

The *Microsynodontis* (Teleostei: Siluriformes: Mochokidae) of the lower Guinea region, west central Africa, with the description of eight new species

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Table of contents

Abstract	1
Résumé	2
Introduction	2
Material and methods	2
<i>Microsynodontis batesii</i> Boulenger, 1903 (Fig. 1)	3
<i>Microsynodontis armatus</i> sp. nov. (Fig. 6)	10
<i>Microsynodontis emarginatus</i> sp. nov. (Fig. 8)	15
<i>Microsynodontis hirsutus</i> sp. nov. (Fig. 10)	20
<i>Microsynodontis laevigatus</i> sp. nov. (Fig. 11)	24
<i>Microsynodontis nannoculus</i> sp. nov. (Fig. 12)	27
<i>Microsynodontis nasutus</i> sp. nov. (Fig. 14)	32
<i>Microsynodontis notatus</i> sp. nov. (Fig. 15)	35
<i>Microsynodontis vigilis</i> sp. nov. (Fig. 16)	39
Discussion	43
Artificial key to the <i>Microsynodontis</i> of the lower Guinea region, west central Africa	49
Comparative material	50
Acknowledgments	50
References	50

Abstract

Species of the mochokid catfish genus *Microsynodontis* Boulenger 1903 from the lower Guinea region in west central Africa (from the Cross River southwards to the Chiloango River drainages) are reviewed. Nine species (of which eight are described as new) are recognized. The status of other nominal species is also reviewed in this study; *Microsynodontis christyi* Boulenger, 1920 (previously considered a junior synonym of *M. batesii*) is shown to be a valid species. Characters useful for diagnosing *Microsynodontis* species are discussed and sexual dimorphism in the genus is also recorded for the first time.

Résumé

Les espèces du genre de Mochokidae *Microsynodontis* Boulenger, 1903 de la région guinéenne inférieure de l'Afrique centrale de l'ouest (du bassin de la Cross au nord jusqu'à celui du Chiloango au sud) sont révisées. On y reconnaît neuf espèces, dont huit nouvelles. Le statut d'autres espèces nominales est réexaminé; *M. christyi* Boulenger, 1920 (prédemment considéré comme un synonyme junior de *M. batesii*) est une espèce valide. On discute les caractères utiles pour distinguer les espèces de *Microsynodontis* et le dimorphisme sexuel est signalé pour la première fois.

Key words: Mochokidae, *Microsynodontis*, freshwater catfish, west central Africa, lower Guinea

Introduction

The genus *Microsynodontis* is restricted to the rivers of western Africa (from the Saint Paul River drainage south and east to the Congo River drainage), and is comprised of small mochokid catfishes diagnosed by the following synapomorphies: a narrow mesethmoid, lack of free orbital margin, transverse ventral fold of branchiostegal membranes, slender cleithral process, and a rounded or truncate caudal fin (Howes, 1980).

Currently, there are four nominal species of *Microsynodontis*, viz. *M. batesii* Boulenger, 1903, *M. christyi* Boulenger, 1920, *M. lamberti* Poll & Gosse, 1963 and *M. polli* Lambert, 1958. *Microsynodontis christyi* has been considered a junior synonym of *M. batesii* (fide Matthes, 1964), but is a valid species. The freshwater ichthyofauna of the lower Guinea region (here defined as the portion of west central Africa delineated by the Cross River drainage to the north and the Chiloango River drainage to the south; fide Roberts, 1975) is one of the least explored in Africa (Teugels & Guégan, 1994). *Microsynodontis batesii* is the only species known from there.

While preparing an account of *Microsynodontis* for a forthcoming publication on the fishes of the lower Guinea region (Ng, in prep.), it was found that material from the region previously identified as *M. batesii* consisted of nine distinct species, eight of which are undescribed. This study reviews the *Microsynodontis* of the lower Guinea region, with the eight new species described herein.

Material and methods

Measurements were made point-to-point using a dial caliper to the nearest 0.1 mm following the methods of Skelton & White (1990) with the following modifications: head length is measured from the tip of the snout to the posteriormost extremity of fleshy opercular flap; head depth is measured at the base of the supraoccipital; dorsal-fin base length is the distance between the first dorsal spine and the last fin-ray (including the dorsal spine); pelvic-fin length is measured from the fin-base to the tip of the longest fin-ray; anal-fin base length is the distance between the first and last anal-fin rays; and body depth at anus is the

maximum depth of the body at the anus. Head width in this study is equivalent to the pectoral-girdle width of Skelton & White (1990). Counts and measurements were made from the left side of specimens whenever possible. Subunits of the head are presented as proportions of head length (HL). Head length and measurements of body parts are given as proportions of standard length (SL). Terminology for the premaxillary teeth follow Skelton & White (1990). The fish were sexed via examination of external genitalia, which was verified in a few specimens by the examination of gonads.

Fin rays were counted from radiographs and under a binocular dissecting microscope using transmitted light. Vertebral counts were taken from radiographs. All counts follow Skelton & White (1990). Numbers in parentheses following a particular fin-ray or vertebral count indicate the number of specimens with that count. An asterisk after a particular count indicates the value for the holotype. The sizes of the tubercles were measured using an ocular micrometer on a dissecting microscope that had been previously calibrated with a stage micrometer. The specimens included in the present study are deposited in: AMNH, American Museum of Natural History, New York; BMNH, Natural History Museum, London; CAS, California Academy of Sciences, San Francisco; CU, Cornell University Museum of Vertebrates, Ithaca; MCZ, Museum of Comparative Zoology, Harvard University, Cambridge; MRAC, Musée Royal d'Afrique Centrale, Tervuren; and RMNH, Nationaal Natuurhistorisch Museum, Leiden.

Microsynodontis batesii Boulenger, 1903 (Fig. 1)

Microsynodontis batesii Boulenger, 1903: 26, Pl. 4 (type locality: Mvile River, south Cameroon); 1905: 50; 1911: 476, Fig. 356; Holly, 1930: 257 (in part); Monod, 1928: 202; Pellegrin, 1929a: 359; 1929b: 452; Howes, 1980: 168.

Material. AMNH 232091 (1), female: 34.6 mm SL; Gabon: Ivindo River drainage, Minkebe gold camp forest, 1°43'38.2"N 12°48'35.8"E. BMNH 1903.7.28.105–110 (6), 3 syntype females: 48.8–58.3 mm SL, 3 syntype males: 75.7–84.7 mm SL; Cameroon: Mvile River. CAS 115547 (1), male: 37.7 mm SL; Cameroon: Mvila River drainage, Menyoo River, Ebolowa, 2°53'N 11°9'E. CAS 147487 (2), unsexed: 18.5 mm SL; Cameroon: Ntem or Campo River drainage, Mfiande and Seng Rivers. CAS 155689 (1), male: 57.8 mm SL; Cameroon: Ntem River drainage, Mbotto River at Assok, 74 km SE of Ebolowa, 2°34'N 11°30'E. CAS 155691 (4), 2 females: 52.8–53.4 mm SL; 2 males: 65.5–66.0 mm SL; Cameroon: Ntem River drainage, Mbotto River at Mékomo, 37 km E of Ebolowa, 2°37'N 11°22'E. CU 80445 (1), male: 48.0 mm SL; Gabon: Woleu-Ntem province, “Bouth” creek where it crosses road from Bitam–Minvoul, 2°15'N 11°39'E. CU 80748 (8), males: 20.3–35.4 mm SL; Gabon: Woleu-Ntem province, “Deghe” creek near Auberge d'Ayengbe, 2°17'N 11°33'E. MCZ 32521 (1), female: 59.4 mm SL; Cameroon: Nyong River. MRAC 93-085-P-0279–0280 (2); females, 28.2–42.6 mm SL; Cameroon:

Mboro River (tributary of Ntem River) at Akonekyé, 2°28'N 11°10'E. MRAC 93-108-P-0651–0655 (5), 3 females: 21.5–26.5 mm SL; 2 males: 27.0–29.8 mm SL; Cameroon: Mengounou River, tributary of Mboua River, in Bilizi between Befio and Ekowong, 2°32'N 12°11'E. MRAC 93-108-P-0656 (1), male: 24.9 mm SL; Cameroon: river located 4 km from Akobass in the direction of Bitche, 2°22'N 12°4'E. MRAC 93-108-P-0657 (1), male: 22.8 mm SL; Cameroon: river after Aboulou in the direction of Mebang, 2°19'N 12°4'E. MRAC 93-108-P-0658 (1), male: 21.0 mm SL; Cameroon: Yété River, tributary of Kom River after Mebasa and before Ngoudjieng, 2°29'N 12°13'E. MRAC 93-108-P-0659 (1), male: 28.2 mm SL; Cameroon: Milolo River, tributary of Kom River between Esaminkou and Andoung, 2°27'N 12°20'E. MRAC 94-028-P-0002 (1), male: 34.4 mm SL; Cameroon: Anga'a River, approximately 10 km from Yaoundé, 3°52'N 11°31'E. MRAC 95-030-P-1443–1448 (6), 1 female: 27.0 mm SL, 5 unsexed: 17.4–21.2 mm SL; Cameroon: first river at confluence at Mvangan, towards Nélefoup, 2°39'N 11°44'E. MRAC 95-030-P-1443-1448 (4), 17.4–27.0 mm SL, Cameroon: Mvong River, tributary of Kong River, 2°48'N 11°39'E. MRAC 95-030-P-1453–1454 (2), 1 male: 26.0 mm SL; 1 unsexed: 17.3 mm SL; Cameroon: Otobewo'o River, tributary of Woo River, between Ekombité and Nkolenyeng, 2°40'N 11°46'E. RMNH 34859 (8), 6 females: 36.1–65.6 mm SL; 2 males: 49.2–74.8 mm SL; Cameroon: Lobé River, waterfalls 9 km S of Kribi.

Diagnosis. *Microsynodontis batesii* is the largest known species of *Microsynodontis*, reaching a size of ca. 100 mm SL (the largest specimen among all other congeners is only ca. 65 mm SL). It can be distinguished from all congeners except *M. hirsutus*, *M. laevigatus* and *M. polli* in having a longer adipose fin (34.4–41.6% SL vs. 21.3–34.5). It differs from *M. hirsutus* in having a gently curved (vs. straight) dorsal spine (Fig. 2) and short (vs. long) tubercles on the dorsal and lateral surfaces of the head (Fig. 3), from *M. laevigatus* in having a serrated (vs. smooth) anterior edge of the pectoral spine (Fig. 4), rounded (vs. truncate) caudal fin (Fig. 9), and more slender caudal peduncle (5.8–9.2% SL vs. 9.3–11.4), and from *M. polli* (n=9) in having a shorter caudal fin (20.3–27.7% SL vs. 29.6–41.6).

Description. Biometric and meristic data as in Table 1. Body compressed. Predorsal profile gently convex; postdorsal body sloping gently ventrally. Preanal profile horizontal. Anus and urogenital openings located at vertical through middle of pelvic fin. Skin smooth. Lateral line complete and midlateral.

Head depressed and broad, broadly rounded when viewed laterally and with rounded snout margin when viewed from above. Gill openings narrow, extending from immediately ventral to posttemporal to immediately ventral to base of pectoral spine. Gill membranes united to, and attached across, isthmus. Bony elements of dorsal surface of head covered with thin skin. Nuchal shield large and terminating posteriorly with two rounded processes on each side. Supracleithral process thin and extending just short of vertical through posteriormost tip of nuchal shield.

TABLE 1. Biometric data for *M. batesii* (n=58).

	RANGE	MEAN±SD
SL (mm)	17.3–84.7	
<u>In % SL</u>		
Predorsal length	31.2–39.8	35.8±2.37
Snout to anal	61.6–70.6	67.2±2.42
Snout to pelvic	42.0–51.9	48.2±2.87
Snout to pectoral	18.5–24.3	20.5±1.81
Dorsal-fin base length	10.2–14.9	12.4±1.43
Dorsal spine length	11.5–20.4	16.7±2.45
Anal-fin base length	12.3–16.7	14.4±1.19
Pelvic-fin length	12.7–17.5	14.5±1.46
Pectoral fin length	18.9–27.0	22.1±2.44
Pectoral spine length	15.9–24.3	19.8±2.36
Caudal total length	20.3–27.7	23.2±2.29
Adipose basal length	34.4–41.6	37.8±2.18
Adipose maximum height	4.7–7.3	6.04±0.90
Dorsal to adipose distance	9.2–16.3	12.9±2.42
Adipose to caudal peduncle	7.6–10.4	9.0±0.96
Caudal peduncle length	14.8–19.7	17.7±1.42
Caudal peduncle depth	5.8–9.2	7.9±1.03
Body depth at anus	11.8–18.7	16.0±1.71
Head length	20.1–26.8	24.1±1.98
Head width	15.8–24.7	21.7±2.54
Head depth	12.7–18.8	16.1±1.95
<u>In % HL</u>		
Snout length	42.1–48.9	46.0±2.33
Interorbital distance	29.1–40.7	34.1±3.43
Orbit diameter	14.7–19.6	16.3±1.34
Maxillary barbel length	90.2–144.6	117.13±15.66
Inner mandibular barbel length	51.2–84.7	64.0±9.61
Outer mandibular barbel length	78.7–130.2	94.8±14.43

Barbels in three pairs. Maxillary barbel long and slender, extending to just beyond base of last pectoral-fin ray. Inner mandibular-barbel origin close to midline, extending to base of pectoral spine and with 2 short, thin branches on anterior half and 3–5 long, thin branches on posterior half. Outer mandibular barbel originates posterolateral of inner mandibular barbel, extending to middle of pectoral-fin base and with 3–5 long, thin branches.

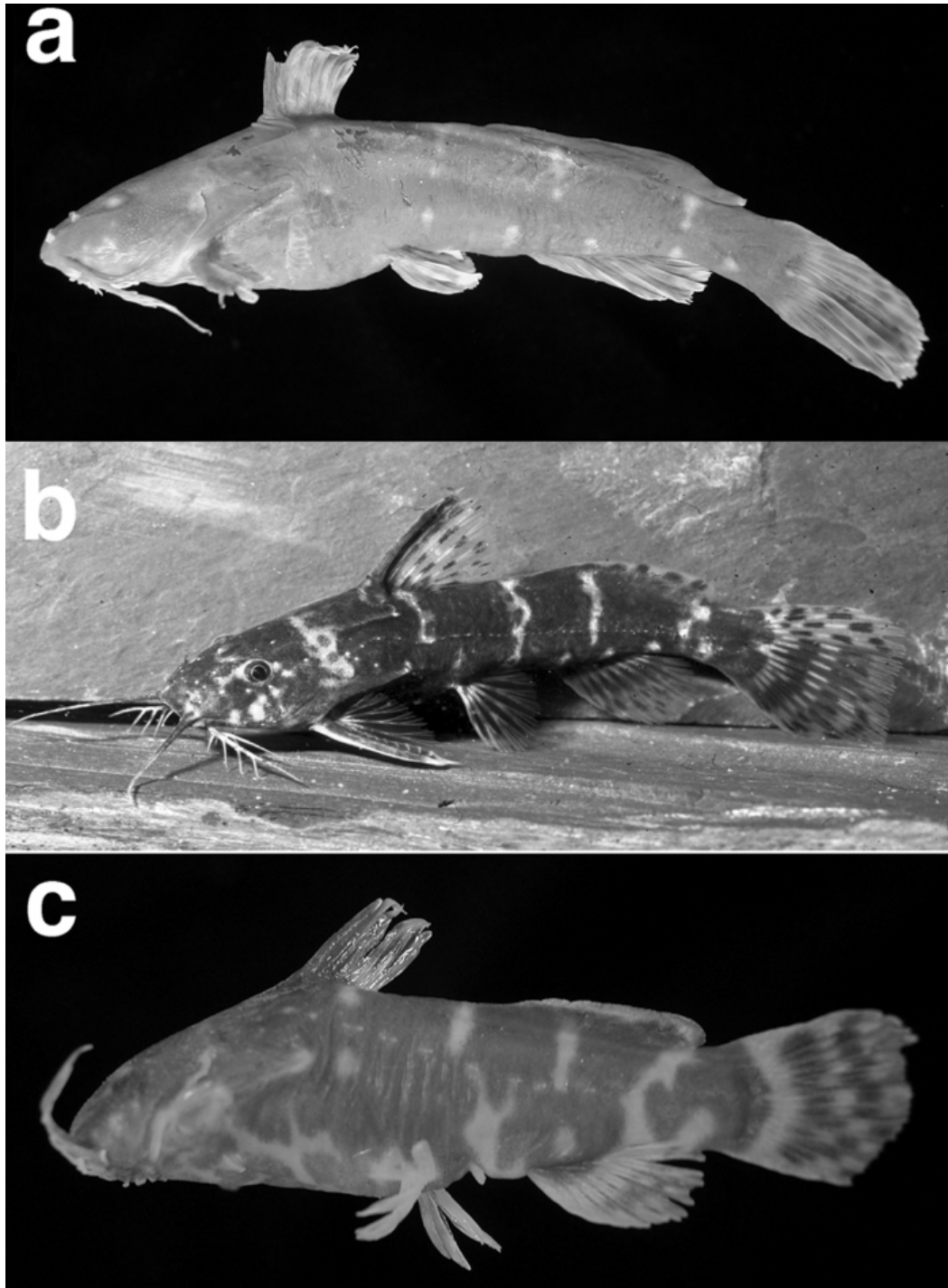


FIGURE 1. *Microsynodontis batesii*: a. adult coloration, RMNH 34859, 74.8 mm SL, Cameroon: Lobé River; b. live coloration (fish from southern Cameroon, ca. 65 mm SL, not preserved), photograph courtesy of Erwin Schraml; c. juvenile coloration MRAC 93-108-P-0657, 22.8 mm SL; Cameroon: Ntem River drainage.

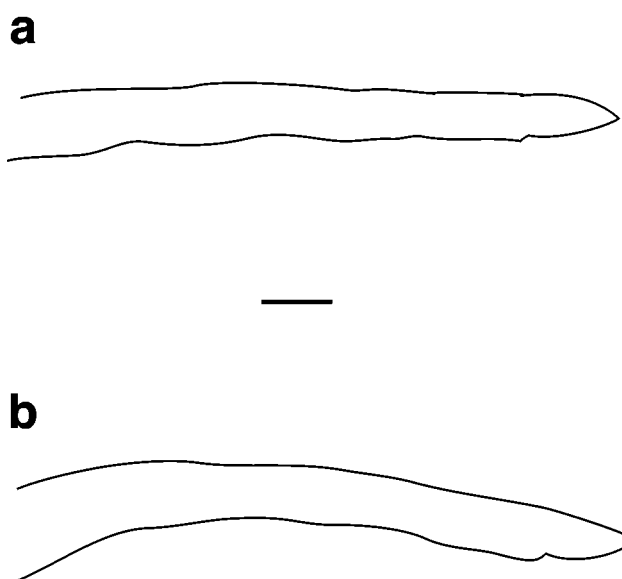


FIGURE 2. Lateral view of dorsal spines of: a. *M. hirsutus*, holotype, CU 87040, 62.0 mm SL and b. all other *Microsynodontis* (represented by *M. batesii*, CAS 155691, 62.4 mm SL). Scale bar represents 1 mm.

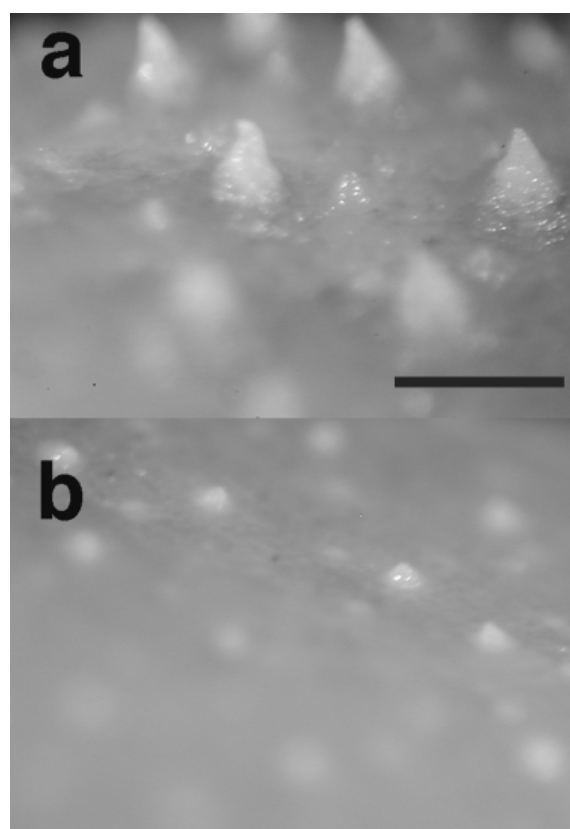


FIGURE 3. Magnified view of the right ventrorbital region, showing tubercle morphology in mature males of: a. *M. hirsutus*, holotype, CU 87040, 62.0 mm SL; and b. all other *Microsynodontis* (represented by *M. batesii*, RMNH 34859, 74.8 mm SL). Both photographs were taken under identical magnification (50X). Scale bar indicates 0.5 mm.

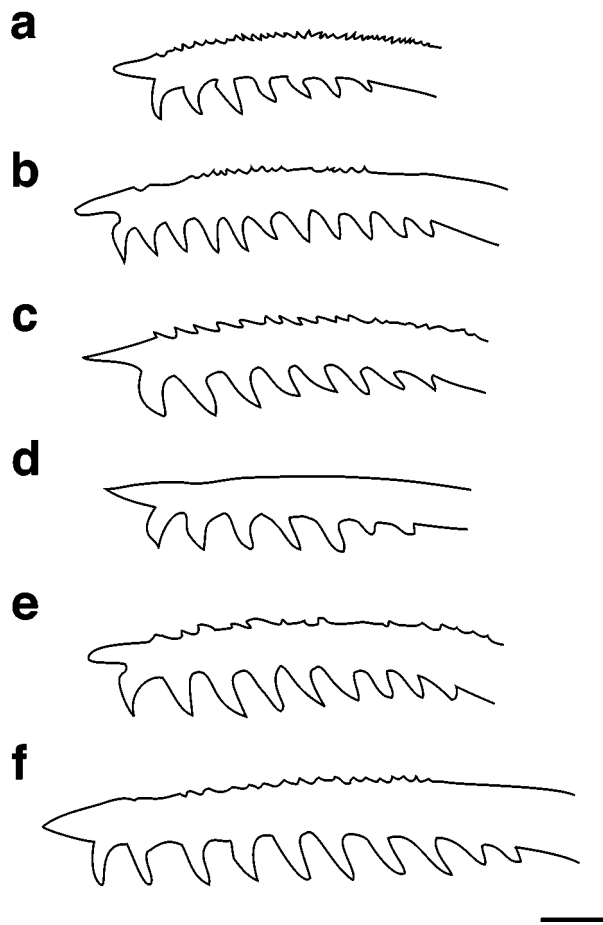


FIGURE 4. Dorsal view of pectoral spines of: a. *M. armatus*, holotype, CU 89392, 27.4 mm SL; b. *M. christyi*, MRAC 61801, 37.5 mm SL; c. *M. emarginatus*, paratype, CU 80567, 32.0 mm SL; d. *M. laevigatus*, paratype, CU 88265, 28.1 mm SL; e. *M. notatus*, holotype, MRAC 80-51-P-839, 41.0 mm SL; f. all other *Microsynodontis* (represented by *M. batesii*, MRAC 93-085-P-0280, 42.6 mm SL). Scale bar represents 1 mm.

Eye ovoid, horizontal axis longest; located entirely in dorsal half of head. Orbit without free margin.

Mouth inferior and crescent-shaped; lips plicate. Oral teeth in rows on all tooth-bearing surfaces. Premaxillae narrow, with narrow ventral shelf and partially exposed when mouth closed. Primary teeth 10–15, conical and separated from secondary teeth by distinct gap. Secondary teeth 40–85, acutely pointed and recurved; disposed in 3–4 rows. Tertiary teeth 17–29, elongate, villiform and extending over full width of premaxillae. Dentary teeth 17–28, acutely pointed, strongly recurved and broader than secondary teeth; disposed in one or two transverse bands.

Dorsal fin located at anterior third of body, with convex margin and II,6 (39) or II,7 (3) rays. Dorsal-fin spine long, stout and slightly curved; smooth on both anterior and posterior margins. Adipose fin long, extending for most of postdorsal distance; margin slightly convex for entire length and posterior end deeply incised. Caudal fin rounded, with i,6,5,i (26) or i,6,6,i (16) principal rays. Procurrent rays symmetrical and extend only slightly

anterior to fin base. Anal-fin base located ventral to posterior half of adipose fin. Anal fin with iv,7 (30); iv,8 (9); iv,9 (2) or iv,10 (1) rays and convex margin. Pelvic-fin origin at vertical ventral to posterior end of dorsal-fin base. Pelvic fin with i,6 (42) rays and slightly convex margin; tip of appressed fin not reaching anal-fin origin. Pectoral fin with I,5,i (13); I,6 (28) or I,6,i (1) rays; spine slightly curved and stout (Fig. 4f). Anterior spine margin with 22–33 small serrations along entire length of spine; serrations antrorse (distally directed) on distal two-thirds and anteriorly directed on proximal third. Posterior spine margin with 6–14 strong serrations along entire length. Pectoral-fin margin convex posteriorly. Vertebrae 13+22=35 (6); 11+25=36 (1); 12+24=36 (4); 13+23=36 (3); 14+22=36 (2); 12+25=37 (5); 13+24=37 (4); 12+26=38 (2); 13+25=38 (7) or 14+23=37 (1).

Males with numerous tubercles on sides of head on region extending from snout to preopercle, and long genital papilla situated immediately posterior to anus. Females with fewer tubercles on sides of head, and with smaller, distally flattened genital papilla.

Coloration. In 70% ethanol (adults larger than ca. 35 mm SL): dorsal and lateral surfaces and of head and body medium brown, fading to cream or light grayish brown on ventral third of body, belly (with large faint brown spots), and ventral surface of head (Fig. 1a). Snout with a series of cream spots delineating anterior and posterior nares, sometimes coalescing to form cream band running from anterior orbital margin to tip of snout. Cheek region with one or two cream spots immediately ventral to orbit. Cream band encircling nape at supraoccipital. Dorsal third of body with series of four cream vertical bar-shaped marks extending beyond lateral midline of body: first at middle of dorsal-fin base, second at adipose-fin origin, third at middle of adipose-fin base and last on caudal peduncle immediately posterior to adipose fin, sometimes encircling caudal peduncle as cream band. Ventral third of flanks with a longitudinal series of five to seven cream spots or vertical bar-shaped marks. Dorsal-, pectoral-, pelvic- and anal-fin rays with brown spots arranged in two or three bands. Caudal-fin rays with brown spots arranged in four bands and hyaline interradiation membranes. Live coloration similar, with the addition of a faint dark reticulate pattern overlying the body (Fig. 1b).

Coloration of juveniles (smaller than ca. 35 mm SL) similar, except for more prominent brown spotting on ventral surfaces, and larger cream markings that sometimes assume more vermiform shapes, partially coalescing to form reticulate pattern (Fig. 1c). Pectoral fins hyaline, with scattered brown spots. Dorsal, anal and caudal fin with brown spots arranged in transverse bands.

Distribution. Known from the Ntem River drainage in southern Cameroon and northern Gabon, as well as the Campo, Ivindo, Lobé, Nyong and Sanaga River drainages in southern and central Cameroon (Fig. 5).

Remarks. Although *M. batesii* appears to have a much wider distribution compared to all other *Microsynodontis* from lower Guinea (Figs. 5, 7 & 13), it is possible that more than one species is involved in what is recognized as *M. batesii* here. In particular, the populations from the northernmost extent of its distribution (i.e. from the Nyong and San-

aga River drainages) should be further studied to verify their conspecificity with the material from southern Cameroon and northern Gabon, but the paucity of relevant material available for study does not allow for more a more conclusive test of this hypothesis.

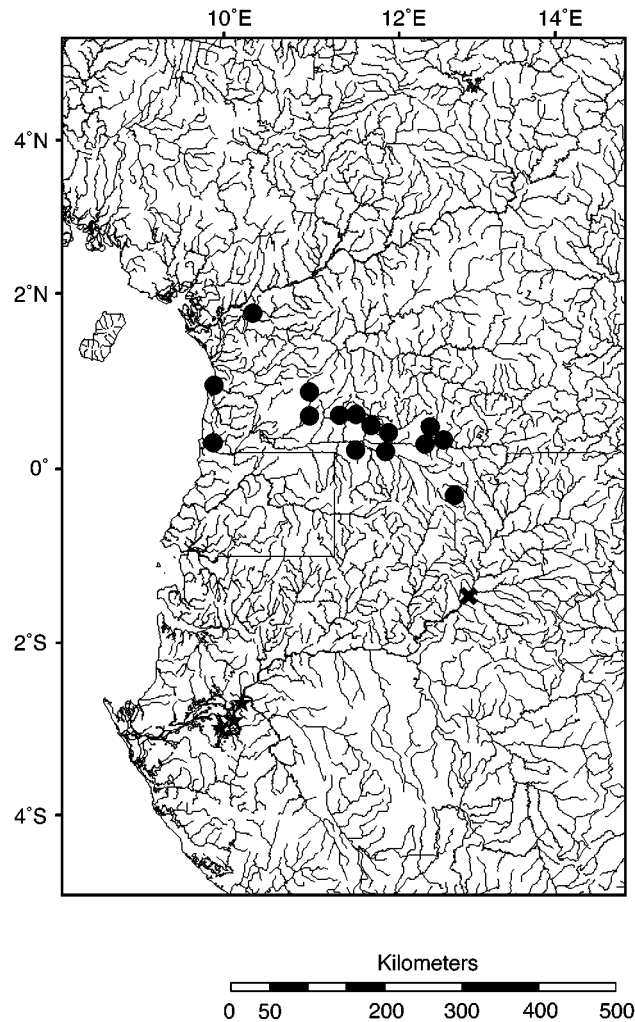


FIGURE 5. Map showing the distribution of *M. batesii* (●), *M. laevigatus* (✕) and *M. notatus* (★).

***Microsynodontis armatus* sp. nov. (Fig. 6)**

Type material: Holotype: CU 89392, male, 27.4 mm SL; Gabon: Ogooué-Ivindo province, Ivindo River drainage, Balé Creek, 0°31'9"N 12°47'58"E; C. D. Hopkins et al., 24 August 2001.

Paratypes: CU 86327 (2), 1 female: 26.6 mm SL; 1 unsexed: 19.7 mm SL; data as for holotype.

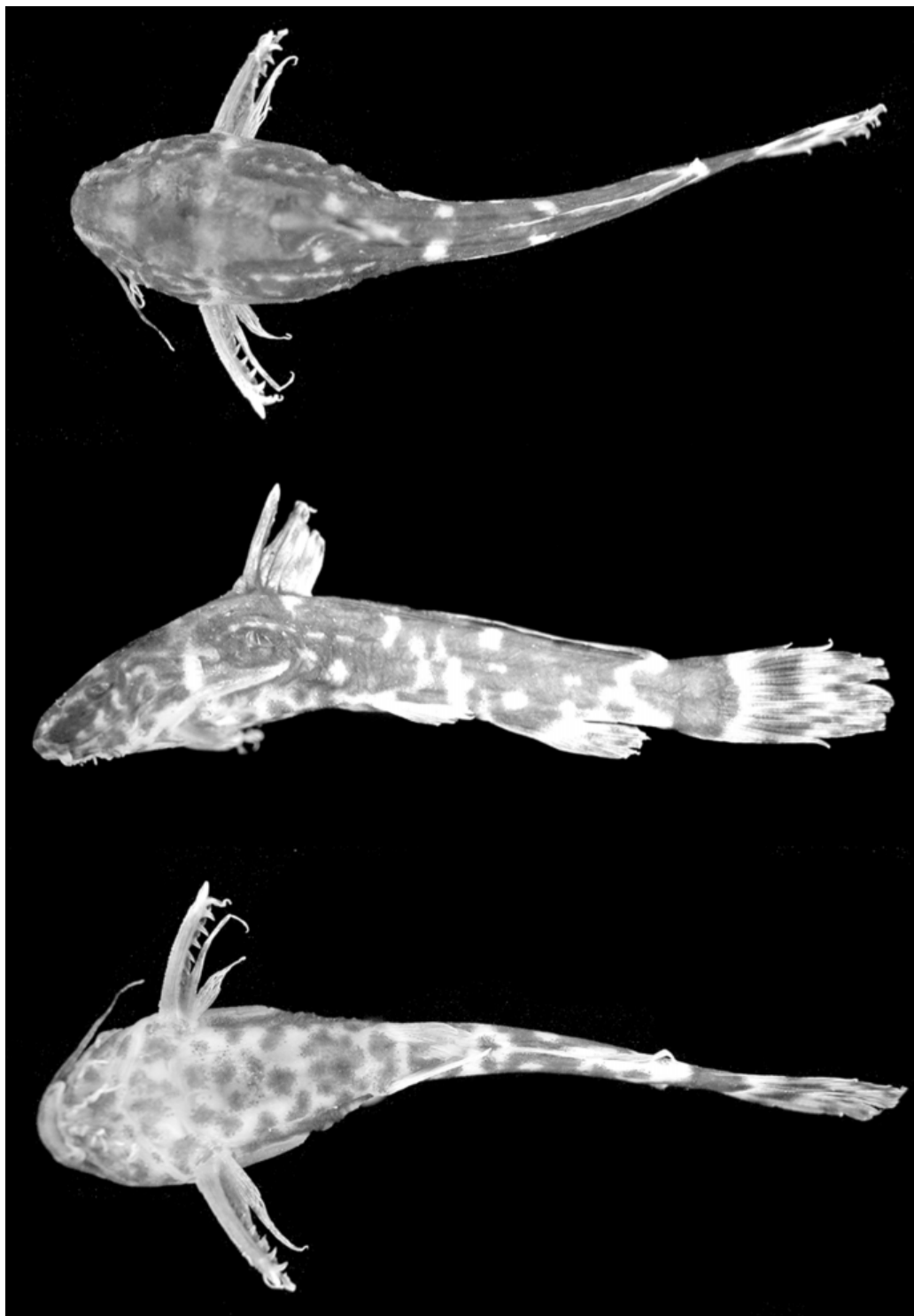


FIGURE 6. *Microsynodontis armatus*, holotype, CU 89392, 27.4 mm SL; Gabon: Ivindo River drainage.

Diagnosis. *Microsynodontis armatus* can be distinguished from all congeners in having retrorse (proximally directed) serrations (vs. smooth or with either anteriorly directed or antrorse (distally directed) serrations) along the proximal third of the anterior edge of the pectoral spine (Fig. 4a).

TABLE 2. Biometric data for *M. armatus* (n=3).

	HOLOTYPE	RANGE	MEAN±SD
SL (mm)	27.4	19.7–27.4	
<u>In % SL</u>			
Predorsal length	36.9	36.9–39.6	38.3±1.35
Snout to anal	67.5	67.5–71.1	68.6±2.02
Snout to pelvic	49.6	49.2–50.0	49.6±0.40
Snout to pectoral	20.1	19.9–20.8	20.3±0.47
Dorsal-fin base length	14.6	10.2–14.6	12.2±2.24
Dorsal spine length	16.4	16.4–20.3	18.5±1.97
Anal-fin base length	14.6	11.2–16.5	14.1±2.69
Pelvic-fin length	13.1	13.1–16.9	15.6±2.17
Pectoral fin length	23.7	23.7–30.5	26.6±3.51
Pectoral spine length	21.9	21.9–24.9	23.1±1.57
Caudal total length	28.1	20.8–28.1	24.4±3.65
Adipose basal length	32.1	25.9–32.9	28.4±3.29
Adipose maximum height	2.6	2.6–3.5	3.0±0.45
Dorsal to adipose distance	19.3	17.3–19.3	18.6±1.15
Adipose to caudal peduncle	8.0	7.9–8.1	8.0±0.10
Caudal peduncle length	20.1	11.2–20.1	15.4±4.47
Caudal peduncle depth	9.1	8.3–9.1	8.7±0.40
Body depth at anus	13.9	13.7–15.0	14.2±0.70
Head length	26.3	25.6–26.3	25.9±0.35
Head width	22.3	22.3–25.4	24.0±1.58
Head depth	15.7	15.7–17.7	16.7±1.00
<u>In % HL</u>			
Snout length	43.1	43.1–48.5	44.9±3.12
Interorbital distance	37.5	37.5–45.1	41.2±3.80
Orbit diameter	13.9	13.9–16.7	15.6±1.49
Maxillary barbel length	94.4	94.4–113.2	103.8±13.29
Inner mandibular barbel length	45.8	45.6–45.8	45.7±0.14
Outer mandibular barbel length	56.9	56.9–92.6	74.8±25.24

Description. Biometric and meristic data as in Table 2. Body compressed. Predorsal profile gently convex; postdorsal body sloping gently ventrally. Preanal profile horizontal.

Anus and urogenital openings located at vertical through middle of pelvic fin. Skin smooth. Lateral line complete and midlateral.

Head depressed and broad, broadly rounded when viewed laterally and with rounded snout margin when viewed from above. Gill openings narrow, extending from immediately ventral to posttemporal to immediately ventral to base of pectoral spine. Gill membranes united to, and attached across, isthmus. Bony elements of dorsal surface of head covered with thin skin. Nuchal shield large and terminating posteriorly with two rounded processes on each side. Supracleithral process thin, extending just short of vertical through posteriormost tip of nuchal shield.

Barbels in three pairs. Maxillary barbel long and slender, extending to just beyond base of last pectoral-fin ray. Inner mandibular-barbel origin close to midline, extending to base of pectoral spine and with 2 short, thin branches on anterior half and 3–4 long, thin branches on posterior half. Outer mandibular barbel originates posterolateral of inner mandibular barbel, extending to middle of pectoral-fin base and with 3–4 long, thin branches.

Eye ovoid, horizontal axis longest; located entirely in dorsal half of head. Orbit without free margin.

Mouth inferior and crescent-shaped; lips plicate. Oral teeth in rows on all tooth-bearing surfaces. Premaxillae narrow, with narrow ventral shelf and partially exposed when mouth closed. Primary teeth 11–12, conical and separated from secondary teeth by distinct gap. Secondary teeth 35–50, acutely pointed and recurved; disposed in 3–4 rows. Tertiary teeth 16–20, elongate, villiform and extending over full width of premaxillae. Dentary teeth 14–18, acutely pointed, strongly recurved and broader than secondary teeth; disposed in one or two transverse bands.

Dorsal fin located at anterior third of body, with II,5,i (2) or II,6* (1) rays and convex margin. Dorsal-fin spine short, stout and slightly curved; smooth on both anterior and posterior margins. Adipose fin moderately long; margin slightly convex for entire length and posterior end deeply incised. Caudal fin rounded, with i,6,5,i (3) principal rays. Procurrent rays symmetrical and extend only slightly anterior to fin base. Anal-fin base located ventral to posterior half of adipose fin. Anal fin with iv,7 (3) rays and convex margin. Pelvic-fin origin at vertical ventral to posterior end of dorsal-fin base. Pelvic fin with i,6 (3) rays and slightly convex margin; tip of appressed fin not reaching anal-fin origin. Pectoral fin with I,6 (3) rays; spine slightly curved and stout (Fig. 4a). Anterior spine margin with 21–27 small serrations along entire length of spine; serrations antrorse (distally directed) on distal two-thirds and retrorse (proximally directed) on proximal third. Posterior spine margin with 6–12 strong serrations along entire length. Pectoral-fin margin convex posteriorly. Vertebrae 12+22=34 (1); 13+21=34 (1) or 12+23=35 (1).

Males with numerous tubercles on sides of head on region extending from snout to preopercle, and long genital papilla situated immediately posterior to anus. Females with fewer tubercles on sides of head, and with smaller, distally flattened genital papilla.

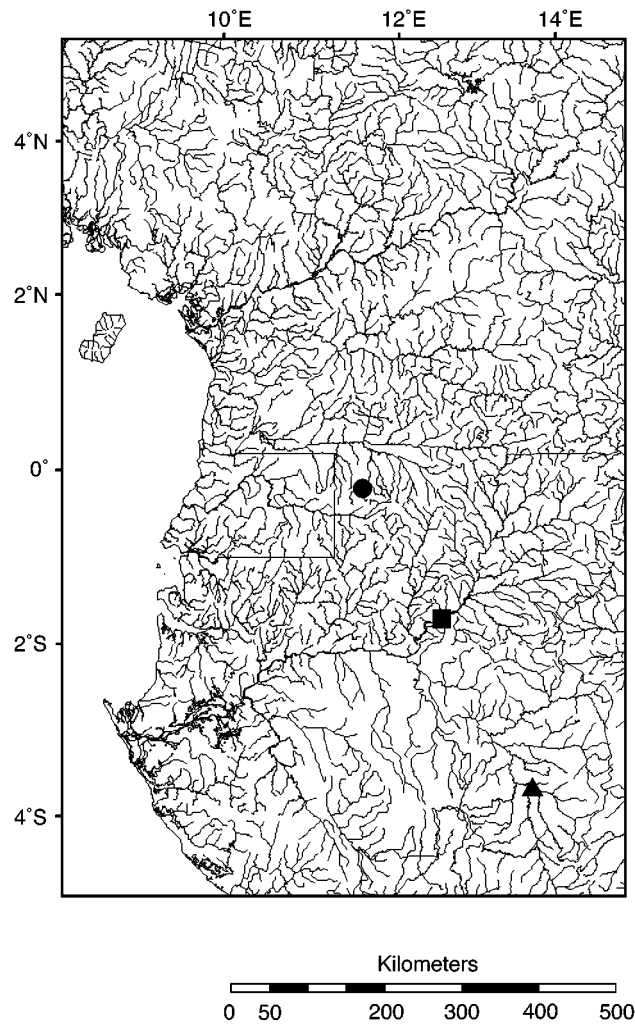


FIGURE 7. Map showing distributions of *M. armatus* (■), *M. emarginatus* (▲) and *M. hirsutus* (●).

Coloration. In 70% ethanol: dorsal and lateral surfaces and of head and body medium brown, fading to cream on belly and ventral surfaces (Fig. 6). Medium-sized brown spots evenly scattered over ventral surfaces. Snout with a series of cream spots delineating anterior and posterior nares, sometimes coalescing to form cream band running from anterior orbital margin to tip of snout. Cheek region with numerous small cream spots ventral and posterior to orbit. Cream band encircling nape at supraoccipital. Dorsal third of body with series of four cream irregular blotches extending short of lateral midline of body: first at middle of dorsal-fin base, second at adipose-fin origin, third at middle of adipose-fin base and last on caudal peduncle immediately posterior to adipose fin, sometimes coalescing

with similar marks ventrally and encircling caudal peduncle as irregular cream band. Ventral third of flanks with a series of irregular cream blotches sometimes coalescent with dorsal markings to form reticulate pattern. Dorsal, pectoral, pelvic and anal fins hyaline and sometimes with one to two rows of faint spots forming longitudinal brown rows. Caudal fin with similar series of elongate marks forming two to three irregular columns.

Distribution. Known only from the Ivindo River in northern Gabon (Fig. 7).

Habitat. The type locality is a blackwater forest stream with sand and leaf litter bottom. Water temperature was 22.0°C and the pH was 5.0. Syntopic fish included: Mormyridae: *Brienomyrus* spp., *Isichthys henryi*, *Marcusenius moorii*, *Mormyrops zanclirostris*, *Petrocephalus christyi*, Characidae: *Brycinus kingsleyae*; Distichodontidae: *Distichodus notospilus*, *Nannocharax fasciatus*; Cyprinidae: *Barbus* spp., *Opsaridium ubangense*, *Raiamas buchholzi*, Clariidae: *Clarias* sp.; Claroteidae: *Parauchenoglanis balayi*; Schilbeidae: *Schilbe laticeps*; Mochokidae: *Synodontis batesii*; Cichlidae: *Hemichromis fasciatus*, *Parananochromis* sp., *Tilapia* sp.

Etymology. From the Latin *armatus*, meaning armed. In allusion to the antrorse (distally directed) and retrorse (proximally directed) serrations on the anterior edge of the pectoral spine unique to this species. Used as a noun in apposition.

Microsynodontis emarginatus sp. nov. (Fig. 8)

Type material. Holotype: CU 89393, male, 33.4 mm SL; Gabon: Haut-Ogooué Province, Motobo I village, Kiéne creek, 1°32'14.1"S 13°32'43.5"E; J. P. Sullivan et al., 12 August 1999.

Paratypes. CU 80567 (29), 8 females: 26.1–30.8 mm SL; 20 males: 23.4–33.6 mm SL; 1 unsexed: 19.5 mm SL; data as for holotype.

Diagnosis. *Microsynodontis emarginatus* can be distinguished from all congeners in having an emarginate (vs. rounded or truncate) caudal fin (Fig. 9). It also exhibits no noticeable sexual dimorphism in the size and density of the tubercles on the dorsal and lateral surfaces of the head, unlike all other lower Guinea species of *Microsynodontis*.

Description. Biometric and meristic data as in Table 3. Body compressed. Predorsal profile gently convex; postdorsal body sloping gently ventrally. Preanal profile horizontal. Anus and urogenital openings located at vertical through middle of pelvic fin. Skin smooth. Lateral line complete and midlateral.

Head depressed and broad, broadly rounded when viewed laterally and with rounded snout margin when viewed from above. Gill openings narrow, extending from immediately ventral to posttemporal to immediately ventral to base of pectoral spine. Gill membranes united to, and attached across, isthmus. Bony elements of dorsal surface of head covered with thin skin. Nuchal shield large and terminating posteriorly with two rounded processes on each side. Supracleithral process thin, extending just short of vertical through posteriormost tip of nuchal shield.

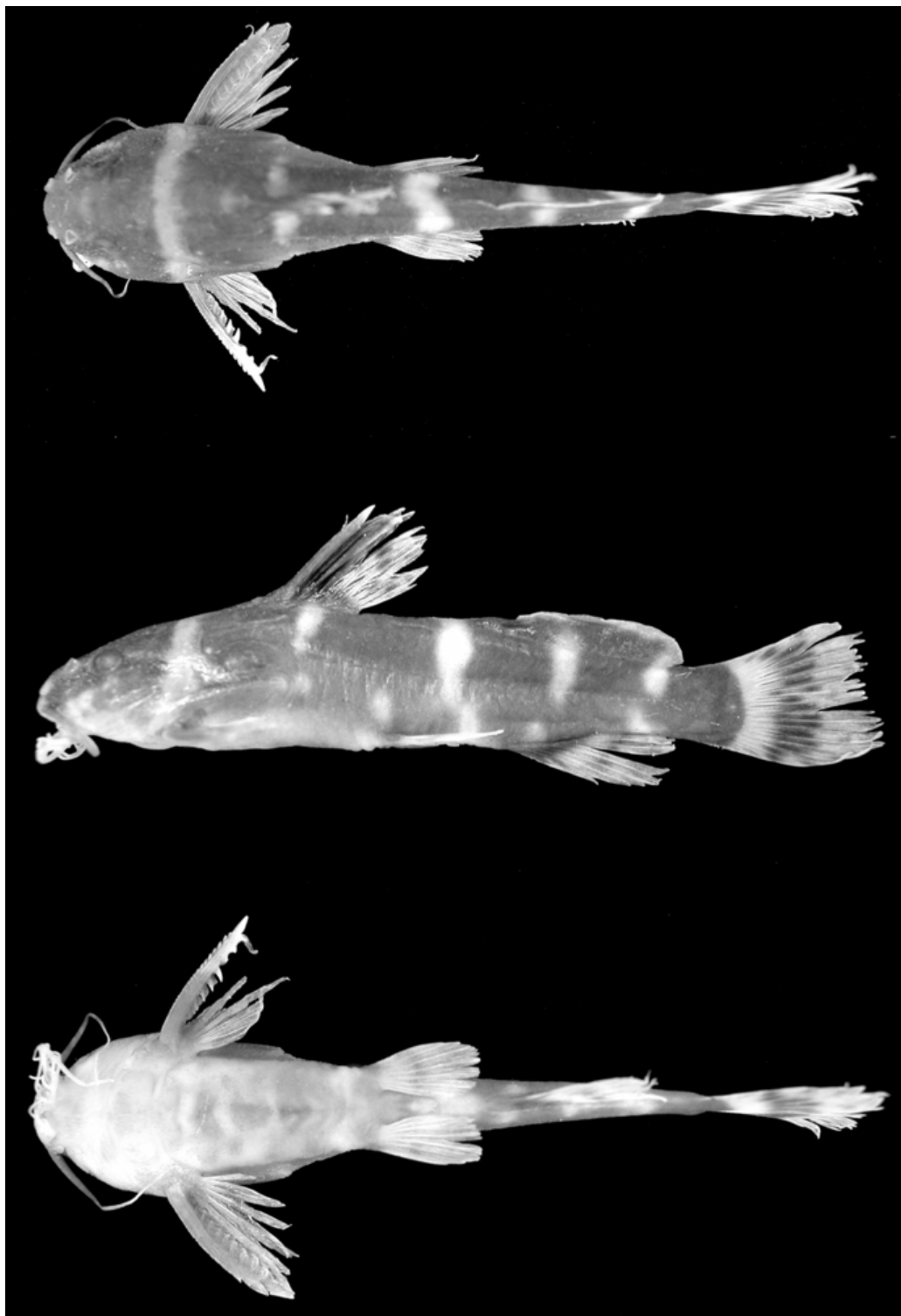


FIGURE 8. *Microsynodontis emarginatus*, holotype, CU 89393, 33.4 mm SL; Gabon: Ogooué River drainage.

TABLE 3. Biometric data for *M. emarginatus* (n=30).

	HOLOTYPE	RANGE	MEAN±SD
SL (mm)	33.4	19.5–33.6	
<u>In % SL</u>			
Predorsal length	35.3	35.3–39.9	36.6±1.49
Snout to anal	68.8	66.5–71.9	68.7±1.74
Snout to pelvic	51.6	48.2–52.6	50.7±1.59
Snout to pectoral	20.3	19.9–24.7	22.4±1.63
Dorsal-fin base length	14.7	13.6–16.5	14.8±0.87
Dorsal spine length	17.2	16.8–19.9	18.0±1.25
Anal-fin base length	12.5	10.5–14.6	12.8±1.44
Pelvic-fin length	13.8	13.8–15.9	14.8±0.67
Pectoral fin length	24.1	21.6–25.1	23.3±1.22
Pectoral spine length	22.5	19.2–22.8	20.9±1.45
Caudal total length	22.5	21.4–25.8	23.7±1.64
Adipose basal length	28.1	27.9–30.2	28.7±0.79
Adipose maximum height	4.1	4.4–5.5	5.1±0.94
Dorsal to adipose distance	18.4	11.8–18.4	15.2±1.97
Adipose to caudal peduncle	8.4	8.4–12.5	10.3±1.35
Caudal peduncle length	16.3	16.1–19.3	17.7±1.31
Caudal peduncle depth	8.8	8.4–9.8	8.8±0.44
Body depth at anus	14.7	14.0–16.9	15.2±0.94
Head length	27.2	25.0–28.2	27.2±1.02
Head width	21.9	21.9–25.2	24.0±1.06
Head depth	16.9	16.2–19.2	17.5±0.93
<u>In % HL</u>			
Snout length	42.5	41.4–47.9	44.8±2.59
Interorbital distance	36.8	34.0–41.2	37.0±2.24
Orbit diameter	21.8	17.8–21.2	19.2±1.04
Maxillary barbel length	98.9	91.8–109.5	102.8±6.92
Inner mandibular barbel length	55.2	44.1–59.5	55.4±5.01
Outer mandibular barbel length	74.7	68.8–85.3	75.5±5.21

Barbels in three pairs. Maxillary barbel long and slender, extending to just beyond base of last pectoral-fin ray. Inner mandibular-barbel origin close to midline, extending to base of pectoral spine and with 2 short, thin branches on anterior half and 3–5 long, thin branches on posterior half. Outer mandibular barbel originates posterolateral of inner mandibular barbel, extending to middle of pectoral-fin base and with 3–5 long, thin branches.

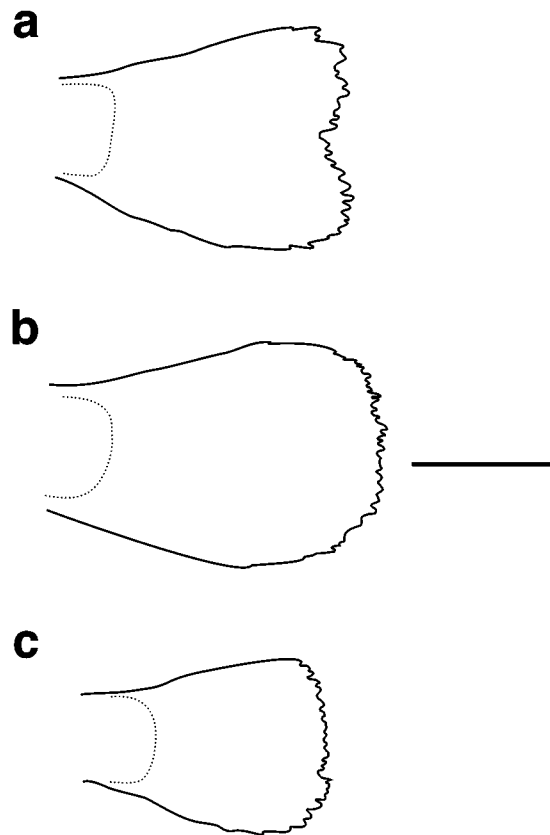


FIGURE 9. Lateral view of caudal fins showing: a. emarginate fin (condition in *Microsynodontis emarginatus*, CU 89393, holotype, 33.4 mm SL); b. rounded fin (other *Microsynodontis* species, represented by *M. batesii*, CU 80748, 33.2 mm SL); c. truncate fin (condition in *M. laevigatus* and *M. lamberti*, represented by *M. laevigatus*, CU 88265, paratype, 22.8 mm SL).

Eye ovoid, horizontal axis longest; located entirely in dorsal half of head. Orbit without free margin.

Mouth inferior and crescent-shaped; lips plicate. Oral teeth in rows on all tooth-bearing surfaces. Premaxillae narrow, with narrow ventral shelf and partially exposed when mouth closed. Primary teeth 9–11, conical and separated from secondary teeth by distinct gap. Secondary teeth 35–50, acutely pointed and recurved; disposed in 3–4 rows. Tertiary teeth 15–24, elongate, villiform and extending over full width of premaxillae. Dentary teeth 15–21, acutely pointed, strongly recurved and broader than secondary teeth; disposed in one or two transverse bands.

Dorsal fin located at anterior third of body, with II,7 (30) rays and convex margin. Dorsal-fin spine long, stout and slightly curved; smooth on both anterior and posterior margins. Adipose fin moderately long; margin slightly convex for entire length and poste-

rior end deeply incised. Caudal fin emarginate (Fig. 10a), with i,6,5,i (3) or i,6,6,i* (27) principal rays. Procurrent rays symmetrical and extend only slightly anterior to fin base. Anal-fin base located ventral to posterior half of adipose fin. Anal fin with iv,6 (1); iv,7* (22) or iv,8 (7) rays and convex margin. Pelvic-fin origin at vertical ventral to posterior end of dorsal-fin base. Pelvic fin with i,6 (30) rays and slightly convex margin; tip of appressed fin not reaching anal-fin origin. Pectoral fin with I,6 (30) rays; spine slightly curved and stout (Fig. 4c). Anterior spine margin with 15–22 small serrations along entire length of spine; serrations antrorse (distally directed) on distal two thirds and anteriorly directed on proximal third. Posterior spine margin with 7–9 strong serrations along entire length. Pectoral-fin margin convex posteriorly. Vertebrae 13+22=35 (1); 12+24=36 (3); 13+23=36* (18); 13+24=37 (6); 14+22=36 (1) or 14+23=37 (1).

No marked sexual dimorphism in the size and density of tubercles on head. Males with long genital papilla situated immediately posterior to anus. Females with smaller, distally flattened genital papilla.

Coloration. In 70% ethanol: dorsal and lateral surfaces and of head and body medium brown, fading to cream or light grayish brown on ventral third of body, belly (with large faint brown spots), and ventral surface of head (Fig. 8). Snout with a series of cream spots delineating anterior and posterior nares, sometimes coalescing to form cream band running from anterior orbital margin to tip of snout. Cheek region with one or two cream spots immediately ventral to orbit. Cream band encircling nape at supraoccipital. Dorsal third of body with series of four cream vertical bar-shaped marks extending beyond lateral mid-line of body: first at middle of dorsal-fin base, second at adipose-fin origin, third at middle of adipose-fin base and last on caudal peduncle immediately posterior to adipose fin, sometimes encircling caudal peduncle as cream band. Ventral third of flanks with a longitudinal series of five to seven cream spots or vertical bar-shaped marks. Dorsal, pectoral, pelvic and anal fins hyaline and sometimes with one to two rows of faint spots forming longitudinal brown rows. Caudal fin with similar series of elongate marks forming two to three irregular columns.

Distribution. Known from the upper Ogooué River in southeastern Gabon (Fig. 7).

Habitat. The type locality is a very slow-flowing creek. Water temperature was 25.4°C and the pH was 5.0. Syntopic fish included: Mormyridae: *Brienomyrus* spp., *Marcusenius moorii*, *Mormyrops zanclirostris*, *Stomatorhinus walkeri*; Characidae: *Brycinus* sp.; Distichodontidae: *Distichodus* sp., *Nannocharax* sp.; Hepsetidae: *Hepsetus odoe*; Cyprinidae: *Barbus* spp.; Amphiliidae: *Amphilius nigricaudatus*, *Phractura* sp., Clariidae: *Clarias* spp.; Claroteidae: *Parauchenoglanis balayi*; Mochokidae: *Synodontis* sp.; Cyprinodontidae: *Plataplochilus terveri*; Channidae: *Parachanna insignis*; Cichlidae: *Hemichromis* sp.; Anabantidae: *Ctenopoma kingsleyae*; Mastacembelidae: *Caecomastacembelus* sp.

Etymology. From the Latin *emarginatus*, meaning notched at the apex; in reference to distinctive shape of the caudal fin. Used as an adjective.

***Microsynodontis hirsutus* sp. nov. (Fig. 10)**

Type material. Holotype: CU 87040, male, 68.0 mm SL; Gabon: Woleu-Ntem province, Ngomo creek, where it crosses Oyem-Minvoul road, 1°41'30.0"N 11°39'18.9"E; J. P. Friel, S. Lavoué & J. P. Sullivan, 11 September 1999.

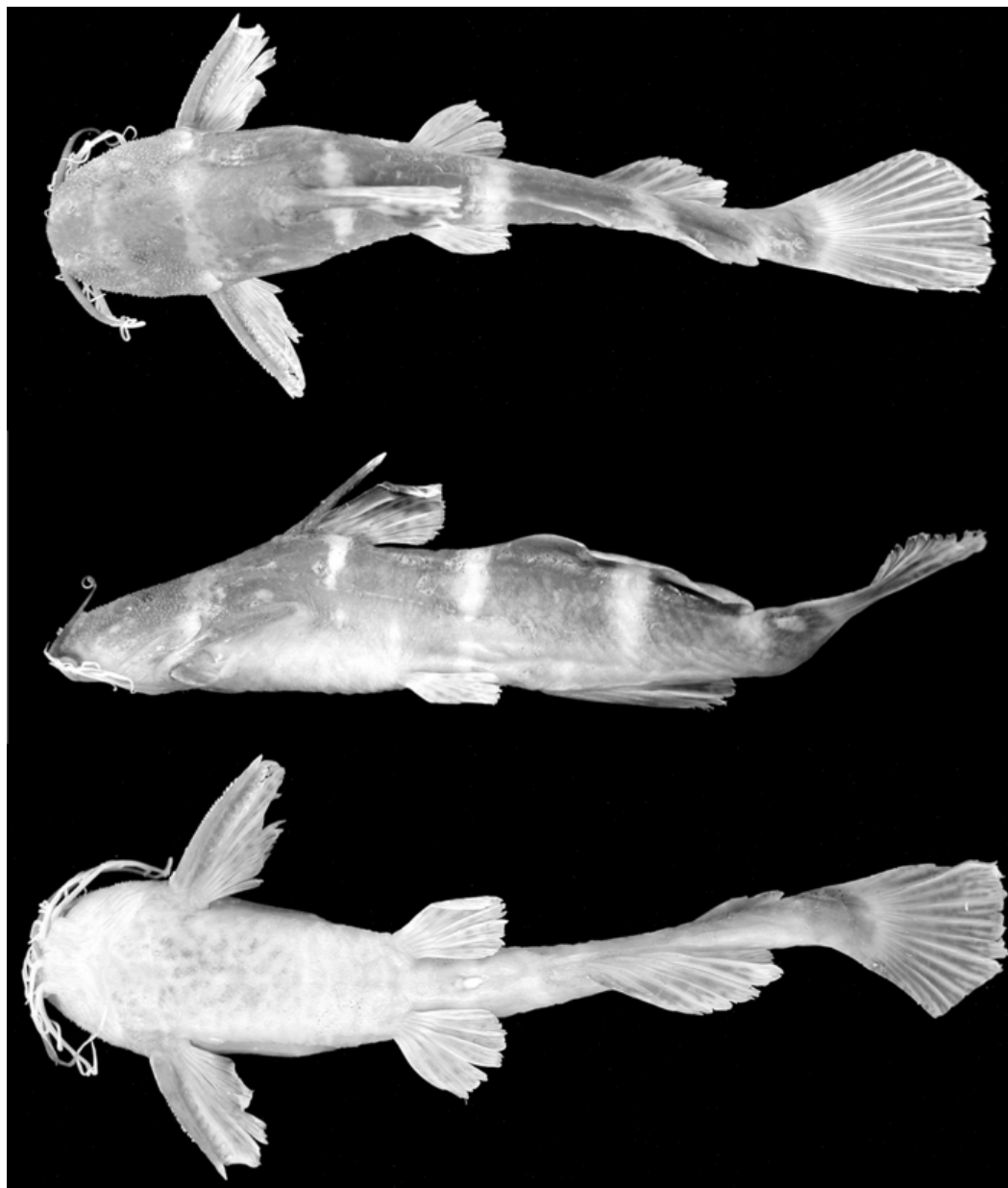


FIGURE 10. *Microsynodontis hirsutus*, holotype, CU 87040, 68.0 mm SL; Gabon: Ntem River drainage.

Paratypes. CU 80584 (3), 2 females: 25.7–26.5 mm SL; 1 male: 28.0 mm SL; data as for holotype.

Diagnosis. *Microsynodontis hirsutus* can be distinguished from all congeners in having long (vs. short) tubercles on the dorsal and lateral surfaces of the head (Fig. 3) and a straight (vs. gently curved) dorsal spine (Fig. 2). The tubercles are typically 0.3 mm long in the holotype of *M. hirsutus*, while in similar-sized specimens of other *Microsynodontis*, they are about 0.05 mm long; the smaller paratype male of *M. hirsutus* (28.0 mm SL) has tubercles 0.1 mm long, as compared to 0.05 mm in other male congeners of similar size. The tubercles are 0.05 mm in the larger paratype female, as compared to 0.02 mm in female congeners of the same size. It further differs from congeners except *M. batesii* and *M. polli* in having a longer adipose fin (34.6–37.9% SL vs. 21.3–35.5). It can be further distinguished from *M. polli* (n=9) in having a shorter caudal fin (20.0–24.3% SL vs. 29.6–41.6).

Description. Biometric and meristic data as in Table 4. Body compressed. Predorsal profile gently convex; postdorsal body sloping gently ventrally. Preanal profile horizontal. Anus and urogenital openings located at vertical through middle of pelvic fin. Skin smooth. Lateral line complete and midlateral.

Head depressed and broad, acutely rounded when viewed laterally and with rounded snout margin when viewed from above. Gill openings narrow, extending from immediately ventral to posttemporal to immediately ventral to base of pectoral spine. Gill membranes united to, and attached across, isthmus. Bony elements of dorsal surface of head covered with thin skin. Nuchal shield large and terminating posteriorly with two rounded processes on each side. Supracleithral process thin, extending just short of vertical through posteriormost tip of nuchal shield.

Barbels in three pairs. Maxillary barbel long and slender, extending to just beyond base of last pectoral-fin ray. Inner mandibular-barbel origin close to midline, extending to base of pectoral spine and with 2 short, thin branches on anterior half and 3–5 long, thin branches on posterior half. Outer mandibular barbel originates posterolateral of inner mandibular barbel, extending to middle of pectoral-fin base and with 3–5 long, thin branches.

Eye ovoid, horizontal axis longest; located entirely in dorsal half of head. Orbit without free margin.

Mouth inferior and crescent-shaped; lips plicate. Oral teeth in rows on all tooth-bearing surfaces. Premaxillae narrow, with narrow ventral shelf and partially exposed when mouth closed. Primary teeth 14–21, conical and separated from secondary teeth by distinct gap. Secondary teeth 40–85, acutely pointed and recurved; disposed in 3–4 rows. Tertiary teeth 19–28, elongate, villiform and extending over full width of premaxillae. Dentary teeth 17–25, acutely pointed, strongly recurved and broader than secondary teeth; disposed in one or two transverse bands.

TABLE 4. Biometric data for *M. hirsutus* (n=4).

	HOLOTYPE	RANGE	MEAN±SD
SL (mm)	68.0	25.7–68.0	
<u>In % SL</u>			
Predorsal length	32.9	32.9–38.5	36.6±2.57
Snout to anal	63.2	63.2–70.0	66.1±3.34
Snout to pelvic	45.9	44.5–49.3	46.5±2.02
Snout to pectoral	19.7	19.7–23.4	22.0±1.64
Dorsal-fin base length	13.1	11.7–13.6	13.0±0.90
Dorsal spine length	17.1	17.1–19.5	18.0±1.14
Anal-fin base length	15.0	12.5–15.0	14.0±1.21
Pelvic-fin length	12.9	12.9–15.4	14.5±1.08
Pectoral fin length	22.1	22.1–26.8	24.7±2.03
Pectoral spine length	19.3	19.1–23.2	20.9±2.00
Caudal total length	24.4	20.0–24.3	22.3±2.35
Adipose basal length	37.9	34.6–37.9	36.1±1.37
Adipose maximum height	6.0	3.9–6.0	5.1±0.94
Dorsal to adipose distance	10.9	10.9–14.3	12.1±1.60
Adipose to caudal peduncle	7.6	5.7–7.6	7.0±0.86
Caudal peduncle length	18.7	12.9–18.7	15.0±2.59
Caudal peduncle depth	7.2	7.1–7.8	7.3±0.32
Body depth at anus	14.3	11.7–15.0	13.9±1.51
Head length	24.1	24.1–26.8	25.6±1.16
Head width	20.3	20.3–25.4	22.6±2.42
Head depth	14.1	14.1–15.6	15.2±0.70
<u>In % HL</u>			
Snout length	45.7	41.8–46.3	44.5±2.02
Interorbital distance	31.1	31.1–43.3	38.0±5.07
Orbit diameter	17.0	16.0–17.0	16.5±0.41
Maxillary barbel length	100.6	100.0–126.9	112.5±14.18
Inner mandibular barbel length	61.0	46.3–68.0	58.8±9.07
Outer mandibular barbel length	95.1	81.3–95.1	88.9±8.33

Dorsal fin located at anterior third of body, with II,7 (4) rays and convex margin. Dorsal-fin spine long, stout and straight; smooth on both anterior and posterior margins. Adipose fin long, extending for most of postdorsal distance; margin slightly convex for entire length and posterior end deeply incised. Caudal fin rounded, with i,6,6,i (4) principal rays. Procurrent rays symmetrical and extend only slightly anterior to fin base. Anal-fin base

located ventral to posterior half of adipose fin. Anal fin with iv,7* (2) or iv,8 (2) rays and convex margin. Pelvic-fin origin at vertical ventral to posterior end of dorsal-fin base. Pelvic fin with i,6 (4) rays and slightly convex margin; tip of appressed fin not reaching anal-fin origin. Pectoral fin with I,6 (4) rays; spine slightly curved and stout (as in Fig. 4f). Anterior spine margin with 12–35 small serrations along entire length of spine; serrations antrorse (distally directed) on distal two-thirds and anteriorly directed on proximal third. Posterior spine margin with 9–13 strong serrations along entire length. Pectoral-fin margin convex posteriorly. Vertebrae 12+24* (3) or 13+24 (1).

Males with numerous tubercles on sides of head on region extending from snout to preopercle, and long genital papilla situated immediately posterior to anus. Females with fewer tubercles on sides of head, and with smaller, distally flattened genital papilla.

Coloration. In 70% ethanol (adults larger than ca. 30 mm SL): dorsal and lateral surfaces and of head and body brownish gray, fading to dirty cream on ventral third of body, belly (with faint traces of brownish gray spots), and ventral surface of head (Fig. 10). Snout with a series of cream spots delineating anterior and posterior nares. Cheek region with one or two cream spots immediately ventral to orbit. Cream band encircling nape at supraoccipital. Dorsal third of body with series of four cream vertical bar-shaped marks extending beyond lateral midline of body: first at middle of dorsal-fin base, second at adipose-fin origin, third at middle of adipose-fin base and last on caudal peduncle immediately posterior to adipose fin, sometimes encircling caudal peduncle as cream band. Ventral third of flanks with a longitudinal series of six to eight cream spots or vertical bar-shaped marks. Pectoral and pelvic fin rays with brownish gray spots arranged in two or three bands. Dorsal-, anal- and caudal-fin rays brownish gray, with hyaline interradiation membranes.

Coloration of juveniles (smaller than ca. 30 mm SL) similar, except for being more brown than gray dorsally, a cream belly with brown spotting on posterior half (vs. spotting almost indistinct in adults), and dorsal-, anal- and caudal-fin rays with brown spots arranged into one or two bands (coalescing to give solidly-colored fin rays in adults).

Distribution. Known from the Nyé River (a tributary of the Ntem River) in northern Gabon (Fig. 7).

Habitat. The type locality was a fast-flowing creek over a rock/pebble substrate. The water was cool (22°C), acidic (pH 5.0) and tannin-stained. Syntopic fish included: Mormyridae: *Brienomyrus* sp.; Distichodontidae: *Distichodus* sp.; Cyprinidae: *Barbus* spp.; Amphiliidae: *Amphilius longirostris*; Clariidae: *Clarias jaensis*; Mochokidae: *Chiloglanis cameronensis*; Mastacembelidae: *Aethiomastacembelus* sp.

Etymology. From the Latin *hirsutus*, meaning hairy; in reference to the long tubercles on the dorsal and lateral surfaces of the head, which gives the species a somewhat hairy appearance of the head. Used as an adjective.

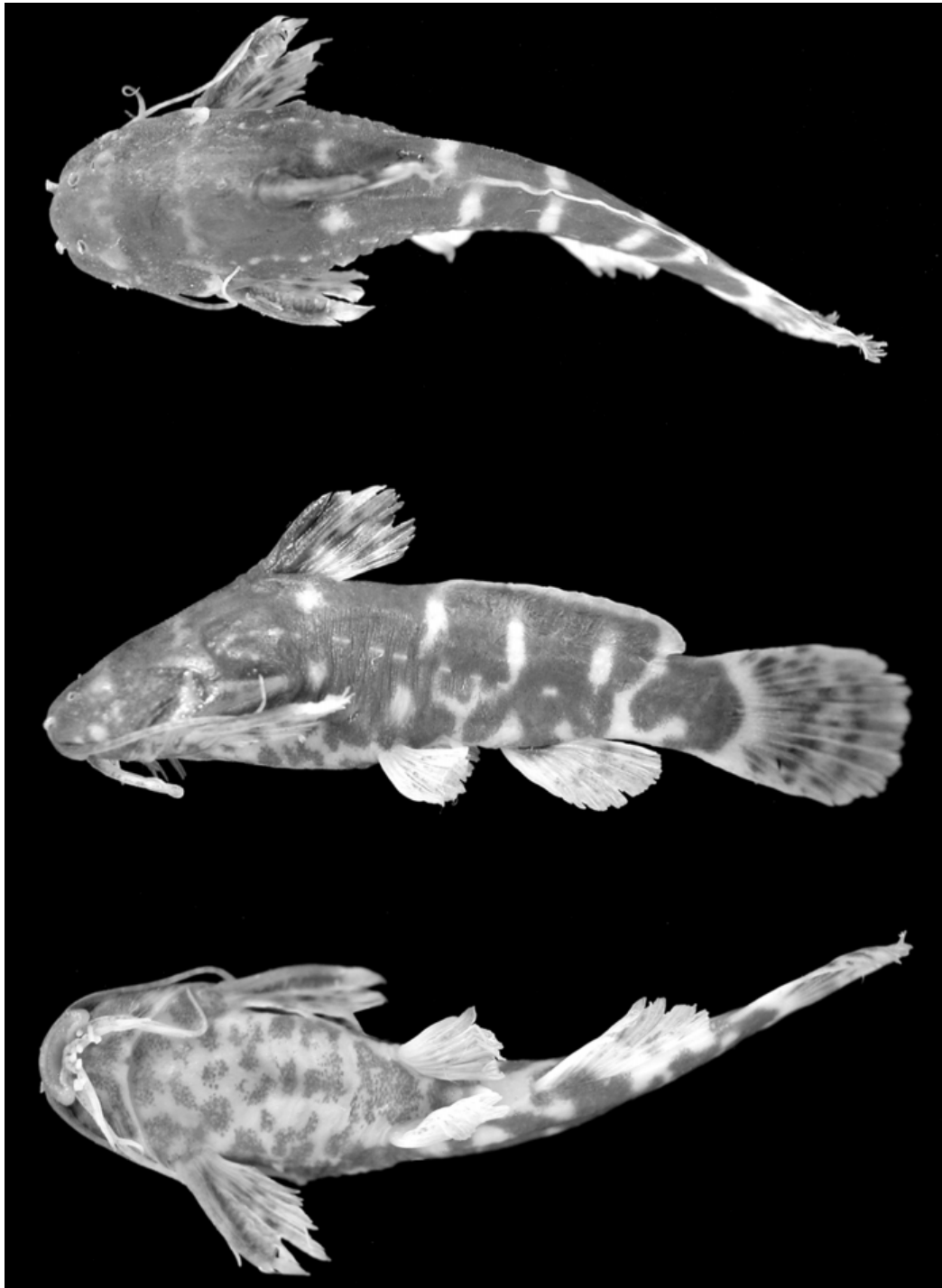


FIGURE 11. *Microsynodontis laevigatus*, holotype, CU 89407, 30.8 mm SL; Gabon: Ivindo River drainage.

Type material: Holotype: CU 89407, male, 30.8 mm SL; Gabon: Ogooué-Ivindo province, Ivindo River drainage, small creek flowing into Ivindo River, Makokou, 0°35'8"N 12°51'22"E; J. P. Friel, S. Lavoué & J. P. Sullivan, 6 September 2002.

Paratypes: CU 88265 (13), 5 females: 21.5–24.5 mm SL; 8 males: 20.5–28.1 mm SL; data as for holotype.

Diagnosis. *Microsynodontis laevigatus* can be distinguished from all congeners (except for *M. lamberti*) in having a smooth (vs. serrated) anterior edge of the pectoral spine (Fig. 4), and a truncate (vs. emarginate or rounded) caudal fin (Fig. 9). It differs from *M. lamberti* (n=4) in having a longer adipose fin (33.3–35.5% SL vs. 25.4–31.4).

Description. Biometric and meristic data as in Table 5. Body compressed. Predorsal profile steep; postdorsal body sloping gently ventrally. Preanal profile horizontal. Anus and urogenital openings located at vertical through middle of pelvic fin. Skin smooth. Lateral line complete and midlateral.

Head depressed and broad, broadly rounded when viewed laterally and with rounded snout margin when viewed from above. Gill openings narrow, extending from immediately ventral to posttemporal to immediately ventral to base of pectoral spine. Gill membranes united to, and attached across, isthmus. Bony elements of dorsal surface of head covered with thin skin. Nuchal shield large and terminating posteriorly with two rounded processes on each side. Supracleithral process thin, extending just short of vertical through posteriormost tip of nuchal shield.

Barbels in three pairs. Maxillary barbel long and slender, extending to just beyond base of last pectoral-fin ray. Inner mandibular-barbel origin close to midline, extending to base of pectoral spine and with 2 short, thin branches on anterior half and 3–4 long, thin branches on posterior half. Outer mandibular barbel originates posterolateral of inner mandibular barbel, extending to middle of pectoral-fin base and with 3–4 long, thin branches.

Eye ovoid, horizontal axis longest; located entirely in dorsal half of head. Orbit without free margin.

Mouth inferior and crescent-shaped; lips plicate. Oral teeth in rows on all tooth-bearing surfaces. Premaxillae narrow, with narrow ventral shelf and partially exposed when mouth closed. Primary teeth 10–14, conical and separated from secondary teeth by distinct gap. Secondary teeth 30–40, acutely pointed and recurved; disposed in 3–4 rows. Tertiary teeth 18–21, elongate, villiform and extending over full width of premaxillae. Dentary teeth 12–20, acutely pointed, strongly recurved and broader than secondary teeth; disposed in one or two transverse bands.

Dorsal fin located at anterior third of body, with II,4,i (1); II,5,i (9) or II,6* (4) rays and convex margin. Dorsal-fin spine short, stout and slightly curved; smooth on both anterior and posterior margins. Adipose fin moderately long; margin slightly convex for entire length and posterior end deeply incised. Caudal fin truncate, with i,6,5,i (14) principal rays. Procurrent rays symmetrical and extend only slightly anterior to fin base. Anal-

fin base located ventral to posterior half of adipose fin. Anal fin with iv,6 (1) or iv,7* (13) rays and convex margin. Pelvic-fin origin at vertical ventral to posterior end of dorsal-fin base. Pelvic fin with i,6 (14) rays and slightly convex margin; tip of appressed fin not reaching anal-fin origin. Pectoral fin with I,5,i (14) rays; spine slightly curved and stout (Fig. 4d). Anterior spine margin smooth along entire length of spine. Posterior spine margin with 7–8 strong serrations along entire length. Pectoral-fin margin convex posteriorly. Vertebrae 11+22 (2); 11+23 (1); 12+22 (6); 12+23 (3) or 13+22* (2).

TABLE 5. Biometric data for *M. laevigatus* (n=14).

	HOLOTYPE	RANGE	MEAN±SD
SL (mm)	30.8	20.5–30.8	
<u>In % SL</u>			
Predorsal length	36.7	34.8–39.1	37.1±1.51
Snout to anal	65.3	64.1–71.0	66.8±2.37
Snout to pelvic	45.5	45.5–53.1	49.1±2.31
Snout to pectoral	25.6	22.8–25.6	23.8±0.91
Dorsal-fin base length	13	12.1–16.1	13.6±1.32
Dorsal spine length	14.9	13.5–17.1	15.3±1.18
Anal-fin base length	14	12.7–17.1	14.8±1.53
Pelvic-fin length	14.9	14.9–17.6	16.4±1.08
Pectoral fin length	23.7	20.1–25.3	23.2±1.68
Pectoral spine length	17.9	16.7–21.8	19.6±2.05
Caudal total length	24.4	24.3–28.5	25.9±1.48
Adipose basal length	35.1	33.3–35.5	34.6±0.93
Adipose maximum height	6.2	4.0–6.2	5.3±0.69
Dorsal to adipose distance	10.4	10.2–12.5	11.3±0.93
Adipose to caudal peduncle	9.7	8.6–10.1	9.6±0.51
Caudal peduncle length	16.6	15.7–19.5	17.2±1.47
Caudal peduncle depth	11	9.3–11.4	10.7±0.74
Body depth at anus	20.1	18.9–22.1	20.3±1.01
Head length	26.9	26.9–30.7	28.5±1.29
Head width	24	24.0–26.9	25.4±1.05
Head depth	20.1	19.2–21.7	20.1±0.93
<u>In % HL</u>			
Snout length	43.4	39.0–45.7	43.0±2.40
Interorbital distance	39.8	35.1–39.8	37.3±1.71
Orbit diameter	18.1	15.6–21.8	18.2±2.45
Maxillary barbel length	139.8	98.7–139.8	121.0±14.2
Inner mandibular barbel length	54.2	54.2–78.2	66.1±9.16
Outer mandibular barbel length	97.6	75.6–120.5	120.5±13.43

Males with numerous tubercles on sides of head on region extending from snout to preopercle, and long genital papilla situated immediately posterior to anus. Females with fewer tubercles on sides of head, and with smaller, distally flattened genital papilla.

Coloration. In 70% ethanol: dorsal and lateral surfaces and of head and body medium brown, fading to cream on belly and ventral surfaces (Fig. 11). Medium-sized brown spots evenly scattered over ventral surfaces. Snout with a series of cream spots delineating anterior and posterior nares, sometimes coalescing to form cream band running from anterior orbital margin to tip of snout. Cheek region with numerous small cream spots ventral and posterior to orbit. Cream band encircling nape at supraoccipital. Dorsal third of body with series of four cream irregular blotches extending short of lateral midline of body: first at middle of dorsal-fin base, second at adipose-fin origin, third at middle of adipose-fin base and last on caudal peduncle immediately posterior to adipose fin, sometimes coalescing with similar marks ventrally and encircling caudal peduncle as irregular cream band. Ventral third of flanks with a series of irregular cream blotches sometimes coalescent with dorsal markings to form reticulate pattern. Dorsal, pectoral, pelvic and anal fins hyaline and sometimes with one to two rows of faint spots forming longitudinal brown rows. Caudal fin hyaline, with elongate brown spots forming two to three irregular columns.

Distribution. Known only from the Ivindo River in northern Gabon (Fig. 5).

Habitat. The type locality is a small, shallow blackwater creek draining into the Ivindo River. The water was extremely low and the substrate was sand with leaf litter, with the area having undergone severe human disturbance. The only other fish species found syntopically was *Barbus* sp. (Cyprinidae).

Etymology. From the Latin *laevigatus*, meaning smooth. In reference to the smooth anterior edge of the pectoral spine. Used as an adjective.

***Microsynodontis nannoculus* sp. nov. (Fig. 12)**

Microsynodontis batesii (non Boulenger) (?) Pappenheim, 1911: 525; Roman, 1971: 131, Fig. 56.

Type material: Holotype: MRAC 173145, male, 39.1 mm SL; Equatorial Guinea: Mami River, a tributary of Kyé River; B. Roman, 5 September 1967.

Paratype: MRAC 173146, female, 35.7 mm SL; data as for holotype.

Diagnosis. *Microsynodontis nannoculus* can be distinguished from all congeners in having a smaller eye (10.6–12.2% SL vs. 13.1–25.7).

Description. Biometric and meristic data as in Table 6. Body compressed. Predorsal profile gently convex; postdorsal body sloping gently ventrally. Preanal profile horizontal. Anus and urogenital openings located at vertical through middle of pelvic fin. Skin smooth. Lateral line complete and midlateral.



FIGURE 12. *Microsynodontis nannoculus*, holotype, MRAC 173145, 39.1 mm SL; Equatorial Guinea: Kyé River drainage.

TABLE 6. Biometric data for *M. nannoculus* (n=2).

	HOLOTYPE	PARATYPE	MEAN±SD
SL (mm)	39.1	35.7	
<u>In % SL</u>			
Predorsal length	37.1	40.1	38.6±2.12
Snout to anal	63.9	76.2	70.1±8.70
Snout to pelvic	47.6	53.8	50.7±4.38
Snout to pectoral	20.7	23.2	22.0±1.77
Dorsal-fin base length	11.5	16.0	13.8±3.18
Dorsal spine length	17.6	25.5	21.6±5.59
Anal-fin base length	16.6	12.6	14.6±2.83
Pelvic-fin length	13.6	16.0	14.8±1.70
Pectoral fin length	23.8	23.5	23.7±0.21
Pectoral spine length	19.9	22.4	21.2±1.77
Caudal total length	23.0	25.5	24.3±1.77
Adipose basal length	33.8	29.4	31.6±3.11
Adipose maximum height	5.1	5.3	5.2±0.14
Dorsal to adipose distance	18.2	17.4	17.8±0.57
Adipose to caudal peduncle	7.4	9.8	8.6±1.70
Caudal peduncle length	17.6	19.9	18.8±1.63
Caudal peduncle depth	9.2	9.8	9.5±0.42
Body depth at anus	17.6	19.0	18.3±0.99
Head length	25.1	26.3	25.7±0.85
Head width	22.5	20.4	21.5±1.48
Head depth	17.9	19.3	18.6±0.99
<u>In % HL</u>			
Snout length	48.0	47.9	48.0±0.07
Interorbital distance	34.7	34.0	34.4±0.49
Orbit diameter	12.2	10.6	11.4±1.13
Maxillary barbel length	110.2	126.6	118.4±11.60
Inner mandibular barbel length	74.5	62.8	68.7±8.27
Outer mandibular barbel length	91.8	100.0	95.9±5.80

Head depressed and broad, acutely rounded when viewed laterally and with rounded snout margin when viewed from above. Gill openings narrow, extending from immedi-

ately ventral to posttemporal to immediately ventral to base of pectoral spine. Gill membranes united to, and attached across, isthmus. Bony elements of dorsal surface of head covered with thin skin. Nuchal shield large and terminating posteriorly with two rounded processes on each side. Supracleithral process thin, extending just short of vertical through posteriormost tip of nuchal shield.

Barbels in three pairs. Maxillary barbel long and slender, extending to just beyond base of last pectoral-fin ray. Inner mandibular-barbel origin close to midline, extending to base of pectoral spine and with 2 short, thin branches on anterior half and 3–4 long, thin branches on posterior half. Outer mandibular barbel originates posterolateral of inner mandibular barbel, extending to middle of pectoral-fin base and with 3–4 long, thin branches.

Eye small and ovoid, horizontal axis longest; located entirely in dorsal half of head. Orbit without free margin.

Mouth inferior and crescent-shaped; lips plicate. Oral teeth in rows on all tooth-bearing surfaces. Premaxillae narrow, with narrow ventral shelf and partially exposed when mouth closed. Primary teeth 14–20, conical and separated from secondary teeth by distinct gap. Secondary teeth 35–40, acutely pointed and recurved; disposed in 3–4 rows. Tertiary teeth 17–23, elongate, villiform and extending over full width of premaxillae. Dentary teeth 18–19, acutely pointed, strongly recurved and broader than secondary teeth; disposed in one or two transverse bands.

Dorsal fin located at anterior third of body, with II,7 (2) rays and convex margin. Dorsal-fin spine short, stout and slightly curved; smooth on both anterior and posterior margins. Adipose fin moderately long; margin slightly convex for entire length and posterior end deeply incised. Caudal fin rounded, with principal rays. Procurrent rays symmetrical and extend only slightly anterior to fin base. Anal-fin base located ventral to posterior half of adipose fin. Anal fin with iv,7 (1) or iv,9* (1) rays and convex margin. Pelvic-fin origin at vertical ventral to posterior end of dorsal-fin base. Pelvic fin with i,6 (2) rays and slightly convex margin; tip of appressed fin not reaching anal-fin origin. Pectoral fin with I,6 (2) rays; spine slightly curved and stout (as in Fig. 4f). Anterior spine margin with 17–20 small serrations along entire length of spine; serrations antrorse (distally directed) on distal two-thirds and anteriorly directed on proximal third. Posterior spine margin with 9–10 strong serrations along entire length. Pectoral-fin margin convex posteriorly. Vertebrae 12+24=36* (1) or 13+23=36 (1).

Males with numerous tubercles on sides of head on region extending from snout to preopercle, and long genital papilla situated immediately posterior to anus. Females with fewer tubercles on sides of head, and with smaller, distally flattened genital papilla.

Coloration. In 70% ethanol: dorsal and lateral surfaces and of head and body medium brown, fading to cream or light grayish brown on ventral third of body, belly (with large faint brown spots), and ventral surface of head (Fig. 12). Snout with a series of cream spots delineating anterior and posterior nares, sometimes coalescing to form cream band

running from anterior orbital margin to tip of snout. Cheek region with one or two cream spots immediately ventral to orbit. Cream band encircling nape at supraoccipital. Dorsal third of body with series of four cream slender, vertical bar-shaped marks extending beyond lateral midline of body: first at middle of dorsal-fin base, second at adipose-fin origin, third at middle of adipose-fin base and last on caudal peduncle immediately posterior to adipose fin, sometimes encircling caudal peduncle as cream band. Ventral third of flanks with a longitudinal series of five to seven cream spots or vertical bar-shaped marks. Dorsal, pectoral, pelvic and anal fins hyaline and with one to two rows of elongate spots forming longitudinal brown rows. Caudal fin hyaline, with elongate brown spots forming two to three irregular columns.

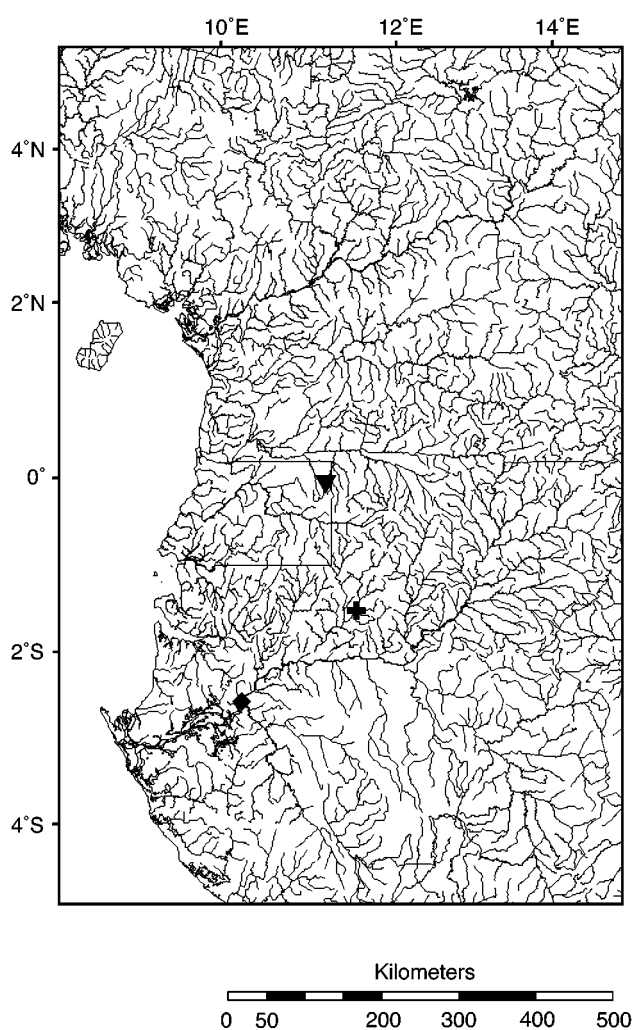


FIGURE 13. Map showing distributions of *M. nannoculus* (▼), *M. nasutus* (+) and *M. vigilis* (◆).

Distribution. Known only from the Kyé River drainage (the Kyé River itself is a tributary of the Ntem River) in eastern Equatorial Guinea (Fig. 13). Pappenheim's (1911)

record of *M. batesii* from the Benito River drainage may belong to this species, but I was unable to examine the specimens to verify their identity.

Etymology. From the Latin *nanus*, meaning small, and *oculus*, meaning eye. In allusion to the relatively small eye. Used as a noun in apposition.

***Microsynodontis nasutus* sp. nov. (Fig. 14)**

Type material. Holotype: CU 89394, male, 30.9 mm SL; Gabon: Woleu-Ntem province, Okano River on rapids 0.5 km S of village of Na, 0°48'35"N 11°38'47"E; C. D. Hopkins & M. E. Arnegard, 17 August 2001.

Paratypes. CU 86328 (7), 5 females: 26.6–36.5 mm SL; 2 males: 26.6–27.5 mm SL; data as for holotype.

Diagnosis. *Microsynodontis nasutus* can be distinguished from all congeners in having a longer snout (50.0–53.3% HL vs. 35.7–50.0).

Description. Biometric and meristic data as in Table 7. Body compressed. Predorsal profile gently convex; postdorsal body sloping gently ventrally. Preanal profile horizontal. Anus and urogenital openings located at vertical through middle of pelvic fin. Skin smooth. Lateral line complete and midlateral.

Head depressed and broad, broadly rounded when viewed laterally and with rounded snout margin when viewed from above. Gill openings narrow, extending from immediately ventral to posttemporal to immediately ventral to base of pectoral spine. Gill membranes united to, and attached across, isthmus. Bony elements of dorsal surface of head covered with thin skin. Nuchal shield large and terminating posteriorly with two rounded processes on each side. Supracleithral process thin, extending just short of vertical through posteriormost tip of nuchal shield.

Barbels in three pairs. Maxillary barbel long and slender, extending to just beyond base of last pectoral-fin ray. Inner mandibular-barbel origin close to midline, extending to base of pectoral spine and with 2 short, thin branches on anterior half and 3–5 long, thin branches on posterior half. Outer mandibular barbel originates posterolateral of inner mandibular barbel, extending to middle of pectoral-fin base and with 3–5 long, thin branches.

Eye ovoid, horizontal axis longest; located entirely in dorsal half of head. Orbit without free margin.

Mouth inferior and crescent-shaped; lips plicate. Oral teeth in rows on all tooth-bearing surfaces. Premaxillae narrow, with narrow ventral shelf and partially exposed when mouth closed. Primary teeth 11–12, conical and separated from secondary teeth by distinct gap. Secondary teeth 35–50, acutely pointed and recurved; disposed in 3–4 rows. Tertiary teeth 16–20, elongate, villiform and extending over full width of premaxillae. Dentary teeth 14–18, acutely pointed, strongly recurved and broader than secondary teeth; disposed in one or two transverse bands.



FIGURE 14. *Microsynodontis nasutus*, holotype, CU 89394, 36.5 mm SL; Gabon: Okano River drainage.

TABLE 7. Biometric data for *M. nasutus* (n=8).

	HOLOTYPE	RANGE	MEAN±SD
SL (mm)	36.5	26.6–36.5	
<u>In % SL</u>			
Predorsal length	36.7	34.0–40.6	38.1±2.09
Snout to anal	65.8	63.8–69.5	66.7±1.85
Snout to pelvic	47.9	46.3–50.0	48.3±1.23
Snout to pectoral	20.3	19.1–22.6	20.7±1.50
Dorsal-fin base length	12.3	11.3–14.5	12.6±1.04
Dorsal spine length	19.5	17.5–21.8	19.7±1.37
Anal-fin base length	12.9	12.9–16.7	14.5±1.28
Pelvic-fin length	14.0	13.3–16.1	14.8±1.03
Pectoral fin length	24.9	22.6–27.2	24.7±1.63
Pectoral spine length	22.2	20.2–24.3	22.2±1.38
Caudal total length	22.5	21.0–25.7	23.6±1.60
Adipose basal length	30.1	28.2–32.0	30.3±1.14
Adipose maximum height	3.5	2.6–5.5	4.4±1.03
Dorsal to adipose distance	13.7	11.8–14.2	13.1±0.82
Adipose to caudal peduncle	7.4	7.0–10.3	8.4±1.26
Caudal peduncle length	16.7	15.2–16.7	15.9±0.55
Caudal peduncle depth	7.9	6.7–9.8	8.3±1.05
Body depth at anus	14.0	12.9–18.9	14.8±1.87
Head length	24.7	24.7–27.1	25.7±0.74
Head width	21.6	21.6–25.5	23.9±1.16
Head depth	17.0	15.0–17.3	16.3±0.87
<u>In % HL</u>			
Snout length	53.3	50.0–53.3	51.4±0.93
Interorbital distance	36.7	33.8–41.2	37.3±2.66
Orbit diameter	16.7	13.8–17.4	16.1±1.12
Maxillary barbel length	123.3	102.9–123.3	113.6±7.11
Inner mandibular barbel length	44.4	44.4–83.8	56.6±12.96
Outer mandibular barbel length	77.7	77.7–102.9	89.6±8.96

Dorsal fin located at anterior third of body, with II,6,i* (6) or II,7 (2) rays and convex margin. Dorsal-fin spine long, stout and slightly curved; smooth on both anterior and posterior margins. Adipose fin moderately long; margin slightly convex for entire length and posterior end deeply incised. Caudal fin rounded, with i,5,6,i (1); i,6,5,i (2) or i,6,6,i* (5) principal rays. Procurrent rays symmetrical and extend only slightly anterior to fin base. Anal-fin base located ventral to posterior half of adipose fin. Anal fin with iv,6* (2) or v,6

(6) rays and convex margin. Pelvic-fin origin at vertical ventral to posterior end of dorsal-fin base. Pelvic fin with i,6 (8) rays and slightly convex margin; tip of appressed fin not reaching anal-fin origin. Pectoral fin with I,6 (8) rays; spine slightly curved and stout (as in Fig. 4f). Anterior spine margin with 16–22 small serrations along entire length of spine; serrations antrorse (distally directed) on distal two thirds and anteriorly directed on proximal third. Posterior spine margin with 7–9 strong serrations along entire length. Pectoral-fin margin convex posteriorly. Vertebrae $11+25=36$ (1) or $12+24=36^*$ (7).

Males with numerous tubercles on sides of head on region extending from snout to preopercle, and long genital papilla situated immediately posterior to anus. Females with fewer tubercles on sides of head, and with smaller, distally flattened genital papilla.

Coloration. In 70% ethanol: dorsal and lateral surfaces and of head and body medium brown, fading to cream or light grayish brown on ventral third of body, belly (with large faint brown spots), and ventral surface of head (Fig. 14). Snout with a series of cream spots delineating anterior and posterior nares, sometimes coalescing to form cream band running from anterior orbital margin to tip of snout. Cheek region with one or two cream spots immediately ventral to orbit. Cream band encircling nape at supraoccipital. Dorsal third of body with series of four cream vertical bar-shaped marks extending beyond lateral midline of body: first at middle of dorsal-fin base, second at adipose-fin origin, third at middle of adipose-fin base and last on caudal peduncle immediately posterior to adipose fin, sometimes encircling caudal peduncle as cream band. Ventral third of flanks with a longitudinal series of five to seven cream spots or vertical bar-shaped marks. Dorsal, pectoral, pelvic and anal fins hyaline and sometimes with one to two rows of faint spots forming longitudinal brown rows. Caudal fin with similar series of elongate marks forming two to three irregular columns.

Distribution. Known from the Okano River, a tributary of the Ogooué River, in northern Gabon (Fig. 13).

Habitat. The type locality was a whitewater river, with the following fish found syntopically: Mormyridae: *Brienomyrus* spp.; Distichodontidae: *Distichodus hypostomatus*; Cyprinidae: *Barbus martorelli*, *Labeo* spp., *Opsaridium ubangense*; Amphiliidae: *Amphilius longirostris*, *Amphilius nigricaudatus*, *Doumea typica*, *Phractura* sp.; Claroteidae: *Anaspidoglanis macrostoma*; Mochokidae: *Atopochilus savorgnani*; Cichlidae: *Hemichromis fasciatus*; Mastacembelidae: *Caecomastacembelus niger*.

Etymology. From the Latin *nasutus*, meaning large nosed; in reference to the long snout of this species. Used as a noun in apposition.

***Microsynodontis notatus* sp. nov. (Fig. 15)**

Microsynodontis batesii (non Boulenger) Pellegrin, 1909: 66; 1915: 503.

Type material: Holotype: MRAC 80-51-P-839, male, 41.0 mm SL: Gabon: Ezanga River,

about midway between Lake Ezanga and Ogooué mainstream; T. R. Roberts, 10 September 1978.

Paratypes: MRAC 73-2-P-1906–1910 (5), 3 females: 26.9–31.0 mm SL; 2 males: 33.3–40.0 mm SL; Gabon: Lake Onangue, Mountsomanie; D. F. E. Thys van den Aude-naerde, 28 August 1981. MRAC 80-51-P-17 (1), female: 53.6 mm SL; Gabon: Ogooué River, mainstream at Lambaréné; T. R. Roberts, 30 July 1978. MRAC 80-51-P-840–866, 16 females: 22.1–39.4 mm SL; 11 males: 24.8–43.7 mm SL; data as for holotype.

Diagnosis. *Microsynodontis notatus* can be distinguished from all congeners except for *M. christyi* and *M. laevigatus* in having a deeper caudal peduncle (9.6–11.9% SL vs. 5.8–9.8). It differs from *M. christyi* in having a larger eye (17.2–25.7% HL vs. 13.6–17.9) and from *M. laevigatus* in having a serrated (vs. smooth) anterior edge of the pectoral spine (Fig. 4) and a rounded (vs. truncate) caudal fin (Fig. 9). It also differs from all congeners in frequently having numerous faint, dark brown elongate spots on the body (vs. spots always absent).

Description. Biometric and meristic data as in Table 8. Body compressed. Predorsal profile steep; postdorsal body sloping gently ventrally. Preanal profile horizontal. Anus and urogenital openings located at vertical through middle of pelvic fin. Skin smooth. Lateral line complete and midlateral.

Head depressed and broad, broadly rounded when viewed laterally and with rounded snout margin when viewed from above. Gill openings narrow, extending from immediately ventral to posttemporal to immediately ventral to base of pectoral spine. Gill membranes united to, and attached across, isthmus. Bony elements of dorsal surface of head covered with thin skin. Nuchal shield large and terminating posteriorly with two rounded processes on each side. Supracleithral process thin, extending just short of vertical through posteriormost tip of nuchal shield.

Barbels in three pairs. Maxillary barbel long and slender, extending to just beyond base of last pectoral-fin ray. Inner mandibular-barbel origin close to midline, extending to base of pectoral spine and with 2 short, thin branches on anterior half and 3–4 long, thin branches on posterior half. Outer mandibular barbel originates posterolateral of inner mandibular barbel, extending to middle of pectoral-fin base and with 3–4 long, thin branches.

Eye large and ovoid, horizontal axis longest; located entirely in dorsal half of head. Orbit without free margin.

Mouth inferior and crescent-shaped; lips plicate. Oral teeth in rows on all tooth-bearing surfaces. Premaxillae narrow, with narrow ventral shelf and partially exposed when mouth closed. Primary teeth 11–14, conical and separated from secondary teeth by distinct gap. Secondary teeth 30–40, acutely pointed and recurved; disposed in 3–4 rows. Tertiary teeth 16–20, elongate, villiform and extending over full width of premaxillae. Dentary teeth 15–19, acutely pointed, strongly recurved and broader than secondary teeth; disposed in one or two transverse bands.

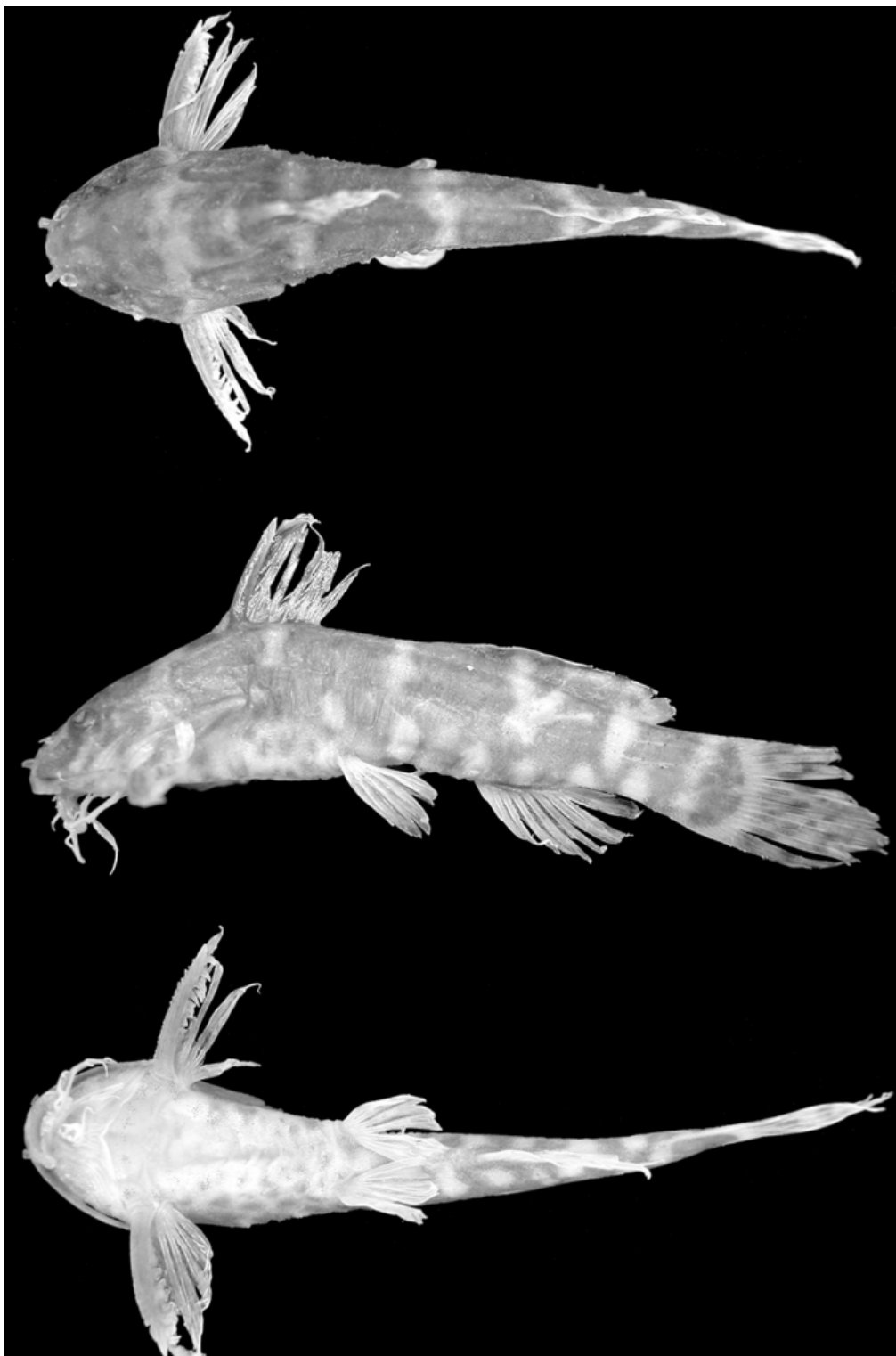


FIGURE 15. *Microsynodontis notatus*, holotype, MRAC 80-51-P-839, 41.0 mm SL; Gabon: Ogooué River drainage.

TABLE 8. Biometric data for *M. notatus* (n=34).

	HOLOTYPE	RANGE	MEAN±SD
SL (mm)	41.0	22.1–53.6	
<u>In % SL</u>			
Predorsal length	33.2	33.2–40.4	36.7±1.63
Snout to anal	63.4	63.1–70.4	66.3±1.95
Snout to pelvic	45.9	45.2–53.2	48.8±1.61
Snout to pectoral	16.6	16.6–22.7	20.1±1.57
Dorsal-fin base length	14.1	12.5–17.0	14.8±1.21
Dorsal spine length	17.3	13.0–23.0	17.1±2.32
Anal-fin base length	13.4	12.1–17.1	14.5±1.23
Pelvic-fin length	14.9	10.0–19.3	15.1±1.69
Pectoral fin length	19.5	19.5–28.6	24.0±2.15
Pectoral spine length	24.4	18.5–25.7	21.0±1.73
Caudal total length	24.9	18.3–26.1	22.1±2.01
Adipose basal length	33.2	28.5–34.5	31.0±1.71
Adipose maximum height	6.1	3.8–6.7	5.6±0.66
Dorsal to adipose distance	15.9	9.1–16.5	13.2±1.88
Adipose to caudal peduncle	11.2	9.3–13.6	11.1±1.10
Caudal peduncle length	19.5	14.2–20.7	17.8±1.47
Caudal peduncle depth	10.2	9.6–11.9	10.6±0.51
Body depth at anus	16.3	14.9–21.5	17.5±1.28
Head length	23.7	23.2–29.4	26.2±1.46
Head width	21.2	21.2–26.7	24.2±1.40
Head depth	16.1	16.1–20.4	18.0±1.06
<u>In % HL</u>			
Snout length	43.3	38.3–48.4	44.4±2.78
Interorbital distance	37.1	33.0–46.8	38.8±3.29
Orbit diameter	21.6	17.2–25.7	20.8±2.18
Maxillary barbel length	127.8	95.2–155.8	112.2±13.70
Inner mandibular barbel length	54.6	37.1–89.3	59.4±10.35
Outer mandibular barbel length	111.3	66.0–111.3	89.5±11.3

Dorsal fin located at anterior third of body, with II,6* (14) or II,7 (20) rays and convex margin. Dorsal-fin spine long, stout and slightly curved; smooth on both anterior and pos-

terior margins. Adipose fin moderately long; margin slightly convex for entire length and posterior end deeply incised. Caudal fin rounded, with i,5,6,i (1) or i,6,6,i* (33) principal rays. Procurrent rays symmetrical and extend only slightly anterior to fin base. Anal-fin base located ventral to posterior half of adipose fin. Anal fin with iii,7 (1); iii,8 (4); iv,7* (11) or iv,8 (18) rays and convex margin. Pelvic-fin origin at vertical ventral to posterior end of dorsal-fin base. Pelvic fin with i,6 (34) rays and slightly convex margin; tip of appressed fin not reaching anal-fin origin. Pectoral fin with I,6 *(32) or I,6,i (2) rays; spine slightly curved and stout (Fig. 4e). Anterior spine margin with 3–16 small serrations along entire length of spine; serrations antrorse (distally directed) on distal two-thirds and anteriorly directed on proximal third. Posterior spine margin with 6–12 strong serrations along entire length. Pectoral-fin margin convex posteriorly. Vertebrae 12+23 (2); 12+24 (6); 13+22 (1); 13+23* (10); 13+24 (12) or 14+23 (3).

Males with numerous tubercles on sides of head on region extending from snout to preopercle, and long genital papilla situated immediately posterior to anus. Females with fewer tubercles on sides of head, and with smaller, distally flattened genital papilla.

Coloration. In 70% ethanol: dorsal and lateral surfaces and of head and body light to medium brown, fading to cream on belly and ventral surfaces (Fig. 15). Dorsal and lateral surfaces of head and body frequently with dark brown elongate spots evenly distributed and forming a reticulate pattern. Snout with a series of cream spots delineating anterior and posterior nares. Cheek region with one or two cream spots immediately ventral to orbit. Cream band encircling nape at supraoccipital. Dorsal third of body with series of five cream vertical bar-shaped marks extending to lateral midline of body: first at middle of dorsal-fin base, second at adipose-fin origin, third at middle of adipose-fin base, fourth at posteriormost point of adipose-fin base and last on caudal peduncle immediately posterior to adipose fin, sometimes encircling caudal peduncle as cream band. Ventral third of flanks with a longitudinal series of four to seven cream spots or vertical bar-shaped marks. Adipose fin brown, with an extensive hyaline margin and sometimes with dark brown spots and vermiform marks. Dorsal, pectoral, pelvic and anal fins hyaline and with one to two rows of elongate spots forming longitudinal brown rows. Caudal fin hyaline, with elongate brown spots forming two to three irregular columns.

Distribution. Known only from the lower Ogooué River in Gabon (Fig. 5).

Etymology. From the Latin *notatus*, meaning marked. In reference to the dark elongate spots frequently present in this species. Used as an adjective.

***Microsynodontis vigilis* sp. nov. (Fig. 16)**

Type material. Holotype: CU 87039, male, 62.0 mm SL; Gabon: Moyen-Ogooué province, 12 km N of Lambaréné, branch of Nzorbang creek near village of same name, 0°34'6.2"S 10°12'46.4"E; C. D. Hopkins et al., 18 July 1999.



FIGURE 16. *Microsynodontis vigilis*, holotype, CU 87039, 62.0 mm SL; Gabon: Ogooué River drainage.

TABLE 9. Biometric data for *M. vigilis* (n=18).

	HOLOTYPE	RANGE	MEAN±SD
SL (mm)	62.0	30.5–62.0	
<u>In % SL</u>			
Predorsal length	32.7	32.7–39.9	35.8±1.88
Snout to anal	64.4	64.4–71.5	68.3±1.86
Snout to pelvic	46.5	45.5–51.0	48.8±1.63
Snout to pectoral	19.0	17.9–21.4	19.8±1.06
Dorsal-fin base length	14.5	11.4–17.9	14.5±1.34
Dorsal spine length	14.4	13.4–19.6	16.1±1.63
Anal-fin base length	13.7	12.4–15.5	13.7±0.89
Pelvic-fin length	16.5	13.8–17.9	15.4±0.98
Pectoral fin length	21.0	19.5–27.2	23.5±2.28
Pectoral spine length	18.1	17.1–22.9	20.2±1.63
Caudal total length	25.3	19.0–28.5	23.2±2.47
Adipose basal length	27.6	22.0–28.2	26.4±1.45
Adipose maximum height	4.7	4.7–7.1	5.8±0.71
Dorsal to adipose distance	17.9	11.5–20.8	16.4±2.32
Adipose to caudal peduncle	10.2	8.6–11.0	9.7±0.57
Caudal peduncle length	19.4	14.8–19.4	17.1±1.12
Caudal peduncle depth	8.7	8.1–9.8	9.0±0.50
Body depth at anus	16.1	15.4–19.2	17.2±1.17
Head length	23.7	23.7–28.0	26.1±1.25
Head width	20.3	20.3–24.4	22.6±1.35
Head depth	15.6	15.3–18.0	16.7±0.85
<u>In % HL</u>			
Snout length	46.3	34.7–47.6	44.1±3.66
Interorbital distance	34.0	28.6–37.8	34.6±2.50
Orbit diameter	21.8	21.3–25.0	22.9±1.10
Maxillary barbel length	109.5	75.6–132.8	106.2±14.84
Inner mandibular barbel length	55.8	25.6–72.7	51.0±11.13
Outer mandibular barbel length	78.2	56.1–104.7	78.3±11.9

Paratypes: CU 80133 (17): 8 females: 30.5–48.0 mm SL; 9 males: 31.5–58.9 mm SL; data as for holotype.

Diagnosis. *Microsynodontis vigilis* can be distinguished from all congeners in having a longer supracleithral process (reaching to vertical through the posteriormost tip of nuchal shield vs. not reaching). It further differs from all other congeners except for *M. armatus* and *M. lamberti* in having a shorter adipose fin (22.0–28.2% SL vs. 27.9–41.6), and except

for *M. emarginatus*, *M. lamberti*, and *M. notatus*, in having a larger eye (19.3–25.0% HL vs. 10.6–19.6). *Microsynodontis vigilis* can be further distinguished from *M. lamberti* in having a serrated (vs. smooth) anterior edge of the pectoral spine and a round (vs. truncate) caudal fin.

Description. Biometric and meristic data as in Table 9. Body compressed. Predorsal profile gently convex; postdorsal body sloping gently ventrally. Preanal profile horizontal. Anus and urogenital openings located at vertical through middle of pelvic fin. Skin smooth. Lateral line complete and midlateral.

Head depressed and broad, acutely rounded when viewed laterally and with rounded snout margin when viewed from above. Gill openings narrow, extending from immediately ventral to posttemporal to immediately ventral to base of pectoral spine. Gill membranes united to, and attached across, isthmus. Bony elements of dorsal surface of head covered with thin skin. Nuchal shield large and terminating posteriorly with two rounded processes on each side. Supracleithral process thin, extending to vertical through posteriormost tip of nuchal shield.

Barbels in three pairs. Maxillary barbel long and slender, extending to just beyond base of last pectoral-fin ray. Inner mandibular-barbel origin close to midline, extending to base of pectoral spine and with 2 short, thin branches on anterior half and 3–5 long, thin branches on posterior half. Outer mandibular barbel originates posterolateral of inner mandibular barbel, extending to middle of pectoral-fin base and with 3–5 long, thin branches.

Eye large and ovoid, horizontal axis longest; located entirely in dorsal half of head. Orbit without free margin.

Mouth inferior and crescent-shaped; lips plicate. Oral teeth in rows on all tooth-bearing surfaces. Premaxillae narrow, with narrow ventral shelf and partially exposed when mouth closed. Primary teeth 13–14, conical and separated from secondary teeth by distinct gap. Secondary teeth 40–85, acutely pointed and recurved; disposed in 3–4 rows. Tertiary teeth 22–26, elongate, villiform and extending over full width of premaxillae. Dentary teeth 17–27, acutely pointed, strongly recurved and broader than secondary teeth; disposed in one or two transverse bands.

Dorsal fin located at anterior third of body, with II,6 (1) or II,7* (17) rays and convex margin. Dorsal-fin spine long, stout and slightly curved; smooth on both anterior and posterior margins. Adipose fin moderately long; margin slightly convex for entire length and posterior end deeply incised. Caudal fin rounded, with i,6,6,i (18) principal rays. Procurrent rays symmetrical and extend only slightly anterior to fin base. Anal-fin base located ventral to posterior half of adipose fin. Anal fin with iii,7 (2); iii,8* (3); iv,7 (10) or iv,8 (3) rays and convex margin. Pelvic-fin origin at vertical ventral to posterior end of dorsal-fin base. Pelvic fin with i,6 (18) rays and slightly convex margin; tip of appressed fin not reaching anal-fin origin. Pectoral fin with I,5 (2); I,6 (14) or I,6,i* (2) rays; spine slightly curved and stout (as in Fig. 4f). Anterior spine margin with 22–28 small serrations along

entire length of spine; serrations antrorse (distally directed) on distal two-thirds and anteriorly directed on proximal third. Posterior spine margin with 8–13 strong serrations along entire length. Pectoral-fin margin convex posteriorly. Vertebrae 11+24 (1); 13+23 (7); 13+24* (6); 14+22 (1) or 14+23 (3).

Males with numerous tubercles on sides of head on region extending from snout to preopercle, and long genital papilla situated immediately posterior to anus. Females with fewer tubercles on sides of head, and with smaller, distally flattened genital papilla.

Coloration. In 70% ethanol: dorsal and lateral surfaces and of head and body dark chocolate brown, fading to light brown on belly (Fig. 16). Snout with a series of light yellow spots delineating anterior and posterior nares. Cheek region with one or two light yellow spots immediately ventral to orbit. Light yellow band encircling nape at supraoccipital. Dorsal third of body with series of four light yellow vertical bar-shaped marks extending to lateral midline of body: first at middle of dorsal-fin base, second at adipose-fin origin, third at middle of adipose-fin base and last on caudal peduncle immediately posterior to adipose fin, sometimes encircling caudal peduncle as light yellow band. Ventral third of flanks with a longitudinal series of four to seven light yellow spots or vertical bar-shaped marks. Dorsal fin with dark chocolate brown base and one to two rows of elongate spots forming longitudinal dark chocolate brown rows. Pectoral, pelvic and anal fins with hyaline bases and similarly marked. Caudal fin hyaline, with elongate brown spots forming two to three irregular columns.

Distribution. Known only from the lower Ogooué River drainage in Gabon (Fig. 13).

Habitat. The type locality is a forest stream with a sandy bottom. Water temperature was 24.4°C and the pH was 5.5. Syntopic fish included: Mormyridae: *Brienomyrus* sp., *Mormyrops zanclirostris*, *Stomatorhinus* spp.; Characidae: *Alestes* sp., *Brycinus* sp.; Diti-chodontidae: *Nannocharax* sp.; Cyprinidae: *Barbus* spp.; Amphiliidae: *Amphilius nigricaudatus*, *Phractura* sp.; Claroteidae: *Anaspidoglanis macrostoma*; Malapteruridae: *Malapterurus beninensis*; Mochokidae: *Synodontis* sp.; Cyprinodontidae: *Epiplatys dageti*, *Plataplochilus chalcopyrus*; Channidae: *Parachanna obscura*; Cichlidae: *Hemichromis* sp.

Etymology. From the Latin *vigilis*, meaning watchful. In allusion to the relatively large eyes of this species. Used as an adjective.

Discussion

The identification of *Microsynodontis* species is often difficult, primarily because of the large amounts of purported variation observed in biometrics and color (Poll & Gosse, 1963; Matthes, 1964); one outcome of this observation was the synonymy of *M. christyi* with *M. batesii* by Matthes (1964). These conclusions were drawn without the examination of large series from a single locality (or at least multiple closely situated localities within the same drainage), and the high degree of variation reported is due to confusion

between intraspecific and interspecific differences. However, after examining a large series of *M. batesii* in this study, the limits of intraspecific variation within *Microsynodontis* can be better understood, and *M. christyi* is found to be a valid species distinguished from *M. batesii* by coloration and other morphological characters (see below).

Examination of large series of specimens (identifiable as *M. batesii*) from within several closely situated localities within the Ntem River drainage in northern Gabon and southern Cameroon leads me to conclude that although intraspecific variation in color (and certainly in biometrics) exists, color patterns are useful diagnostic characters once the degree of intraspecific variation is understood. Furthermore, diagnostic characters not previously identified, some of which have been used in other mochokid genera, were found to be useful for distinguishing species of *Microsynodontis*. These characters consist of the snout, fin spine (both dorsal and pectoral) and tubercle morphology, all of which have been previously used to diagnose species in other mochokid genera, but not in *Microsynodontis*. Although a combination of these characters is the easiest way to distinguish among the *Microsynodontis* of the lower Guinea region, some biometric characters can also be used to diagnose the species (diagnostic biometric characters for the other species of *Microsynodontis* not found in the lower Guinea region are given in Table 10). However, the numbers of oral teeth, a character considered diagnostic in other mochokid genera, are not useful in diagnosing species of *Microsynodontis*, as they are apparently highly conservative in the genus.

The variation in color is largely of an ontogenetic nature, and its use as a more reliable diagnostic character is possible once the limits of variation are understood. The ontogenetic change in color pattern is most marked for *M. batesii*, and consists of changes in both the pigmentation pattern of the abdomen and the shape of the light-colored markings on the body. In the former case, many juvenile specimens have a dense aggregation of melanophores concentrated in a series of evenly distributed large spots on the abdomen that fade with age (Fig. 1c), and in the latter case, the dorsal and ventral light-colored markings may coalesce to form complete bands encircling the body, especially in the region of the caudal peduncle (Fig. 1c). The light-colored markings on the ventral third of the body in juvenile specimens are also more vermiform (Fig. 1c). In any case, *M. batesii* (and all other species from the lower Guinea region) of all sizes always possess a light-colored band encircling the nape, which is absent in *M. christyi* of all sizes examined, even in preserved material. Therefore, the absence of this band is a useful diagnostic character for distinguishing *M. christyi* from *M. batesii* (and all other species of *Microsynodontis* from the lower Guinea region).

Microsynodontis christyi can also be distinguished from *M. batesii* in having a deeper caudal peduncle (10.0–11.8% SL vs. 5.8–9.2). The distributions of the two species also suggest that they are different: *M. christyi* is only known from the middle Congo River drainage while *M. batesii* is only known from the lower Guinea region (in the Campo, Ivindo, Ntem, Nyong and Sanaga River drainages). Very little material of *Microsynodon-*

tis from the middle Congo River drainage was available for study, but the examination of all material available suggests that there are no species in common between the middle Congo River drainage and those of the lower Guinea region. This is so even when the tributaries of the Congo and the smaller coastal drainages of the lower Guinea region are immediately adjacent, as in the case of the material identified as *M. batesii* from the Dja River (a tributary of the Congo River flowing approximately southwest in southern Cameroon and located adjacent to the Ntem River drainage), which is not conspecific with *M. batesii* and represents a distinct, undescribed species.

TABLE 10. Diagnostic biometric data for *Microsynodontis* occurring outside of the Lower Guinea region.

	RANGE	MEAN±SD
Caudal-fin length (%SL)		
<i>M. christyi</i>	26.1–29.8	27.5±1.17
<i>M. lamberti</i>	23.5–26.8	24.6±1.88
<i>M. polli</i>	29.6–41.6	32.9±4.18
Adipose basal length (% SL)		
<i>M. christyi</i>	26.5–34.1	30.2±2.10
<i>M. lamberti</i>	25.4–31.4	27.6±2.66
<i>M. polli</i>	30.8–43.0	34.3±3.54
Caudal peduncle depth (% SL)		
<i>M. christyi</i>	10.0–11.8	10.7±0.57
<i>M. lamberti</i>	9.1–9.8	9.5±0.36
<i>M. polli</i>	7.3–8.9	8.0±0.49
Snout length (% HL)		
<i>M. christyi</i>	35.7–41.0	38.9±2.10
<i>M. lamberti</i>	38.2–42.3	40.6±2.14
<i>M. polli</i>	40.6–49.2	43.5±2.99
Eye diameter (% HL)		
<i>M. christyi</i>	13.6–17.9	15.3±1.29
<i>M. lamberti</i>	17.6–19.2	18.5±0.82
<i>M. polli</i>	12.5–15.6	14.3±1.17

This study reveals the importance of some biometric measurements as diagnostic characters. In particular, two of the species described here, *M. nannoculus* and *M. nasutus*, are distinguished from congeners chiefly by biometric measurements. Bivariate analyses

(ANCOVA) of the regression lines of eye diameter (Fig. 17), snout length (Fig. 18), caudal peduncle depth (Fig. 19), adipose basal length (Fig. 20) and caudal-fin length (Fig. 21) on SL are significantly different (given the number of taxa used in the analysis, it was not possible to display all of them on the biplots without obscuring key patterns and only the key taxa for each biometric value are used in Figs. 17–21). The P values of the analyses are given in Table 11, and it can be seen that regression lines are all significantly different for the eye diameter of *M. nannoculus* and for the snout length of *M. nasutus*, when both are compared to the corresponding data for all congeners.

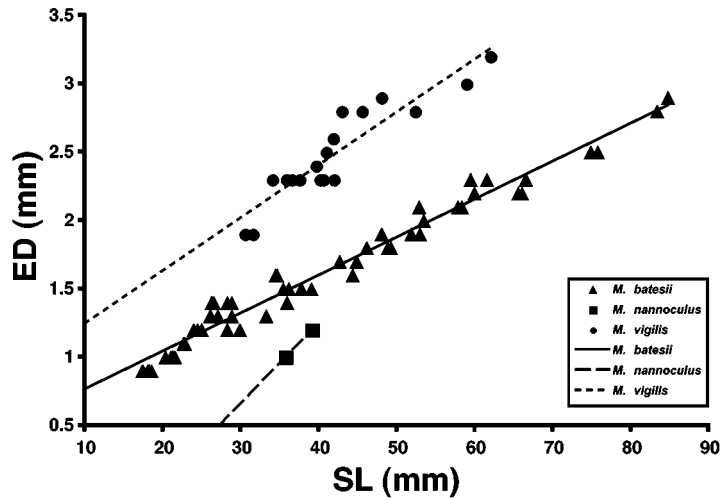


FIGURE 17. Scatterplot of eye diameter (ED) against standard length for *M. batesii*, *M. nannoculus* and *M. vigilis*.

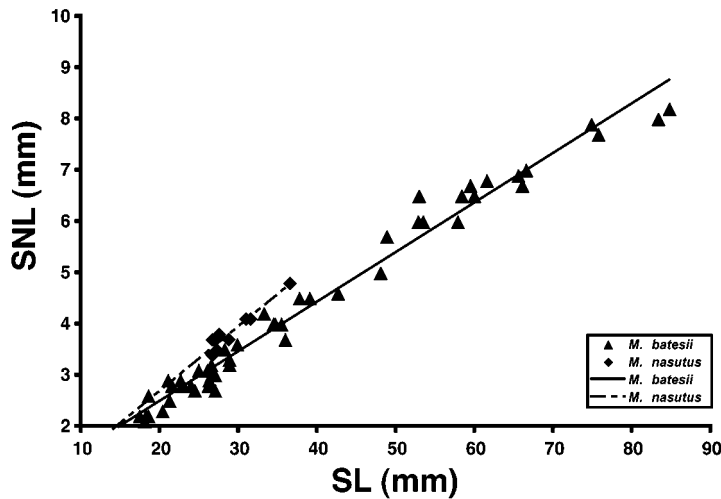


FIGURE 18. Scatterplot of snout length (SNL) against standard length for *M. batesii* and *M. nasutus*.

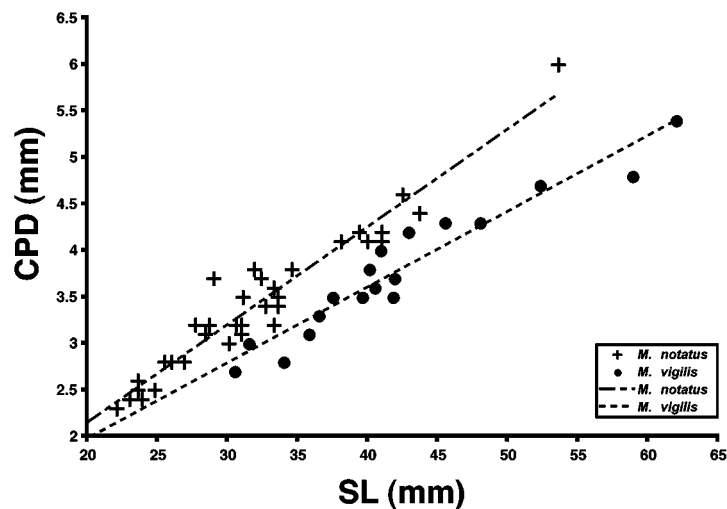


FIGURE 19. Scatterplot of caudal peduncle depth (CPD) against standard length for *M. notatus* and *M. vigilis*.

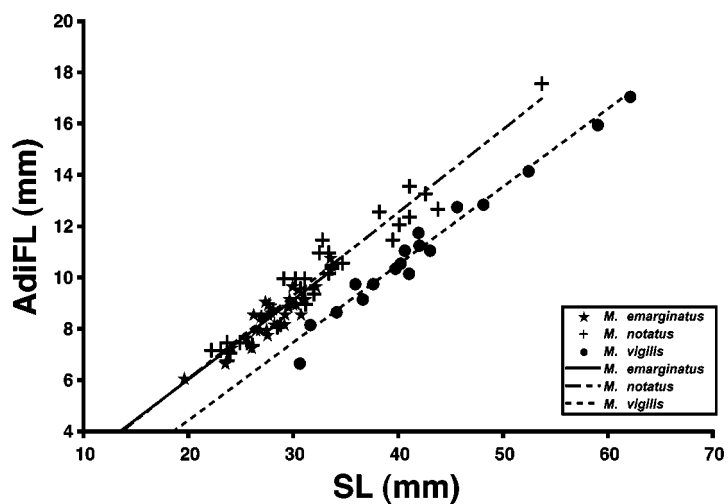


FIGURE 20. Scatterplot of adipose-fin basal length (AdiFL) against standard length for *M. emarginatus*, *M. notatus* and *M. vigilis*.

Sexual dimorphism in *Microsynodontis* is reported for the first time in this study. Males of *Microsynodontis* species can be distinguished from females by the presence of a conical genital papilla immediately posterior to the anus (females have a smaller papilla that is distally flattened) and (especially in mature adults of all lower Guinea species

except for *M. emarginatus*) by a much denser aggregation of tubercles on the dorsal and lateral surfaces of the head, especially in the region on the sides of the head from the snout to the preopercle. The presence of tubercles has been used as a diagnostic character in the Mochokidae, e.g. in *Synodontis* (see Boulenger, 1900) and *Chiloglanis* (see Roberts, 1989), but has not been previously used for *Microsynodontis*. The results of this study indicate that tubercle shape is useful in diagnosing at least one species, *M. hirsutus*, from its congeners. Although the number and density of tubercles differ both sexually and ontogenetically, the tubercles retain their characteristic shape in specimens of both sexes and all sizes in *M. hirsutus*, making it a useful diagnostic character for this species.

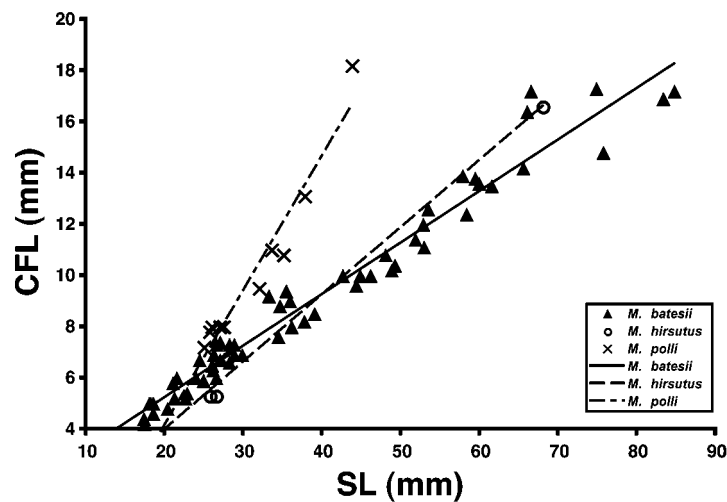


FIGURE 21. Scatterplot of caudal-fin length (CFL) against standard length for *M. batesii*, *M. hirsutus* and *M. polli*.

Despite the fact that *Microsynodontis* species are occasionally imported for the aquarium trade and are not considered rare, very little is known of their biology, from either field or aquarium observations. This is probably because these fishes, like many other small fishes in ichthyological expeditions, are often overlooked and are thus not particularly well represented in collections. With the number of species identified in this study, it is clear that this element of the ichthyofauna (the miniature species) is in need of further study.

TABLE 11. P values for bivariate analyses (ANCOVA) of the regression lines on SL of select biometric measurements of *Microsynodontis* species. Figures in bold indicate significant differences.

	<i>armatus</i>	<i>batesii</i>	<i>christyi</i>	<i>emarginatus</i>	<i>hirsutus</i>	<i>lamberti</i>	<i>laevigatus</i>	<i>nannoculus</i>	<i>nasutus</i>	<i>notatus</i>	<i>polli</i>	<i>vigilis</i>
<u>Caudal-fin length</u>												
<i>polli</i>	<0.0001	<0.0001	0.0006	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	—	<0.0001
<u>Adipose basal length</u>												
<i>batesii</i>	0.0039	—	<0.0001	<0.0001	0.4534	<0.0001	0.173	0.0313	<0.0001	<0.0001	0.2535	<0.0001
<i>hirsutus</i>	0.0055	0.4534	<0.0001	<0.0001	—	<0.0001	0.0293	0.0326	<0.0001	<0.0001	0.1979	<0.0001
<u>Caudal peduncle depth</u>												
<i>laevigatus</i>	0.0004	<0.0001	0.1931	<0.0001	<0.0001	0.0048	—	<0.0001	0.0061	<0.0001	<0.0001	0.1758
<i>notatus</i>	0.0002	<0.0001	0.9547	<0.0001	<0.0001	0.0095	0.1758	0.0027	<0.0001	—	<0.0001	<0.0001
<u>Eye diameter</u>												
<i>nannoculus</i>	0.0125	0.0484	0.0005	<0.0001	<0.0001	0.0008	<0.0001	—	0.0006	<0.0001	0.0433	<0.0001
<i>vigilis</i>	0.0232	<0.0001	<0.0001	0.1826	<0.0001	0.0126	0.0037	<0.0001	<0.0001	0.001	<0.0001	—
<u>Snout length</u>												
<i>nasutus</i>	0.0018	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	0.0105	—	<0.0001	<0.0001	0.0001

Artificial key to the *Microsynodontis* of the lower Guinea region, west central Africa

1. Caudal fin emarginate (Fig. 9a) (Ogooué River drainage).....*M. emarginatus*
Caudal fin rounded or truncate (Figs. 9b–c) 2
2. Anterior edge of pectoral spine smooth (Ivindo River drainage)..... *M. laevigatus*
Anterior edge of pectoral spine serrated 3
3. Body always without numerous dark brown elongate spots; caudal peduncle slender (5.8–9.8% SL) 4
Body frequently with numerous dark brown elongate spots; caudal peduncle deep (9.6–11.9% SL) (Ogooué River drainage) *M. notatus*
4. Adipose-fin base long (34.4–41.6% SL) 5
Adipose fin-base short (21.3–33.8% SL) 6
5. Dorsal and lateral surfaces of head with long tubercles in both sexes (up to 0.3 mm long); dorsal spine straight (Ntem River drainage).....*M. hirsutus*

- Dorsal and lateral surfaces of head with small rounded tubercles in both sexes (not more than 0.1 mm long); dorsal spine gently curved (Campo, Ivindo, Ntem, Nyong, Ogooué and Sanaga River drainages) *M. batesii*
6. Supracleithral process reaching to vertical through posteriormost tip of nuchal shield; eye large (19.3–25.0% HL) (Ogooué River drainage) *M. vigilis*
Supracleithral process not reaching to vertical through posteriormost tip of nuchal shield; eye small (10.6–19.6% HL) 7
7. Snout long (50.0–53.3% HL) (Okano River drainage) *M. nasutus*
Snout short (43.1–48.5% HL) 8
8. Body slender (13.7–15.0% SL); anterior edge of pectoral spine with retrorse (proximally directed) serrations along proximal half; eye larger (13.9–19.6% HL) (Ivindo River drainage) *M. armatus*
Body deep (17.6–19.9% SL); anterior edge of pectoral spine with anteriorly directed serrations along proximal half; eye smaller (10.6–12.2% HL) (Ntem River drainage) *M. nannoculus*

Comparative material

Microsynodontis christyi: BMNH 1919.9.10.281, syntype, 39.8 mm SL; Congo Democratic Republic: Poko. MRAC 61788–61801, 14 ex., 17.8–37.5 mm SL; Congo Democratic Republic: Buta.

M. lamberti: MRAC 137840–41, 2 paratypes, 22.8–26.0 mm SL; MRAC 37842–43, 2 paratypes, 29.5–29.6 mm SL; Congo Democratic Republic: Lilanda River at Yangole.

M. polli: MRAC 119547, holotype, 32.0 mm SL; Guinea: Gbin River (photograph examined). MRAC 172458–172460 (3), 25.0–27.0 mm SL; Congo Democratic Republic: Kinshasa, Stanley Pool. MRAC 88-01-P-2122 (1), 35.1 mm SL; Congo Democratic Republic: Kinshasa, rapids at the exit of Stanley Pool. MRAC 88-01-P-2126–2128 (3), 26.0–37.8 mm SL; Congo Democratic Republic: Large island of Djili, Congo-Ubangi drainage. MRAC 88-01-P-2171 (1), 25.7 mm SL; Congo Democratic Republic: mouth of Nutile River. MRAC 99-078-P-0017 (1), 43.8 mm SL; Congo Democratic Republic: Kwango.

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