

Mouth inferior, lips form ventrally-directed oral disc. Oral disc quite large, nearly as wide as head and covered by numerous papillae. Posterior margin of oral disc with well-developed cleft present at midline. Barbels in three

pairs. Maxillary barbel short, thick and unbranched, about as long as diameter of eye; emanating from posterolateral region of oral disc. Mandibular barbels incorporated into lower lip and visible as trifurcate structures in cleared and stained specimens. Medial mandibular barbels on each side of midline; primary and auxiliary barbels visible as three small bumps in lower lip margin. Lateral mandibular barbels just lateral to medial mandibular barbels, somewhat more pronounced; primary and auxiliary barbels visible as three small bumps in lower lip margin; middle of tips presenting as short pointed barbel, one half length of maxillary barbel.

Premaxillae formed as claw-shaped plates supporting 57–89,"S"-shaped (in lateral view), pointed primary teeth distrubuted in oval patches on ventral surface; 20–40 smaller secondary teeth on posterior surface of premaxillae; 8–16 needle-like teeth inserting above and behind secondary teeth towards roof of mouth and gathered at midline. Number of premaxillary teeth increases with overall body size. Dentary with well-formed tooth cup along anterior margin supporting one or two rows of 7 or 8 robust, "S"-shaped (in lateral view) teeth with pointed tips; when present, posterior row represents replacement teeth. Mandibular teeth bunched at midline (Fig. 1A & Fig. 3).

Eyes small and ovoid, horizontal axis slightly longer than vertical axis; less than one third of orbital interspace. Orbit without free margin. Anterior nares and posterior nares equidistant. Anterior nares tubular with short, raised rim. Posterior nares with elevated flaps along anterior margin.

Dorsal fin located at anterior third of body. Dorsal fin with spinelet, spine and 5 or 6 rays; fin membrane not adnate with body. Dorsal-fin spine short and straight, between 2 to 3 times as long as diameter of eye; smooth along anterior and posterior margins. Adipose fin short, base up to one sixth of SL, originating near posterior third of body; margin convex and deeply incised posteriorly. Caudal fin sexually dimorphic; shallowly forked in females and trilobate in males (middle rays elongated); count i, 7, 8, i. Procurrent caudal-fin rays symmetrical and extending only slightly anterior to fin base. Anal-fin base located ventral to adipose-fin base; margin convex. Anal-fin count iii, 6–8. Pelvic-fin origin at vertical between bases of adipose and dorsal fin. Pelvic-fin margins convex, tip of appressed fin just reaching anal-fin origin. Pelvic-fin count i, 6. Pectoral fin with slightly curved, short, stout spine; anterior and posterior spine margins smooth. Pectoral fin count I, 8 or 9. Cleithral processes short and obtusely pointed, largely buried in skin. Very small axillary pore present, but may be difficult to see or obscured by cleithral process in some specimens.

In addition to dimorphism in shape of caudal fin, dimorphism in body size is present: largest specimens in all samples examined are males.

Coloration. In 70% ethanol: The general pigmentation of this species is shown in Figure 3. In dorsal view, specimens appear medium brown, with indistinct lighter bands or rows of spots posterior to head. Most well-formed bands between dorsal and adipose fins and at terminus of adipose fin. Head uniformly light to medium brown.

In lateral view, specimens appear mostly medium brown with lighter abdomen and numerous lighter spots. Above lateral line, small spots in 6 or 7 evenly spaced vertical rows, corresponding to free neuromasts; spots slightly enlarged between bases of dorsal and adipose fin bases and at terminus of adipose fin. Lateral line with tiny lighter spots corresponding to pores. Below lateral line, large light spots at anal fin origin and below terminus of adipose fin.

Ventral surface cream colored with some spots of dark pigment from origin of pelvic fins to end of anal-fin base. Oral disc, all barbels, anus and urogenital opening cream colored.

Dorsal and pectoral spines and rays light brown; base of dorsal and pectoral-fin rays generally darker; fin membranes nearly translucent. Pelvic and anal fins milky-white; base of anal-fin rays darker or cream colored. Adipose fin with medium brown base and translucent milky-white posterodorsal margin. Base of caudal-fin rays dark; wide band of darker pigment along middle of rays separated from dark basal color by cream-colored patch; tips generally cream colored.

Etymology. The specific name refers to the type locality of this species, Igamba Falls on the Malagarasi River. This is the first major series of waterfalls encountered while navigating upriver from Lake Tanganyika, and is a potential site for a hydroelectric dam. Used as a noun in apposition.

Distribution. This species is known from two general localities in the lower Malagarasi River (the type locality at Igamba Falls (Fig. 2) and upriver near Uvinza), and is probably endemic to the basin. This species is most abundant within the Igamba Falls area and associated large rapids, and is much less common in smaller rapids both above and below these falls.

***Chiloglanis kazumbei* sp. nov.**
(Figs. 1B & 4; Table 2)

Chiloglanis aff. *lukugae* — De Vos *et al*. 2001: 131.
Chiloglanis sp. "burundi" — Vigliotta 2008: 125.

Holotype. CU 95230, male ALC, 49.1 mm SL; Tanzania, Kigoma Region, Malagarasi River at rapids ~6.4 km upriver from Ilagala barge crossing, 5.2013400° S, 29.9001400° E; J.P. Friel, P.B. McIntyre & R.C. Schelly, 14 August 2009.

Paratypes. AMNH 251410, 20 ALC, 26.0–54.1 mm SL; same collection data as holotype. — CU 95231, 19 ALC, 1 C&S, 25.5-54.5 mm SL; same collection data as holotype. — MRAC 2010-006-P-6-10, 5 ALC., 27.1–56.8 mm SL, same collection data as holotype. — SAIAB 87164, 5 ALC, 30.6–51.9 mm SL, same collection data as holotype.

Non-type specimens. AMNH 251409, 8 ALC, 26.3–35.0 mm SL; Tanzania, Kigoma Region, Malagarasi River down river 4 km W from Uvinza, near village of Nkwasa, 5.0979300° S, 30.3544900° E; J.P. Friel, P.B. McIntyre & R.C. Schelly, 11 August 2009. — CU 90387, 10 ALC, 1 C&S, 38–63 mm SL; Burundi, Ruyigi, River Rugoma at point south of route from Kinyinya to Rumpungwe; L. De Vos, L. & L. Taverne, 2 June 1992. — CU 90402, 1 ALC, 56.0 mm SL; Tanzania, Kigoma Region, Malagarasi River, 5.2010000° S, 29.9020000° E; J.P. Friel & G. Kazumbe, 9 September 2004. — CU 90405, 1 ALC, 35 mm SL; Tanzania, Kigoma Region, Luiche River near Ujiji, 4.9328000° S, 29.7057000° E; J.P. Friel, G. Kazumbe & S. Loader, 14 September 2004. — CU 90420, 1 ALC, 47 mm SL; Tanzania, Kigoma Region, Malagarasi River, upriver from bridge at Malagarasi City, 5.0885000° S, 30.8473000° E; J.P. Friel, G. Kazumbe & E. Michel, 24 September 2004. — CU 90565, 4 ALC, 34.6–38.7 mm SL; Tanzania, Tabora, Igombe River Forest Preserve, 4.5190000° S, 31.9068000° E; J.P. Friel & S. Loader, 29 September 2004. — CU 90566, 4 ALC, 38.2–44.6 mm SL; Tanzania, Kigoma Region, Luiche River at bridge, 4.8682000° S, 29.7403000° E; J.P. Friel, G. Kazumbe & S. Loader, 14 September 2004. — CU 90570, 5 ALC, 44.6-50.3; Tanzania, Kigoma Region, Ruchugi River at bridge in Uvinza, 5.0963000° S, 30.3863000° E; J.P. Friel, G. Kazumbe & S. Loader, 19 September 2004. — CU 90571, 1 ALC, 41.4 mm SL; same collection data as CU 90420. — CU 90573, 9 ALC, 26.7–43.9 mm SL; same collection data as CU 90405. — CU 90574, 7 ALC, 28.6–61.3 mm SL; same collection data as CU 90420. — CU 90754, 1 ALC, 40.9 mm SL; Tanzania, Kigoma Region, Malagarasi River at Uvinza, small side channel, 5.1110000° S, 30.3932000° E; J.P. Friel, G. Kazumbe & S. Loader, 18 September 2004. — CU 95228, 1 ALC, 45.1 mm SL; Tanzania, Kigoma Region, Malagarasi River at rapids ~8 km down river of Igamba Falls, 5.1799300° S, 29.9803500° E; J.P. Friel, P.B. McIntyre & R.C. Schelly, 7 August 2009. — CU 95229, 7 ALC, 23.9–38.4 mm SL; same collection data as AMNH 251409. — MRAC 91-03-P-0464-0502, 36 ALC, 32.2–62.9 mm SL, Burundi, Ntanga River, Malagarasi affluent, at bridge on General Interest Route 4 at 7 km from Kinyinya, De Vos and Taverne, 05 April 1991. — MRAC 93-152-P-0260-0299, 39 ALC, 34.2–65.9 mm SL, Tanzania, Kigoma Region, Mungonya River, affluent of Luiche, route from Kigoma Region to Kasulu, ~10 km, 4.883333° S, 29.716667° E, L. De Vos, 19 August 1993. — MRAC 93-152-P-0361-0366, 6 ALC, 35.9–71.1 mm SL, Tanzania, Kigoma Region, Kaseke River, Luiche affluent, km 17 on route from Kigoma Region to Kasulu, 4.883333° S, 29.8° E, L. De Vos, 19 August 1993.

Diagnosis. *Chiloglanis kazumbei* can be distinguished from all species in the Malagarasi and Luiche basins by the following combination of features: relatively long dorsal spine length (16.1–21.3 % SL vs. 7.5–13.6 % SL in *C. asymetricaudalis*; 8.2–12.7 % SL in *C. igamba*; 4.1–7.8 % SL in *C. orthodontus*); relatively long pectoral spine length (19.1–23.6 % SL vs. 12.1–16.5 % SL in *C. asymetricaudalis*; 9.9–15.1 % SL in *C. igamba*; 10.9–17.2 % SL in *C. orthodontus*); relatively wide occipital shield width (6.1–8.3 % SL vs. 3.7–4.7 % SL in *C. asymetricaudalis*; 2.8–4.9 % SL in *C. igamba*; 2.4–3.8 % SL in *C. orthodontus*); and moderately long adipose fin length (17.1–22.8 % SL vs. 13.3-19.8 % SL in *C. asymetricaudalis*; 10.3–16.3 % SL in *C. igamba*; 25.0-31.3 % SL in *C. orthodontus*). Additional features that distinguish *C. kazumbei* from congeners within its range include a distinctive pigmentation pattern with dark patches on the dorsal and pectoral fins, a dark band on the anal fin, and a caudal fin that is deeply forked with a slightly longer lower lobe vs. not deeply forked (*C. lufirae*, *C. igamba* (Fig. 3) & *C. orthodontus* (Fig. 5), or forked with greatly elongated upper lobe in males (*C. asymetricaudalis* (Fig. 6)).

Description. Dorsal, lateral and ventral views in Figure 4 illustrate body shape, form and position of fins and barbels. Morphometric and meristic data for holotype and 19 paratypes are summarized in Table 2.

TABLE 2. Summary of morphometric measurements and meristic counts for *Chiloglanis kazumbei* **sp. nov.** (N=20; holotype and 19 paratypes). Standard length expressed in mm. All other measurements expressed as % SL. Meristic data for holotype is identified by an asterisk, and the number of specimens with a particular value for fin rays, ribs and vertebrae is shown in parentheses.

MORPHOMETRICS	Holotype	Range	Mean±%SD
Standard length (mm)	49.1	25.2–54.2	
Head length	33.4	30.4–35.5	33.3±1.36
Head depth (maximum)	18.1	15.7–18.1	16.9±0.71
Body depth at anus	17.1	14.0–17.1	15.1±0.68
Occipital shield width (minimum)	7.1	6.1–8.3	7.2±0.61
Prepectoral length	29.7	27.3–31.1	29.4±1.18
Predorsal length	41.8	38.4–42.0	40.6±1.14
Prepelvic length	58.5	55.2–59.6	57.2±1.04
Preanal length	72.5	68.5–72.5	70.0±1.23
Eye diameter (horizontal)	4.9	4.2–5.5	4.9±0.43
Orbital interspace	9.6	8.1–10.5	9.3±0.65
Snout length	20.4	17.8–21.0	19.9±0.79
Premaxillary tooth-patch width	14.9	12.9–16.3	14.6±0.80
Premaxillary tooth-patch length	3.7	2.5–4.0	3.4±0.40
Mandibular tooth row width	3.1	2.1–3.6	2.7±0.36
Anterior nares interspace	5.3	4.0–5.7	5.0±0.41
Posterior nares interspace	4.7	3.3–4.8	4.2±0.41
Maxillary barbel length	8.4	5.5–10.2	8.0±1.03
Medial mandibular barbel length	3.1	1.9–3.5	2.7±0.48
Lateral mandibular barbel length	4.5	2.7–5.8	4.1±0.78
Mouth width	12.2	9.6–12.7	11.0±0.76
Oral disc width	22.6	19.5–22.8	21.2±0.94
Oral disc length	20.0	16.8–20.6	19.0±1.09
Upper lip length	4.7	3.6–5.7	4.6±0.52
Lower lip length	9.4	7.8–10.1	8.9±0.76
Pectoral-spine length	20.6	19.1–23.6	21.3±1.06
Pectoral-fin length	22.0	20.1–23.9	22.0±1.08
Width at pectoral-fin insertion	26.5	23.9–27.0	25.5±0.85
Length of postcleithral process	11.2	9.1–13.1	11.0±0.90
Pelvic-fin length	13.0	12.0–16.0	13.6±1.03
Depth at dorsal-fin insertion	22.0	17.0–22.0	18.8±1.25
Dorsal-spine length	18.3	16.1–21.3	18.2±1.61
Dorsal-fin length (longest ray)	17.7	16.4–20.8	18.4±1.03
Dorsal-fin base length	10.8	10.4–14.4	12.4±1.30
Dorsal fin to adipose-fin length	21.0	15.2–22.0	19.7±1.91
Adipose-fin base length	19.8	17.1–22.8	20.2±1.62
Adipose fin to caudal-peduncle length	16.3	14.7–17.5	16.0±0.71
Adipose-fin height	4.7	3.0–5.2	4.1±0.57
Anal-fin length (longest ray)	15.5	11.8–19.9	15.4±2.21
Anal-fin base length	11.2	10.9–15.1	12.2±1.05

continued next page

TABLE 2. (continued)

MORPHOMETRICS	Holotype	Range	Mean±%SD
Lower caudal-fin lobe length	23.8	22.3–28.4	24.9±1.93
Upper caudal-fin lobe length	22.2	20.1–25.2	22.5±1.62
Caudal-peduncle depth (maximum)	11.2	9.2–11.4	10.7±0.57
Caudal-peduncle length	17.9	15.9–21.6	17.5±1.21
MERISTICS			
Mandibular tooth rows	1 or 2*		
Mandibular tooth count (total)	12–24; 17*		
Mandibular tooth count (functional anterior row)	7–14; 9*		
Mandibular tooth count (posterior replacement row)	3–12; 8*		
Primary premaxillary teeth (total)	47–85; 68*		
Secondary premaxillary teeth (total)	30–40		
Tertiary premaxillary teeth (total)	16		
Pectoral–fin count	I, 7(1); I, 8*(19)		
Pelvic–fin count	i, 6*(20)		
Dorsal–fin count	II, 5(3); II, 6*(17)		
Anal–fin count	iii, 7(13); iii, 8*(7)		
Caudal–fin count	i, 7, 8, i*(20)		
Pleural rib count (pairs)	7(2); 8*(18)		
Total vertebral count	34(4); 35*(16)		

Moderately sized *Chiloglanis* species, maximum standard length <70 mm. Body roughly cylindrical, depressed anteriorly and compressed posteriorly. Predorsal profile gently convex; postdorsal body sloping gently ventrally. Preanal profile horizontal. Anus and urogenital opening located slightly behind vertical though origin of adipose fin. Skin covered with rounded unculiferous tubercles. Lateral line complete and midlateral along side of body.

Head depressed and broad, snout margin rounded when viewed dorsally. Gill opening restricted to lateral aspect of head from level of base of pectoral spine to level of middle of eye. Gill membranes broadly united to, and attached across isthmus, supported by 6 or 7 branchiostegal rays. Skin covering skull roof with numerous small, round unculiferous tubercles. Occipital-nuchal shield large, slightly visible through skin dorsally. Mouth inferior, lips form ventrally-directed oral disc. Oral disc moderate in size, wider than long and covered by numerous papillae. Posterior margin of oral disc with well-developed cleft present at midline. Barbels in three pairs and well developed. Maxillary barbel slender and unbranched, originating just anterior to widest point of oral disc and extending to middle of eye. Short basal membrane present on maxillary barbel. Mandibular barbels incorporated into lower lip and visible as trifurcate structures in cleared and stained specimens. Medial mandibular barbels on each side of midline; primary barbel elongate and bordered by short auxiliary barbel on each side. Lateral mandibular barbels just lateral to medial mandibular barbels, somewhat more pronounced than medial mandibular barbels; primary barbel elongate and bordered medially by single short auxiliary barbel.

Premaxillae formed as block-like plates supporting 47–85 “S”-shaped (in lateral view), pointed primary teeth on ventral surface; 30-40 small secondary teeth on posterior surface of premaxillae; 16 needle-like tertiary teeth inserting above and behind secondary teeth towards roof of mouth and gathered at midline. Dentary with well-formed tooth cup along anterior margin supporting one or two rows of 3–14 robust, “S”-shaped (in lateral view) teeth per row with pointed tips; when present, posterior row represents replacement teeth. Mandibular teeth bunched at midline (Fig. 1B).

Eyes small and ovoid, horizontal axis slightly longer than vertical axis; approximately one half of orbital interspace. Orbit without free margin. Anterior nares slightly further apart than posterior nares. Anterior nares tubular with short, raised rim. Posterior nares with elevated flaps along anterior margin.

FIGURE 4. Dorsal, lateral and ventral views of *Chiloglanis kazumbei* **sp. nov.**, holotype, CU 95230, Tanzania, Kigoma Region, Malagarasi River at rapids ~6.4 km upriver from Ilagala barge crossing. Photo by T.R. Vigliotta. Scale bar equals 1 cm.

Dorsal fin located at anterior third of body. Dorsal fin with spinelet, spine and 5 or 6 rays; fin membrane not adnate with body. Dorsal-fin spine long and straight; relatively smooth along anterior margin, but posterior margin with weakly developed serrations only visible in cleared and stained specimens. Adipose fin moderate in size, base less than one quarter of SL; margin gently convex and incised posteriorly. Caudal fin forked; count i, 7, 8, i. Procurrent caudal-fin rays symmetrical and extending only slightly anterior to fin base. Anal-fin base located ventral to adipose-fin base; margin convex. Anal-fin count iii, 7 or 8. Pelvic-fin origin at vertical between bases of adipose and dorsal fins. Pelvic-fin margins convex, tip of appressed fin just short of anal-fin origin. Pelvic-fin count i, 6. Pectoral fin with slightly curved, stout spine; anterior margin smooth, but posterior margin with weakly developed

serrations only visible in cleared and stained specimens. Pectoral fin count I, 7 or 8. Cleithral processes moderate in length and pointed, but largely buried in skin. Axillary pore present along ventral margin of cleithral process; often depigmented relative to surrounding skin surface.

No obvious sexual dimorphism in body ornamentation or skin tuberculation. The head and body of males and females of all sizes are covered with numerous unculiferous tubercles (Fig. 4). Adult males with slightly larger anal fins (up to 19.8% SL vs. up to 15.5% SL in females).

Coloration. In 70% ethanol: The general pigmentation of this species is shown in Figure 4. In dorsal view, specimens appear dark brown, with two lighter bands on posterior half of body. First band lies midway between dorsal and adipose fins. Second band lies at posterior end of adipose fin. Head is uniformly dark brown. In lateral view, specimens appear dark brown with varying numbers of small irregular light patches. Ventral surface cream colored and peppered with dark melanophores from oral disc to caudal fin. Oral disc, all barbels, anus and urogenital opening cream colored. Some specimens with midline cluster of melanophores just anterior to premaxillae.

Dorsal and pectoral spines and rays light brown; base of dorsal and pectoral-fin rays generally darker; fin membranes translucent with dark patch, broadest at spine and tapering towards inner rays. Pelvic and anal fins translucent. Anal fin bisected by dark band running across fin rays. Adipose fin translucent with dark base. Each lobe of caudal fin with dark crescent-shaped patch ventral patch continuous with very dark pigment at base of fin rays.

Etymology. This species is eponymously named for Mr. George Kazumbe, an expert fisherman and friend from Kigoma, Tanzania. He has assisted the authors and several of our colleagues doing fieldwork in Tanzania, and we wish to honor him for his service.

Distribution. This species is known from both the lower Malagarasi River and adjacent Luiche River (Fig. 2), and is typically found in small to moderate sized rapids.

Chiloglanis orthodontus sp. nov.

(Figs. 1C & 5; Table 3)

Holotype. CU 90567, 1 male ALC, 26.3 mm SL; Tanzania, Kigoma Region, side channel of Malagarasi River around island, 5.2005000°, S, 29.8987000° E; J.P. Friel & G. Kazumbe, 9 September 2004.

Paratypes. AMNH 251411, 15 ALC, 27.7–34.3 mm SL; Tanzania, Kigoma Region, Malagarasi River at rapids ~8 km down river of Igamba Falls, 5.1799300° S, 29.9803500° E; J.P. Friel, P.B. McIntyre & R.C. Schelly, 07 August 2009. — CU 90568, 1 female, 27.2 mm SL; Tanzania, Kigoma Region, Malagarasi River, at bridge between Kafura and Makere, 4.0257000°S, 30.5518000° E; J.P. Friel & S. Loader, 4 October 2004. — CU 94006, 9 male ALC, 18.4–28.7 mm SL, 4 female ALC, 21.1–22.4 mm SL; collection data as for holotype. — CU 95232, 15 ALC, 26.1-31.8 mm SL; same collection data as AMNH 251411. — MRAC 2010-006-P-11-12, 2 ALC, 31.7–32.6 mm SL; same collection data as AMNH 251411. — SAIAB 87165, 2 ALC, 29.9–32.6 mm SL; same collection data as AMNH 251411.

Non-type specimens. AMNH 251412, 1 ALC, 26.7 mm SL; Tanzania, Kigoma Region, Malagarasi River down river 4 km W from Uvinza at village of Nkwasa, 5.0979300° S, 30.3544900° E; J.P. Friel, P.B. McIntyre & R.C. Schelly, 11 August 2009. — AMNH 251413, 10 ALC, 24.2–33.1mm SL; Tanzania, Kigoma Region, Malagarasi River at rapids ~6.4 km upriver from Ilagala barge crossing, 5.2013400° S, 29.9001400° E; J.P. Friel, P.B. McIntyre & R.C. Schelly, 14 August 2009. — CU 90755, 4 male ALC, 26.0–1.6 mm SL, 2 female ALC, 30.5–3.2 mm SL, 1 undetermined gender C&S, 37.0 mm; Tanzania, Kigoma Region, Malagarasi River, 5.2010000° S, 29.9020000° E; J.P. Friel & G. Kazumbe, 9 September 2004. — CU 94104, 1 male ALC, SL unknown (damaged); same collection data as holotype. — CU 95233, 2 ALC, 22.2–33.7 mm SL; same collection data as AMNH 251412. — CU 95234, 11 ALC, 24.8–31.8 mm SL; same collection data as AMNH 251413.

Diagnosis. *Chiloglanis orthodontus* is a relatively small species (<30mm SL) that can be distinguished from all other Malagarasi congeners by possessing dentary teeth spread out across the mouth opening as opposed to being concentrated at the midline (Figs. 1 & 5), and a very short dorsal spine (4.1–7.8% SL vs. always greater than 8.2%). This species is further distinguished from all Lake Tanganyika region species except *C. productus*, by a relatively long adipose fin (25.0–31.3% SL vs. <23.4% SL in all other *Chiloglanis* species except *C. productus* (22.5–26.2% SL)).

Additional features useful for distinguishing this species from other species of *Chiloglanis* include a relatively small oral disc (width: 16.5–21.7% SL; length: 12.1–16.3% SL) with relatively elongate barbels (maxillary: 9.4–14.8% SL; lateral mandibular: 3.8–10.7% SL; medial mandibular: 3.8–5.9% SL). These features and the widely spaced teeth of the lower jaw are associated with another distinctive character in this species: the shape of the lower jaw. In most species of *Chiloglanis* the lower jaw is similar to that found in species of *Synodontis*, where elongate "S"-shaped teeth insert in a cavity on the anterior side of the dentary (Fig. 1A&B), the dentary tooth cup of Vigliotta (2008). In *C. orthodontus* the dentary tooth cup is poorly developed (Fig. 1C); the dentary teeth project from the anterodorsal surface of the dentary and are only very gently "S"-shaped. Thus far among *Chiloglanis* species, only *Chiloglanis voltae* Daget & Stauch 1963, known from the Volta and upper Bénoué River basins in western Africa, possesses a similar jaw morphology.

Description. Dorsal, lateral and ventral views in Figure 5 illustrate body shape, form and position of fins and barbels. Morphometric and meristic data for holotype and 14 paratypes are summarized in Table 3.

TABLE 3. Summary of morphometric measurements and meristic counts for *Chiloglanis orthodontus* **sp. nov.** (N=15; holotype and 14 paratypes). Standard length expressed in mm. All other measurements expressed as % SL. Meristic data for holotype is identified by an asterisk, and the number of specimens with a particular value for fin rays, ribs and vertebrae is shown in parentheses.

MORPHOMETRICS	Holotype	Range	Mean±%SD
Standard length (mm)	26.3	18.4–28.7	
Head length	28.5	25.3–33.6	30.1±2.22
Head depth (maximum)	14.1	14.0–19.9	15.8±1.74
Body depth at anus	14.8	13.7–17.4	14.9±0.89
Occipital shield width (minimum)	3.0	2.4–3.8	2.8±0.31
Prepectoral length	27.8	25.7–31.5	28.3±1.53
Predorsal length	39.5	31.8–43.0	38.1±2.55
Prepelvic length	51.7	45.1–55.0	50.6±2.35
Preanal length	67.7	58.7–71.7	66.1±3.24
Eye diameter (horizontal)	3.8	2.2–5.0	4.2±0.68
Orbital interspace	7.6	6.4–8.6	7.4±0.65
Snout length	16.0	12.0–17.6	15.5±1.50
Premaxillary tooth-patch width	13.3	10.0–13.7	12.1±1.21
Premaxillary tooth-patch length	2.7	1.3–2.7	2.0±–0.39
Mandibular tooth-row width	8.0	8.0–10.9	8.9±0.64
Anterior nares interspace	4.6	3.8–5.8	4.9±0.51
Posterior nares interspace	4.9	3.3–5.9	5.0±0.64
Maxillary barbel length	12.5	9.4–14.8	13.1±1.35
Medial mandibular barbel length	4.9	3.8–5.9	5.1±0.65
Lateral mandibular barbel length	9.5	3.8–10.7	8.9±1.65
Mouth width	10.6	8.7–11.9	10.4±0.72
Oral disc width	19.0	16.5–21.7	19.1±1.23
Oral disc length	13.3	12.1–16.3	14.3±1.23
Upper lip length	3.0	1.6–3.1	2.4±0.47
Lower lip length	8.7	7.3–9.2	8.5±0.53
Pectoral-spine length	12.9	10.9–17.2	13.9±1.81
Pectoral-fin length	17.9	14.1–20.1	17.2±1.61
Width at pectoral-fin insertion	25.9	23.9–27.8	25.8±0.99
Length of postcleithral process	-	-	-

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TABLE 3. (continued)

MORPHOMETRICS	Holotype	Range	Mean±%SD
Pelvic-fin length	11.8	11.0–15.1	13.1±1.38
Depth at dorsal-fin insertion	16.7	15.2–21.7	17.7±1.85
Dorsal-spine length	4.9	4.1–7.8	6.2±1.20
Dorsal-fin length (longest ray)	12.5	11.5–14.1	13.0±0.81
Dorsal-fin base length	12.5	9.3–14.3	11.5±1.22
Dorsal fin to adipose fin length	18.3	13.0–19.8	16.2±1.99
Adipose-fin base length	28.5	25.0–31.3	28.3±1.67
Adipose fin to caudal peduncle length	9.5	9.5–13.8	12.3±1.16
Adipose-fin height	3.8	3.2–5.0	4.2±0.52
Anal-fin length (longest ray)	14.4	12.9–17.9	14.7±1.25
Anal-fin base length	15.2	9.8–15.2	12.4±1.71
Lower caudal-fin lobe length	20.2	19.8–23.9	21.7±1.11
Upper caudal-fin lobe length	18.3	18.3–22.3	20.0±1.13
Caudal-peduncle depth (maximum)	11.8	9.9–12.9	12.1±0.77
Caudal-peduncle length	17.9	17.9–23.0	20.8±1.52
MERISTICS			
Mandibular tooth rows	1* or 2		
Mandibular tooth count (total)	11–20; 14*		
Mandibular tooth count (functional anterior row)	11–20; 14*		
Mandibular tooth count (posterior replacement row)	-		
Primary premaxillary teeth (total)	10–35; 24*		
Secondary premaxillary teeth (total)	-		
Tertiary premaxillary teeth (total)	-		
Pectoral-fin count	I, 8*(15)		
Pelvic-fin count	i, 6*(15)		
Dorsal-fin count	II, 5*(15)		
Anal-fin count	iii, 7*(10); iii, 6(5)		
Caudal-fin count	i, 7, 8, i*(15)		
Pleural rib count (pairs)	6*(14); 7(1)		
Total vertebral count	32(3); 33(8); 34*(4)		

Small species with maximum standard length <30 mm. Body roughly cylindrical, depressed anteriorly and compressed posteriorly. Predorsal profile gently convex; postdorsal body sloping gently ventrally. Preanal profile horizontal. Anus and urogenital opening located at vertical though origin of adipose fin. Skin fairly smooth. Lateral line complete and midlateral along side of body.

Head depressed and broad, snout margin rounded when viewed dorsally. Gill opening restricted to lateral aspect of head from level of base of pectoral spine to level of ventral margin of eye. Gill membranes broadly united to, and attached across isthmus, supported by 7 branchiostegal rays. Bony elements of skull roof lack any superficial ornamentation. Skin covering skull roof relatively smooth. Occipital-nuchal shield small, not visible through skin dorsally.

Mouth inferior, lips form ventrally-directed oral disc. Oral disc small, wider than long and covered by numerous indistinct papillae. Posterior margin of oral disc with well-developed cleft present at midline. Barbels in three pairs and well developed. Maxillary barbel slender and unbranched, originating just anterior to widest point of oral disc and extending to just beyond united gill membranes. Short basal membrane present on maxillary barbel. Man-

dibular barbels incorporated into lower lip and visible as trifurcate structures in cleared and stained specimens. Medial mandibular barbels on each side of midline; primary barbel elongate and bordered by short auxiliary barbel on each side. Lateral mandibular barbels just lateral to medial mandibular barbels, somewhat more pronounced than medial mandibular barbels; primary barbel elongate and bordered medially by single short auxiliary barbel.

FIGURE 5. Dorsal, lateral and ventral views of *Chiloglanis orthodontus* **sp. nov.**, holotype, CU 90567, Tanzania, Kigoma Region, side channel of Malagarasi River around island. Photo by T.R. Vigliotta. Scale bar equals 1 cm.

Premaxillae formed as block-like plates supporting 10–35,"S"-shaped (in lateral view), pointed primary teeth on ventral surface. Secondary teeth on posterior surface of premaxillae, very small and difficult to accurately count. Tertiary teeth not obviously differentiated from secondary teeth. Increased numbers of premaxillary teeth in larger specimens. Dentary with poorly formed anterodorsally directed tooth cup supporting 11–20, gently "S"-shaped (in lateral view) teeth with pointed tips. Cleared and stained specimens reveal a poorly defined posterior row of small replacement teeth that are difficult to count accurately in intact specimens. Mandibular teeth, in general, are arranged relatively loosely along dentary, rather than distinctly concentrated at midline (Fig. 1C).

Eyes small and ovoid, horizontal axis slightly longer than vertical axis; approximately one half of orbital interspace. Orbit without free margin. Anterior nares and posterior nares equidistant. Anterior nares tubular with short, raised rim. Posterior nares with elevated flaps along anterior margin.

Dorsal fin located at anterior third of body. Dorsal fin with spinelet, spine and 5 rays; fin membrane not adnate with body. Dorsal-fin spine very short and straight, scarcely longer than diameter of eye; smooth along anterior and posterior margins. Adipose fin very long, base up to one third of SL, originating at second half of body; margin gently convex and deeply incised posteriorly. Caudal fin gently forked; count i, 7, 8, i. Procurrent caudal-fin rays symmetrical and extending only slightly anterior to fin base. Anal-fin base located ventral to adipose-fin base, but much shorter; margin convex. Anal-fin count iii, 6 or 7. Pelvic-fin origin at vertical between bases of adipose and dorsal fin. Pelvic-fin margins convex, tip of appressed fin just short of anal-fin origin. Pelvic-fin count i, 6. Pectoral fin with straight, stout spine; anterior and posterior spine margins smooth. Pectoral fin count I, 8. Cleithral process altogether absent. No obvious axillary pore present.

No apparent sexual dimorphism in shape or size of fins, body ornamentation, or tuberculation of skin.

Coloration. In 70% ethanol: General pigmentation of this species is shown in Figure 5. In dorsal view, specimens appear medium brown, with two lighter bands or rows of spots on posterior half of body. First band lies at origin of adipose fin and second band lies at terminus of adipose fin. Head light to medium brown, darkest between eyes.

In lateral view, specimens appear mostly medium brown with lighter abdomen and set of lighter spots. Lighter spot at origin of adipose fin, above lateral line only and separated from dorsal spot by thin line of pigment. Lighter spot at terminus of adipose fin continuous with dorsal spot, extending more or less to ventral midline, but with notable pigmentation along lateral line. Additional lighter spot present below lateral line at origin of anal fin.

Ventral surface cream colored with some spots of dark pigment from origin of pelvic fins to end of anal-fin base. Oral disc, all barbels, anus and urogenital opening cream colored.

Dorsal and pectoral spines and rays translucent milky-white; base of dorsal and pectoral-fin rays generally darker; fin membranes translucent. Pelvic and anal fins milky-white; base of anal-fin rays darker. Adipose fin with very dark base and translucent milky-white posterodorsal margin. Base of caudal-fin rays very dark; wavy band of dark pigment towards tips of rays; barbell-shaped milky-white spot inbetween.

Etymology. A combination of the Greek word *orthos*, meaning straight or erect, and the Greek word *odontos*, meaning tooth. This name refers to the mandibular dentition in this species, which is relatively straight and evenly spread across the dentary as compared to most other members of the genus. Used as a noun in apposition.

Distribution. *Chiloglanis orthodontus* sp. nov is known from several greatly separated sites in the lower Malagarasi River, and is likely endemic to the basin. It is most commonly encountered in small riffles, or in peripheral regions of rapids where the water velocity is much slower.

Key to *Chiloglanis* species of the Luiche and Lower Malagarasi rivers of Tanzania

1. Oral disc length >16% SL; teeth arranged in tight clump along midline of lower jaw (Fig. 1A&B). 2
- Oral disc length <16% SL; teeth broadly distributed along lower jaw (Fig. 1C); long adipose fin (Fig. 5). . . . . *Chiloglanis orthodontus* (Malagarasi).
2. Caudal fin truncate in juveniles and adult females, elongated middle rays in adult males (Fig. 3); short dorsal (8.2–12.7% SL) and pectoral spines (9.9–15.1% SL) . . . . . *Chiloglanis igamba* (Malagarasi).
- Caudal fin forked. 3
3. Long dorsal (16.1–21.3% SL) and pectoral spines (19.1–23.6 % SL); dorsal and pectoral fins with distinctive dark patches (Fig. 4). . . . . *Chiloglanis kazumbei* (Luiche & Malagarasi).
- Relatively short dorsal (7.5–13.6% SL) and pectoral spines (12.1–16.5 % SL); adult males with elongated upper lobe of caudal fin (Fig. 6) . . . . . *Chiloglanis asymetricaudalis* (Luiche).

Discussion

Historically the *Chiloglanis* species collected in the Malagarasi basin have been misidentified as species originally described from the upper Congo River basin, west of Lake Tanganyika, such as *C. lufirae* Poll 1976 and *C. lukugae* Poll 1944 (De Vos *et al*. 2001). The presence of any Congolese species in the Malagarasi might initially seem pos-

sible given the existence of a proto-Malagarasi-Congo River prior to the formation of Lake Tanganyika (Tiercelin & Mondeguer 1991). However, estimates for the initial inundation of the proto-Malagarasi-Congo River date to around 20 Ma, and as a result Lake Tanganyika has served as a potential barrier for a considerable time. While the lake is not a barrier to all fish species, all *Chiloglanis* species are exclusively rheophilic fishes unlikely to be able to disperse across any lake, and often show high levels of endemism. Thus our finding that no modern *Chiloglanis* species has a distribution on both sides of the lake supports this view.

FIGURE 6. Dorsal, lateral and ventral views of *Chiloglanis asymetricaudalis*, CU 90575, Tanzania, Kigoma Region, Luiche River. Photo by T.R. Vigliotta. Scale bar equals 1 cm.

In our review of *Chiloglanis* species we also compared all congeners present in other tributaries of Lake Tanganyika to explore the possibility that their distributions might extend into the Malagarasi basin. Several *Chiloglanis* species have been described from rivers at both the northern and southern ends of the lake. *Chiloglanis asymetricaudalis* De Vos 1993 and *Chiloglanis ruziziensis* De Vos 1993 were described from the Ruzizi River, which drains

from Lake Kivu into the northern end of Lake Tanganyika (Fig. 2). Our review reveals that *C. asymetricaudalis* is more broadly distributed and reaches a southern limit at the Luiche River, a small affluent of Lake Tanganyika just north of the Malagarasi. *Chiloglanis kalambo* Seegers 1996 and *Chiloglanis productus* Ng & Bailey 2006 were described from the Kalambo and Lunzua basins respectively, both of which drain into the southern end of Lake Tanganyika (Fig. 2). Our review of material reveals that *C. productus* is also present in the Lufubu River in Zambia, another southern affluent of Lake Tanganyika. However neither species is found to extend north to the Malagarasi.

Finally, Seegers (1996) described three *Chiloglanis* species endemic to the Lake Rukwa basin, *C. mbozi*, *C. rukwaensis* and *C. trilobatus* (Fig. 2). The Lake Rukwa basin is an endorheic basin near the southeastern end of Lake Tanganyika that borders the Malagarasi basin. Seegers (1996) suggested a recent and perhaps still active connection between the Malagarasi (via the Nkululu, a southern tributary) and Lake Rukwa (via the Rungwa, a northern affluent of the lake). Despite such historical connections between these two basins, our review of all available Malagarasi basin material confirmed that these Rukwa endemic species are not present in the Malagarasi.

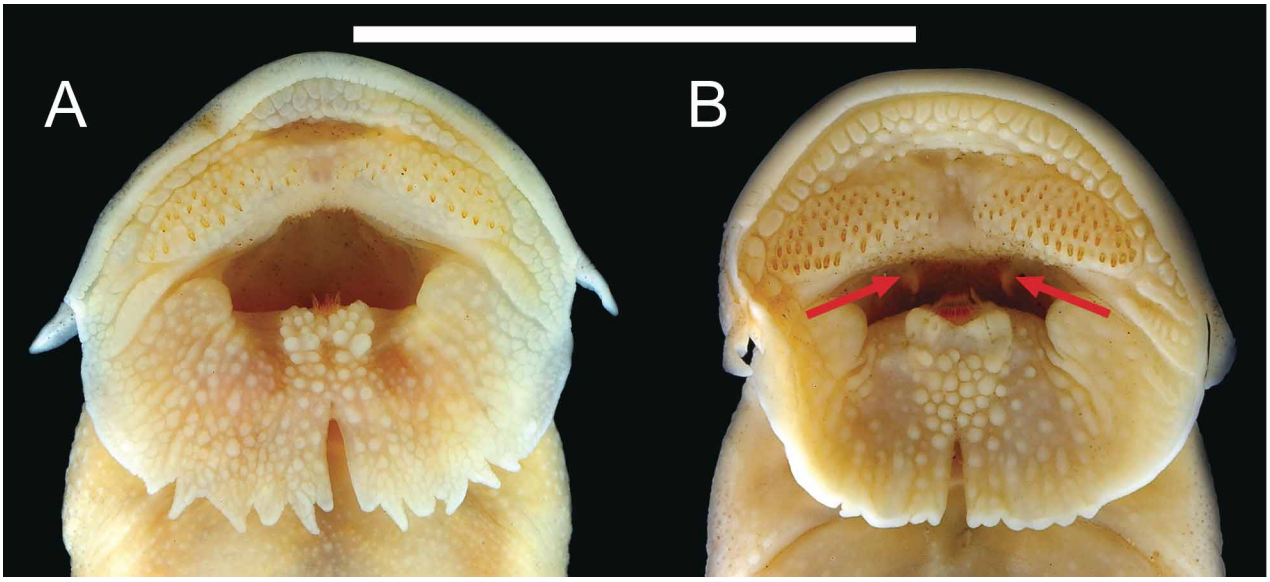

FIGURE 7. Ventral view of the head illustrating morphological differences in the mouth and oral disc. A. *Chiloglanis batesii*, MRAC 94-049-P-0517-0549, Cameroon, Mvi River, Sanaga basin; B. *Chiloglanis micropogon*, MRAC 91479, holotype, Democratic Republic of the Congo Nzokwe River, Ulindi basin. Arrows point to a pair of prominent papillae present on the roof of the oral cavity. Photo by T.R. Vigliotta. Scale bar equals 1 cm.

Validity of *Chiloglanis pojeri* Poll 1944 and *Chiloglanis micropogon* Poll 1952

Our review of *Chiloglanis* type specimens during this study convinced us that a least two nominal species that have been subsequently synonymized by other researchers are in fact distinct taxa that should be resurrected as valid species.

First, we recognize both *Chiloglanis lukugae* Poll 1944 and *Chiloglanis pojeri* Poll 1944 as valid species. These species were described in the same publication from Congo basin tributaries west of Lake Tanganyika. Ng & Bailey (2006: 11) recognized, based solely on their comparison of Poll's original descriptions and the close proximity of the type localities (Fig. 2), *C. pojeri* as a subjective junior synonym of *C. lukugae*. This interpretation seemed surprising as Poll's original descriptions contained illustrations that clearly depict several differences between these species including the size and shape of the oral disc, the length of the mandibular barbels and the disposition of the mandibular teeth. Photographs of the holotypes for both species (IRSNB 72 for *C. lukugae* (image available at http://acsi.acnatsci.org/base/getthumbnail.php?mode=full&target=134557)) & IRSNB 74 for *C. pojeri* (image available at http://acsi.acnatsci.org/base/getthumbnail.php?mode=full&target=136196) confirm that these differences are real, and that the specimens are not conspecific.

Second, we recognize both *Chiloglanis batesii* Boulenger 1904 (type locality in southern Cameroon) and *Chiloglanis micropogon* Poll 1952 (type locality in eastern DR Congo) as valid species. Despite the considerable

distance between these type localities, Roberts (1989: 152) recognized *C. micropogon* as a subjective junior synonym of *C. batesii* based on his examination of both type and non-type specimens. This synonymy made *C. batesii* the most broadly distributed *Chiloglanis* species ranging from the Niger to Congo basins. Our examination of both type and non-type specimens of these nominal species does not support this synonymy. While both species do share a few features in common (e.g., reduced mandibular barbels along the posterior edge of the oral disk, and an elongated upper lobe of the caudal fin in sexually mature males), there are also consistent differences between them. In comparing these species we find the following features of the mouth and lips can be used to distinguish them from each other (Fig. 7): the presence of a distinctive pair of papillae on the roof of the oral cavity in *C. micropogon* vs. the absence of such structures in *C. batesii*; a greater number of dentary teeth in *C. micropogon* vs. *C. batesii* when comparing similarly sized specimens; relatively blunt tipped teeth in *C. micropogon* vs. acutely pointed teeth in *C. batesii*, and a relatively continuous ridge of soft tissue directly posterior to dentary teeth in *C. micropogon* vs. a row of several papillae in *C. batesii*.

Comparative material examined

Chiloglanis asymetricaudalis*:** CU 90575, 15 ALC, Tanzania, Luiche basin. — MRAC 93-152-P-0136-0259, 123 ALC, Tanzania, Luiche basin. — MRAC P-86-038-141–148, 8 ALC paratypes, Rwanda, Ruzizi basin. — ***Chiloglanis batesii*:** BMNH 1904.7.1.97-100, photographs of 4 ALC syntypes, Cameroon, Kienke basin. — BMNH 1904.7.1.127, photographs of 1 ALC syntype, Cameroon, Lobe basin. — CU 90101, 1 ALC, Cameroon, Sanaga basin. — CU 90102, 2 ALC, Cameroon, Lokoundjé basin. — CU 90230, 1 ALC, Cameroon, Sanaga basin. — CU 91434, 3 C&S, 81 ALC, Central African Republic, Chari basin. — MRAC 94-049-P-0517-0549, Cameroon, Mvi River, Sanaga basin. — USNM 303409, 10 ALC, 2 C&S, Cameroon, Ndian basin. — ***Chiloglanis cameronensis*:** AMNH 215403, 1 ALC, Cameroon, Sanaga basin. — CU 80599, 1 ALC, Gabon, Ntem basin. — CU 80632, 1 ALC, Gabon, Okano basin. — ***Chiloglanis carnosus: MCZ 50541, 3 C&S, Democratic Republic of the Congo, Congo basin. — MCZ 50241, 21 ALC, Democratic Republic of the Congo, Congo basin. — ***Chiloglanis congicus*:** MCZ 50149, 2 ALC, Democratic Republic of the Congo, Congo basin. — MCZ 50540, 3 C&S, 10 ALC, Democratic Republic of the Congo, Congo basin. — ***Chiloglanis disneyi*:** USNM 303505, 2 C&S, 8 ALC, Cameroon, Akpa Yafé basin. — ***Chiloglanis elisabethianus*:** MRAC 12126, 1 ALC holotype, Democratic Republic of the Congo, Lumbumbashi basin. — MRAC 83415, 1 ALC, Democratic Republic of the Congo, Lumbumbashi basin. — MRAC 73-25-799-801, 2 ALC, Democratic Republic of the Congo, Lumbumbashi basin. — ***Chiloglanis kalambo*:** MRAC 94-34-P-1081-1084, 4 ALC paratypes, Tanzania, Kalambo basin. — ***Chiloglanis lufirae*:** MRAC 79-1-P-4731–4732, 2 ALC paratypes, Democratic Republic of the Congo, Lufira basin. — MRAC 79-1-P-4733–4738, 6 ALC paratypes, Democratic Republic of the Congo, Lufira basin. — ***Chiloglanis lukugae*:** IRSNB 72, photographs of holotype, Democratic Republic of the Congo, Lukuga basin. — MRAC 90291, 1 ALC, Democratic Republic of the Congo, Lukuga basin. — ***Chiloglanis macropterus:*** CU 91007, 2 C&S, 111 ALC, Zambia, Luongo basin. — ***Chiloglanis marlieri*:** MRAC 91478, 1 ALC holotype, Democratic Republic of the Congo, Luhoho basin. — ***Chiloglanis mbozi*:** MRAC 94-34-P-928-93, 4 ALC paratypes, Tanzania, Lake Rukwa basin. — ***Chiloglanis micropogon*:** CAS 60799, 1 ALC, Democratic Republic of the Congo, Congo basin. — CAS 60800, 60 ALC, Democratic Republic of the Congo, Congo basin. — CAS 60802, 2 ALC, Democratic Republic of the Congo, Congo basin. — CAS 60803, 33 ALC, 2 C&S, Democratic Republic of the Congo, Congo basin. — CAS 60804, 1 ALC, Democratic Republic of the Congo, Congo basin. — CAS 60805, 1 ALC, Democratic Republic of the Congo, Congo basin. — CAS 60806, 163 ALC, Democratic Republic of the Congo, Congo basin. — CAS 60807, 2 ALC, Democratic Republic of the Congo, Congo basin. — CAS 60814, 21 ALC, Democratic Republic of the Congo, Congo basin. — MRAC 91479, 1 ALC holotype, Democratic Republic of the Congo, Ulindi basin. — MRAC 91480-81, 2 ALC paratypes, Democratic Republic of the Congo, Ulindi basin. — ***Chiloglanis microps***: MRAC 140908, holotype, Democratic Republic of the Congo, Lufira basin. — ***Chiloglanis norman*:** MNHN 1932-0301, photographs of 1 ALC syntype, Ivory Coast, Cavally Basin. — NMBA 4253, photographs of 1 ALC syntype, Ivory Coast, Cavally basin. — ***Chiloglanis occidentalis***: SU 62926, 2 C&S, 44 ALC, Ghana, Ankobra basin. — UMMZ 182016, 1 ALC, 1 C&S, Senegal, Senegal basin. — ***Chiloglanis pojeri***: IRSNB 74, photographs of 1 ALC holotype, Democratic Republic of the Congo, Lukuga basin. — ***Chiloglanis polypogon***: AMNH 222889, 10 ALC, Cameroon, Cross basin. — USNM 304263, 1 C&S, Cameroon, Cross basin. – ***Chiloglanis productus*:** CAS 61353, 5 ALC, Tanzania, Lunzua basin. — ***Chiloglanis rukwaensis*:** MRAC 94-34-P-933–937, 4 ALC para-

types, Tanzania, Lake Rukwa basin. — ***Chiloglanis ruziziensis*****:** MRAC 87-05-P-254-262, 9 ALC paratypes, Rwanda, Ruzizi basin. — ***Chiloglanis somereni*****:** BMNH 1958.7.18.1, photographs of 1 ALC holotype, Kenya, Nzoia basin. — ***Chiloglanis trilobatus*****:** MRAC 94-34-P-939-947, 9 ALC paratypes, Tanzania, Lake Rukwa basin. — ***Chiloglanis voltae*****:** MRAC 87-18-P-4266-4288, 21 ALC, 2 C&S, Ghana, Volta basin.

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