

TAXONOMIC REVISION OF LAKE TANGANYIKAN *SYNODONTIS* (SILURIFORMES: MOCHOKIDAE)

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ABSTRACT

The taxonomy of the *Synodontis* of Lake Tanganyika was investigated by examining 312 museum specimens. Morphometric, meristic, and nontraditional internal and external characters were examined, resulting in the recognition of 11 species of *Synodontis* from Lake Tanganyika. Ten of the species are endemic to the lake basin, and three are new to science. *Synodontis grandiops* n. sp. is most similar to *S. multipunctatus* but is distinguished by measurements of the eye (64.2-81.0% of snout length vs. 44.9-62.0% in *S. multipunctatus*) and pectoral-fin ray counts (7 vs. 8 in *S. multipunctatus*). *Synodontis lucipinnis* n. sp. is most similar to *S. petricola* but is distinguished by the lack of an axillary pore and the presence of light-colored windows at the bases of the rayed fins. *Synodontis ilebrevis* n. sp. is most similar to *S. polli* but is distinguished by the absence of a hindgut chamber, the shortness of the gut (0.8-1.4 times TL in *S. ilebrevis* vs. 4.0-5.5 times TL in *S. polli*), and the presence of short, flattened papillae on the skin (vs. villous papillae in *S. polli*).

Key Words: Catfishes, *Synodontis*, Mochokidae, Lake Tanganyika, Africa.

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INTRODUCTION

Catfishes of the genus *Synodontis* are small to moderately sized fishes (up to 800 mm total length) that occur throughout sub-Saharan Africa and the Nile River Valley. Poll (1971) divided the genus into eight geographically defined groups: 1) the northern supra-equatorial group; 2) the exclusively Nilotic group; 3) the group of species occurring exclusively in the Niger; 4) the western supra-equatorial group from the Senegal River to the Ogowe River; 5) the Congo Basin group; 6) the southernmost sub-equatorial group; 7) the *Synodontis* of eastern Africa ranging between Uebi Shebeli and the Rufigi River; and 8) the Lake Tanganyikan group (Fig. 1).

The *Synodontis* of Lake Tanganyika inhabit mainly rocky shoreline areas but also venture out over sandy and shell bottoms (Matthes 1962; Coulter 1991a). The vertical distribution of these species is limited to a maximum depth of 50-100 m in the northern end of the lake and to about 240 m in the southern end (Coulter & Spigel 1991). These depths represent the lower depth limits of oxygen and differ with geography due to the fact that Lake Tanganyika is composed of many sub-basins along its length, which vary greatly in depth (from 350 m to 1470 m) (Coulter & Spigel 1991; Tiercelin & Mondeguer 1991). Locality data indicate that all species have a lake-wide distribution, with the possible exceptions of *S. dhonti*, *S. ilebrevis* and *S. lucipinnis* (see species descriptions).

Although many different color patterns exist within *Synodontis*, few are as striking or as instantly recognizable as the pattern that is typical of most species of *Synodontis* from Lake Tanganyika. This pattern consists of dark triangles at the bases of all of the rayed fins and dark spots on the upper body that may or may not extend onto the belly. The barbels are typically white, but may have scattered, dusky pigmentation at their bases. Body color varies widely and may be nearly any shade of yellow, green, brown, or gray, depending on the species. Body size varies widely, from fairly small (maximum TL 100 mm in *S. lucipinnis*) to large (maximum TL 585 mm in *S. tanganaicae*).

Male *Synodontis* have a distinct, cone-shaped genital papilla (Matthes 1962). Minor differences in body shape between sexes also occur in some species, with females having slightly more robust bodies. Opercular ornamentation has recently been discussed as a sexually dimorphic trait in some mochokid species (Friel & Vigliotta 2006), but none of the Tanganyikan *Synodontis* species have ornamented operculae. Information on reproduction in Tanganyikan species of *Synodontis* is mostly restricted to egg counts from gravid females. The exception is *S. multipunctatus*, whose unique brood-

parasitism behavior has been well documented (Sato 1986).

Dietary information is slightly more abundant, and a variety of prey items are utilized. Most species include insect larvae and at least a small amount of algal matter in their diet. More specialized prey items that may be taken include gastropods, bivalves, sponges, crustaceans, and eggs of other fishes (Poll 1946, 1953; Matthes 1962; Coulter 1965-1966, 1991a).

SYSTEMATIC HISTORY

Synodontis is a genus of Mochokidae, a family of catfishes endemic to sub-Saharan Africa and the Nile River valley. With approximately 120 recognized species, *Synodontis* is the most diverse of any African catfish genus and, with the exception of *Barbus*, of any African ostariophysan (Poll 1971). Poll (1971), the last to revise *Synodontis*, recognized as valid seven species from Lake Tanganyika: *Synodontis multipunctatus* Boulenger, *Synodontis granulosus* Boulenger, *Synodontis dhonti* Boulenger, *Synodontis petricola* Matthes, *Synodontis lacustricolus* Poll (*Synodontis tanganaicae* Borodin), *Synodontis eurystomus* Matthes (*Synodontis polli* Gosse), and *Synodontis nigromaculatus* Boulenger (recognized herein as *Synodontis melanostictus* Boulenger). All but *S. melanostictus* are endemic to the lake basin. The ten endemic species recognized in this study can be distinguished from all other species of *Synodontis* by the presence of a black triangle at the base of the dorsal and pectoral fins and vertical skin folds along the sides of the body. With the exceptions of *S. grandioops* and *S. multipunctatus*, all endemic Tanganyikan *Synodontis* species also have well developed black triangles on the base of the anal and pelvic fins. The triangles can no longer be seen in the single known specimen of *S. dhonti*; however, the original description of this species (Boulenger 1917) and an earlier examination of this specimen (Matthes 1962) indicate that the color pattern of the rayed fins in this species was consistent with that of the remaining endemic species of Tanganyikan *Synodontis*.

Poll's revision of *Synodontis*, while thorough for its time, suffered from a lack of material, and appears to have stifled taxonomic research on this genus, with only a handful of new species described after its publication. The *Synodontis* of Lake Tanganyika have largely been ignored by taxonomists for the last 30 years. Recent expeditions, particularly those to the Zambian coast of the lake, which has historically been poorly sampled for *Synodontis*, as well as the increased popularity of certain Tanganyikan *Synodontis* as aquarium species, have

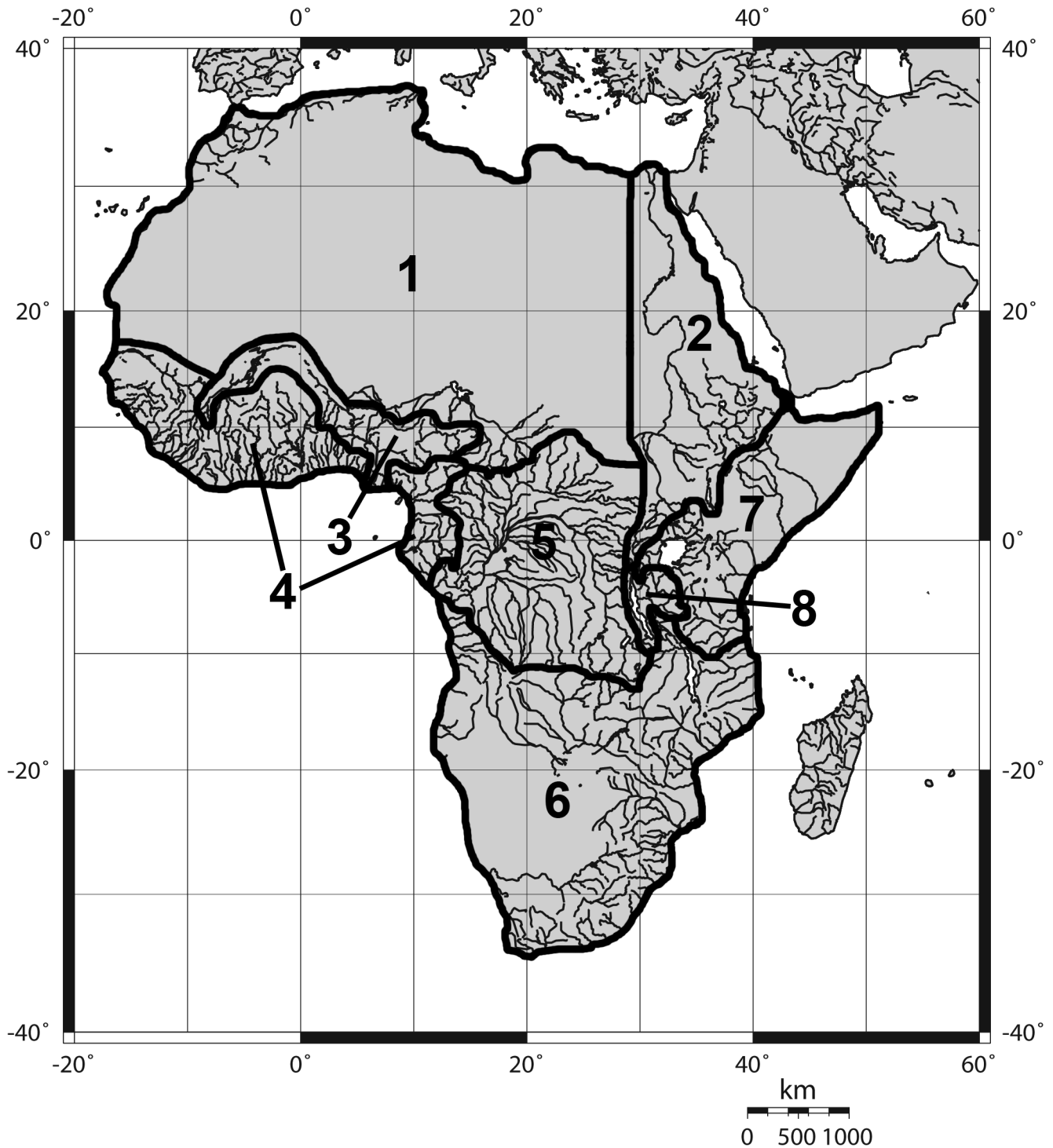


Figure 1. Drainage map of the African continent with Poll's geographic divisions outlined. 1 = Northern supra-equatorial, 2 = Nile River drainage, 3 = Niger River drainage, 4 = Western supra-equatorial from the Senegal River to the Ogowe River, 5 = Congo Basin, 6 = Southernmost sub-equatorial, 7 = Eastern Africa between Uebi Shebeli and the Rufigi River, 8 = Lake Tanganyika drainage.

led to the availability of more specimens for study. Schraml (2003) recently suggested that many of the specimens entering the aquarium trade represent cryptic, undescribed species. The aim of this study was to evaluate the taxonomy of this group, bearing in mind that cryptic species may exist. This possibility has led to the utilization of several unconventional diagnostic characters, which have revealed undescribed species of *Synodontis* from Lake Tanganyika.

Phylogenetic relationships of the endemic species of *Synodontis* in Lake Tanganyika have not been intensively studied. Brichard (1978) suggested that the species do not form a monophyletic group. However, the unique pattern of rayed fin coloration and the presence of vertical folds in the skin constitute two synapomorphies supporting the monophyly of the endemic species of *Synodontis* in Lake Tanganyika. It is possible that *S. melanostictus* does not share a most recent common ancestor with the Tanganyikan endemics, given its wider distribution and differences from the endemic species in its rayed fin coloration and lack of vertical folds on the skin.

METHODS AND TERMINOLOGY

Measurements were taken from the left side to the nearest 0.1 mm using digital calipers and follow Poll (1971). All counts were made using a Leica MZ75 dissecting microscope. Vertebral and caudal-fin ray counts were taken using lateral radiographs. Vertebral counts follow the method of Skelton and White (1990), with the first five fused vertebrae of the Weberian apparatus excluded from reported values. Notation for fin ray counts is as follows: upper case Roman numeral = fin spine, lower case Roman numeral = unbranched rays, Arabic numeral = branched fin rays. Terminology for premaxillary dentition follows Skelton and White (1990). Gut length measurements and observations of the hindgut chamber of all species were performed only on specimens that had a belly cut made prior to the beginning of this study, with the exception of UF specimens, which were dissected. The hindgut chamber corresponds to the "poche intestinal" of Taverne and Aloulou-Triki (1974). All photographs were taken using a Kodak EasyShare CX7430 digital camera and edited using Adobe Photoshop CS2. Maps were produced using Adobe Illustrator. Institutional abbreviations follow Leviton et al. (1985) except for that of the South African Institute of Aquatic Biodiversity (SAIAB).

CHARACTERS EXAMINED

In addition to the 22 morphometric measurements and seven meristic counts that were made for all speci-

mens, several new characters were found to be diagnostically useful. This is in contrast to most of the work that has previously been done in this genus, which has tended to rely mainly on morphometric ratios to diagnose species. These new characters are particularly appealing because they allow for easy and accurate visual identification of specimens. Some of these characters, such as fin spine color are self-explanatory. Others are explained below.

Foremost among these characters is the axillary pore, an opening (or series of openings) that is located between the base of the pectoral fin spine and ventral margin of the humeral process (Figs. 2-5). The function of the axillary pore is unknown in mochokids, and the absence or presence of this structure has been noted in only one previously described species of *Synodontis* (Friel & Vigliotta 2006). The presence of a similar structure has been noted in seven other catfish genera: *Ariopsis* (Ariidae) (Halstead et al., 1953), *Ameiurus*, *Ictalurus*, and *Noturus* (Ictaluridae) (Reed 1907; Birkhead 1967, 1972), *Acrochordonichthys* (Akysidae) (Ng & Ng 2001), *Ituglanis* (Trichomycteridae) (Datovo and Landim 2005), and is also present in *Glyptothorax* (Sisoridae) (pers. obs.). In *Acrochordonichthys*, this structure has been shown to produce a mucosal secretion that possesses toxic properties (Ng & Ng 2001). The utility of this secretion in the other genera has been a matter of some debate. The presence or absence of this character divides the 11 Tanganyikan species of *Synodontis* into two groups; six species have an axillary pore (Table 1) and five (including the non-endemic *S. melanostictus*) do not (Table 2).

All species of *Synodontis* have a premaxillary toothpad, with several rows of unicuspid, chisel-shaped teeth. In some species this toothpad is continuous, while in others it is clearly composed of two elements, which are separated by a thin band of skin or a suture that

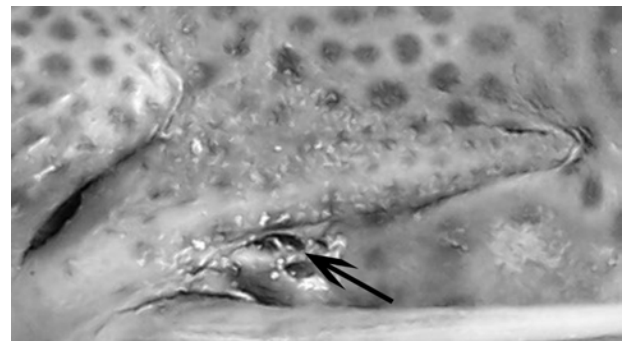


Figure 2. The axillary pore of *Synodontis multipunctatus*, holotype, BMNH 1898.9.9.76, 280 mm TL, 220 mm SL.

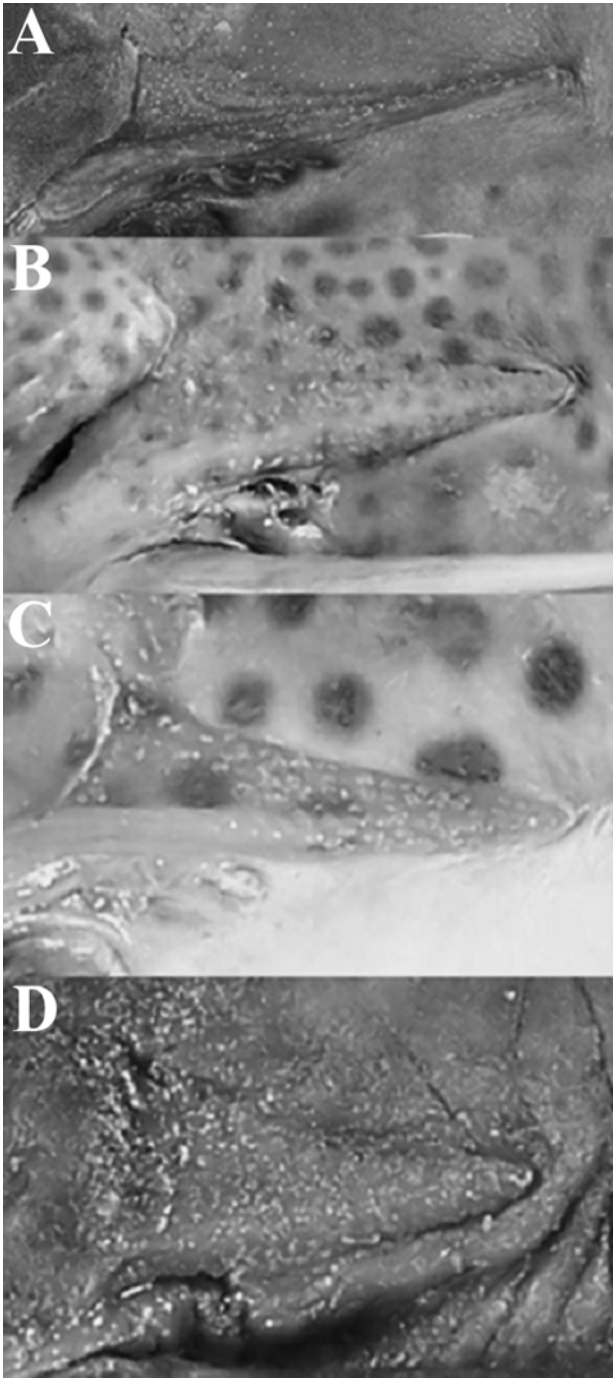


Figure 3. Humeral processes of A) *Synodontis granulosus*, UF 160945, 192 mm TL, 149 mm SL, B) *S. multipunctatus*, holotype, BMNH 1898.9.9.76, 280 mm TL, 220 mm SL, C) *S. grandioops*, MRAC 53096-53100, 114 mm TL, 91 mm SL, D) *S. petricola*, MRAC A3-033-P-0002-0011, 117 mm TL, 98 mm SL. An axillary pore is present in all of these species.

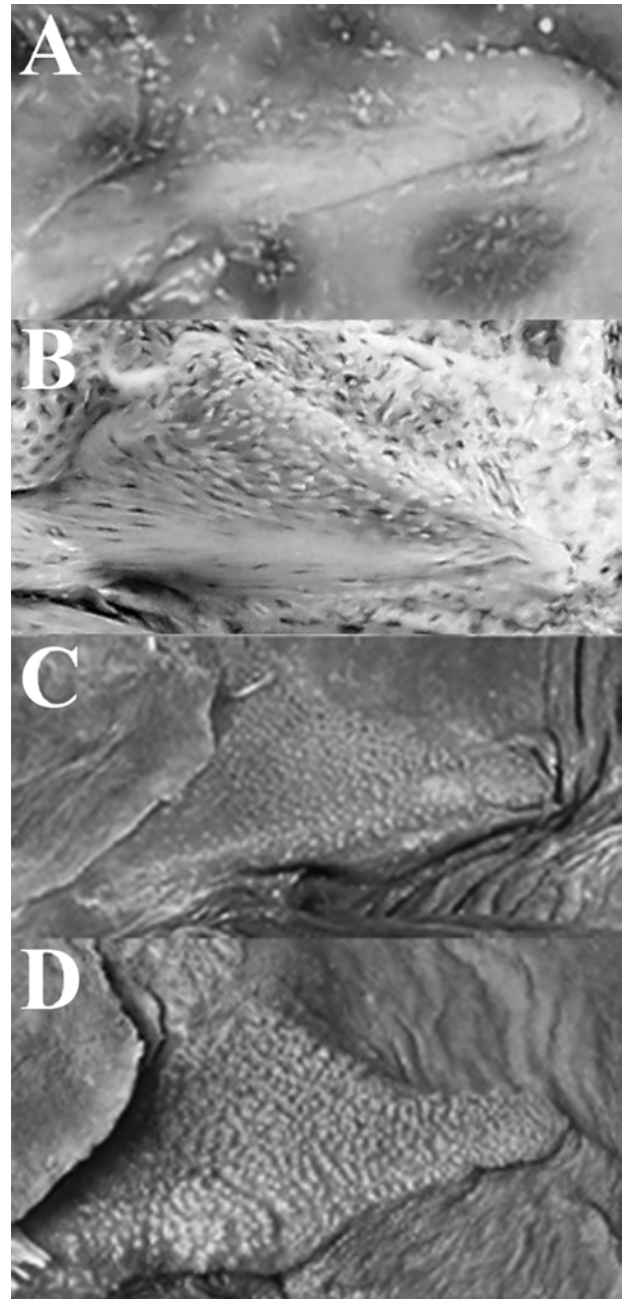


Figure 4. Humeral processes of A) *Synodontis lucipinnis*, holotype SAIAB 77880, 97 mm TL, 78 mm SL, B) *S. melanostictus*, holotype, BMNH 1906.9.8.72, TL 290 mm, SL 237 mm, C) *S. tanganaicae*, lectotype, MCZ 32538, 415 mm TL, 320 mm SL, D) a paratype of *S. lacustricolus*, MRAC 90288, 519 mm TL, 434 mm SL, provided for comparison with C. An axillary pore is absent in A) and B), present in C) and D).

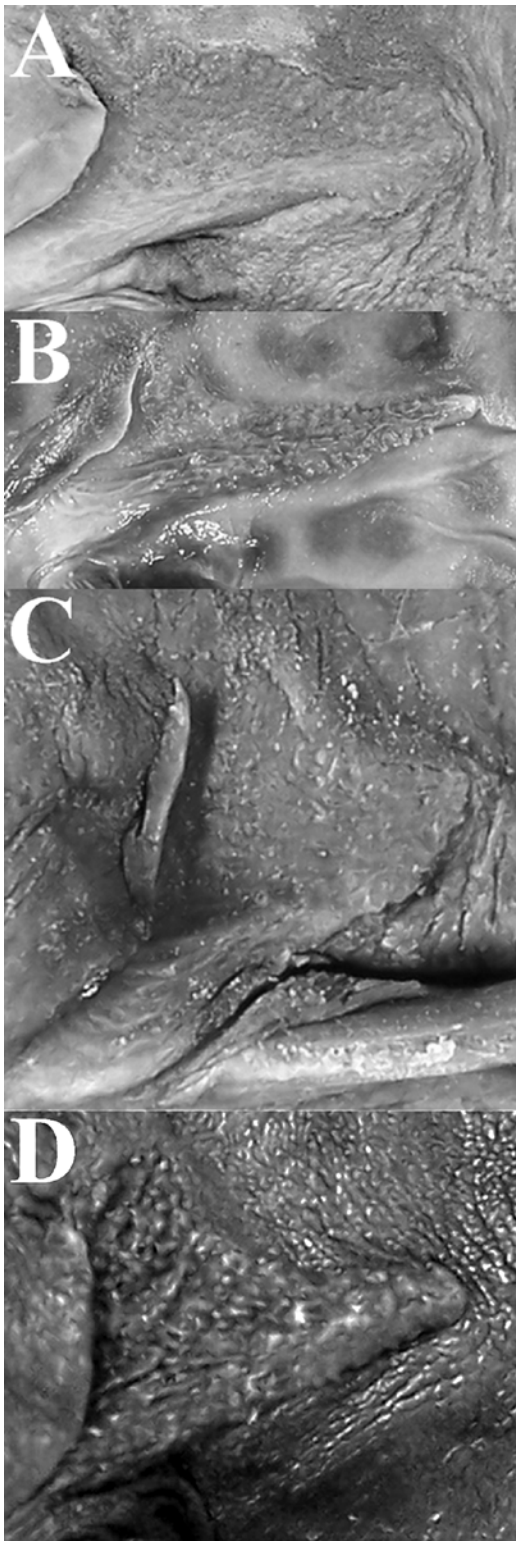


Figure 5. Humeral processes of A) *Synodontis dhonti*, holotype, MRAC 14344, 395 mm TL, 325 mm SL, B) *S. irsacae*, MRAC A3-033-P-0036-0040, 139 mm TL, 116 mm SL, C) *S. polli*, MRAC A3-033-P-0076-0080, 160 mm TL, 132 mm SL, D) *S. ilebrevis*, UF 160942, holotype, 139 mm TL, 116 mm SL. An axillary pore is present in A), absent in other species shown.

transversely bisects the toothpad. The separated condition is referred to herein as interrupted, and the unseparated condition as uninterrupted. This appears to be the first study to examine this character in *Synodontis*, although the length of the premaxillary toothpad has often been used in previous morphological examinations of *Synodontis* species.

The skin of the ten endemic species of Tanganyikan *Synodontis* is unique within the genus in having numerous minute, vertical skin folds. The purpose of these folds is unknown. The folds distinguish the Tanganyikan species from species outside the lake's basin but are not helpful in distinguishing among species from the lake. The papillae on the skin of certain species, however, separates them from other Tanganyikan species in which the skin is bare. This character is most useful in the identification of fresh or well-preserved specimens, as the papillae may degrade.

Some species of *Synodontis* have a swelling in the posterior part of the intestine which Taverne and Aloulou-Triki (1974) termed the "poche intestinal" and which is referred to herein as the hindgut chamber. A similar structure is known only in species of Kyphosidae, a family of herbivorous, marine fishes that utilizes fermentative digestion in the hindgut (Rimmer & Wiebe 1987; Clements & Choat 1997; Mountfort et al. 2002). The presence of a similar structure in highly herbivorous mochokid species such as *S. polli*, *Brachysynodontis batensoda*, and *Hemisynodontis membranaceus* suggests that the mochokid hindgut chamber may play a similar role. If so, this is the first time that such a behavior and structure has been found in a freshwater fish. The presence or absence of the hindgut chamber appears to be species-specific and can distinguish between species for which few good external diagnostic characters exist.

TAXONOMIC DESCRIPTIONS

Order Siluriformes Hay 1929

Family Mochokidae Jordan 1923

Genus *Synodontis* Cuvier 1817

Diagnosis. – Lateral line complete and midlateral, extending onto base of caudal fin. Cone-shaped genital papilla in male; papilla absent in female. Anterior nostrils tubular; posterior nostrils with semicircular flaps of skin along anterior margin. Gill opening extends from lower edge of ventral rounded occipital-nuchal process to point horizontal to base of pectoral fin spine. Gill membranes broadly joined at isthmus. Well developed, papillate, membranous flap immediately posterior to premaxillary toothpad. Eye with free orbital margin.

Table 1. Diagnostic characters for Lake Tanganyikan species of *Synodontis* in which an axillary pore is present.

	<i>S. dhonti</i>	<i>S. grandiops</i>	<i>S. granulosis</i>	<i>S. multipunctatus</i>	<i>S. petricola</i>	<i>S. tanganaicae</i>
Mandibular teeth	22	17-26	28-51	13-29	31-50	33-49
Axillary pore	Large	Large	Large	Large	Small	Large
Spots on body	Absent	Large	Absent or small	Large	Large	Absent or small
Fin spine color	Dark	Dark	Dark	Dark	White	Dark
Triangles on rayed fins	Present	Present - dorsal, pectoral Absent - anal, pelvic	Present	Present - dorsal, pectoral Absent - anal, pelvic	Present	Present- juvenile Absent- adult
Pectoral-fin rays	8	7	7-8	8	8-9	8-9
Eye/Snout length	23.1%	64.2-81.0%	31.2-50.2%	44.9-62.0%	28.7-40.1%	16.0-26.9%
Premaxillary toothpad	Uninterrupted	Uninterrupted	Uninterrupted	Uninterrupted	Interrupted	Interrupted
Maximum TL, mm	395	150	270	280	135	585
Secondary branches on medial mandibular barbel	Present	Absent	Absent	Absent	Present	Present
Occipito-nuchal shield covered with skin	No	Yes	No	Yes	Yes	No
Papillae on body skin	Granular	Absent	Granular	Absent	Absent	Granular
Gut/Body length	No data	0.8-0.9	0.5	0.5-0.8	1.2-1.3	No data
Hindgut chamber	No data	Absent	Absent	Absent	Present	Absent

Table 2. Diagnostic characters for Lake Tanganyikan species of *Synodontis* that lack an axillary pore. Traits not diagnostic within this group (premaxillary toothpad, secondary branches on medial mandibular barbel) are included to facilitate comparison with species in Table 1.

	<i>S. ilebrevis</i>	<i>S. irsacae</i>	<i>S. lucipinnis</i>	<i>S. melanostictus</i>	<i>S. polli</i>
Mandibular teeth	50-66	15-29	35-51	23-36	40-70
Spots on body	Small	Large	Large	Small	Moderate to Large
Fin spine color	Dark	Dark	White	Dark	Dark
Triangles on rayed fins	Present	Present	Present	Absent	Present
Pectoral-fin rays	8-9	8-9	8-9	9-10	8-9
Eye/Snout length	26.0-33.4%	28.7-43.7%	25.2-35.8%	31.5-38.1%	25.8-39.3%
Body depth/SL	18.2-20.1%	17.7-28.6%	15.7-23.9%	20.0-23.4%	20.2-27.0%
Premaxillary toothpad	Interrupted	Interrupted	Interrupted	Interrupted	Interrupted
Maximum TL, mm	150	190	100	520	180
Secondary branches on medial mandibular barbel	Present	Present	Present	Present	Present
Occipito-nuchal shield covered with skin	Yes	Yes	Yes	No	Yes
Papillae on body skin	Flat, granular	Absent	Absent	Villous	Villous
Gut/Body length	0.8-1.4	0.7-0.8	No data	1.3-1.6	4.0-4.5
Hindgut chamber	Absent	Absent	No data	Present	Present

Synodontis dhonti Boulenger, 1917

(Figs. 5A, 6, 7; Tables 1, 3)

Synodontis dhonti Boulenger, 1917:367, description, Kilewa Bay, Lake Tanganyika; 1920:42, description, Kilewa Bay, Lake Tanganyika. – Worthington and Ricardo, 1936:1067, 1077, 1101, note, Lake Tanganyika. – Poll, 1946:221, figs. 21, 22, description, Kilewa Bay, Lake Tanganyika; 1971:364, figs. 168 and 169, pls. VI.6, XI.19. – Matthes, 1962:37, fig. a, pl. 3, description, diet, Lake Tanganyika.

Material Examined. – Holotype, MRAC 14344, TL 395 mm, SL 325 mm, Lake Tanganyika, Kilewa, coll. Stappers, 18.V.1912.

Diagnosis. – Axillary pore present, large; mandibular teeth 22; body lacking spots; fin spines brown; 8 pectoral-fin rays; black patches at base of rayed fins present; eye 23.1% snout length; premaxillary toothpad uninterrupted; secondary branches on medial mandibular barbel present; occipito-nuchal shield not covered with skin; granular papillae present on skin of body; maximum TL 395 mm.

Synodontis dhonti can be distinguished from *S. ilebrevis*, *S. irsacae*, *S. lucipinnis*, *S. melanostictus*, and *S. polli* by the presence of an axillary pore, an uninterrupted premaxillary toothpad, and a smaller eye (23.1% of snout length vs. 26.0-33.4% in *S. ilebrevis*, 28.7-43.7% in *S. irsacae*, 25.2-35.8% in *S. lucipinnis*, 31.5-38.1% in *S. melanostictus*, and 25.8-39.3% in *S. polli*). *Synodontis dhonti* is separated from *S. granulosus*, *S. ilebrevis*, *S. lucipinnis*, *S. melanostictus*, *S. petricola*, *S. polli*, and *S. tanganaicae* by having a smaller number of mandibular teeth (22 vs. 50-66 in *S. ilebrevis*, 28-51 in *S. granulosus*, 35-51 in *S. lucipinnis*, 23-36 in *S. melanostictus*, 31-50 in *S. petricola*, 40-70 in *S. polli*, and 33-49 in *S. tanganaicae*). The presence of secondary branches on the medial mandibular barbel and a smaller eye (23.1% of snout length vs. 64.2-81.0% in *S. grandiops*, 31.2-50.2% in *S. granulosus*, and 44.9-62.0% in *S. multipunctatus*) differentiates *S. dhonti* from *S. grandiops*, *S. granulosus*, and *S. multipunctatus*. *Synodontis dhonti* differs further from *S. grandiops*, *S. irsacae*, *S. lucipinnis*, *S. multipunctatus*, and *S. petricola* in having granular papillae on the body (vs. papillae absent). Brown fin spines further distinguish *S. dhonti* from *S. lucipinnis* and *S. petricola*, in which they are white. A lack of spots on the body and an elevated number ($n=25$) of elongated gill rakers distinguishes *S. dhonti* from all other Tanganyikan *Synodontis* with the exception of adult *S. tanganaicae*. *Synodontis dhonti* can be further dis-

tinguished from *S. tanganaicae* by having a poorly developed adipose fin (vs. well developed) and an uninterrupted premaxillary toothpad (vs. interrupted in *S. tanganaicae*).

Description. – Morphometric and meristic data in Table 3. Maximum TL 395 mm, SL 325 mm. Body not compressed. Predorsal profile straight, interrupted by convex ridge formed by orbit of eye. Preanal profile convex. Skin on body forming numerous vertical folds covered with granular papillae extending onto all fins.

Head slightly depressed and broad; skin covered with granular papillae. Snout with bluntly rounded margin when viewed laterally and dorsally. Anterior nostrils tubular; posterior nostrils with semicircular flaps of skin along anterior margin. Occipito-nuchal shield rugose, not covered with skin; terminating posteriorly with narrow, rounded process on either side of dorsal spine; ventrally with narrow, bluntly pointed process that extends to upper margin of humeral process on either side of body. Eye located dorsolaterally; ovoid; horizontal axis longer. Interorbital area flat.

Mouth subterminal; lips wide and papillate. Mandibular teeth 22, unicuspid; arranged in single transverse row. Premaxillary toothpad uninterrupted; primary, secondary and tertiary premaxillary teeth discrete; numerous; arranged in 4, 5, and 1 irregular rows, respectively.

Maxillary barbel with narrow basal membrane; lacking branches or crenulations; extending at least to base of pectoral fin. Lateral mandibular barbel extending to point just short of anterior margin of pectoral girdle, with 4-5 non-tuberculate branches; lacking secondary branches. Medial mandibular barbel about 1/2 length of lateral barbel; with 2 pairs of tuberculate branches; secondary branches present.

Dorsal fin II,7; posterior margin straight. Dorsal-fin spine long, striated, nearly straight, terminating in short, dark filament; anterior margin smooth; posterior margin with small serrations distally. Pectoral fin I,8; posterior margin straight. Pectoral-fin spine roughly equal in length to dorsal-fin spine, striated, slightly curved, terminating in short, dark filament; anterior spine margin granulous; posterior margin with large retrorse serrations along entire length. Adipose fin poorly developed, margin convex. Pelvic fin i,6; located at vertical through posterior base of dorsal fin; tip of appressed fin barely reaches base of anal fin. Anal fin v,8; posterior margin rounded; base located ventral to adipose fin. Caudal fin i,7,8,i; forked; lobes pointed.

Humeral process narrow, elongated, granulous; possessing distinct ridge on ventral margin; dorsal margin concave; terminating in blunted point (Fig. 5a). Large axillary pore just ventral to humeral process.

Table 3. Morphometric and meristic counts for *Synodontis dhonti*. All morphometrics given in percent of base measurement. SL = Standard length, HL = Head length, LMB = Lateral mandibular barbel, MMB = Medial mandibular barbel, HPL = Humeral process length, HPD = humeral process depth, CPL = Caudal peduncle length, CPD = Caudal peduncle depth.

MEASUREMENT	HOLOTYPE
Body depth/SL	27.2
Head length/SL	33.3
Snout-dorsal length/SL	42.6
Adipose fin length/SL	25.1
Maxillary barbel length/SL	23.8
Dorsal spine length/SL	23.9
Pectoral spine length/SL	24.4
Head width/HL	81.7
Head depth/HL	82.5
Humeral process length/HL	49.9
Snout length/HL	48.6
Eye/HL	11.2
Interorbital width/HL	35.8
Postorbital length/HL	43.4
Mouth length/HL	34.2
Maxillary barbel length/HL	71.3
LMB/HL	33.3
MMB/HL	16.9
MMB/LMB	50.7
Dorsal spine length/HL	71.8
Pectoral spine length/HL	73.2
Eye/Snout length	23.1
Interorbital width/Snout length	73.7
Postorbital length/Snout length	89.5
Eye/Interorbital width	31.4
Eye/Postorbital length	25.8
HPL/HPD	232.7
CPL/CPD	107.8
MERISTICS	
Mandibular tooth count	22
Dorsal fin count	II,7
Pectoral fin count	I,8
Pelvic fin count	i,6
Anal fin count	v,8

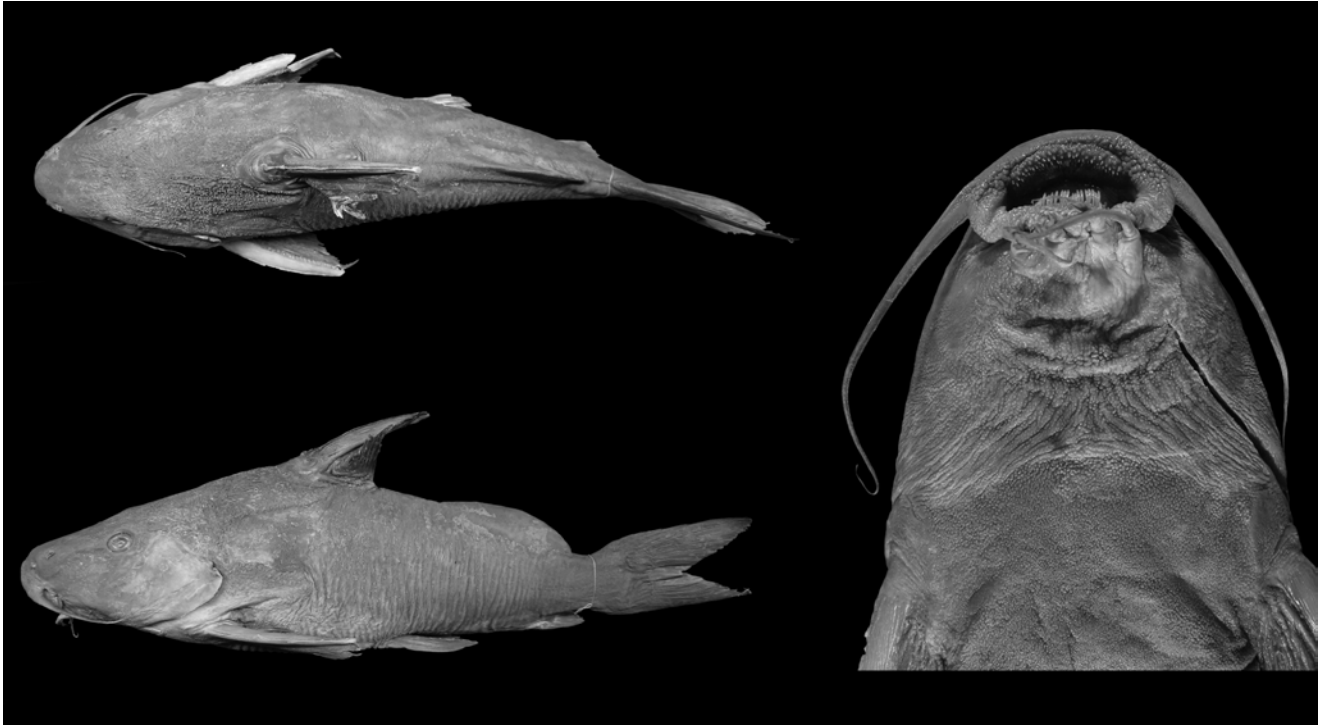


Figure 6. Holotype of *Synodontis dhonti*, MRAC 14344, 395 mm TL, 325 mm SL.

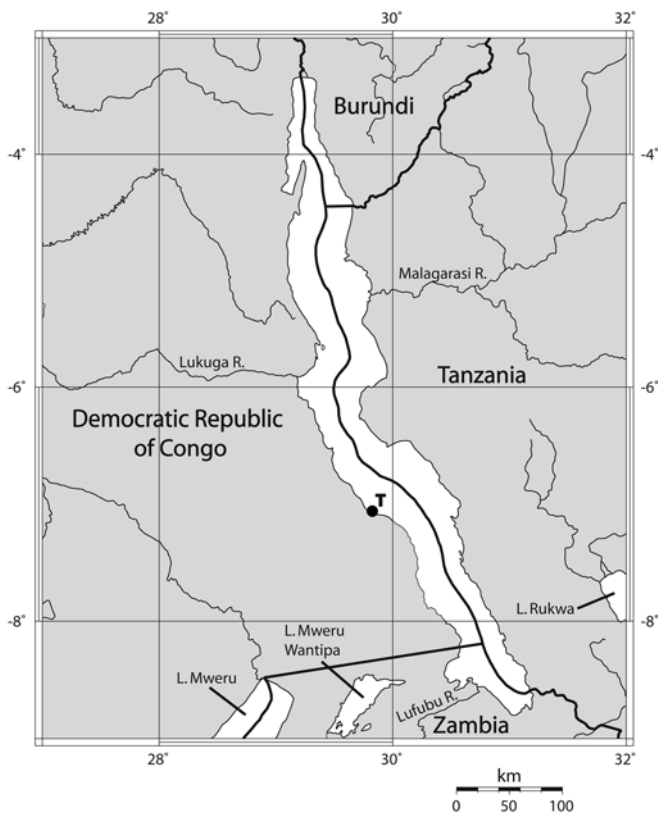


Figure 7. Known distribution of *Synodontis dhonti*. T denotes type locality.

Coloration in alcohol. – Body uniformly brown (Fig. 6). All barbels brown. Dorsal and pectoral-fin spines brown, filaments dark. All rayed fins uniformly brownish.

Distribution. – Known only from Kilewa, Lake Tanganyika (Fig. 7).

Habitat. – Unknown.

Diet. – Unknown.

Reproduction. – No information exists regarding the reproduction of *Synodontis dhonti*.

Taxonomic Remarks. – *Synodontis dhonti* Boulenger is known from a single specimen, collected in 1912. *Synodontis irsacae* Matthes was placed into the synonymy of *S. dhonti* by Matthes (1962). Morphological differences between these species were said to be due to ontogeny, but we have found no specimens that support this claim. We consider *S. dhonti* and *S. irsacae* to be distinct species. Evidence for this conclusion is presented in the description of *S. irsacae*.

Synodontis grandioops n. sp.
(Figs. 3C, 8, 9, 10; Tables 1, 4)

Holotype. – BMNH 1982.4.13.4785, TL 129 mm, SL 96 mm, Mwakizega coastline, L. Tanganyika, coll. R. Travers.

Paratypes. – (1) BMNH 1982.4.13.4786, TL 112 mm, SL 91 mm, collection information same as for holotype, (2) BMNH 1920.5.25.83-84, TL 98-103 mm, SL 76-79 mm, Vua Bay, L. Tanganyika, coll. L. Stappers, (1) BMNH 1955.12.20.1833, TL 103 mm, SL 80 mm, Moba Bay, L. Tanganyika, coll. Inst. Roy. Sci. Nat. Belge, 7.III.1947, (1) BMNH 1955.12.20.1837, TL 101 mm, SL 78 mm, Rumonge Bay, L. Tanganyika, coll. Inst. Roy. Sci. Nat. Belge, (1) BMNH 1982.4.13.4784, TL 105 mm, SL 81 mm, Kamara Bay, L. Tanganyika, coll. R. Travers, (3) BMNH 1982.4.13:4789-4791, TL 109-117 mm, SL 86-92 mm, Kigonga Bay, L. Tanganyika, coll. R. Travers, (2) BMNH 1982.4.13:4787-4788, TL 104-120 mm, SL 81-93 mm, Elephant's Foot Peninsula, L. Tanganyika, coll. R. Travers, (3) MRAC 39186-39188, TL 93-100 mm, SL 72-80 mm, Moba (Lake Tanganyika), coll. Van Maldern, 1932, (2) MRAC 53096-53097, TL 107-114 mm, SL 80-91 mm, Nyanza (L. Tang.), coll. A. Testiade, 1937, (3) MRAC 90273-90275, TL 123-147 mm, SL 96-111 mm, Stat: 63, offshore from the Malagarasi, 10-15 km from the coast, coll. M. Poll, 3.II.1947, (2) MRAC 91606-91607, TL 114-121 mm, SL 96-98 mm, Uvira, Lake Tanganyika, coll. G. Marlier, 1.IX.1949, (3) SAIAB 77890, TL 98-104 mm, SL 75-81 mm, Jacobsen's Beach, Tanzania, 04°54'31"S, 029°36'02"E, 05.X.1992.

Diagnosis. – Axillary pore present, large; mandibular teeth 17-26; body with large spots; fin spines brown to black; 7 pectoral-fin rays; black patches at base of pelvic and anal fins absent or poorly developed; eye 64.2-81.0% snout length; premaxillary toothpad uninterrupted; secondary branches on medial mandibular barbel absent; occipito-nuchal shield covered with skin; papillae on skin of body absent; hindgut chamber absent; maximum TL 150 mm.

This species is most similar in appearance to *Synodontis multipunctatus*, but is distinguished by its much larger eye (64.2-81.0% of snout length vs. 44.9-62.0% in *S. multipunctatus*). A consistent difference also exists in pectoral-fin ray counts, with *S. grandiope* having a count of I,7 and *S. multipunctatus* having a count of I,8, and *S. grandiope* reaching a much smaller maximum TL than does *S. multipunctatus* (150 mm vs. 280 mm). *Synodontis grandiope* is distinguished from other Tanganyikan species of *Synodontis* by its much larger eye (Tables 1 and 2) and modal pectoral-fin ray count of I,7; other species have modal pectoral-fin ray counts of I,8 or I,9.

Description. – Morphometric and meristic data in Table 4. Maximum TL 150 mm, SL 110 mm. Body compressed laterally. Predorsal profile convex; interrupted by ridge formed by dorsal rim of eye. Preanal

profile convex. Skin on body forming numerous vertical folds; papillae absent.

Head somewhat depressed, broad; skin smooth. Snout subconical when viewed laterally; rounded when viewed dorsally. Occipito-nuchal shield completely covered with skin; terminating posteriorly with narrow, rounded process on either side of dorsal spine; ventrally with wide, rounded process (covered with skin in smaller specimens) that extends to upper margin of humeral process on either side of body, also covered with skin in smaller specimens. Eye dorsolateral, ovoid; horizontal axis longer. Interorbital area flat to slightly convex.

Mouth subterminal; lips wide and papillate. Mandibular teeth 17-26, short, unicuspid; arranged in single transverse row. Premaxillary toothpad uninterrupted; primary, secondary and tertiary premaxillary teeth discrete, numerous, arranged in 2, 2, and 1 irregular rows, respectively.

Maxillary barbel without basal membrane; lacking branches or crenulations; extending at least to base of pectoral fin. Lateral mandibular barbel extending to point just short of anterior margin of pectoral girdle; with 4-5 non-tuberculate branches; lacking secondary branches. Medial mandibular barbel 1/2 to 2/3 length of lateral barbel; with 4-5 pairs non-tuberculate branches; lacking secondary branches.

Dorsal fin II,7; posterior margin straight. Dorsal-fin spine long, striated, nearly straight, terminating in short, white filament; anterior margin of fin spine with 0-3 small serrations distally; posterior margin with small serrations distally. Pectoral fin I,7; posterior margin straight. Pectoral-fin spine roughly equal in length to dorsal-fin spine, striated, slightly curved, terminating in short, white filament; anterior spine margin with many small, antrorse serrations; posterior margin with large, retrorse serrations along entire length. Adipose fin short, poorly developed, margin convex. Pelvic fin i,6; located anterior to vertical through origin of adipose fin; tip of appressed fin barely reaches base of anal fin. Anal fin iii-iv,6-8; posterior margin nearly straight; base located ventral to adipose fin. Caudal fin i,7,8,i; forked; lobes pointed.

Humeral process narrow, elongated, granulous; possessing distinct ridge on ventral margin; dorsal margin convex; terminating in sharp point (Fig. 3C). Large, dark-colored axillary pore present just ventral to humeral process. Gut length 0.8-0.9 times body length (n = 4, MRAC 53096-53097, MRAC 90273-90275). Hindgut chamber absent.

Coloration in alcohol. – Dorsum pale yellow to brown, covered with large black spots (Figs. 8, 9). Spots larger, irregular, sometimes confluent in juvenile specimens. Belly white, with or without black spots. Maxil-

Table 4. Morphometrics and meristic counts for *S. grandioops*. All morphometrics given in percent of base measurement. *Meristic data for holotype. Abbreviations as in Table 3.

MEASUREMENT	HOLOTYPE	<i>S. grandioops</i> (n=25)	MEAN±SD
Body depth/SL	27.2	20.2-27.2	23.2±1.8
Head length/SL	30.2	27.8-32.4	29.6±1.0
Snout-dorsal length/SL	39.5	35.1-43.0	39.2±1.8
Adipose fin length/SL	33.1	20.3-33.1	27.9±3.3
Maxillary barbel length/SL	26.3	26.3-37.8	30.9±3.4
Dorsal spine length/SL	27.8	21.7-31.1	27.0±2.8
Pectoral spine length/SL	-	22.7-32.4	27.1±2.8
Head width/HL	78.1	73.0-92.9	80.6±4.4
Head depth/HL	75.8	69.0-83.2	75.3±3.6
HPL/HL	56.4	52.0-62.8	55.9±2.5
Snout length/HL	41.1	39.4-46.6	42.7±1.8
Eye/HL	30.0	27.4-31.9	29.7±1.4
Interorbital width/HL	34.9	26.1-37.4	31.9±2.9
Postorbital length/HL	35.6	31.4-41.3	35.3±2.3
Mouth length/HL	28.3	28.0-37.7	31.9±2.5
Maxillary barbel length/HL	95.4	90.2-127.0	104.3±10.3
LMB/HL	53.5	45.9-68.2	55.5±5.9
MMB/HL	27.4	20.4-44.2	30.3±4.6
MMB/LMB	51.2	44.4-65.5	54.6±5.7
Dorsal spine length/HL	91.9	73.2-103.6	91.2±10.1
Pectoral spine length/HL	-	76.6-108.0	92.0±9.9
Eye/Snout length	72.9	64.2-81.0	69.7±4.6
Interorbital width/Snout length	85.0	58.4-85.0	74.6±6.4
Postorbital length/Snout length	86.6	69.5-100.0	83.0±7.6
Eye/Interorbital width	85.8	77.7-120.7	94.2±11.8
Eye/Postorbital length	84.2	73.7-100.2	84.5±7.3
HPL/HPD	286.6	241.4-431.9	310.8±38.4
CPL/CPD	107.7	107.7-189.6	144.4±18.9

MERISTICS	
Mandibular tooth count	17(1); 18(2); 19(2); 20(4); 21(6); 22*(3); 23(1); 24(4); 25(1); 26(1);
Dorsal fin count	II,7*(25)
Pectoral fin count	I,7*(21); I,7,i(4)
Pelvic fin count	i,6*(25)
Anal fin count	iii,6(1); iii,6,i(1); iii,7(3); iii,7,i(1); iv,6(1); iv,6,i(1); iv,7*(13); iv,7,i(1); iv,8(3)
Caudal fin count	i,7,8,i(3)
Total vertebrae count	34(3)



Figure 8. *Synodontis multipunctatus* (top), BMNH 1982.4.13.4789, 115 mm TL, 91 mm SL vs. *S. grandiops* (bottom), BMNH 1982.4.13.4784, 105 mm TL, 81 mm SL. The eye of *S. grandiops* is noticeably larger than that of *S. multipunctatus*, particularly in proportion to the length of the snout.

lary and mandibular barbels white. Iris yellowish to copper colored. Dorsal and pectoral-fin spines brown to black, filaments white. Pectoral spine with thin, light stripe along anterior margin. Dorsal and pectoral fins with black triangles at their base, posterior margins white in color. Triangles may be completely solid or composed of closely spaced spots. Anal and pelvic fins white, lacking dark triangles of other Tanganyikan species, single black spot may be present at base of these fins. Adipose fin with white dorsal edge. Both lobes of caudal fin with black bar from base to tip of fin; posterior margin of fin white.

Distribution. – Lake Tanganyika (Fig. 10); apparently common, though less so than *Synodontis multipunctatus*.

Habitat. – Likely inhabits littoral to benthic zones over shell, sand and mud bottoms, as do most of the other *Synodontis* species of the lake.

Diet. – No information exists regarding the diet of

Synodontis grandiops. It is likely that *S. grandiops* feeds on small gastropods, as do the other species of *Synodontis* from the lake.

Reproduction. – It is unknown whether *Synodontis grandiops* shares the brood parasite behavior of *S. multipunctatus*. In fact, without examining the specimens used in the original study of this behavior (Sato 1986), it is impossible to say whether *S. multipunctatus* or *S. grandiops* was observed in this study. Unfortunately, the specimens used do not appear to have been preserved. Differences in spawning time are likely to exist, as one mixed lot (now split into MRAC 39186-39188 and MRAC 39189-39192) containing specimens of *S. multipunctatus* and *S. grandiops* of similar size contained gravid females of the latter species, while the females of *S. multipunctatus* lack mature gonads.

Etymology. – The specific name is a Latinized combination of the Latin *grandis*, meaning large or big, and the Greek *ops*, meaning eye, a reference to the in-

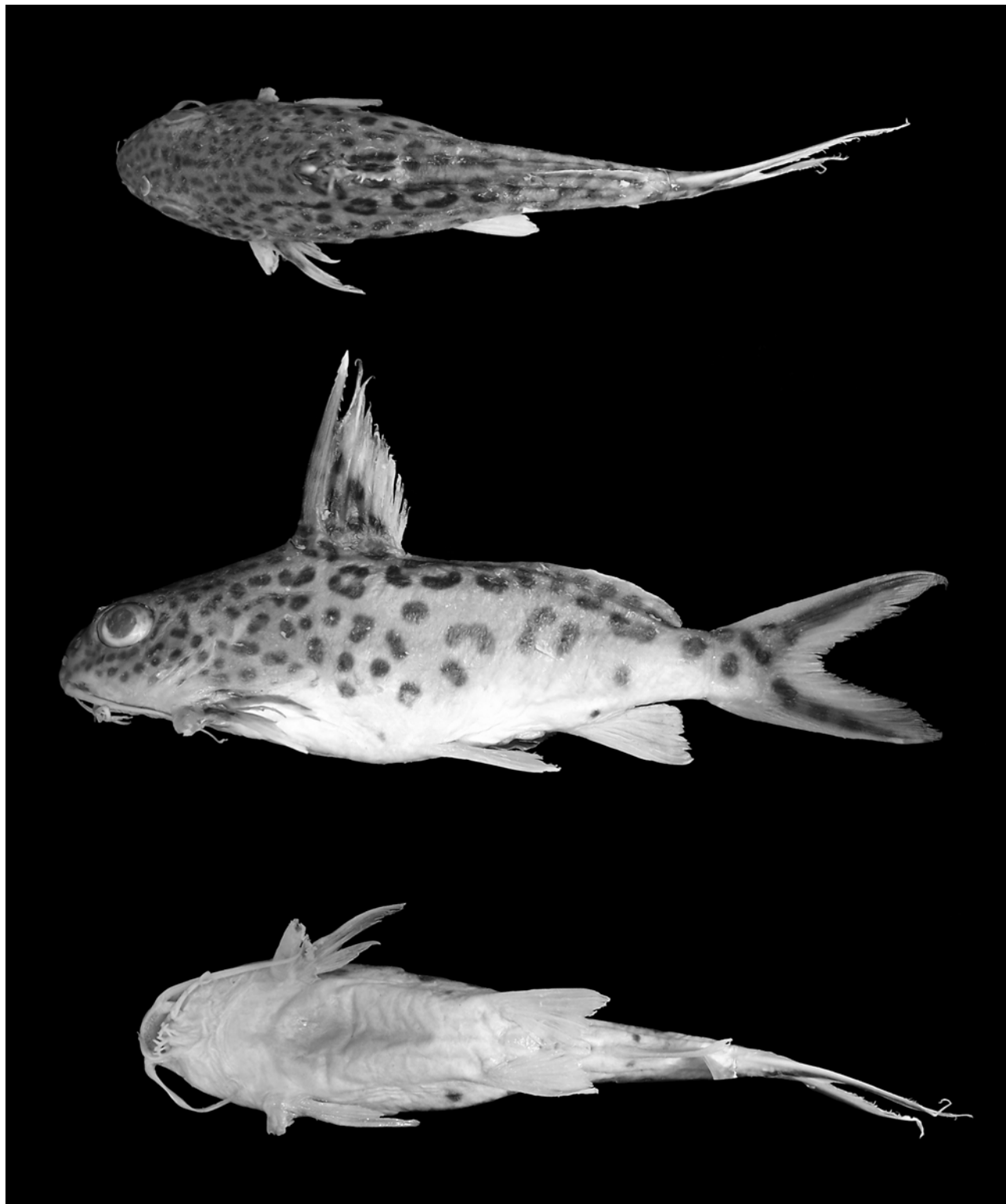


Figure 9. Holotype of *Synodontis grandiops*, BMNH 1982.4.13.4785, TL 129 mm, SL 96 mm.

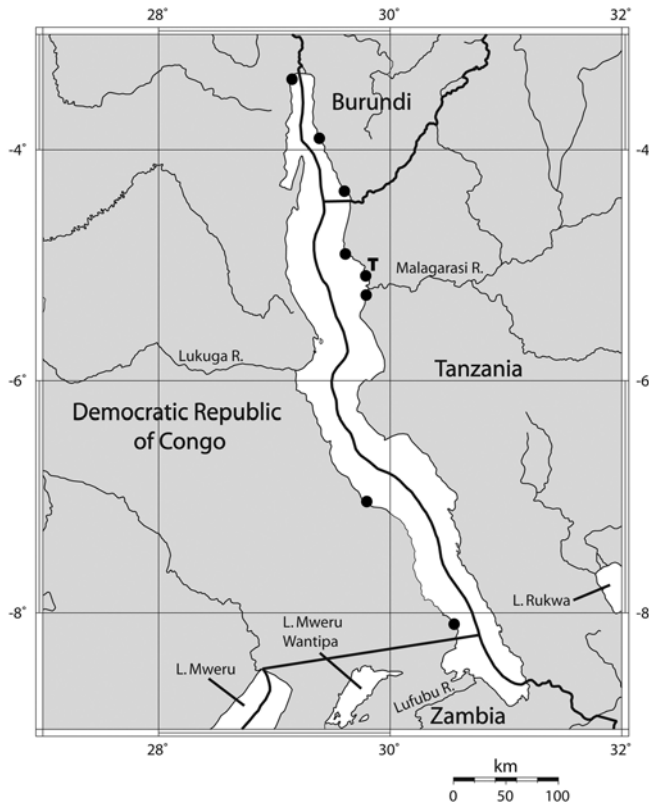


Figure 10. Known distribution of *Synodontis grandiosus*. T denotes type locality.

creased size of the eye of this species, particularly in relation to snout length. Gender: feminine.

Synodontis granulosus Boulenger, 1900
(Figs. 3A, 11, 12; Tables 1, 5)

Synodontis granulosus Boulenger, 1900:480, description, northern end of Lake Tanganyika; 1901a:308, description, northern end of Lake Tanganyika; 1901b:149, pl. 16, description, northern end of Lake Tanganyika; 1911:413, fig. 311, description, northern end of Lake Tanganyika. – Moore, 1903:166, fig., northern Lake Tanganyika. – Worthington and Ricardo, 1936:1067, 1077, 1101, note, Kabanga Bay, Lake Tanganyika. – Poll, 1946:219, description, Kilewa Bay; 1953:152, description, Lake Tanganyika; 1971:303, fig. 138, 139, pl. V, XI, description, Lake Tanganyika. – Hulot, 1950:170, Lake Tanganyika. – Matthes, 1962:44, description, Lake Tanganyika. – Coulter, 1965-1966:34, abundance, Lake Tanganyika; 1991a:152, 154, 181, 182, table 8.2, 8.3, 8.16, abundance, ecology, Lake Tanganyika. – Brichard, 1978:424, identification, Lake Tanganyika; 1989:478, 479, photo, identification. – Sands, 1983:23, check-list. – Daget, Gosse, & Thys van den Audenaerde,

1986:129, check-list. – Burgess, 1989:576, pl. 94, Lake Tanganyika. – Kobayagowa, 1989:14, photo.

Material Examined. – Lectotype (Poll, 1971), BMNH 1906.9.6.40, TL 270 mm, SL 216 mm, north end of Lake Tanganyika, coll. J.E.S. Moore, (2) paralectotypes, BMNH 1906.9.6.41-42, TL 220-246 mm, SL 181-202 mm, north end of Lake Tanganyika, coll. J.E.S. Moore, (3) BMNH 1936.6.15.1199-1201, TL 213-249 mm, SL 165-189 mm, Lake Tanganyika, coll. Christy, (1) MRAC 130378, TL 186 mm, SL 143 mm, Island of Moboko, Lake Tanganyika, coll. H. Matthes, 3.IX.1958, (1) MRAC 94-069-P-0289, TL 153 mm, SL 124 mm, Luhanga ± 15 km S. of Uvira, Lake Tanganyika (Zaire), coll. L. DeVos, 15.II.1994, (1) MRAC 14165, TL 226 mm, SL 181 mm, Kilewa, in front of the Tombala River, Lake Tanganyika, coll. Stappers, 25.VII.1912, (1) MRAC 14157, TL 260 mm, SL 209 mm, Kilewa Bay, Lake Tanganyika, coll. Stappers, 9.IV.1912, (1) MRAC 130465, TL 56 mm, SL 42 mm, Kalundu, Lake Tanganyika, coll. H. Matthes (I.R.S.A.C.), 21.X.1960, (4) MRAC 82-012-P-13-16, TL 141-194 mm, SL 112-154 mm, Magara, Lake Tanganyika (Burundi), coll. Schreyen, XII.1981, (1) MRAC A1-094-P-52, TL 109 mm, SL 84 mm, Crocodile Island, Lake Tanganyika (Zambia), coll. Snoeks, Hanssens, Verheyen et al., 16.X.2001, (1) UF 160945, TL 192 mm, SL 149 mm, Lake Tanganyika at Ikola, Tanzania, via Pete Hauschner, Tropical Fish Collector, coll. V.2005.

Diagnosis. – Axillary pore present, large; mandibular teeth 28-51; body lacking large spots; fin spines brown to black; 7-8 pectoral-fin rays; black triangles present on bases of all rayed fins; eye 31.2-50.2% snout length; premaxillary toothpad uninterrupted; secondary branches on medial mandibular barbel absent; occipito-nuchal shield not covered with skin; granular papillae present on skin of body; humeral process length 253.8-437.2% of humeral process width; hindgut chamber absent; maximum TL 270 mm.

Synodontis granulosus can be distinguished from *S. ilebrevis*, *S. irsacae*, *S. lucipinnis*, *S. melanostictus*, and *S. polli* by the presence of an axillary pore. *Synodontis granulosus* is further distinguished from these species, and also from *S. dhonti* and *S. tanganaicae* by the lack of secondary branches on the medial mandibular barbel (vs. present). An uninterrupted premaxillary toothpad further separates *S. granulosus* from *S. ilebrevis*, *S. irsacae*, *S. lucipinnis*, *S. melanostictus*, *S. petricola*, *S. polli*, and *S. tanganaicae*. *Synodontis granulosus* further differs from *S. tanganaicae* by differences in humeral process shape (humeral process length 253.8-437.2% of humeral process width in *S. granulosus* vs. 172.9-

Table 5. Morphometric data and meristic counts for *Synodontis granulosis*. All morphometrics given in percent of base measurement. *Meristic data for lectotype. Abbreviations as in Table 3.

MEASUREMENT	LECTOTYPE	RANGE (n=17)	MEAN±SD
Body depth/SL	28.1	20.8-30.8	25.2±2.8
Head length/SL	27.7	27.4-31.7	28.8±1.4
Snout-dorsal length/SL	36.9	36.9-41.9	38.9±1.4
Adipose fin length/SL	26.4	25.6-39.0	30.0±3.7
Maxillary barbel length/SL	28.5	22.9-38.3	31.1±4.7
Dorsal spine length/SL	26.5	24.3-31.9	28.3±2.2
Pectoral spine length/SL	23.8	23.8-31.1	27.0±1.9
Head width/HL	94.8	90.1-105.2	97.0±3.7
Head depth/HL	88.4	71.4-88.6	81.6±4.5
HPL/HL	63.7	57.4-76.4	67.0±5.7
Snout length/HL	47.4	41.3-50.0	46.4±2.1
Eye/HL	14.8	14.8-22.6	19.4±2.3
Interorbital width/HL	43.6	37.0-44.0	41.0±2.2
Postorbital length/HL	42.6	37.0-44.5	40.2±1.9
Mouth length/HL	44.1	32.9-44.1	37.5±3.7
Maxillary barbel length/HL	103.1	81.4-122.6	107.4±12.6
LMB/HL	70.5	41.8-75.2	58.8±9.0
MMB/HL	24.8	20.8-32.3	27.5±3.6
MMB/LMB	35.2	32.2-65.6	47.8±9.6
Dorsal spine length/HL	95.7	85.5-110.3	98.2±8.8
Pectoral spine length/HL	86.0	84.0-101.8	93.6±5.9
Eye/Snout length	31.2	31.2-50.2	41.9±6.2
Interorbital width/Snout length	92.0	81.0-96.0	88.3±4.1
Postorbital length/Snout length	89.9	80.3-107.9	86.6±6.5
Eye/Interorbital width	34.0	34.0-60.6	47.5±7.3
Eye/Postorbital length	34.7	34.7-61.1	48.4±6.8
HPL/HPD	321.8	253.8-437.2	333.8±52.0
CPL/CPD	124.6	93.4-154.5	126.6±16.4

MERISTICS

Mandibular tooth count	28(1); 32(1); 36(2); 37(1); 42(1); 43(1); 44(2); 45(1); 46*(2); 48(1); 51(1)
Dorsal fin count	II,7*(13); II,7,i(1); II,8(3)
Pectoral fin count	I,7(3); I,8(14)
Pelvic fin count	i,6*(15); i,7(2)
Anal fin count	iii,8*(2); iii,9(1); iv,6,i(1); iv,7(3); iv,8(2); iv,8,i(1); iv,9,i(1); v,7(1); v,7,i(1); v,8(3);
Caudal fin count	i,7,8,i(5)
Total vertebrae count	38(3), 39(1)

255.4% in *S. tanganaicae*) (Figs. 3A, 4C,D). *Synodontis granulosus* can be further distinguished from *S. dhonti* by having a greater number of mandibular teeth (28-51 vs. 22 in *S. dhonti*) and a larger eye (31.2-50.2% of snout length vs. 23.1% in *S. dhonti*).

Synodontis granulosus differs from *S. multipunctatus* and *S. grandioops* in lacking large spots on the body, having a higher number of mandibular teeth (28-51 vs. 13-29 in *S. multipunctatus* and 17-26 in *S. grandioops*), a smaller eye (31.2-50.2% of snout length vs. 44.9-62.0% in *S. multipunctatus* and 64.2-81.0% in *S. grandioops*), an occipito-nuchal shield which is not covered by skin, and body skin which is covered by granular papillae. *Synodontis granulosus* is distinguished from *S. petricola* and further separated from *S. lucipinnis* by lacking large spots on the body and secondary branches on the medial mandibular barbel, having a large axillary pore (vs. very small in *S. petricola*, absent in *S. lucipinnis*), dark fin spines, 7-8 pectoral-fin rays (vs. 8-9 in *S. petricola* and *S. lucipinnis*), an uninterrupted premaxillary toothpad, much larger body size (maximum TL 270 mm vs. 135 mm in *S. petricola*, 100 mm in *S. lucipinnis*), an occipito-nuchal shield which is not covered by skin, and skin which is covered by granular papillae.

Description. – Morphometric and meristic data in Table 5. Maximum TL 270 mm, SL 216 mm. Body compressed laterally. Predorsal profile straight, interrupted by convex ridge formed by orbit of eye. Preanal profile straight to gently convex. Skin on body forming numerous vertical folds covered with granular papillae extending onto all fins.

Head depressed and broad; skin covered with granular papillae. Snout with bluntly rounded margin when viewed laterally and dorsally. Anterior nostrils tubular; posterior nostrils with semicircular flaps of skin along anterior margin. Occipito-nuchal shield rugose, not covered with skin; terminating posteriorly with narrow, rounded process on either side of dorsal spine; ventrally with narrow, bluntly pointed process that extends to upper margin of humeral process on either side of body. Eye dorsolateral; ovoid; horizontal axis longer. Interorbital area flat.

Mouth subterminal; lips wide and papillate. Mandibular teeth 28-51, short, unicuspid; arranged in single transverse row. Premaxillary toothpad uninterrupted; primary, secondary and tertiary premaxillary teeth discrete; numerous; arranged in 4, 4, and 2 irregular rows, respectively.

Maxillary barbel with narrow basal membrane;



Figure 11. *Synodontis granulosus*, UF 160945, 192 mm TL, 149 mm SL.

lacking branches or crenulations; extending at least to base of pectoral fin. Lateral mandibular barbel extending to point just short of anterior margin of pectoral girdle, with 4-5 non-tuberculate branches; lacking secondary branches. Medial mandibular barbel about 1/2 length of lateral barbel; with 4-5 pairs of tuberculate branches; lacking secondary branches.

Dorsal fin II,7-8; posterior margin straight. Dorsal-fin spine long, striated, nearly straight, terminating in short black filament; anterior margin smooth; posterior margin with small serrations distally. Pectoral fin I,7-8; posterior margin straight. Pectoral-fin spine roughly equal in length to dorsal-fin spine, striated, slightly curved, terminating in short, black filament; anterior spine margin granulate in adults; many small antrorse serrations along anterior margin in juveniles; posterior margin with large retrorse serrations along entire length. Adipose fin long, well developed, margin convex. Pelvic fin i,6-7; located anterior to vertical through origin of adipose fin; tip of appressed fin barely reaches base of anal fin. Anal fin iii-v,7-9,i; posterior margin nearly straight; base located ventral to adipose fin. Caudal fin i,7,8,i; forked; lobes pointed.

Humeral process narrow, elongated, granulous; possessing distinct ridge on ventral margin; dorsal margin concave; terminating in sharp point (Fig. 3A). Large, dark-colored axillary pore just ventral to humeral process. Gut 0.5 times body length ($n = 1$, UF 160945). Hindgut chamber absent.

Coloration. – Body slate-gray to olive brown (Fig. 11). Belly ranging from pale yellow to gray. Scattered, small black spots present on juveniles. Maxillary barbel white. Mandibular barbels white, bases sometimes with scattered dusky pigmentation. Iris copper colored. Dorsal and pectoral-fin spines brown to black, filaments black. All rayed fins with black triangles at base, posterior margins white to yellowish in color. Both lobes of caudal fin with black bar from base to tip of fin; posterior margin of fin white to yellowish in color.

Distribution. – Lake Tanganyika (Fig. 12); rare but widely distributed.

Habitat. – Littoral to benthic zones over shell, sand and mud bottoms; to a maximum depth of 130 m (Coulter 1991a).

Diet. – Almost nothing is known about the diet of this species. Worthington and Ricardo (1936) reported a single *Limnothrissa* sp. (Teleostei: Atherinidae) in the stomach of one specimen. Many other Tanganyikan species of *Synodontis* prey largely on mollusks and algae scraped from rocky substrates. Presumably, *S. granulosus* has a similar diet.

Reproduction. – No information exists regarding

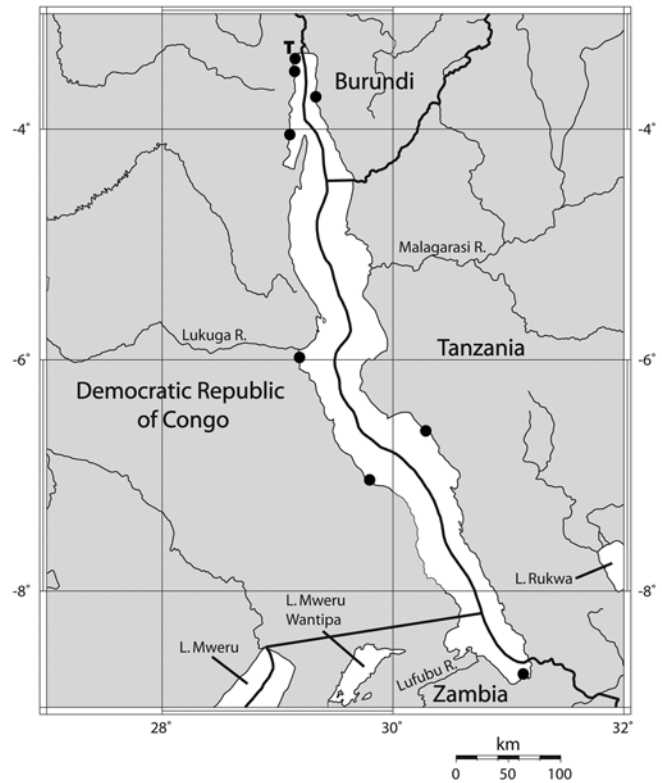


Figure 12. Known distribution of *Synodontis granulosus*. T denotes type locality.

the reproduction of *Synodontis granulosus*.

Taxonomic Remarks. – *Synodontis granulosus* is sufficiently distinct that it is one of only two described Tanganyikan species of *Synodontis* for which the taxonomy has remained unaltered since the original description (the other being *S. multipunctatus*). Minor differences in coloration pattern occur throughout its range (mainly in the color of the fin margins), but they do not appear to follow any geographic pattern.

***Synodontis ilebrevis* n. sp.**
(Figs. 5D, 13, 14, 16; Tables 2, 6)

Holotype. – UF 160942, TL 138 mm, SL 116 mm, Lake Tanganyika at Chaitika, Zambia, via Pete Hauschner, Tropical Fish Collector, coll. V.2005.

Paratypes. – (8) UF 162562, TL 128-148 mm, SL 108-121 mm, collection data same as for holotype, (1) SAIAB 78410, TL 141 mm, SL 118 mm, collection information same as for holotype, (5) MRAC 78-25-P-20-24, TL 93-136 mm, SL 79-114 mm, Cape Chaitika, S. Lake Tanganyika (Zambia); coll. P. Brichard, IV.1978.

Diagnosis. – Axillary pore absent; mandibular teeth 50-66; body with moderately sized spots; fin spines dark; 8-9 pectoral-fin rays; black triangles on bases of all rayed

fins; eye 26.0-33.4% snout length; premaxillary toothpad interrupted; secondary branches on medial mandibular barbel present; occipito-nuchal shield covered with skin; short, flat papillae on skin of body; short gut; hindgut chamber absent; body depth 18.2-20.1% SL; maximum TL 150 mm.

The lack of an axillary pore distinguishes *Synodontis ilebrevis* from *S. dhonti*, *S. grandioops*, *S. granulosus*, *S. multipunctatus*, *S. petricola*, and *S. tanganaicae*. *Synodontis ilebrevis* is separated from *S. irsacae* and *S. lucipinnis* and further separated from *S. dhonti* and *S. petricola* by having a greater number of mandibular teeth (50-66 vs. 15-29 in *S. irsacae*, 35-51 in *S. lucipinnis*, 22 in *S. dhonti*, and 31-50 in *S. petricola*). *Synodontis ilebrevis* can also be separated from *S. petricola* and *S. lucipinnis* by having dark fin spines (vs. white). The size of the spots on the body distinguishes *S. ilebrevis* from *S. granulosus*, *S. melanostictus*, and *S. tanganaicae*, and the black triangle at the base of all the rayed fins further separates *S. ilebrevis* from *S. melanostictus* and adults of *S. tanganaicae*. *Synodontis ilebrevis* is further distinguished from *S. dhonti*, *S. granulosus*, *S. melanostictus*, and *S. tanganaicae* in having the occipito-nuchal shield covered by skin. *Synodontis ilebrevis* differs from *S. polli* in having a short gut (0.8-1.4 times TL vs. 4.0-5.5 times TL in *S. polli*) (Figs. 14, 15), no hindgut chamber (Fig. 14), slightly shallower body (body depth 18.2-20.1% SL vs. 20.2-27.0 in *S. polli*), short flat papillae on the skin (vs. villous papillae in *S. polli*), and small, round, widely spaced spots on the skin (vs. moderate to large, irregular, more closely spaced spots in *S. polli*).

Description. – Morphometric and meristic data in Table 6. Maximum TL 150 mm, SL 120 mm. Body not compressed. Predorsal profile slightly convex. Preanal profile straight to slightly convex. Skin on body forming numerous vertical folds; short, flat papillae present, giving skin pebbled texture.

Head slightly depressed and broad; skin covered with papillae; papillae extend onto base of maxillary barbel and onto paired fins. Snout with bluntly rounded margin when viewed laterally and dorsally. Occipito-nuchal shield covered with skin, terminating posteriorly with wide, pointed process on either side of dorsal spine; ventrally with wide, rounded process that extends to upper margin of the humeral process on either side of body. Eyes dorsolateral; ovoid; horizontal axis longer. Interorbital area flat to slightly convex.

Mouth inferior; lips widened and papillate. Mandibular teeth 50-66, short, unicuspid; arranged in 8 short, transverse rows. Premaxillary toothpad interrupted;

primary, secondary and tertiary premaxillary teeth discrete; numerous; arranged in 3-4, 2, and 1-2 irregular rows, respectively.

Maxillary barbel short; extending at least to base of pectoral spine; small papillae at base; basal membrane narrow. Lateral mandibular barbel extending to point just past anterior margin of pectoral girdle; with 3-6 short, weakly tuberculate branches; usually lacking secondary branches. Medial mandibular barbel approximately 1/3 to 1/2 length of lateral barbel; with 3-5 pairs of tuberculate branches; many secondary branches present.

Dorsal fin II,7; posterior margin straight to slightly concave. Dorsal-fin spine short; striated; slightly curved, terminating in short, dusky filament; anterior margin of fin spine granulous, posterior margin with small serrations distally. Pectoral fin I,8-9; posterior margin straight to broadly rounded. Pectoral-fin spine roughly equal in length to dorsal-fin spine, striated, slightly curved, terminating in short, dusky filament; anterior spine margin granulous; posterior margin with large, retrorse serrations along entire length. Adipose fin long, well developed, margin convex. Pelvic fin i,6; located at vertical through adipose fin base; tip of appressed fin does not reach base of anal fin. Anal fin iii-v,7-9,i; posterior margin rounded; base located at vertical through center of adipose fin. Caudal fin i,7,8,i; forked; lobes rounded.

Humeral process triangular; granulous; poorly developed ridge on ventral margin; dorsal margin concave; terminating in sharp point (Fig. 5D). Axillary pore absent. Gut short, 0.8-1.4 times body length (n = 8, UF 160942, 162562, SAIAB 78410). Hindgut chamber absent (Fig. 14).

Coloration. – Dorsum olive brown, covered with small, regularly shaped, widely spaced, black spots (Fig. 13). Belly lighter, with smaller, regularly shaped, black spots. Maxillary and mandibular barbels white. Iris copper colored. Dorsal and pectoral-fin spines dark, terminating in short, dusky filaments. Pectoral spine with thin, light stripe along anterior margin. All rayed fins with black triangles at their base; posterior margins dusky. Triangles may be completely solid or composed of closely spaced spots. Both lobes of caudal fin with black bars from base to tip of fin; posterior margin dusky.

Distribution. – Lake Tanganyika (Fig. 16). Known only from the Cape Chaitika area; local abundance unknown.

Habitat. – The exact habitat of this species is unknown. Like the other small-bodied species of *Synodontis*, *S. ilebrevis* probably inhabits fairly shallow, rocky coastal areas.

Diet. – Most of the specimens examined were

Table 6. Morphometric and meristic counts for *Synodontis iblebrevis*. All morphometrics given in percent of base measurement. *Meristic data for holotype. Abbreviations as in Table 3.

MEASUREMENT	HOLOTYPE	RANGE (n=15)	MEAN±SD
Body depth/SL	19.2	18.2-20.1	19.3±0.6
Head length/SL	29.6	27.5-30.6	29.2±1.0
Snout-dorsal length/SL	36.5	34.9-38.3	36.3±1.1
Adipose fin length/SL	43.6	31.2-44.8	38.4±4.0
Maxillary barbel length/SL	13.4	12.9-26.4	18.2±3.8
Dorsal spine length/SL	17.8	16.1-22.3	18.6±1.8
Pectoral spine length/SL	20.3	17.6-23.8	21.0±1.9
Head width/HL	83.5	78.2-86.6	82.9±2.6
Head depth/HL	67.9	63.6-73.8	68.4±3.0
HPL/HL	37.1	36.9-46.4	40.9±2.6
Snout length/HL	55.4	53.4-59.2	56.0±1.6
Eye/HL	18.5	14.5-18.5	17.1±1.1
Interorbital width/HL	35.0	33.6-40.3	36.5±1.7
Postorbital length/HL	36.7	34.0-36.9	35.5±1.0
Mouth length/HL	54.1	49.0-57.0	52.0±2.2
Maxillary barbel length/HL	45.1	44.0-92.3	62.5±14.0
LMB/HL	32.9	32.4-53.9	43.1±5.8
MMB/HL	19.3	16.2-26.4	20.8±2.9
MMB/LMB	58.5	34.7-63.1	49.2±9.1
Dorsal spine length/HL	60.2	55.1-74.9	63.6±5.8
Pectoral spine length/HL	68.6	59.2-79.1	71.9±6.6
Eye/Snout length	33.4	26.0-33.4	30.6±2.3
Interorbital width/Snout length	63.1	61.4-73.8	65.2±3.2
Postorbital length/Snout length	66.2	57.4-68.0	63.4±3.0
Eye/Interorbital width	52.9	38.2-53.0	47.0±4.3
Eye/Postorbital length	50.4	42.5-52.6	48.3±2.7
HPL/HPD	163.2	149.0-228.0	169.5±20.4
CPL/CPD	101.3	94.7-117.0	107.0±7.4
MERISTICS			
Mandibular tooth count		50(1); 52(1); 54(1); 55(1); 57(1); 58(3); 59(2); 60(2); 62(1); 64(1); 66*(1)	
Dorsal fin count		II,7*(15)	
Pectoral fin count		I,8(10); I,9*(5)	
Pelvic fin count		i,6*(15)	
Anal fin count		iii,7(1); iv,7(1); iv,7,i(2); iv,8(5); iv,8,i*(3); iv,9(1); iv,9,i(1); v,9(1)	
Caudal fin count		i,7,8,i*(10)	
Total vertebrae count		35*(4); 36(6)	



Figure 13. Holotype of *Synodontis ilebrevis*, UF 160942, 139 mm TL, 116 mm SL.



Figure 14. *Synodontis ilebrevis*, UF 162562, 138 mm TL, 118 mm SL, with intestine extracted. Note the relative shortness of the intestine and lack of a discernible hindgut chamber.

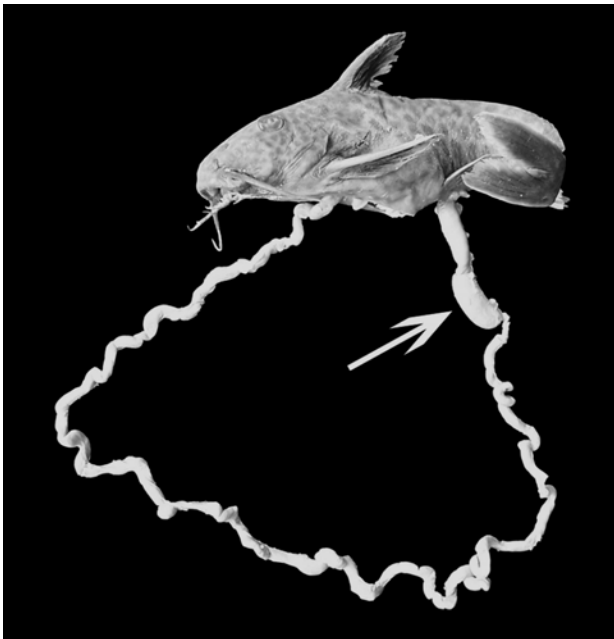


Figure 15. *Synodontis polli*, MRAC 131007-008, 137 TL, 112 SL, with intestine extracted. Hindgut chamber indicated with white arrow.

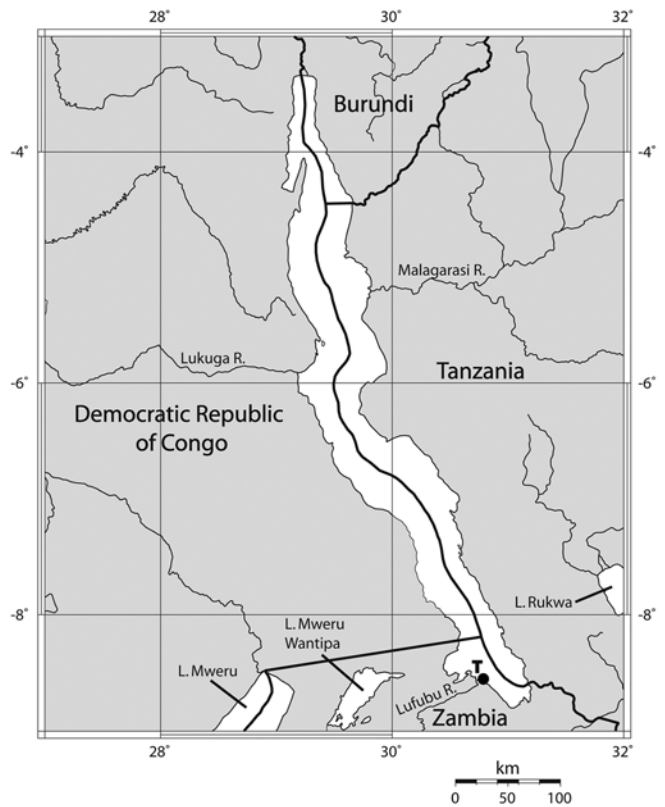


Figure 16. Known distribution of *Synodontis ilebrevis*. T denotes type locality.

obtained through the aquarium trade and had not been feeding on their natural diet. Though these specimens readily ingested algal matter, their short gut and lack of a hindgut chamber suggest that this species is suited to a more carnivorous diet. Examination of the stomach contents of freshly caught specimens is needed to determine differences in diet between this species and *Synodontis polli*, which may have led to differences in the gut morphology of these species.

Reproduction. – No information exists regarding the reproduction of *Synodontis ilebrevis*.

Etymology. – The specific name is a combination of the Latin *ile*, meaning intestine, and the Latin *brevis*, meaning short, a reference to the relatively short gut of this species. Gender: feminine.

Synodontis irsacae Matthes, 1959
(Figs. 5B, 17, 18; Tables 2, 7)

Synodontis irsacae Matthes, 1959:78, description, Lake Tanganyika; 1962:37, placed into synonymy of *S. dhonti*.

Synodontis dhonti. – Matthes, 1962:37, fig. a, pl. 3, description, diet, Lake Tanganyika. – Poll, 1971:364, description. – Brichard, 1978:423, key; 1989:479, key. – Sands, 1983:23, checklist. – Daget, Gosse, & Thys van den Audenaerde, 1986:125, check-list. – Burgess, 1989:195, checklist. – Kobayagawa, 1989:14, photo (misidentified). – Coulter, 1991a:182, 191, table 8.16, habitat, diet, reproduction.

Material Examined. – Holotype, MRAC 130315, TL 142 mm, SL 116 mm, Kalundu, N. Lake Tanganyika, coll. H. Matthes, 27.X.1959, (6) paratypes, MRAC 130316-321, TL 55-156 mm, SL 46-124 mm, Kalundu, N. Lake Tanganyika, coll. H. Matthes, 14.IV.1960, (6) MRAC 130332-130337, TL 47-102 mm, SL 38-84 mm, Luhanga, Lake Tanganyika, coll. H. Matthes (I.R.S.A.C.), IV.1959, (1) MRAC 77-40-P-5-7, TL 99 mm, SL 80 mm, Chipimbi, S.W. Coast of Lake Tanganyika (Zambia), coll. P. Brichard, 6.VII.1977, (2) MRAC 92-081-P-0127-0128, TL 83-105 mm, SL 69-85 mm, Ulwile Island, northern shore, Lake Tanganyika S7°27.40' E30°24.20' (Tanzania), coll. Exp. Tanganyika 1992, 27.V.1992, (2) MRAC 95-096-P-2561-2562, TL 88-107 mm, SL 71-85 mm, Kasenga Point, Zambia, 08°43.31'S, 31°08.01'E, coll. Verheyen, Snoeks, Hanssens, Ruber, Stermbauer, 4.IV.1995, (4) MRAC A3-033-P-0036-0040, TL 117-161mm, SL 91-133 mm, Pemba, S. of Uvira, Lake Tanganyika (Zaire), coll. L. De Vos, 18.VIII.1995, (1) MRAC A1-094-P-0055-0059, TL 103 mm, SL 81 mm, Katoto, Lake Tanganyika (Zambia), coll. Snoeks, Hanssens, Verheyen et al., 18.X.2001, (1) BMNH

1955.12.20.1859, TL 190 mm, SL 157 mm, Albertville, Lulumduie village, Lake Tanganyika, coll. Inst. Roy. Sci. Nat. Belge, 28-29.XI.1946, (1) BMNH 2005.9.26.3, TL 90 mm, SL 72 mm, Mpulungu, Zambia, Lake Tanganyika, coll. J. Day, 2005, (1) BMNH 2005.9.26.17, TL 116 mm, SL 94 mm, Mpulungu, Zambia, Lake Tanganyika, coll. J. Day, 2005, (5) SAIAB 40177, TL 86-121 mm, SL 70-97 mm, Zambia, Lake Tanganyika, Mbita Island, 08°45'00"S, 031°06'00"E, 08.VIII.1992, (2) SAIAB 56687, TL 94-97 mm, SL 75-79 mm, Tanzania, Lake Tanganyika; Muzungu beach, 04°54'53"S, 029°35'58"E, 10.X.1997, (2) SAIAB 76105, TL 93-98 mm, SL 76-80 mm, Zambia, Mbala, Lake Tanganyika; Mbita Island (northwest end), 08°45.18'S, 31°05.07'E, coll. 29.II.2004, (1) SAIAB 76174, TL 97 mm, SL 79 mm, Zambia, Mbala, Lake Tanganyika; Musende Rocks beach, 08°45.18'S, 31°05.07'E, coll. 29.II.2004, (1) SAIAB 77883, TL 133 mm, SL 108 mm, Cave, Kigoma hotel below Hill top, 04°53'03"S, 029°37'11"E, 04.X.1997, (1) SAIAB 77892, TL 91 mm, TL 72 mm, Tanzania; Jacobsen's Beach, 04°54'31"S, 029°36'02"E, 05.X.1997, (2) UF 160940, TL 104-124 mm, SL 86-102 mm, Cape Chaitika, Lake Tanganyika, Zambia, via Pete Hauschner, Tropical Fish Collector, V.2005, (2) CU 88750, TL 102-121 mm, SL 85-102 mm, Tanzania; Kigoma; Jacobsen's Beach, coll. P.B. McIntyre, 18.VII.2002.

Diagnosis. – Axillary pore absent; mandibular teeth 15-29; body with large spots; fin spines dark; 8-9 pectoral-fin rays; black triangles at bases of all rayed fins; eye 28.7-43.7% snout length; premaxillary toothpad interrupted; secondary branches on medial mandibular barbel present; occipito-nuchal shield covered with skin; skin of body smooth; hindgut chamber absent; maximum TL 190 mm.

The absence of an axillary pore distinguishes *Synodontis irsacae* from *S. dhonti*, *S. grandioops*, *S. granulatus*, *S. multipunctatus*, *S. petricola*, and *S. tanganaicae*. *Synodontis irsacae* can be further separated from *S. dhonti*, *S. grandioops*, *S. granulatus*, and *S. multipunctatus* by the interrupted premaxillary toothpad (vs. uninterrupted). The presence of secondary branches on the medial mandibular barbel further distinguishes *S. irsacae* from *S. grandioops*, *S. granulatus*, and *S. multipunctatus*. *Synodontis irsacae* differs further from *S. dhonti*, *S. granulatus*, *S. melanostictus*, and *S. tanganaicae* in having an occipito-nuchal process which is covered by skin. *Synodontis irsacae* can be distinguished from *S. ilebrevis*, *S. lucipinnis*, *S. polli*, and further separated from *S. petricola*, by having a lower number of mandibular teeth (15-29 in *S. irsacae* vs. 50-66 in *S. ilebrevis*, 35-51 in *S. lucipinnis*, 40-70 in *S. polli*, and 31-50 in *S.*

Table 7. Morphometrics and meristic counts for *Synodontis irsacae*. All morphometrics given in percent of base measurement. *Meristic data for holotype. Abbreviations as in Table 3.

MEASUREMENT	HOLOTYPE	RANGE (n=42)	MEAN±SD
Body depth/SL	28.6	17.7-28.6	23.5±2.5
Head length/SL	30.4	27.9-32.8	31.0±1.0
Snout-dorsal length/SL	38.1	36.7-41.8	39.4±1.3
Adipose fin length/SL	32.3	26.9-41.5	33.3±3.3
Maxillary barbel length/SL	26.8	16.1-28.4	22.0±3.1
Dorsal spine length/SL	24.4	18.8-28.0	23.4±2.1
Pectoral spine length/SL	25.3	19.0-27.5	23.7±1.6
Head width/HL	86.8	75.9-97.1	82.8±4.1
Head depth/HL	82.3	59.1-82.3	69.8±5.4
HPL/HL	46.3	35.7-55.8	47.5±4.3
Snout length/HL	51.1	50.4-58.2	53.5±2.1
Eye/HL	17.3	16.0-22.6	18.7±2.0
Interorbital width/HL	44.3	27.3-44.3	34.7±3.6
Postorbital length/HL	37.3	29.8-41.0	35.2±2.5
Mouth length/HL	37.4	33.7-52.8	40.9±4.3
Maxillary barbel length/HL	88.1	52.4-91.8	71.0±9.9
LMB/HL	49.5	38.2-63.0	46.9±6.2
MMB/HL	20.9	14.4-30.7	21.7±3.5
MMB/LMB	42.2	28.6-59.6	46.5±6.6
Dorsal spine length/HL	80.3	59.6-88.3	75.4±6.6
Pectoral spine length/HL	83.2	60.6-88.7	76.7±6.0
Eye/Snout length	33.8	28.7-43.7	35.1±4.0
Interorbital width/Snout length	86.7	50.9-86.7	65.0±7.5
Postorbital length/Snout length	73.1	56.0-81.2	66.0±6.3
Eye/Interorbital width	39.0	39.0-72.7	54.8±8.9
Eye/Postorbital length	46.2	41.8-69.3	53.7±7.8
HPL/HPD	327.8	180.3-358.2	280.7±39.4
CPL/CPD	81.5	60.4-128.8	94.7±15.0

MERISTICS

Mandibular tooth count	15(1); 16(2); 18(1); 19(1); 21(5); 22*(8); 23(5); 24(5); 25(4); 26(5); 27(4); 29(1)
Dorsal fin count	II,7*(42)
Pectoral fin count	I,8* (31), I,9 (11),
Pelvic fin count	i,6*(42)
Anal fin count	iii,7(1); iii,8(2); iii,8,i(2); iii,9(1); iv,7(10); iv,7,i(4); iv,8*(22)
Caudal fin count	i,7,8,i(5)
Total vertebrae count	34(3); 35(2)

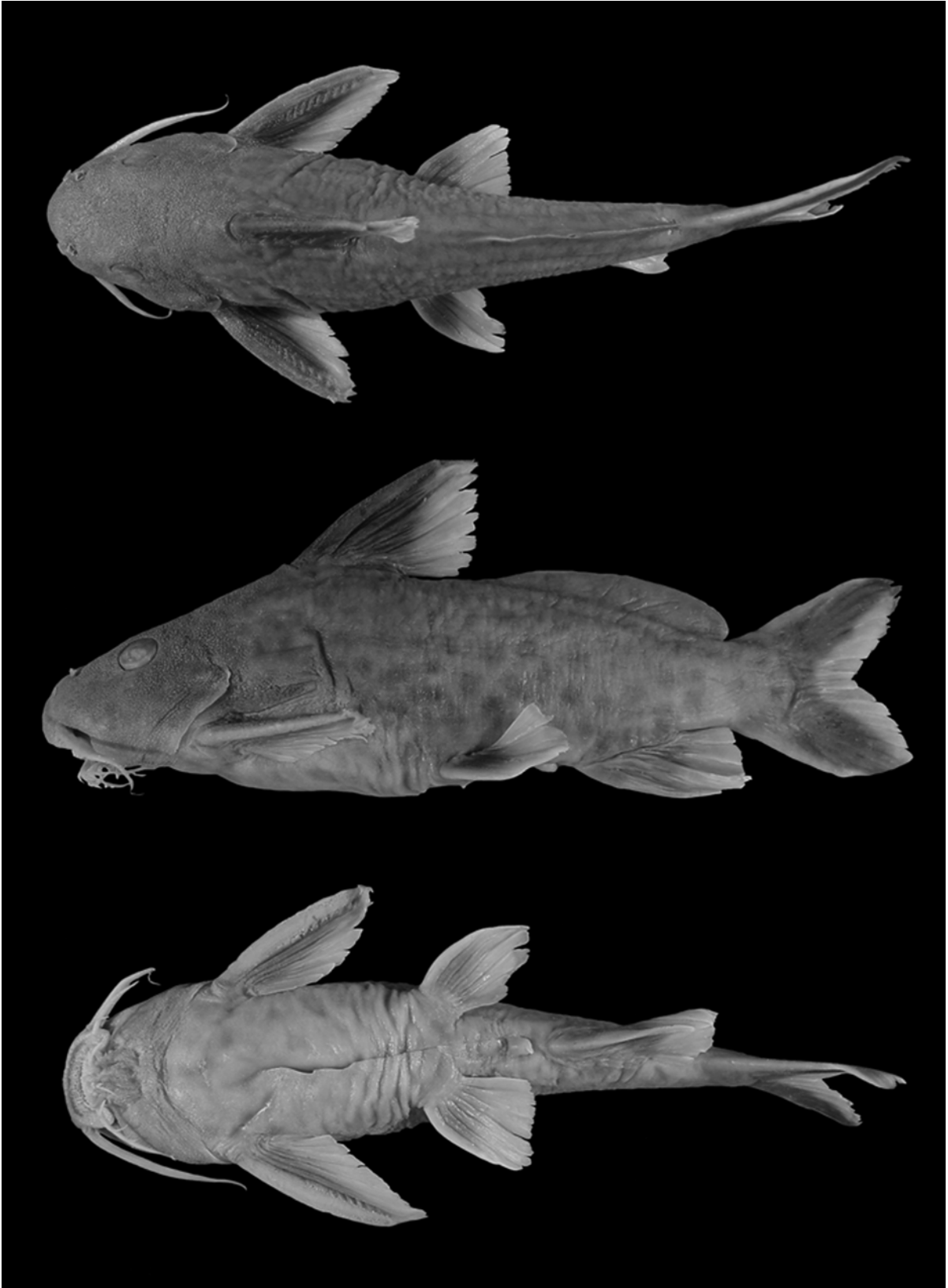


Figure 17. Holotype of *Synodontis irsacae*, MRAC 130315, 142 mm TL, 116 mm SL.

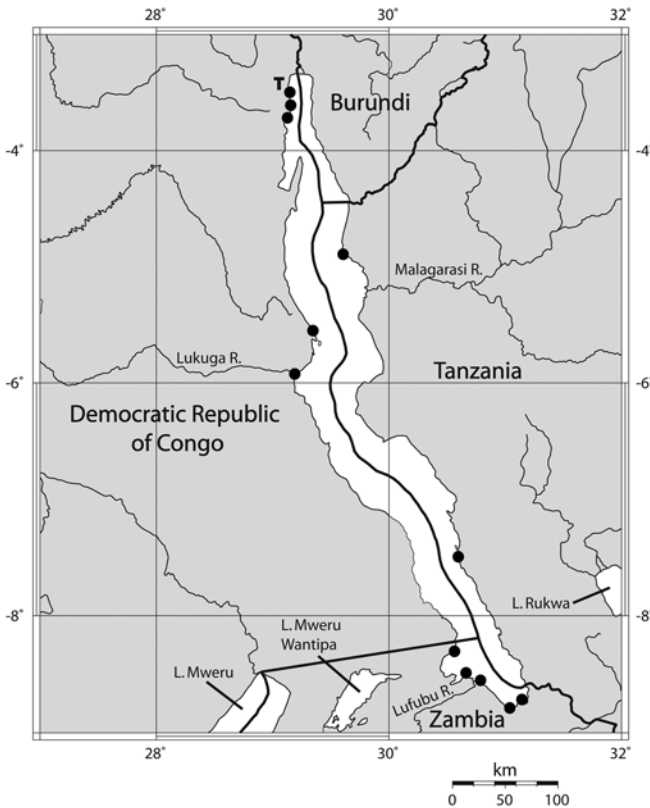


Figure 18. Known distribution of *Synodontis irsacae*. T denotes type locality.

petricola). *Synodontis irsacae* is further separated from *S. petricola* and *S. lucipinnis* in having dark fin spines (vs. white fin spines). Black triangles on the rayed fins of *S. irsacae* and the lack of papillae on the skin (vs. villous papillae) further separate this species from *S. melanostictus*, and adult *S. tanganaicae*.

Description. – Morphometric and meristic data in Table 7. Maximum TL 190 mm, SL 157 mm. Body not compressed. Predorsal profile slightly convex. Preanal profile straight to convex. Skin on body forming numerous vertical folds; papillae absent.

Head slightly depressed; broad; skin covered with granular papillae; papillae extend onto base of maxillary barbel and anterior portion of body only. Snout long, with bluntly rounded margin when viewed laterally and dorsally. Occipito-nuchal shield covered with skin; terminating posteriorly with narrow, bluntly pointed process on either side of dorsal spine; ventrally with wide, rounded process that extends to upper margin of humeral process on either side of body. Eyes dorsolateral; ovoid; horizontal axis longer. Interorbital area flat.

Mouth inferior; lips wide and papillate. Mandibular teeth 15–29, short, unicuspid; arranged in single transverse row. Premaxillary toothpad interrupted; primary, secondary and tertiary premaxillary teeth discrete; nu-

merous; arranged in 3, 1–2, and 1 irregular rows, respectively.

Maxillary barbel with distinct basal membrane; extending to, or just past base of pectoral fin; granular papillae on base and along anterior margin. Lateral mandibular barbel extending to point just short of anterior margin of pectoral girdle, with 2–7 short, tuberculate branches; secondary branches sometimes present. Medial mandibular barbel about half length of lateral barbel; with 4–5 pairs of tuberculate branches; secondary branches present.

Dorsal fin II,7; posterior margin straight. Dorsal-fin spine short; striated, slightly curved, terminating in short, dark filament; anterior margin of fin spine smooth in small specimens; becoming granulous with growth; posterior margin with small serrations distally. Pectoral fin I,8–9; posterior margin straight to broadly rounded. Pectoral-fin spine roughly equal in length to dorsal-fin spine; striated, slightly curved, terminating in short, dark filament; anterior spine margin granulous in adult specimens; smooth in juvenile specimens; posterior margin with large retrorse serrations along entire length. Adipose fin long, well developed, margin convex. Pelvic fin i,6; located at vertical midway between posterior base of dorsal fin and origin of adipose fins; tip of appressed fin barely reaches base of anal fin. Anal fin iii–v,7–9; posterior margin rounded; base located ventral to anterior third of adipose fin. Caudal fin i,7,8,i; forked; lobes rounded.

Humeral process narrow, elongated, granulous; weakly developed ridge on ventral margin; dorsal margin concave; terminating in rounded point (Fig. 5B). Axillary pore absent. Gut 0.7–0.8 times body length ($n = 5$, MRAC 130315, MRAC A3-033-P-0036-0040, UF 160941). Hindgut chamber absent.

Coloration. – Dorsum grayish to cuprous brown (Fig. 17). Belly coloration slightly lighter than dorsum. Scattered, irregularly-shaped black spots present on juvenile specimens. Spots becoming slightly smaller in large specimens. Maxillary barbel white. Mandibular barbels white, bases sometimes with scattered dusky pigmentation. Iris copper colored. Dorsal and pectoral-fin spines dark, terminating in short, light to dusky colored filaments. Anterior margin and venter of pectoral fin light colored. All rayed fins with black triangles at their base in young specimens; posterior margins white in color. Both lobes of caudal fin black, posterior margin white.

Distribution. – Lake Tanganyika (Fig. 18); common and widely distributed.

Habitat. – Littoral to benthic zones over shell, sand and mud bottoms, to a maximum depth of 40 m (Coulter

1991a).

Diet. – *Synodontis irsacae* is omnivorous, feeding on algae, sponges, ostracods, small crabs, insect larvae, and fish eggs (Matthes 1959; Coulter 1991a).

Reproduction. – As with most of the other species of *Synodontis* in the lake, information regarding the reproduction of *S. irsacae* is nonexistent.

Taxonomic Remarks. – Originally described by Matthes (1959), *Synodontis irsacae* was quickly placed in the synonymy of *S. dhonti* Boulenger (Matthes 1962). Specimens of *S. irsacae* were thought to be juvenile individuals of *S. dhonti*, a species for which the holotype was the only known specimen. A number of ontogenetic changes in external morphology and morphometric ratios were proposed to account for the differences between specimens of *S. irsacae* and the holotype of *S. dhonti*. A list of these changes, given by Matthes (1962), follows (translation by first author):

- The relative length of the snout increases.
- The relative size of the eye diminishes.
- The head and the body become more squat.
- The bone structure of the cranium, the occipito-nuchal shield and the humeral process becomes rugose and more strongly developed, causing a general increase in the relative size of the head.
- The humeral process becomes more blunt.
- The number of mandibular teeth increases.
- The band of premaxillary teeth becomes wider.
- The dorsal- and pectoral-fin spines become relatively shorter, wider and more rugose, while the anterior serrations become obscured.

Examination of material identified as *S. dhonti* and *S. irsacae* has revealed additional differences between the *S. dhonti* holotype and specimens recognized herein as *S. irsacae*.

- A large, conspicuous axillary pore is present in the holotype of *S. dhonti*, while this structure is lacking in *S. irsacae*.
- The premaxillary toothpad of *S. irsacae* is interrupted, while that of the holotype of *S. dhonti* is uninterrupted.
- The number of primary and secondary premaxillary tooth rows is different between *S. irsacae* and the holotype of *S. dhonti* (three and two vs. four and five, respectively).
- No papillae are present on the body skin of *S. irsacae*, while granulous papillae cover the body of the *S. dhonti* holotype.
- The holotype of *S. dhonti* has 25 elongated gill rakers on the first branchial arch; 10 specimens of *S. irsacae* showed a range of 12-16 gill rakers, none of which was conspicuously elongated.

In light of these new findings, *Synodontis irsacae*

is recognized herein as a distinct species from *S. dhonti*. The differences between the *S. dhonti* holotype and the *S. irsacae* specimens examined in this study do not vary with ontogeny in other Tanganyikan species of *Synodontis*, and there is no reason to believe that they do in *S. irsacae*. There have been no specimens collected that appear to be intermediate in size and appearance between *S. dhonti* and *S. irsacae* that might lend support to the idea that specimens of *S. irsacae* are juvenile *S. dhonti*. A specimen cited by Matthes (1962) as being intermediate between the two species (MRAC 90279) is actually a specimen of *S. tanganaicae*.

***Synodontis lucipinnis* n. sp.**
(Figs. 4A, 19, 20; Tables 2, 8)

Holotype. – SAIAB 77880, TL 97 mm, SL 78 mm, Zambia, Lake Tanganyika; Musende Rocks, 08°46'00"S, 031°07'00"E, 10.X.1992.

Paratypes. – (10) SAIAB 39577, TL 58-98 mm, SL 47-79 mm, Zambia, Mpulungu, Musende Rocks, 08°46'00"S, 031°51'00"E, 07.VII.1992, (3) SAIAB 77879, TL 70-85 mm, SL 56-69 mm, Zambia, Musende Rocks, 08°46'00"S, 031°06'00"E, 05.VIII.1992, (4) SAIAB 77882, TL 55-97 mm, SL 44-78 mm, Zambia, Lake Tanganyika; Musende Rocks, 08°46'00"S, 031°07'00"E, 10.X.1992, (1) SAIAB 77894, TL 88 mm, SL 73 mm, Zambia, Mbala, Lake Tanganyika, Mbita Island (northwest end), 08°45.18'S, 031°05.07'E, 29.II.2004.

Diagnosis. – Axillary pore absent; mandibular teeth 35-51; body with large spots; fin spines white; 8-9 pectoral-fin rays; black triangles on bases of all rayed fins with light colored window at base (except caudal fin); eye 25.2-35.8% snout length; premaxillary toothpad interrupted; secondary branches on medial mandibular barbel present; occipito-nuchal shield covered with skin; papillae on skin of body absent; maximum TL 100 mm.

The lack of an axillary pore distinguishes *Synodontis lucipinnis* from *S. dhonti*, *S. grandioops*, *S. granulosus*, *S. multipunctatus*, *S. petricola*, and *S. tanganaicae*. *Synodontis lucipinnis* is further separated from *S. petricola* by the presence of light colored windows at the bases of the rayed fins (with the exception of the caudal fin). Morphometric measurements vary little between these two species. *Synodontis lucipinnis* differs from *S. dhonti*, *S. granulosus*, *S. ilebrevis*, *S. irsacae*, *S. melanostictus*, *S. polli*, and *S. tanganaicae* in having white fin spines (vs. brown to black) and also differs from all of these species (with the exception of *S. irsacae*) in lacking papillae on the skin of the body. The occipito-nuchal shield being cov-

Table 8. Morphometrics and meristic counts for *S. lucipinnis*. All morphometrics given in percent of base measurement. *Meristic data for holotype. Abbreviations as in Table 3.

MEASUREMENT	HOLOTYPE	RANGE (N=18)	MEAN±SD
Body depth/SL	22.2	15.7-23.9	20.0±2.7
Head length/SL	27.6	27.6-31.2	29.8±1.0
Snout-dorsal length/SL	36.5	35.7-40.3	38.1±1.4
Adipose fin length/SL	35.5	27.6-38.7	32.6±2.9
Maxillary barbel length/SL	27.5	20.7-27.5	23.0±1.9
Dorsal spine length/SL	18.7	17.6-22.8	19.6±1.4
Pectoral spine length/SL	17.2	17.2-24.2	21.3±1.8
Head width/HL	84.4	76.0-86.1	82.9±2.7
Head depth/HL	64.5	55.0-64.5	59.6±2.5
HPL/HL	48.0	41.5-50.1	46.0±2.5
Snout length/HL	54.6	51.4-55.0	53.0±1.1
Eye/HL	18.3	13.9-18.5	16.6±1.3
Interorbital width/HL	33.1	28.5-37.1	32.0±2.3
Postorbital length/HL	33.6	33.6-38.6	35.9±1.3
Mouth length/HL	57.2	41.5-57.2	48.8±3.9
Maxillary barbel length/HL	99.5	68.5-99.5	77.4±7.7
LMB/HL	50.0	42.6-60.4	49.8±4.7
MMB/HL	24.4	19.3-28.3	24.1±2.4
MMB/LMB	48.7	42.4-61.8	48.6±5.3
Dorsal spine length/HL	67.7	59.2-76.6	66.2±4.6
Pectoral spine length/HL	62.0	62.0-79.8	71.4±4.9
Eye/Snout length	33.4	25.2-35.8	31.4±2.7
Interorbital width/Snout length	60.5	53.8-71.9	60.5±4.8
Postorbital length/Snout length	61.5	61.5-75.1	67.9±3.4
Eye/Interorbital width	55.3	43.9-58.5	52.0±4.6
Eye/Postorbital length	54.4	39.5-54.4	46.2±3.8
HPL/HPD	262.8	213.7-319.1	262.8±24.3
CPL/CPD	94.2	87.1-141.4	104.4±15.7

MERISTICS	
Mandibular tooth count	35(2); 36(3); 38(4); 39(2); 41(2); 43(1); 44(1); 47*(2); 51(1)
Dorsal fin count	II,7*(17); II,7,i(1)
Pectoral fin count	I,8*(17); I,9(1)
Pelvic fin count	i,6*(18)
Anal fin count	iv,8*(12); iv,8,i(2); iv, 9(4)
Caudal fin count	i,7,8,i(10)
Total vertebrae count	34(3); 35(6)

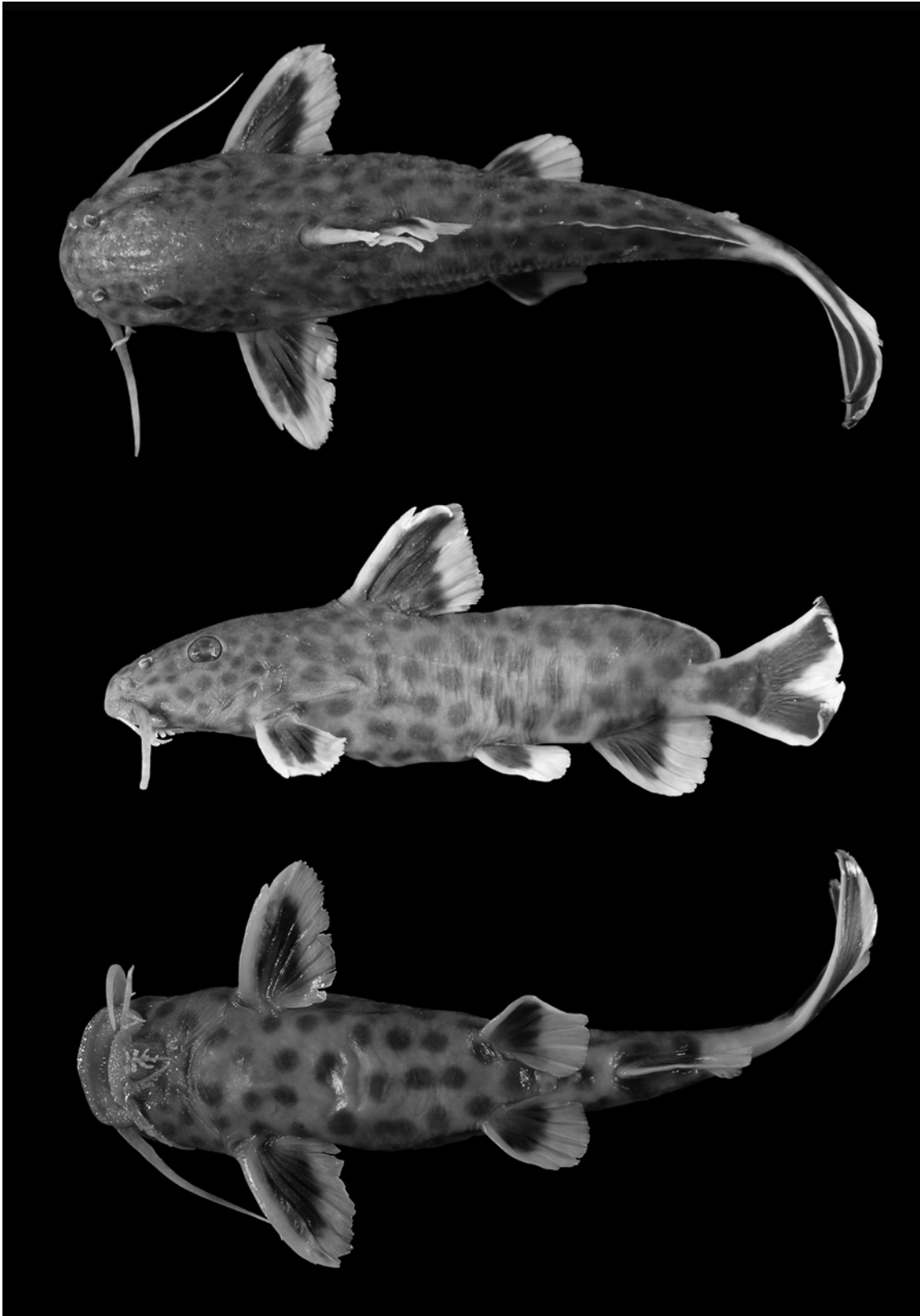


Figure 19. Holotype of *Synodontis lucipinnis*, SAIAB 77880, TL 97 mm, SL 78 mm.

ered with skin further separates *S. lucipinnis* from *S. dhonti*, *S. granulatus*, *S. melanostictus*, and *S. tanganaicae*, all of which also have a much larger maximum TL (395, 270, 520, and 585 respectively vs. 100 mm in *S. lucipinnis*). The black triangles at the base of all the rayed fins further distinguish *S. lucipinnis* from *S. melanostictus*, while the windows at the base of the triangles further differentiate *S. lucipinnis* from *S. dhonti*, *S. grandiope*, *S. granulatus*, *S. ilebrevis*, *S. irsacae*, *S. multipunctatus*, *S. polli*, and *S. tanganaicae*. *Synodontis lucipinnis* can be further separated from *S. dhonti*, *S. grandiope*, *S. granulatus*, and *S. multipunctatus* by having an interrupted premaxillary toothpad (vs. uninterrupted).

Description. – Morphometric and meristic data in Table 8. Maximum TL 100 mm, SL 80 mm. Body not compressed. Predorsal profile slightly convex. Preanal profile slightly convex. Skin on body forming numerous vertical folds; papillae absent.

Head slightly depressed and broad; skin covered with villous papillae; papillae extend onto base of maxillary barbel, pectoral fin and anterior portion of body only. Snout with bluntly rounded margin when viewed laterally and dorsally. Occipito-nuchal shield covered with skin, terminating posteriorly with wide, pointed process on either side of dorsal spine, ventrally with wide, rounded process that extends to upper margin of the humeral process on either side of body. Eyes dorsolateral; ovoid; horizontal axis longer. Interorbital area flat to slightly convex.

Mouth inferior; lips widened and papillate. Mandibular teeth 35-51, short, unicuspid; arranged in 6 short, transverse rows. Premaxillary toothpad interrupted; primary, secondary and tertiary premaxillary teeth discrete, numerous, arranged in 3, 3, and 1 irregular rows, respectively.

Maxillary barbel short; extending at least to base of pectoral spine; small papillae at base; basal membrane narrow. Lateral mandibular barbel extending to point just past anterior margin of pectoral girdle; with 4-6 short, simple, weakly tuberculate branches; usually lacking secondary branches. Medial mandibular barbel approximately 1/3 to 1/2 length of lateral barbel; with 4-6 pairs of tuberculate branches; many secondary branches present.

Dorsal fin II,7-7,i; posterior margin straight to slightly concave. Dorsal-fin spine short, striated, slightly curved, terminating in a short, white filament; anterior margin of fin spine smooth; posterior margin with small serrations distally. Pectoral fin I,8-9; posterior margin broadly rounded. Pectoral-fin spine roughly equal in length to dorsal-fin spine, striated, slightly curved termi-

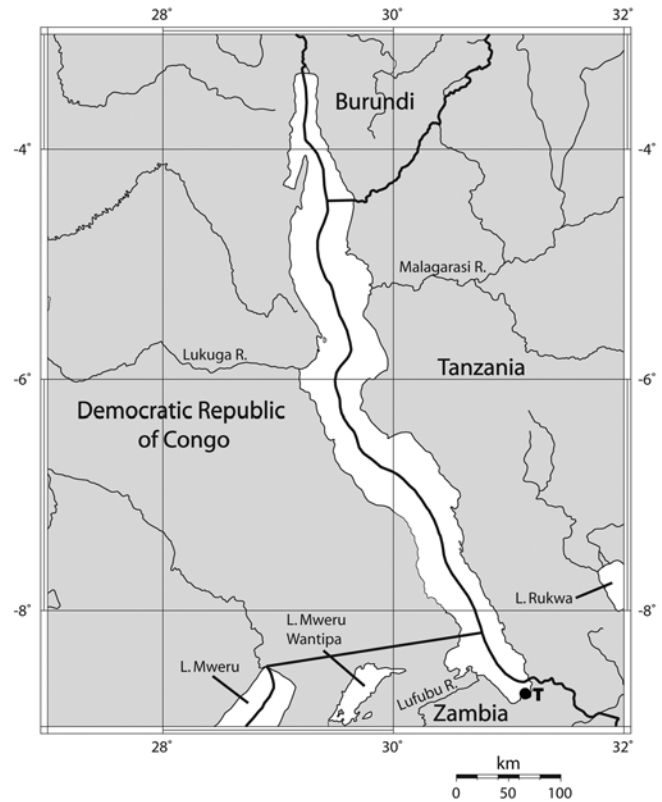


Figure 20. Known distribution of *Synodontis lucipinnis*. **T** denotes type locality.

nating in short, white filament; anterior spine margin smooth; posterior margin with large, retrorse serrations along entire length. Adipose fin long, well developed, margin convex. Pelvic fin i,6; located at vertical midway between posterior base of dorsal fin and origin of anal fin. Anal fin iv,8-9; posterior margin rounded; base located at vertical through center of adipose fin. Caudal fin i,7,8,i; forked; lobes rounded.

Humeral process triangular; granulous; covered with many small, villous papillae; poorly-developed ridge on ventral margin; dorsal margin convex; terminating in a sharp point (Fig. 4A). Axillary pore absent.

Coloration in alcohol. – Dorsum yellowish to cuprous brown, covered with large, irregularly shaped, black spots (Fig. 19). Belly lighter, with more regularly shaped black spots. Maxillary and mandibular barbels white. Iris copper colored. Dorsal and pectoral-fin spines white, terminating in short, white filaments. All rayed fins with black triangles at base; posterior margins white. Triangles have large, lightly colored windows at bases, most noticeable in dorsal and anal fins. Both lobes of caudal fin with black bar from base to tip of fin; posterior margin of fin white.

Distribution. – Lake Tanganyika (Fig. 20). Known

only from the Musende Rocks area (Mpulungu), local abundance unknown.

Habitat. – Rocky, coastal areas. Maximum depth unknown.

Diet. – Unknown.

Reproduction. – No information exists regarding the reproduction of *Synodontis lucipinnis*.

Etymology. – The specific name is a combination of the Latin *luci*, meaning bright or clear, and the Latin *pinnis*, meaning fin, a reference to the light patches found at the base of the black triangles found on the rayed fins of this species. Gender: feminine.

Synodontis melanostictus Boulenger, 1906
(Figs. 4B, 21, 22; Tables 2, 9)

Synodontis melanostictus Boulenger, 1906:553, pl. 34, description, Lofu (Lake Tanganyika); 1911:418, fig. 314, description, Lofu (Lake Tanganyika); 1916:316, note. – Pappenheim and Boulenger, 1914:251, note. – Poll, 1946:220, description, Lake Tanganyika. – Worthington and Ricardo, 1933:1067, 1077, 1101, note, Lake Tanganyika. – Ricardo-Bertram, 1940:209, first placed in synonymy of *S. nigromaculatus*. – Matthes, 1962:41, table 2, comparison of specimens from Lake Tanganyika and Mweru-Luapula, comparison with *S. serratus tanganaicae* and *S. lacustricolus*. – Sterba, 1963:408, fig. 610, Lake Tanganyika. – Coulter, 1965-1966:34, abundance at different depths, Lake Tanganyika. – Brichard, 1978:424, key.

Synodontis nigromaculatus. – Brichard, 1989:479, key, 478, 480, 483, photos. – Burgess, 1989:196, checklist, pl. 78, 82, 83, 94. – Coulter, 1991a:152, 154, 156, 181, 191, abundance, habitat, reproduction; 1991b:287, phylogenetic relationship to Tanganyikan endemics.

Material Examined. – Holotype, BMNH 1906.9.8.72, TL 290 mm, SL 237 mm, Lake Tanganyika, coll. Cunningham, (4) MRAC 100515-100518, TL 183-237 mm, SL 138-188 mm, Petite-Ruzizi, coll. G. Marlier and N. Leleup, V-VII.1955, (2) MRAC 126293-294, TL 152-172 mm, SL 122-134 mm, Uvira, Lake Tanganyika, coll. G. Marlier, 13.IX.1958, (1) MRAC 96-083-P-0002, SL 199 mm, Lufubu River, lower course, beginning of Yendwe Valley escarpment, Lake Tanganyika basin (Zambia), coll. L. De Vos, 26.X.1995.

Comparative Material Examined. – Holotype, *S. nigromaculatus*, BMNH 1905.11.10.10, TL 237 mm, SL 186 mm, Lake Bangwelo, Zambia, coll. Esq. R. Melland, (1) *S. nigromaculatus*, BMNH 1908.11.6.29, TL 244 mm, SL 177 mm, Maramba River, Upper Zambezi, coll. G.T. Corrington, (1) *S. nigromaculatus*, BMNH 1907.9.30.9, TL 319 mm, SL 238 mm, Lake

Bangwelo, coll. R.H. Melland, (4) *S. nigromaculatus*, BMNH 1920.5.26.95-102, TL 58-115 mm, SL 46-93 mm, Cape Kasangeneke, Lake Mweru, coll. L. Stappers, (6) *S. nigromaculatus*, BMNH 1943.7.27.414-421, TL 176-271 mm, SL 133-208 mm, River Chambezi, Bangweulu Swamps, and Lake Bangweulu; coll. C. Ricardo et al., (1) *S. nigromaculatus*, BMNH 1976.3.18: 2439-2440, TL 192 mm, SL 153 mm, Thalamakane River at Maun (Botswana), coll. K. Berne, (1) *S. nigromaculatus*, MRAC 34006, TL 383 mm, SL 307 mm, Lukonzolwa, Lake Moero, coll. DeWitte, 9-17.II.1931, (1) *S. nigromaculatus*, MRAC 34007, TL 324 mm, SL 250 mm, Lukonzolwa, Lake Moero, coll. DeWitte, 9-17.II.1931, (2) *S. nigromaculatus*, MRAC 37814-815, TL 177-317 mm, SL 134-252 mm, Kasenga, Luapula River, coll. DeWitte, 10.III.1931, (1) *S. nigromaculatus*, MRAC 56319-56320, TL 132 mm, SL 104 mm, Luapula au Bangwelo, coll. Breolo, III.1938, (2) *S. nigromaculatus*, MRAC 162207-208, TL 86-114 mm, SL 62-87 mm, Dundo, afflt. Luachimo River called “Musapa wa Kamakenza” by indigenous peoples (Angola), coll. Barros Machado (Dundo Museum), 2.VI.1949, (1) *S. nigromaculatus*, MRAC 87132-133, TL 154 mm, SL 129 mm, Kasaji, Katanga, coll. Rev. S. Fischer, 5.XII.1952, (1) *S. nigromaculatus*, MRAC 162219, TL 183 mm, SL 141 mm, Lake Calundo, coll. indigenous peoples, I.1955, (2) *S. nigromaculatus*, MRAC 162210-213, TL 274-306 mm, SL 209-229 mm, Chiumbe River, near the junction with the Chilambo River (S7°45', E21°05') (Angola), coll. Barros Machado (Dundo Museum), 24.XI.1957, (1) *S. nigromaculatus*, MRAC 149537, TL 181 mm, SL 142 mm, Luwohoshi River, affl. Ruashi River, village of Shindaika, Katanga, coll. M. Lips, 25.III.1963, (1) *S. nigromaculatus*, MRAC 165806-807, TL 104 mm, SL 80 mm, Chambeshi River (Zambia), coll. H. Matthes, 16.VI.1965, (1) *S. nigromaculatus*, MRAC 172442, TL 177 mm, SL 134 mm, Lake Bangwelo, coll. Bell-Cross, (1) *S. nigromaculatus*, MRAC 94-019-P-1007, TL 152 mm, SL 116 mm, South Mofwe Lagoon, Luapula Swamp (Zambia), coll. P. Van Zweiten, 16.II.1993-26.III.1993, (1) *S. nigromaculatus*, MRAC 94-019-P-2136, TL 208 mm, SL 158 mm, Pembe lagoon, near Katotoma, south lagoon, Luapula swamps (Zambia), coll. P. Van Zweiten, 17.VIII.1993, (1) *S. nigromaculatus*, MRAC 162203-204 (orig. I.D. *S. zambesensis*), TL 180 mm, SL 132 mm, Nhefo River, afflt. The river to the left of the Luachimo, close to 50 km S. of Dundo (Angola), coll. Barros Machado (Dundo Museum), III.1948, (1) *S. nigromaculatus*, MRAC 162206 (orig. I.D. *S. zambesensis*), TL 241 mm, SL 186 mm, Dundo, Luachimo River (Angola), coll. Barros Machado (Dundo

Museum), XI.1948, (1) *S. nigromaculatus*, MRAC 162214 (orig. I.D. *S. zambesensis*), TL 265 mm, SL 196 mm, Dundo, Luachimo River, barrage (Angola), coll. Casalescol (Dundo Museum), 12.V.1960, (1) *S. nigromaculatus*, MRAC 162215 (orig. I.D. *S. zambesensis*), TL 180 mm, SL 136 mm, Cachimo, Tuembe River, S8°06', E21°29' (Angola), coll. A.L. Teixeira (Dundo Museum), 22.VIII.1961, (1) *S. nigromaculatus*, MRAC 149538 (orig. I.D. *S. zambesensis*), TL 160 mm, SL 122 mm, Moushoshi River near the junction with the Kofubu River (Katanga), coll. M. Lips (don. M. Mignolet), 6.V.1963.

Diagnosis. – Axillary pore absent; mandibular teeth 23-36; body with small spots; fin spines brown; 9-10 pectoral-fin rays; black triangles absent on all rayed fins; eye 31.5-38.1% of snout length; premaxillary toothpad interrupted; secondary branches on medial mandibular barbel absent; occipito-nuchal shield not covered by skin; villous papillae present on skin of body; hindgut chamber present; maximum TL 520 mm;

The only species of *Synodontis* not endemic to the Lake Tanganyika basin, *S. melanostictus* lacks the rayed fin coloration common to almost all of its Tanganyikan congeners, having spotted fins which completely lack black triangles at their bases. The black triangles on the fins of *S. tanganaicae* may become indistinct in large specimens and the body may have small black spots that resemble those found in *S. melanostictus*. In these cases, mandibular tooth counts (23-36 in *S. melanostictus* vs. 33-49 in *S. tanganaicae*), differences in eye size (31.5-38.1% of snout length in *S. melanostictus* vs. 16.0-26.9% in *S. tanganaicae*), the villous papillae on the skin of *S. melanostictus* (vs. granular in *S. tanganaicae*), and differences in humeral process shape (Fig. 4) distinguish these species from one another. *Synodontis melanostictus* differs from *S. dhonti* in having a greater number of mandibular teeth (23-36 vs. 22), an interrupted premaxillary toothpad (vs. uninterrupted), and small, black spots covering the body (vs. spots absent).

Description. – Morphometric and meristic data in Table 9. Maximum TL 520 mm, maximum SL 425 mm. Body compressed laterally. Predorsal profile straight anterior to eye; slightly convex posterior to eye. Preanal profile straight. Skin on body lacking vertical folds; covered with villous papillae, not extending onto fins.

Head depressed and broad, skin covered with small, granular papillae. Snout with subconical margin when viewed laterally, bluntly pointed margin when viewed dorsally. Occipito-nuchal shield rugose, not covered with skin; terminating posteriorly with narrow, rounded process on either side of dorsal spine; ventrally with wide,

rounded process that extends to upper margin of humeral process on either side of body. Eyes dorsolateral, ovoid, horizontal axis longer. Interorbital area flat to slightly convex.

Mouth subterminal; lips wide and papillate. Mandibular teeth 23-36, short, unicuspid; arranged in single transverse row. Premaxillary toothpad interrupted; primary, secondary, and tertiary premaxillary teeth discrete; primary premaxillary teeth in 2-3 rows; secondary premaxillary teeth in 2-3 rows; tertiary premaxillary teeth in 1-2 rows.

Maxillary barbel with narrow basal membrane; lacking branches or crenulations; extending at least to the base of the pectoral fin. Lateral mandibular barbel extending to point just short of anterior margin of pectoral girdle; with 7-8 long, non-tuberculate branches; short secondary branches present. Medial mandibular barbel about half the length of the lateral barbel; with 4-5 pairs of non-tuberculate branches; secondary branches present.

Dorsal fin II,7; posterior margin concave. Dorsal fin-spine long, striated, slightly curved, terminating in short black filament; anterior margin of fin spine smooth; posterior margin with small serrations distally. Pectoral fin I,9-10; posterior margin straight. Pectoral-fin spine roughly equal in length to dorsal-fin spine, striated, slightly curved, terminating in a moderate length filament; anterior spine margin with many fine, long, antrorse serrations along anterior margin; posterior margin with large, retrorse serrations along entire length. Adipose fin long, well developed, margin convex. Pelvic fin i,6; located anterior to vertical through posterior base of dorsal fin; tip of appressed fin barely reaches base of anal fin. Anal fin iii-v,7-9; posterior margin nearly straight; base located ventral to first 1/3 of adipose fin. Caudal fin forked, i,7,8,i.

Humeral process triangular; wide at base; tapering to sharp point; striated along lower half; becoming granulous along upper margin; possessing weakly developed ridge along ventral margin; dorsal margin slightly concave (Fig 4B). Axillary pore absent. Gut 1.3-1.6 times body length (n=2, MRAC 100515-100518). Well developed hindgut chamber.

Coloration in alcohol. – Body grayish to cuprous brown (Fig. 21). Belly pale. Scattered, small black spots present, sometimes confluent. Maxillary and mandibular barbels white. Iris copper colored. Dorsal- and pectoral-fin spines brown, terminating in dusky filaments. All rayed fins with small, black spots, similar to those found on body.

Distribution. – Lake Tanganyika and its tributaries (Fig. 22).

Habitat. – Littoral to benthic zones over shell, sand

Table 9. Morphometric and meristic counts for *Synodontis melanostictus*. All morphometrics given in percent of base measurement. *Meristic data for holotype. Abbreviations as in Table 3.

MEASUREMENT	HOLOTYPE	RANGE (n=8)	MEAN±SD
Body depth/SL	20.0	20.0-23.4	21.8±0.9
Head length/SL	25.8	25.8-28.4	26.7±0.9
Snout-dorsal length/SL	36.3	36.2-40.3	37.5±1.4
Adipose fin length/SL	29.4	16.1-34.5	25.0±5.0
Maxillary barbel length/SL	32.4	27.5-41.6	33.4±4.8
Dorsal spine length/SL	24.9	23.3-27.5	25.3±1.7
Pectoral spine length/SL	25.2	21.5-26.6	25.0±1.8
Head width/HL	97.3	90.6-98.6	95.1±2.8
Head depth/HL	77.0	70.9-81.8	75.3±4.0
Humeral process length/HL	60.0	60.0-70.8	66.5±3.6
Snout length/HL	51.3	50.6-52.1	51.4±0.6
Eye/HL	17.0	16.4-19.3	17.5±1.0
Interorbital width/HL	41.0	34.1-41.0	37.8±2.4
Postorbital length/HL	38.8	34.5-38.8	36.2±1.4
Mouth length/HL	32.6	30.9-40.0	34.3±3.4
Maxillary barbel length/HL	125.5	103.6-158.2	125.2±18.8
LMB/HL	100.8	69.5-107.3	87.8±14.3
MMB/HL	45.3	26.6-51.2	41.5±8.2
MMB/LMB	44.9	36.3-52.6	47.2±5.3
Dorsal spine length/HL	96.6	88.6-104.0	94.5±5.5
Pectoral spine length/HL	97.8	80.7-101.3	94.0±7.7
Eye/Snout length	33.1	31.5-38.1	34.2±2.1
Interorbital width/Snout length	79.8	67.2-79.8	73.6±4.4
Postorbital length/Snout length	75.6	67.4-75.6	70.5±2.7
Eye/Interorbital width	41.5	41.5-56.7	46.7±5.2
Eye/Postorbital length	43.8	43.8-55.8	48.6±4.0
HPL/HPD	200.1	200.1-255.9	238.2±17.4
CPL/CPD	113.0	66.9-116.4	100.1±16.8
MERISTICS			
Mandibular tooth count		23(1); 27(3); 29(1); 31(1); 35(1); 36*(1)	
Dorsal fin count		II,7*(8)	
Pectoral fin count		I,9*(7); I,10(1)	
Pelvic fin count		i,6*(8)	
Anal fin count		iii,9(2); iv,8,i(3); iv,9(2); v,9*(1)	
Caudal fin count		i,7,8,i(5)	
Total vertebrae count		38(3); 39(2)	

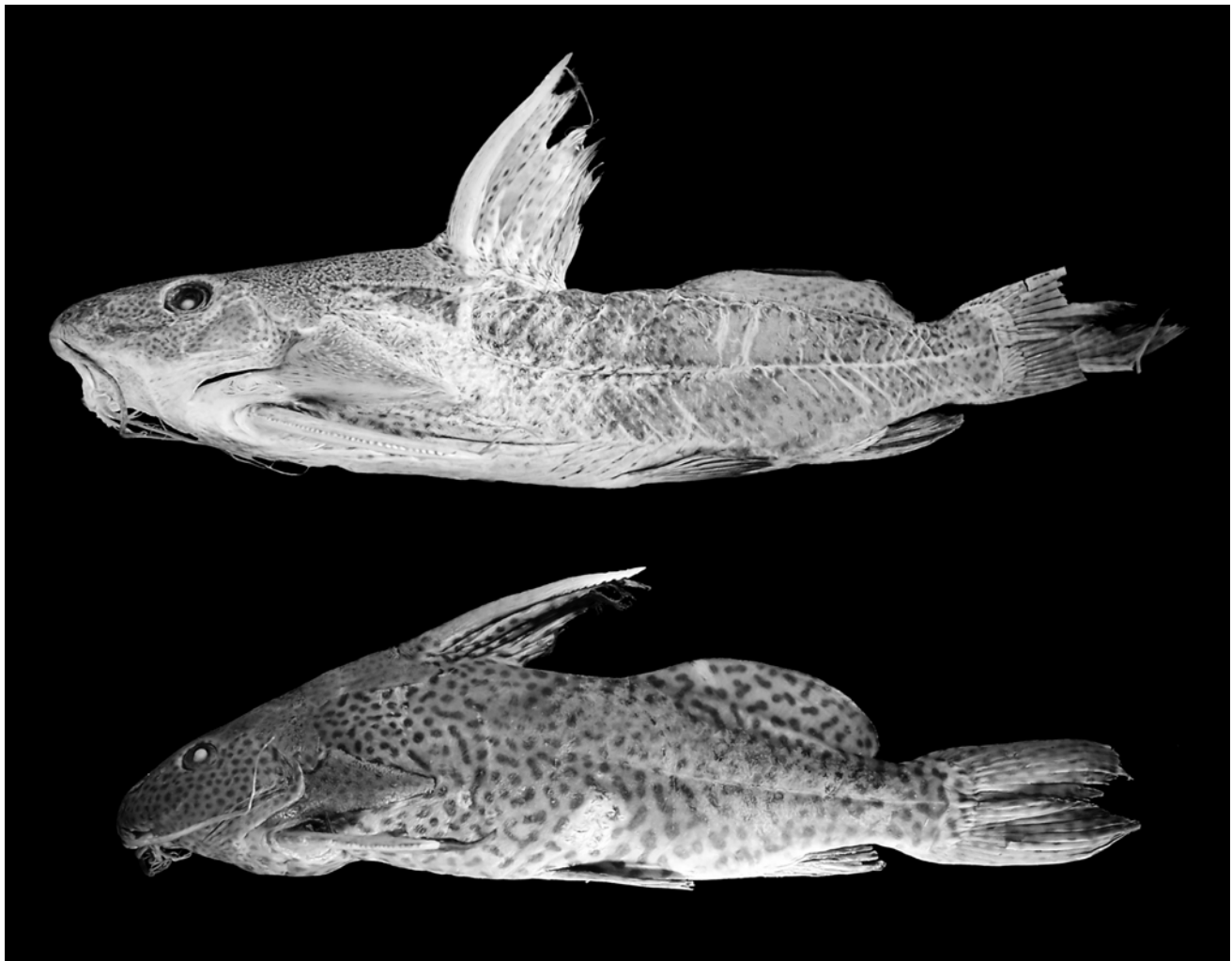


Figure 21. *Top* – Holotype of *S. melanostictus*, BMNH 1906.9.8.72, 290 mm TL, 237 mm SL. *Bottom* – Holotype of *S. nigromaculatus*, BMNH 1905.11.10.10, 237 mm TL, 186 mm SL.

and mud bottoms, to a maximum depth of 150 m (Coulter 1991a).

Diet. – Nothing is known about the diet of this species.

Reproduction. – Coulter (1991) cites Matthes (1962) as reporting that gravid females *S. melanostictus* were found to contain up to 3,000 eggs. The latter reference, however, includes no egg counts or other information on the reproduction of *S. melanostictus*.

Taxonomic Remarks. - *Synodontis nigromaculatus* Boulenger was described from Lake Bangweulu (Zambia) and has since been reported from the Congo, Cunene, Limpopo, Luapula, Okovango, and Zambezi Rivers, as well as Lakes Mweru and Tanganyika (Boulenger 1905; Poll 1971). Some of these populations (Congo and Limpopo Rivers, Lake Tanganyika) have been described as new species or iden-

tified as other previously described species, only to be synonymized with *S. nigromaculatus* in later works, based on similarities in morphometric ratios (Boulenger 1923, Poll 1967, 1971). While the identity of specimens from some drainages is questionable, we can be certain that *S. nigromaculatus* occurs in Lake Bangweulu, and probably also occurs in Lake Mweru and the Luapula River, which joins the two lakes. Tanganyikan specimens were therefore compared primarily to specimens from these areas. These comparisons have shown that Lake Tanganyikan specimens are diagnosible from *S. nigromaculatus*.

Synodontis melanostictus Boulenger was described from the Lofu River (now the Lofubu), a tributary of Lake Tanganyika, and was distinguished from *S. nigromaculatus* by having numerous, villous papillae on the body (Boulenger 1906). Ricardo-Bertram (1940)

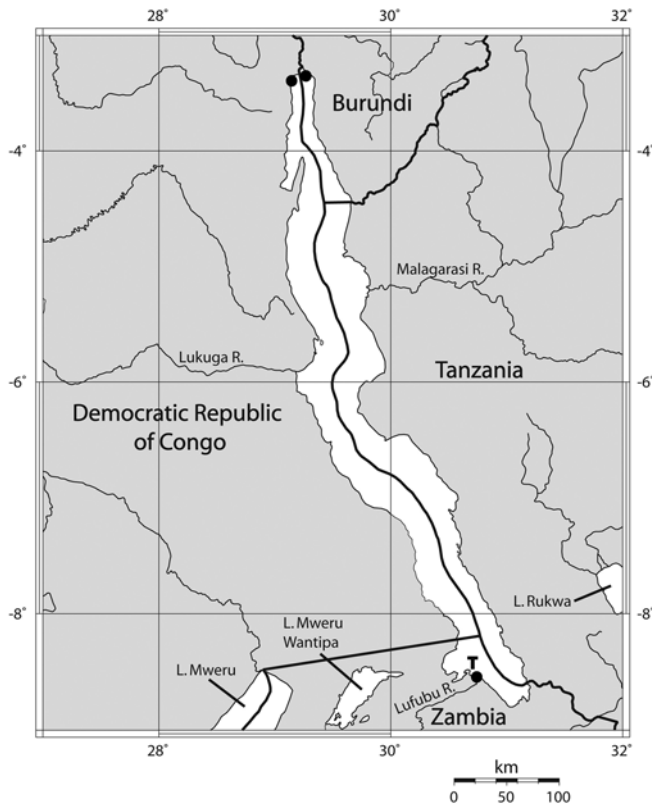


Figure 22. Known distribution of *Synodontis melanostictus*. T denotes type locality.

first suggested placing *S. melanostictus* in the synonymy of *S. nigromaculatus*, stating that the presence or absence of these papillae depended upon the condition and preservation of a particular specimen. This appears to be the case in the holotype of *S. melanostictus*, which lacks any indication of papillae on its body. While the papillae are not as diagnostic as was once thought, other evidence has been found to support the distinctiveness of *S. melanostictus*.

The interrupted condition of the premaxillary toothpad of *Synodontis melanostictus* differentiates it from *S. nigromaculatus*, in which the premaxillary toothpad is uninterrupted. Vertebral counts also differ between these species with *S. melanostictus* having 38-39 total vertebrae ($n=5$, BMNH 1906.9.8.72, MRAC 100515-100518) vs. 36-37 in *S. nigromaculatus* ($n=13$, BMNH 1905.11.10.10, 1920.5.26.95-102, 1943.7.27.414-421, 1976.3.18: 2439-2440). Finally, although small dark spots are present in both species, these spots are discrete in *S. melanostictus*, while *S. nigromaculatus* always has some confluent spots (Fig. 21). Based upon these differences, *S. melanostictus* is recognized herein as a valid species that is endemic to the Lake Tanganyika drainage.

Synodontis multipunctatus Boulenger, 1898
(Figs. 2, 3B, 8, 23, 24; Tables 1, 10)

Synodontis multipunctatus Boulenger, 1898:24, pl. 8, description, Sumba (Lake Tanganyika); 1899:95, note, Lake Tanganyika; 1901:313, pl. 15, description, Sumbu, Kalambo, Moliro, Albertville; 1901b:149, Kalambo (Lake Tanganyika); 1906:553, Niamkolo (Lake Tanganyika); 1911:420, fig. 316, description, Sumba, Kalambo, Niamkolo. – Moore, 1903:166, fig., description, Sumbu (Lake Tanganyika). – Worthington and Ricardo, 1933:1067, 1077, 1101, note, diet, Usumbura, Kigoma, Kala (Lake Tanganyika). – Borodin, 1936:10, Kasanga (Lake Tanganyika). – David and Poll, 1937:267, Tembwe, Moba, Rumonge, Uvira. – Poll, 1946:220, description, Lake Tanganyika; 1953:155, pl. 6, fig. 4, description, diet, Lake Tanganyika. – Hulot, 1950:170, diet, Lake Tanganyika. – Lambert, 1960:26, figs. 26 and 27, note. – Matthes, 1962:5, photo, 45, note, sexual dimorphism, Uvira (Lake Tanganyika). – Coulter, 1965-1966:34, table, abundance at different depths, Lake Tanganyika; 1991a:152, 154, 181, 182, table 8.2, 8.3, 8.16, abundance, ecology, Lake Tanganyika. – Brichard, 1978:360, 361, 423, photos, identification, Lake Tanganyika; 1989:476, 478, 481, 483, 474, 479, photos, coloration and identification. – Sands, 1983:23, 24, 76, check-list, diet, photo. – Daget, Gosse, & Thys van den Audenaerde, 1986:134, check-list. – Sato, 1986:58-59, brood parasitism, Lake Tanganyika. – Burgess, 1989:190, pl. 74, 77, 78, 85, 94, behavior, Lake Tanganyika. – Kobayagowa, 1989:14, photo.

Material Examined. – Holotype, BMNH 1898.9.9.76, TL 280 mm, SL 220 mm, Sumba, coll. J.E.S. Moore, (2) BMNH 1906.9.8.70-71, TL 249-267 mm, SL 193-205 mm, Niamkolo, L. Tanganyika, coll. Cunningham, (2) BMNH 1955.12.20.1840-1841, TL 213-256 mm, SL 168-199 mm, Usumbura, L. Tanganyika, coll. Inst. Roy. Sci. Nat. Belge, (1) BMNH 1955.12.20.1836, TL 78 mm, SL 61 mm, Nyanza Bay, L. Tanganyika, coll. Inst. Roy. Sci. Nat. Belge, (2) BMNH 1955.12.20.1857-1858, TL 200-214 mm, SL 152-172 mm, Lagosa, L. Tanganyika, coll. Inst. Roy. Sci. Nat. Belge, (1) BMNH 1955.12.20.1852, TL 99 mm, SL 75 mm, Moba Bay, Lake Tanganyika, coll. Inst. Roy. Sci. Nat. Belge, (1) BMNH 1955.12.20.1842, TL 225 mm, SL 175 mm, Albertville, indigenous market, Lake Tanganyika, coll. Inst. Roy. Sci. Nat. Belge, 21.XI.1946, (1) BMNH 1955.12.20.1845, TL 213 mm, SL 168 mm, M'Pala, L. Tanganyika, coll. Inst. Roy. Sci. Nat. Belge, 7.I.1947, (1) BMNH 1955.12.20.1833, TL 69 mm, SL 54 mm, Moba Bay, L. Tanganyika, coll. Inst. Roy. Sci.

Nat. Belge, 7.III.1947, (2) BMNH 1955.12.20.1855-1856, TL 150-209 mm, SL 123-166 mm, S. of Malagarasi delta, offshore of the southern point of the Malagarasi delta, L. Tanganyika, coll. Inst. Roy. Sci. Nat. Belge, 26.III.1947, (2) BMNH 1955.12.20.1838-1839, TL 136-214 mm, SL 107-175 mm, opposite the Lugumba R., Lake Tanganyika, coll. Inst. Roy. Sci. Nat. Belge, 23.V.1947, (2) BMNH 1982.4.13:4789-4790, TL 93-115 mm, SL 76-91 mm, Kigonga Bay, L. Tanganyika, coll. R. Travers, (3) BMNH 2005.9.26.5-7, TL 67-79 mm, SL 53-64 mm, Mpulungu, Lake Tanganyika (Zambia), coll. J. Day, 2005, (3) BMNH 2005.9.26.8-10, TL 61-69 mm, SL 48-55 mm, Edith Bay, Lake Tanganyika (Tanzania), coll. J. Day, 2005, (1) BMNH 2005.9.26.11-16, TL 94 mm, SL 73 mm, Kigoma, Tanzania, coll. J. Day, 2005, (3) BMNH 2005.9.26.19-21, TL 99-106 mm, SL 77-84 mm, Democratic Republic of Congo, Lake Tanganyika, coll. J. Day, 2005, (5) BMNH 2005.9.26.70-74, TL 71-99 mm, SL 54-74 mm, Kigoma, Lake Tanganyika (Tanzania), coll. J. Day, 2005, (2) MRAC 39189-39192, TL 94-96 mm, SL 72-73 mm, Moba (Lake Tanganyika), coll. Van Maldern, 1932, (3) MRAC 53098-53100, TL 104-112 mm, SL 79-88 mm, Nyanza (L. Tang.), coll. A. Testiade, 1937, (1) MRAC 90265, TL 211 mm, SL 165 mm, Albertville, coll. Poll (Expl. Hydrol. Tang.), 21.XI.1946, (2) MRAC 90276-90277, TL 200-216 mm, SL 152-166 mm, Stat: 63, offshore from the Malagarasi, 10-15 km from the coast, coll. M. Poll, 3.II.1947, (2) MRAC 90283-90284, TL 94-236 mm, SL 74-187 mm, Stat. 224, Moba Bay, coll. Poll (Expl. Hydrol. Tang.), 4.IV.1947, (1) MRAC 90287, TL 207 mm, SL 161 mm, Stat. 250, Bay of Burton, over the bottom of the bay, coll. M. Poll (Exp. Hydr. Tang.), 18-19.IV.1947, (1) MRAC 91608, TL 203 mm, SL 150 mm, Uvira, Lake Tanganyika, coll. G. Marlier, 1.IX.1949, (1) MRAC 80538, TL 183 mm, SL 143 mm, Rumonge (L. Tang.), coll. Buscoïn, 1950, (3) MRAC A3-033-P-0050-0052, TL 75-105 mm, SL 60-83 mm, Magara, route Bujumbura-Nyanza Lac (Burundi), coll. L. De Vos, 19.10.1994, (1) MRAC A1-094-P-0054, TL 80 mm, SL 61 mm, Kasakalawe, Lake Tanganyika, S8°47.23', E31°04.40' (Zambia), coll. Snoeks, Hanssens, Verheyen et al., (2) SAIAB 39578, TL 77-85 mm, SL 62-67 mm, Zambia, Lake Tanganyika; Mpulungu, Musende Rocks, 08°46'00"S, 031°51'00"E, coll. 7.VII.1992, (3) SAIAB 40174, TL 58-96 mm, SL 45-76 mm, Zambia, Lake Tanganyika; Musende Rocks, 08°46'00"S, 031°06'00"E, coll. 05.VIII.1992, (1) SAIAB 56212, TL 73 mm, SL 57 mm, Kigoma Bay, below Hill top Hotel, Tanzania, 04°53'03"S, 029°37'11"E, coll. 08.X.1997, (1) SAIAB 56251, TL 71 mm, SL 58 mm, Jacobsen's Beach, Tanzania, 04°54'31"S, 029°36'02"E, coll. 04.X.1997, (2)

SAIAB 56254, TL 82-97 mm, SL 63-78 mm, Jacobsen's Beach, Tanzania, 04°54'31"S, 029°36'02"E, 05.X.1997, (1) SAIAB 76164, TL 78 mm, SL 63 mm, Zambia, Mbala, Lake Tanganyika; Mbata Island (northwest end), 8°45.18'S, 31°05.07'E, 29.II.2004, (3) SAIAB 76175, TL 56-76 mm, SL 44-59 mm, Zambia, Mbala, Lake Tanganyika; Musende Rocks beach, 08°45.18'S, 31°05.07'E, 29.II.2004, (1) UF 160941, TL 127 mm, SL 100 mm, Cape Chaitika, Lake Tanganyika (Zambia), via P. Hauschner, V.2005, (2) CU 90975, TL 101-103 mm, SL 77-79 mm, Tanzania; Kigoma; Jacobsen's Beach; coll. Catherine Wagner, 13.VIII.2005.

Diagnosis. – Axillary pore present; mandibular teeth 13-29; body with large spots; fin spines dark; 8 pectoral-fin rays; black triangles at base of pelvic and anal fins absent or poorly developed; eye 44.9-62.0% snout length; premaxillary toothpad uninterrupted; secondary branches on medial mandibular barbel absent; occipito-nuchal shield usually covered with skin; papillae on skin of body absent; hindgut chamber absent; maximum TL 280 mm.

Synodontis multipunctatus can be distinguished from *S. ilebrevis*, *S. irsacae*, *S. lucipinnis*, *S. melanostictus*, and *S. polli* by the presence of an axillary pore. *Synodontis multipunctatus* differs from *S. petricola* in having a large axillary pore (vs. small in *S. petricola*), brown to black fin spines (vs. white in *S. petricola*), a much larger eye (44.9-62.0% of snout length in *S. multipunctatus* vs. 28.7-40.1% in *S. petricola*), and an uninterrupted premaxillary toothpad. This premaxillary toothpad condition also helps to distinguish *S. multipunctatus* from *S. ilebrevis*, *S. irsacae*, *S. lucipinnis*, *S. melanostictus*, *S. polli*, and *S. tanganaicae*. The number of mandibular teeth further separates *S. multipunctatus* from *S. ilebrevis*, *S. lucipinnis*, *S. melanostictus*, *S. petricola*, *S. polli*, and *S. tanganaicae*, as well as from *S. granulosus* (13-29 in *S. multipunctatus* vs. 50-66 in *S. ilebrevis*, 35-51 in *S. lucipinnis*, 23-36 in *S. melanostictus*, 31-50 in *S. petricola*, 40-70 in *S. polli*, 33-49 in *S. tanganaicae*, and 28-51 in *S. granulosus*). *Synodontis multipunctatus* can be further distinguished from other endemic Tanganyikan species (with the exception of *S. grandioops*) by its lack of well developed black triangles at the base of the pelvic and anal fins. *Synodontis multipunctatus* can be distinguished from *S. dhonti* and further differentiated from *S. granulosus* and *S. tanganaicae* by the presence of many large spots (vs. spots absent or very small), skin covering the occipito-nuchal shield, and lack of papillae on the body. *Synodontis multipunctatus* is further distinguished from *S. dhonti* and *S. tanganaicae* by the lack of secondary

Table 10. Morphometrics and meristic counts for *Synodontis multipunctatus*. All morphometrics given in percent of base measurement. *Meristic data for holotype. Abbreviations as in Table 3.

MEASUREMENT	HOLOTYPE	RANGE (n=66)	MEAN±SD
Body depth/SL	28.8	19.6-29.4	24.3±2.2
Head length/SL	28.6	26.2-33.2	30.0±1.3
Snout-dorsal length/SL	39.2	35.8-42.7	40.0±1.3
Adipose fin length/SL	25.2	23.9-34.9	29.2±2.2
Maxillary barbel length/SL	34.6	21.5-48.6	31.1±5.1
Dorsal spine length/SL	27.0	22.7-35.3	26.9±2.4
Pectoral spine length/SL	26.2	21.1-31.3	26.8±1.8
Head width/HL	88.2	78.5-92.7	84.0±3.1
Head depth/HL	96.8	69.3-96.7	77.7±5.3
HPL/HL	59.8	47.8-66.0	57.0±3.9
Snout length/HL	47.1	41.8-50.8	45.8±1.6
Eye/HL	22.2	21.6-30.2	25.3±1.7
Interorbital width/HL	42.7	29.7-42.7	35.0±2.2
Postorbital length/HL	39.1	29.7-41.7	37.3±2.1
Mouth length/HL	34.3	24.2-42.3	32.8±3.5
Maxillary barbel length/HL	120.7	68.3-133.8	102.4±16.4
LMB/HL	53.6	39.9-78.1	54.4±8.7
MMB/HL	27.0	18.2-39.0	27.5±4.5
MMB/LMB	50.4	33.0-67.2	51.0±6.8
Dorsal spine length/HL	94.2	73.2-111.3	89.6±9.2
Pectoral spine length/HL	91.4	66.9-106.0	89.3±7.4
Eye/Snout length	47.1	44.9-62.0	55.4±3.9
Interorbital width/Snout length	90.7	64.3-90.7	76.6±4.7
Postorbital length/Snout length	83.0	61.7-94.5	81.7±6.0
Eye/Interorbital width	51.9	51.9-87.6	72.5±6.3
Eye/Postorbital length	56.8	55.6-91.0	68.1±6.9
HPL/HPD	267.7	221.2-414.9	307.6±36.5
CPL/CPD	130.8	109.8-190.2	142.1±18.6

MERISTICS

Mandibular tooth count	13(2); 14(4); 15(3); 16(6); 17(4); 18(8); 19*(5); 20(5); 21(6); 22(10); 23(3); 24(6); 26(3); 29(1)
Dorsal fin count	II,7*(66)
Pectoral fin count	I,8*(66)
Pelvic fin count	i,6*(66)
Anal fin count	iii,6(9); iii,6,i(2); iii,7(28); iii,7,i(5); iii,8*(10); iv,6(4); iv,6,i(2); iv,7(3); iv,7,i(1); iv,8(2)
Caudal fin count	i,7,8,i(4)
Total vertebrae count	33(3); 34(1)

branches on the medial mandibular barbel. *Synodontis multipunctatus* and *S. grandioops* are most reliably separated by pectoral-fin ray counts (8 unbranched elements in *S. multipunctatus* vs. 7 in *S. grandioops*) and eye size (44.9-62.0% of snout length in *S. multipunctatus* vs. 64.2-81.0% in *S. grandioops*).

Description. – Morphometric and meristic data in Table 10. Maximum TL 280 mm, SL 220 mm. Body moderately compressed laterally. Predorsal profile straight to slightly concave. Preanal profile convex. Skin on body forming numerous vertical folds; papillae absent.

Head depressed and broad; skin smooth in all but largest specimens, where ridges from underlying bone protrude. Snout subconical when viewed laterally; rounded when viewed dorsally. Occipito-nuchal shield rugose; completely covered with skin in smaller specimens (<150 mm), lacking skin in larger specimens; terminating posteriorly with narrow, bluntly pointed process on either side of dorsal spine; ventrally with wide, rounded process that extends to upper margin of humeral process on either side of body, also covered with skin in smaller specimens. Eyes dorsolateral; ovoid; horizontal axis longer. Interorbital area slightly concave to slightly convex.

Mouth subterminal; lips slightly widened, papillate. Mandibular teeth 13-29, short, unicuspid; arranged in a single transverse row. Premaxillary toothpad uninterrupted; primary, secondary and tertiary premaxillary teeth discrete, numerous, arranged in 3, 3, and 2 irregular rows, respectively.

Maxillary barbel with or without thin basal membrane; lacking branches or crenulations; extending anywhere from base of the pectoral fin to end of humeral process. Lateral mandibular barbel extending to point just beyond posterior margin of pectoral girdle; with 4-6 long, non-tuberculate branches; lacking secondary branches. Medial mandibular barbel 1/3 to 1/2 length of lateral barbel; with 3-4 pairs of non-tuberculate branches; lacking secondary branches.

Dorsal fin II,7; posterior margin slightly concave to straight. Dorsal-fin spine long, striated, nearly straight, terminating in short, white filament; anterior margin of fin spine with 0-3 small serrations distally; posterior margin with small serrations distally. Pectoral fin I,8; posterior margin straight. Pectoral-fin spine roughly equal in length to dorsal-fin spine, striated, slightly curved, terminating in short, white filament; anterior spine margin smooth in adult specimens; many small, antrorse serrations along anterior margin in juvenile specimens; posterior margin with large, retrorse serrations along entire length. Adipose fin short, poorly developed, margin con-

vex. Pelvic fin i,6; located anterior to vertical through origin of adipose fin; tip of appressed fin not reaching base of anal fin. Anal fin iii-iv,6-8; posterior margin nearly straight; base located ventral to center of adipose fin. Caudal fin i,7,8,i; forked; lobes pointed.

Humeral process narrow in juveniles, becoming wider in adults; elongated; granulous; possessing distinct ridge on its ventral margin in young specimens; ridge becoming indistinct in adults; dorsal margin concave; terminating in sharp point (Fig. 3B). Large, dark-colored axillary pore present just ventral to humeral process. Gut 0.5-0.8 times body length (n = 4, (2) MRAC 53098-53100, MRAC 90276-90277). Hindgut chamber absent.

Coloration. – Dorsum pale yellow to brown, covered with large black spots (Fig. 8, 23). Spots larger, irregular, sometimes confluent in juvenile specimens. Belly white, with or without black spots. Maxillary and mandibular barbels white. Iris yellowish to copper colored. Dorsal and pectoral-fin spines brown to black, filaments white. Pectoral spine with thin, light stripe along anterior margin. Dorsal and pectoral fins with black triangles at base, posterior margins white in color. Triangles in this species may be completely solid or composed of closely spaced spots. Anal and pelvic fins white, lacking dark triangles of other Tanganyikan species; single black spot may be present at base of these fins. Adipose fin with white dorsal edge. Both lobes of caudal fin with black bar from base to tip of fin, posterior margin of fin white.

Distribution. – Lake Tanganyika (Fig. 24); common.

Habitat. – Littoral to benthic zones over shell, sand and mud bottoms; to a maximum depth of 170 m (Coulter 1991a).

Diet. – *Synodontis multipunctatus* is generally considered to be a specialized predator of *Neothauma tanganyicense*, a common Tanganyikan gastropod (Poll 1953; Brichard 1989; Coulter 1991a). The method by which the snail is extracted from its shell is unknown. Other authors have reported the presence of crustaceans, insect larvae and lamellibranches, in addition to *Neothauma*, in the stomach of *S. multipunctatus* (Worthington & Ricardo 1936; Poll 1953; Coulter 1991a), though later accounts of this species' diet fail to mention these prey items. Large numbers of lamellibranch shells were present in the intestine of MRAC 90283. These shells were packed tightly into the intestine and showed little evidence of mechanical or chemical digestion, while the bodies of the mollusks were mostly intact. It may be that they are ingested incidentally, though the large number of shells found in this particular specimen suggests otherwise.



Figure 23. Holotype of *Synodontis multipunctatus*, BMNH 1898.9.9.76, 280 mm TL, 220 mm SL.

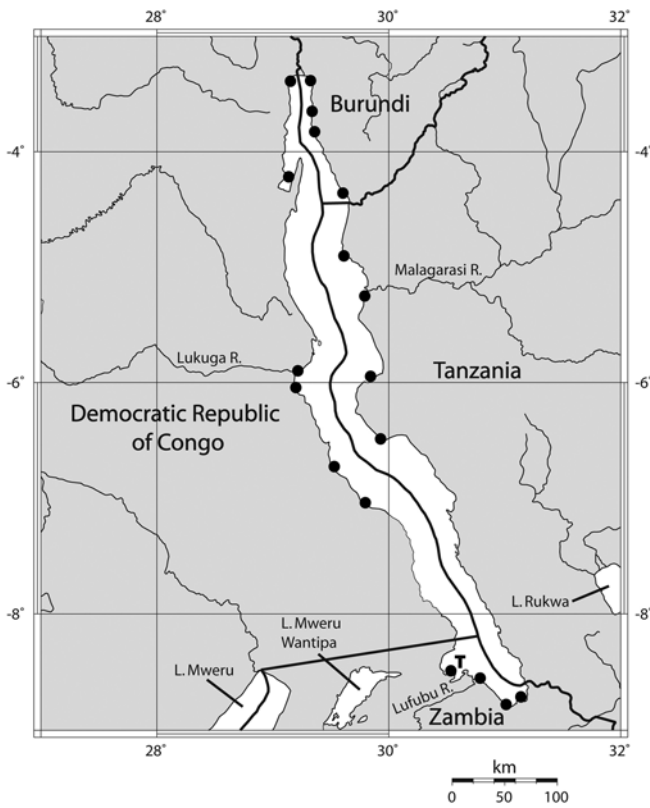


Figure 24. Known distribution of *Synodontis multipunctatus*. T denotes type locality.

Reproduction. – *Synodontis multipunctatus* is the only fish species known to exhibit true interspecific brood parasitism (Sato 1986). Eggs are deposited and fertilized among those of at least six species of mouth-brooding cichlids (Sato 1986). These eggs are taken up by the female cichlid and brooded with the cichlid's own eggs. The *S. multipunctatus* hatch before the cichlids and after absorbing their own yolk sac, devour the cichlid eggs and developing fry. It is unknown whether *S. multipunctatus* is an obligate brood parasite, or if alternate spawning behaviors exist.

Taxonomic Remarks. – *Synodontis multipunctatus* joins *S. granulatus* as the only Tanganyikan *Synodontis* for which no other names have been proposed or mistakenly applied in the literature. Like most species of *Synodontis* in the lake, slight variation in color pattern occurs among localities, but not consistently enough to be able to distinguish among populations.

Synodontis petricola Matthes, 1959
(Figs. 3D, 25, 26; Tables 1, 11)

Synodontis petricola Matthes, 1959:78, description, Lake Tanganyika; 1962:34, pl. 2, fig. a, description, diet, Lake Tanganyika. – Poll, 1971:409, figs. 192, 193, pls. VI.18, XII.9. – Brichard, 1978:360, 424, pho-

tos (misidentified), key; 1989:474, 475, 476, 479, 481, 483, skin texture, key, photos (some misidentifications). – Daget, Gosse, & Thys van den Audenaerde, 1986:140, check-list. – Burgess, 1989:196, 556, 559, 560, 567, check-list, photos (some misidentifications). – Kobayagowa, 1989:14, photo (misidentified). – Coulter, 1991a:181, 182, table 8.16, diet, habitat, reproduction.

Synodontis multimaculatus. – Worthington, E.B. and Ricardo, C.K., 1936:1067, 1077, 1101, note. – Poll, M., 1946:223, probable absence from Lake Tanganyika.

Material Examined. – Holotype, MRAC 130357, TL 98 mm, SL 82 mm, Kashekezi, N. Lake Tanganyika, coll. H. Matthes, 3.IV.1959, (9) paratypes, MRAC 130368-130376, TL 40-82 mm, SL 32-67 mm, Luhanga, South of Makobola, coll. H. Matthes, 3.IV.1959, (1) MRAC 78-25-P-19, TL 61 mm, SL 51 mm, Cape Chaitika, S. Lake Tanganyika (Zambia), coll. P. Brichard, III.1978, (5) MRAC A3-033-P-0013-0017, TL 97-140 mm, SL 78-111 mm, Mahumba, km 36 route Bujumbura-Lake Nyanza, Lake Tanganyika (Burundi), coll. L. De Vos, 29.I.1994, (1) MRAC A3-033-P-0012, TL 102 mm, SL 83 mm, Magara, route Bujumbura-Lake Nyanza (Burundi), coll. L. De Vos, 8.III.1994, (1) MRAC 96-031-P-0581, TL 134 mm, SL 113 mm, Luhanga, km 17 (Zaire), coll. M'boko, 8.III.1994, (2) MRAC 94-069-P-0290-0291, TL 68-89 mm, SL 54-71 mm, Luhanga, Lake Tanganyika (Zaire), coll. L. De Vos, 8.III.1994, (7) MRAC A3-033-P-0005-0011, TL 88-117 mm, SL 69-98 mm, Magara, route Bujumbura-Lake Nyanza (Burundi), coll. L. De Vos, 11.V.1994, (3) MRAC A3-033-P-0018-0023, TL 76-92 mm, SL 61-74 mm, Karunga, close to Ubwari, Lake Tanganyika (Zaire), coll. L. De Vos, 2.X.1995, (1) MRAC 95-096-P-2576, TL 69 mm, SL 56 mm, 08°20.24'S, 30°31.21'E, Chisiki, coll. Verheyen, Snoeks, Hanssens, Ruber, Sturmbauer, 10.IV.1995, (1) MRAC A1-094-P-53, TL 81 mm, SL 65 mm, Crocodile Island, Lake Tanganyika (Zambia), coll. Snoeks, Hanssens, Verheyen et al., 16.X.2001, (1) paratype, BMNH 1936.6.14.1232, TL 88 mm, SL 71 mm, Lake Tanganyika, coll. Christy, (1) SAIAB 77881, TL 74 mm, SL 59 mm, Zambia, Lake Tanganyika; Musende Rocks, 08°46'00"S, 031°07'00"E, coll. 10.X.1992, (1) SAIAB 56255, TL 68 mm, SL 55 mm, Tanzania; Jacobsen's Beach, 04°54'31"S, 029°36'02"E, coll. 05.X.1997, (1) SAIAB 56225, TL 75 mm, SL 61 mm, Tanzania; Kigoma Bay, below Hill top Hotel, 04°53'03"S, 029°37'11"E, coll. 09.X.1997, (1) SAIAB 56232, TL 80 mm, SL 64 mm, Tanzania; Cave, Kigoma Hotel below Hill top, 04°53'03"S, 029°37'11"E, coll. 11.X.1997, (1) SAIAB 56244, TL 79 mm, SL 64 mm, Tanzania; Bangwe, shingle

beach, 04°53'53"S, 029°35'39"E, coll. 12.X.1997.

Diagnosis. – Axillary pore present; mandibular teeth 31-50; body with large spots; fin spines white; 8-9 pectoral-fin rays; black triangles present on bases of all rayed fins; eye 28.7-40.1% snout length; premaxillary toothpad interrupted; secondary branches on medial mandibular barbel present; occipito-nuchal shield covered with skin; papillae on skin of body absent; hindgut chamber present; maximum TL 135 mm.

The presence of an axillary pore distinguishes *Synodontis petricola* from *S. ilebrevis*, *S. irsacae*, *S. lucipinnis*, *S. melanostictus*, and *S. polli*. The occipito-nuchal shield being covered with skin separates *S. petricola* from *S. dhonti*, *S. granulosus*, *S. melanostictus*, and *S. tanganaicae*, all of which also have a much larger maximum TL (395, 270, 520, and 585 mm, respectively vs. 135 mm in *S. petricola*). Mandibular tooth counts serve to further distinguish *S. petricola* from *S. dhonti* and *S. irsacae* (31-50 in *S. petricola* vs. 22 in *S. dhonti* and 15-29 in *S. irsacae*). *Synodontis petricola* differs from *S. granulosus*, *S. multipunctatus*, and *S. grandioops* and further differs from *S. dhonti* in having an interrupted premaxillary toothpad and secondary branches on the medial mandibular barbel. It is further distinguished from all other Tanganyikan *Synodontis*, with the exception of *S. lucipinnis*, by having completely white fin spines. *Synodontis petricola* is most easily distinguished from *S. lucipinnis* by the presence of an axillary pore and the lack of light colored patches at the bases of the dark triangles on its fins. *Synodontis petricola* also somewhat resembles *S. polli*, but the white fin spines and lack of papillae on the body of *S. petricola* (present, villous in *S. polli*) serve to separate these species.

Description. – Morphometric and meristic data in Table 11. Maximum TL 135 mm, SL 115 mm. Body not compressed. Predorsal profile slightly convex. Preanal profile straight to slightly convex. Skin on body forming numerous vertical folds; papillae absent.

Head slightly depressed and broad; skin covered with villous papillae; papillae extend onto base of maxillary barbel and anterior portion of body only. Snout with nearly flattened margin when viewed laterally; bluntly rounded when viewed dorsally. Occipito-nuchal shield covered with skin, terminating posteriorly with wide, pointed process on either side of dorsal spine, ventrally with wide, rounded process that extends to upper margin of the humeral process on either side of body. Eyes dorsolateral; ovoid; horizontal axis longer. Interorbital area flat to slightly convex.

Mouth inferior; lips widened and papillate. Mandibular teeth 31-50, short, unicuspid; arranged in 6 short,

Table 11. Morphometric measurements and meristic counts for *Synodontis petricola*. All morphometrics given in percent of base measurement. *Meristic data for holotype. Abbreviations as in Table 3.

MEASUREMENT	HOLOTYPE	RANGE (n=38)	MEAN±SD
Body depth/SL	21.6	14.3-25.0	20.3±2.6
Head length/SL	27.9	26.5-30.5	28.5±1.0
Snout-dorsal length/SL	36.6	32.6-40.2	36.5±1.6
Adipose fin length/SL	33.9	22.6-44.7	34.3±4.4
Maxillary barbel length/SL	18.7	12.5-29.8	22.4±3.6
Dorsal spine length/SL	22.9	17.6-27.0	21.9±2.7
Pectoral spine length/SL	21.8	18.2-26.6	21.8±2.0
Head width/HL	84.7	75.6-95.0	83.6±4.6
Head depth/HL	66.5	53.7-76.9	63.2±5.4
HPL/HL	39.4	39.4-57.6	46.6±4.0
Snout length/HL	52.6	49.6-60.9	53.1±2.3
Eye/HL	16.4	15.1-22.3	17.8±1.4
Interorbital width/HL	41.9	27.7-47.2	35.0±4.6
Postorbital length/HL	37.7	31.8-41.2	35.3±1.9
Mouth length/HL	42.1	37.0-52.9	43.8±4.1
Maxillary barbel length/HL	67.0	45.2-97.7	78.5±12.1
LMB/HL	59.4	37.3-72.8	54.9±8.1
MMB/HL	28.0	16.3-36.0	25.3±4.2
MMB/LMB	47.2	34.9-68.7	46.7±7.1
Dorsal spine length/HL	82.1	61.1-98.8	77.6±9.4
Pectoral spine length/HL	77.9	64.9-97.4	77.1±7.0
Eye/Snout length	31.2	28.7-40.1	33.6±2.5
Interorbital width/Snout length	79.5	53.9-83.0	65.8±7.0
Postorbital length/Snout length	71.6	52.3-75.7	66.6±4.6
Eye/Interorbital width	39.3	38.4-62.9	51.6±6.2
Eye/Postorbital length	43.6	41.2-60.9	50.7±5.2
HPL/HPD	143.2	192.1-333.9	245.9±35.4
CPL/CPD	84.5	66.3-129.9	92.6±17.0

MERISTICS

Mandibular tooth count	31(1); 33(1); 34(2); 35(1); 36(2); 37(2); 38(5); 39(6); 40(4); 41*(4); 42(4); 43(1); 45(3); 47(1); 50(1)
Dorsal fin count	II,6(3); II,7*(35)
Pectoral fin count	I,8*(25); I,9(13)
Pelvic fin count	i,6*(38)
Anal fin count	iii,8(2); iii,9(4); iv,7(3); iv,7,i(4); iv,8*(18); iv,8,i(5); iv,9(2)
Caudal fin count	i,7,8,i(18)
Total vertebrae count	33(2); 34(12); 35(4)



Figure 25. Holotype of *Synodontis petricola*, MRAC 130357, 98 mm TL, 82 mm SL.

transverse rows. Premaxillary toothpad interrupted; primary, secondary and tertiary premaxillary teeth discrete, numerous, arranged in 2, 2, and 1 irregular rows, respectively.

Maxillary barbel short; extending at least to base of pectoral spine; small papillae at base; basal membrane narrow. Lateral mandibular barbel extending to point just past anterior margin of pectoral girdle; with 4-7 short, simple, weakly tuberculate branches; usually lacking secondary branches. Medial mandibular barbel approximately 1/3 to 2/3 length of lateral barbel; with 4-6 pairs of tuberculate branches; many secondary branches present.

Dorsal fin II,7; posterior margin straight to slightly concave. Dorsal-fin spine long, striated, slightly curved, terminating in a short, white filament; anterior margin of fin spine smooth; posterior margin with small serrations distally. Pectoral fin I,8-9; posterior margin broadly rounded. Pectoral-fin spine roughly equal in length to dorsal-fin spine, striated, slightly curved, terminating in short, white filament; anterior spine margin smooth; posterior margin with large, retrorse serrations along entire length. Adipose fin long, well developed, margin convex. Pelvic fin i,6; located at vertical midway between posterior base of dorsal fin and origin of adipose fin; tip of appressed fin does not reach base of anal fin. Anal fin iii-iv,7-9; posterior margin rounded; base located at vertical through center of adipose fin. Caudal fin i,7,8,i; forked; lobes rounded.

Humeral process triangular; granulous; covered with many small, villous papillae; poorly-developed ridge on ventral margin; dorsal margin convex; terminating in a sharp point (Fig. 3D). Axillary pore small. Gut 1.2-1.3 times body length ($n = 2$, MRAC A3-033-P-0002-0011). Well developed hindgut chamber.

Coloration in alcohol. – Dorsum yellowish to cuprous brown, covered with large, irregularly shaped, black spots (Fig. 25). Spots proportionately larger, sometimes confluent in juvenile specimens. Belly lighter, with small, irregularly shaped spots. Maxillary and mandibular barbels white. Iris copper colored. Dorsal and pectoral-fin spines white; terminating in short, white filaments. All rayed fins with black triangles at base; posterior margins white. Both lobes of caudal fin with black bars, extending from base to tip of fin; posterior margin white.

Distribution. – Lake Tanganyika (Fig. 26). The large amount of material available in museum collections suggests that this species is more common than previously thought (Matthes 1959; Coulter 1991a).

Habitat. – Rocky coasts within the littoral zone, to a maximum depth of 30 m (Matthes 1959; Coulter 1991a).

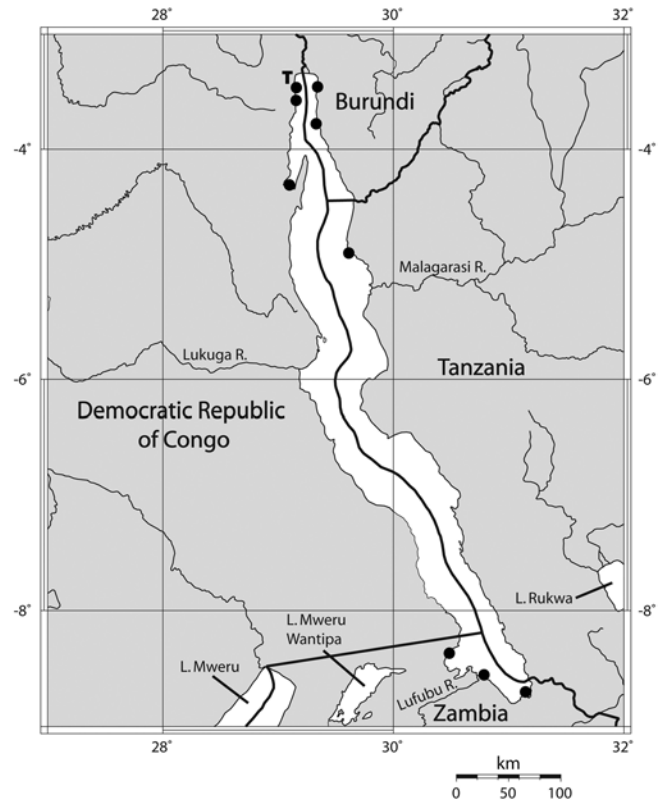


Figure 26. Known distribution of *Synodontis petricola*. T denotes type locality.

Diet. – Young individuals appear to be primarily carnivorous, subsisting mainly on hydracarians, ostracods and insect larvae (trichopterans, chironomids) (Matthes 1959). Adults feed on algae scraped from rocky substrates, and small invertebrates (Matthes 1959, Coulter 1991a).

Reproduction. – No information exists on the spawning behavior of this species. One female specimen was found to contain approximately 100 eggs (Matthes 1959).

Taxonomic Remarks. – *Synodontis petricola* is sufficiently distinct that there has been little confusion regarding its taxonomy. *Synodontis petricola* shows considerable variation in the nature of its spotted pattern, with the size and spacing of the spots varying considerably, even among specimens from the same locality.

Synodontis polli Gosse, 1982
(Figs. 5C, 15, 27, 28; Tables 2, 12)

Synodontis eurystomus Matthes, 1959:77, description, Lake Tanganyika; 1962:31, pl. 1, figs. B, C, description, diet, Lake Tanganyika. – Poll, 1971:405, figs. 190, 191, pls. VII.1, XII.8, description. – Brichard,

1978:357, 424, photos, key. – Gosse, J.P., 1982:48, junior homonym of *S. eurystomus* Pfeffer, replaced with *S. polli* nom. nov. – Sands, 1983:23, 79, checklist, photo. – Kobayagawa, 1989:14, photo (misidentified). – Coulter, 1991a:181, 182, table 8.16, habitat, diet, reproduction.

Synodontis polli Gosse, 1982:48, nom. nov. – Daget, Gosse, & Thys van den Audenaerde, 1986:141, checklist. – Brichard, 1989:474, 475, 478, 479, 483, skin texture, photos (some misidentifications). – Burgess, 196, 556, 559, 560, 576, checklist, photos (some misidentifications).

Material Examined. – Holotype, MRAC 130440, TL 148 mm, SL 125 mm, Luhanga, N. Lake Tanganyika, coll. H. Matthes, 3.IV.1959, (3) paratypes, MRAC 130444-446, TL 97-144 mm, SL 79-120 mm, Makobola, Lake Tanganyika, coll. H. Matthes (I.R.S.A.C.), 10.XI.1958, (2) paratypes, MRAC 130442-443, TL 48-58 mm, SL 38-47 mm, Luhanga, N. Lake Tanganyika, coll. H. Matthes (I.R.S.A.C.), 31.VIII.1950, (1) paratype, MRAC 130464, TL 115 mm, SL 96 mm, Bemba, Lake Tanganyika, coll. H. Matthes (I.R.S.A.C.), 26.IV.1958, (2) paratype, MRAC 130452-453, TL 57-60 mm, SL 46-48 mm, Makobola, Lake Tanganyika, coll. H. Matthes (I.R.S.A.C.), 28.VI.1960, (2) paratypes, MRAC 130462-463, TL 69-85 mm, SL 56-70 mm, Kashkezi, Lake Tanganyika, coll. H. Matthes (I.R.S.A.C.), 5.II.1959, (6) paratypes, MRAC 130454-461, TL 39-116 mm, SL 31-96 mm, Makobola, coll. H. Matthes (I.R.S.A.C.), 8.XI.1960, (2) MRAC 131007-131008, TL 137-144 mm, SL 112-116 mm, Kalungwe, Lake Tanganyika, coll. G. Leleup, 13.VII.1961, (2) MRAC 96-031-P-0889-0890, TL 117-148 mm, SL 94-123 mm, Luhanga, km 16-17, S. of Uvira-Ubwa, Lake Tanganyika, coll. L. De Vos, 8.III.1994, (5) MRAC A3-033-P-0076-0080, TL 115-160 mm, SL 95-132 mm, Luhanga, km 16 S. of Uvira-Ubwari, Lake Tanganyika (Zaire), coll. M'boko, 28.VII.1995, (1) MRAC A3-033-P-0075, TL 121 mm, SL 103 mm, Pemba, S. of Uvira, Lake Tanganyika (Zaire), coll. L. De Vos, 4.XI.1995, (1) MRAC 75-1-P-117, TL 101 mm, SL 84 mm, 8 km S. of Bujumbura, Lake Tanganyika, coll. P. Brichard, VII.1974, (1) MRAC A3-033-P-0082, TL 146 mm, SL 120 mm, Magara, route Bujumbura-Lake Nyanza (Burundi), coll. L. De Vos, 14.VII.1995, (1) MRAC, A4-044-P-0007, TL 120 mm, SL 97 mm, Jacobsen's Beach, aka Mwamahunga, Lake Tanganyika, 04°57.87'S, 29°35.86'E (Tanzania), coll. G. Kazumbe, 7.VI.2004, (2) MRAC 77-40-P-5-7, TL 88-99 mm, SL 70-82 mm, Chipimbi, cote Sud-Ouest du Lac Tanganyika (Zambia); coll. P. Brichard, 6.VII.1977, (1) MRAC 78-25-P-17-18, TL 89 mm, SL 73 mm, Cap Kachese, S. Lake Tanganyika (Zambia); coll. P.

Brichard, (6) MRAC 95-096-P-2561-2575, TL 85-108 mm, SL 71-90 mm, Kasenga Point, lake Tanganyika, 08°43'31"S, 31°08'01"E [Zambia]; coll. Exp. Tanganyika 95, 4.IV.1995, (5) MRAC 95-096-P2576-2585, TL 90-116 mm, SL 74-98 mm, Chisiki, 08°20'24"S, 30°31'21"E [Zambia]; coll. Exp. Tanganyika 95, 10.IV.1995, (7) MRAC 95-096-P-2586-2608, TL 88-125 mm, SL 70-104 mm, Cape Kachese, lake Tanganyika, 08°29'22"S, 30°28'32"E [Zambia], coll. Exp. Tanganyika 95, 10.IV.1995, (1) MRAC 95-096-P-2609, TL 135 mm, SL 112 mm, Kasaba Bay, lake Tanganyika, 08°30'57"S, 30°38'52"E [Zambia]; coll. Exp. Tanganyika 95, 11.IV.1995, (4) MRAC 95-096-P-2610-2613, TL 83-106 mm, SL 69-89 mm, Kala Bay, lake Tanganyika, 08°08'47"S, 30°58'14"E [Zambia]; coll. Exp. Tanganyika 95, 19.IV.1995, (1) MRAC 95-096-P-2627, TL 108 mm, SL 87 mm, Chikulina Bay, lake Tanganyika, 08°32'41"S, 30°43'36"E [Zambia]; coll. Exp. Tanganyika 95, 12.IV.1995, (1) BMNH 2005.9.26.17-18, TL 120 mm, SL 98 mm, Mpulungu, Zambia, Lake Tanganyika, coll. J. Day, 2005, (3) SAIAB 40171, TL 980114 mm, SL 81-94 mm, Zambia, Lake Tanganyika; Musende Rocks, 08°46'00"S, 031°06'00"E, 05.VIII.1992, (1) SAIAB 42518, TL 105 mm, SL 87 mm, Zambia, Lake Tanganyika; Musende Rocks, 08°46'00"S, 031°07'00"E, 10.X.1992, (2) SAIAB 56262, TL 122-150 mm, SL 100-127 mm, Tanzania; Jacobsen's Beach, 04°54'31"S, 029°36'02"E, 10.X.1997, (1) SAIAB 76167, TL 117 mm, SL 100 mm, Zambia, Mbala, Lake Tanganyika, Lake Tanganyika; Mbita Island (northwest end), 08°45.18'S, 031°05.07'E, 29.II.2004, (1) CU 88758, TL 180 mm, SL 145 mm, Tanzania; Kigoma; Jacobsen's Beach, coll. P.B. McIntyre, 18.VII.2002.

Diagnosis. – Axillary pore absent; mandibular teeth 40-70; body with large spots; fin spines dark; 8-9 pectoral-fin rays; black triangles on bases of all rayed fins; eye 25.8-39.3% snout length; premaxillary toothpad interrupted; secondary branches on medial mandibular barbel present; occipito-nuchal shield covered with skin; villous papillae present on skin of body; long gut; well developed hindgut chamber; body depth 20.2-27.0% SL; maximum TL 180 mm.

The lack of an axillary pore immediately distinguishes *Synodontis polli* from *S. dhonti*, *S. grandioops*, *S. granulosus*, *S. multipunctatus*, *S. petricola*, and *S. tanganaicae*. Additionally, *S. polli* generally has a greater number of mandibular teeth than all other Tanganyikan species (except *S. ilebrevis*), though some overlap does occur (40-70 in *S. polli* vs. 22 in *S. dhonti*, 17-26 in *S. grandioops*, 28-51 in *S. granulosus*, 15-29 in *S. irsacae*, 35-51 in *S. lucipinnis*, 13-29 in *S. multipunctatus*, 23-36 in *S. melanostictus*, 31-50 in *S.*

Table 12. Morphometric measurements and meristic counts for *Synodontis polli*. All morphometrics given in percent of base measurement. *Meristic data for holotype. Abbreviations as in Table 3.

MEASUREMENT	HOLOTYPE	RANGE (n=66)	MEAN±SD
Body depth/SL	22.0	20.2-27.0	23.0±1.7
Head length/SL	28.2	26.3-32.6	29.8±1.2
Snout-dorsal length/SL	38.6	35.2-41.4	37.9±1.4
Adipose fin length/SL	35.8	29.2-45.6	35.6±3.4
Maxillary barbel length/SL	13.6	10.6-28.3	19.2±3.8
Dorsal spine length/SL	19.2	12.8-23.4	19.6±2.5
Pectoral spine length/SL	22.5	17.8-25.0	22.0±1.6
Head width/HL	86.6	79.6-94.5	85.8±3.1
Head depth/HL	73.1	61.9-79.6	68.6±3.2
HPL/HL	44.6	35.0-51.5	43.8±3.4
Snout length/HL	55.7	50.8-60.2	55.2±1.8
Eye/HL	18.8	15.1-21.2	18.4±1.3
Interorbital width/HL	43.3	31.8-44.3	36.9±2.8
Postorbital length/HL	35.4	30.9-38.2	34.4±1.4
Mouth length/HL	57.3	44.4-62.2	54.6±4.0
Maxillary barbel length/HL	48.0	45.4-93.5	65.1±11.7
LMB/HL	41.9	30.9-67.1	48.3±7.6
MMB/HL	25.0	15.5-31.5	23.4±3.1
MMB/LMB	59.6	34.1-69.3	49.1±7.6
Dorsal spine length/HL	68.2	42.9-80.1	65.7±8.7
Pectoral spine length/HL	79.8	59.8-84.0	73.8±5.6
Eye/Snout length	33.7	25.8-39.3	33.4±2.7
Interorbital width/Snout length	77.8	57.2-81.0	67.0±5.2
Postorbital length/Snout length	63.6	52.4-69.7	62.3±3.3
Eye/Interorbital width	43.3	38.3-60.9	50.1±5.0
Eye/Postorbital length	53.0	41.4-66.3	53.7±4.8
HPL/HPD	192.8	146.8-252.2	192.6±24.9
CPL/CPD	127.5	86.9-144.0	108.0±12.6

MERISTICS

Mandibular tooth count	40(1); 41(1); 43(3); 44(2); 45(3); 46(3); 47(3); 48(1); 49(2); 50(5); 51(1); 52(6); 53(4); 54(6); 55(3); 56(2); 57(1); 58(3); 60(2); 61(1); 62(3); 63*(3); 65(1); 66(1); 67(1); 70(1)
Dorsal fin count	II,7*(66)
Pectoral fin count	I,8(32); I,9*(33)
Pelvic fin count	i,6*(65)
Anal fin count	iii,8(5); iii,8,i(4); iii,9(11); iv,7(4); iv,8*(28); iv,8,i(4); iv,9(9); v,7(1)
Caudal fin count	i,7,8,i(8)
Total vertebrae count	35(2); 36(4); 37(2)

petricola, and 33-49 in *S. tanganaicae*). *Synodontis polli* further differs from *S. petricola* and *S. lucipinnis* by having dark fin spines (vs. white in *S. petricola* and *S. lucipinnis*). The large spots on the body distinguish *S. polli* from *S. dhonti*, *S. granulosus*, *S. melanostictus* and *S. tanganaicae*, and the black triangles at the base of all the rayed fins further separate *S. polli* from *S. melanostictus* and adult *S. tanganaicae*. *Synodontis polli* is further distinguished from *S. dhonti*, *S. granulosus*, *S. melanostictus*, and *S. tanganaicae* in having an occipito-nuchal shield which is covered by skin. The interrupted premaxillary toothpad further separates *S. polli* from *S. dhonti*, *S. grandiops*, *S. granulosus*, and *S. multipunctatus*, in which it is uninterrupted, and the presence of secondary branches on the medial mandibular barbel further distinguishes *S. polli* from *S. grandiops*, *S. granulosus*, and *S. multipunctatus*. *Synodontis polli* differs from *S. ilebrevis* in having a long gut (4.0-5.5 times TL in *S. polli* vs. 0.8-1.4 times TL in *S. ilebrevis*) (Fig. 14, 15), a well developed hindgut chamber (Fig. 15), deeper body (body depth 20.2-27.0% SL in *S. polli* vs. 18.2-20.1% SL in *S. ilebrevis*), villous papillae on the skin (vs. short, flattened papillae in *S. ilebrevis*), and large, irregular, closely spaced spots on the skin (vs. small, regular, more widely spaced spots in *S. ilebrevis*).

Description. – Morphometric and meristic data in Table 12. Maximum TL 180 mm, SL 145 mm. Body not compressed. Predorsal profile convex. Preanal profile slightly convex. Skin on body forming numerous vertical folds covered with villous papillae which do not extend onto fins, giving skin somewhat velvety texture.

Head deep and broad; skin covered with villous papillae. Snout with broadly rounded margin when viewed laterally and dorsally. Occipito-nuchal shield covered with skin, terminating posteriorly with wide, pointed process on either side of dorsal spine, ventrally with wide, rounded process that extends to upper margin of humeral process on either side of body. Eyes dorsolateral, ovoid, horizontal axis longer. Interorbital area flat to slightly convex.

Mouth inferior; lips widened and papillate. Mandibular teeth 40-70, short, unicuspid; arranged in 6-8 short, transverse rows. Premaxillary toothpad interrupted; primary, secondary and tertiary premaxillary teeth discrete; numerous; arranged in 3, 2, and 1 irregular rows, respectively.

Maxillary barbel short; extending at least to base of pectoral spine; lacking branches or crenulations; basal membrane narrow. Lateral mandibular barbel extending to point just short of anterior margin of pectoral girdle; with 4-5 short, non-tuberculate branches; lacking sec-

ondary branches. Medial mandibular barbel approximately 1/3 to 2/3 length of lateral barbel; with 3-5 pairs of tuberculate branches; many secondary branches present.

Dorsal fin II,7; posterior margin slightly concave. Dorsal-fin spine short; striated; slightly curved, terminating in short, dark filament; anterior margin of fin spine smooth; posterior margin with small serrations distally. Pectoral fin I,8-9; posterior margin straight. Pectoral-fin spine roughly equal in length to dorsal-fin spine, striated, slightly curved, terminating in short, dark filament; anterior spine margin granulate in adult specimens; many small, antrorse serrations along anterior margin in juvenile specimens; posterior margin with large, retrorse serrations along entire length. Adipose fin long, well developed, margin convex. Pelvic fin i,6; located at or anterior to vertical through origin of adipose fin; tip of appressed fin does not reach base of anal fin. Anal fin iii-v,7-9; posterior margin rounded; base located at vertical through center of adipose fin. Caudal fin i,7,8,i; forked; lobes rounded.

Humeral process wide; triangular; granulous; poorly developed ridge on ventral margin; dorsal margin convex; terminating in a sharp point (Fig. 5C). Axillary pore absent. Gut long, 4.0-5.5 times TL (n = 3, MRAC 130440, MRAC 131007-008). Well developed hindgut chamber present (Fig. 15).

Coloration in alcohol. – Dorsum olive brown, covered with large, irregularly shaped, black spots (Figs. 15, 27). Spots proportionately larger, irregular, sometimes confluent in juvenile specimens. Belly lighter, with smaller, irregularly shaped spots. Maxillary and mandibular barbels white. Iris copper colored. Dorsal and pectoral-fin spines dark, terminating in short, dusky filaments. Pectoral spine with thin, light stripe along anterior margin. All rayed fins with black triangles at their base; posterior margins white in color, becoming dusky as specimen grows. Triangles may be completely solid or composed of closely spaced spots. Both lobes of caudal fin with black bar from base to tip of fin; posterior margin of fin white, becoming dusky with growth.

Distribution. – Lake Tanganyika (Fig. 28); common.

Habitat. – Rocky coasts within the littoral zone, to a maximum depth of 20 m (Matthes 1959; Coulter 1991a).

Diet. – *Synodontis polli* feeds on algae scraped from rocky substrates and small invertebrates (e.g. ostracods, chironomid larvae, small shrimps) (Matthes 1959; Coulter 1991a).

Reproduction. – No information exists regarding the spawning season, behavior, or habitat of this species, although mature specimens appear to be caught at



Figure 27. Holotype of *Synodontis polli*, MRAC 130440, 148 mm TL, 125 mm SL.

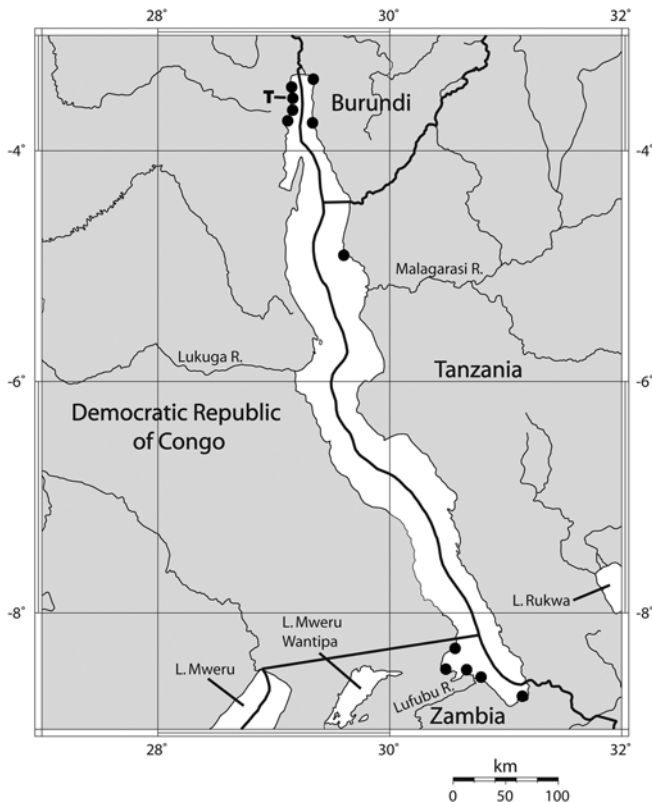


Figure 28. Known distribution of *Synodontis polli*. T denotes type locality.

many different times of the year. One female specimen has been found to contain approximately 110 eggs (Matthes 1959).

Taxonomic Remarks. – The taxonomic status of *Synodontis polli* has remained fairly stable, except for the replacement of its original name *S. eurystomus* Matthes, a junior homonym of *Synodontis eurystomus* Pfeffer, a synonym of *Chiloglanis deckenii* Peters (Gosse 1982).

Specimens from the southern part of this species' range show significant variation in their color pattern, with the spots on the body becoming smaller or, in some cases, disappearing as body size increases. In other respects, these specimens closely resemble specimens collected in the northern part of the lake.

Synodontis tanganaicae Borodin, 1936
(Figs. 4C, 4D, 29, 30, 31; Tables 1, 13)

Synodontis serratus tanganaicae Borodin, 1936:9, n. sp. of *S. serratus* Rüppel, Kasenga, Lake Tanganyika.
Synodontis lacustricolus Poll, 1953:157, fig. 18a, pl. 6, fig. 3, description, diet, Lake Tanganyika; 1971:402, fig. 188, 189, pl. 6, 12, description. – Matthes, 1962:41, pl. 3, fig. a, description. – Coulter, 1965-1966:34, abun-

dance at different depths, Lake Tanganyika; 1991a:152, 154, 181, 182, table 8.2, 8.3, 8.16, abundance, habitat, diet. – Brichard, 1978:424, key; 1989:479, key. – Sands, 1983, 23, check-list. – Daget, Gosse, & Thys van den Audenaerde, 1986:131, check-list. – Burgess, 1989:196, check-list. – De Vos and Thys van den Audenaerde, 1998:147, synonymy with *S. tanganaicae*.

Synodontis tanganyicae. – De Vos, L. and Thys van den Audenaerde, D., 1998:147.

Material Examined. – Lectotype (De Vos and Thys van den Audenaerde 1998), MCZ 32538, TL 416 mm, SL 321 mm, Kasanga, Lake Tanganyika, coll. A. Loveridge, 1930, (1) paralectotype, MCZ 148517, TL 403.6 mm, SL 322.41 mm, Kasanga, Lake Tanganyika, coll. A. Loveridge, 1930, (1) holotype, *S. lacustricolus*, ISRN 197, TL 601 mm, SL 503 mm, Stat. 123: near Karema, depth: about 30 m, coll. Expl. hydrobiol. du lac Tanganyika, 15.II.1947, (1) paratype, *S. lacustricolus*, ISRN 198, TL 429 mm, SL 352 mm, Tembwe Bay, Tanganyika district, Belgian Congo, coll. Explor. hydrobiol. du lac Tanganyika, 13.II.1947, (1) paratype, *S. lacustricolus*, ISRN 199, TL 413 mm, SL 336 mm, M'Vue Bay, Tanganyika district, Belgian Congo, coll. Explor. hydrobiol. du Lac Tanganyika, 12.III.1947, (1) paratype, *S. lacustricolus*, MRAC 130720, TL 333 mm, SL 255 mm, Mboko Island, N. Lake Tanganyika, coll. Marlier (I.R.S.A.C.), 7.II.1957, (1) paratype, *S. lacustricolus*, MRAC 90288, paratype (*S. lacustricolus*), TL 519 mm, SL 434 mm, Tembwe Bay, Lake Tanganyika, coll. M. Poll/Expl. Hydrobio. Tang., 13.II.1947, (1) paratype, *S. lacustricolus*, MRAC 90289, TL 582 mm, SL 489 mm, Edith Bay, Lake Tanganyika, coll. M. Poll/Expl. Hydrobio. Tang., 14-15.II.1947, (1) MRAC 90279, SL 203.5 mm SL, Albertville, St. 103, depth 7-10 m, trawl with panels, coll. Miss. D'Explor. Hydr. L. Tang., 3.II.47, (2) MRAC 96-083-P-003-004, TL 300-330 mm, SL 240-265 mm, Zambia, coll. De Vos, 1996, (1) paratype, *S. lacustricolus*, BMNH 1955.12.20.1849, TL 385 mm, SL 315 mm, Opposite Kala, Lake Tanganyika, Inst. Roy. Nat. Belge, (1) paratype, *S. lacustricolus*, BMNH 1955.12.20.1850, TL 361 mm, SL 291 mm, Tembwe Bay, Lake Tanganyika, Inst. Roy. Nat. Belge, (1) paratype, *S. lacustricolus*, BMNH 1955.12.20.1851, Malagarasi, Lake Tanganyika, coll. Inst. Roy. Nat. Belge, 12.V.1947, (3) BMNH 1936.6.15.1203-5 (orig. I.D. *S. granulosus*), TL 400-522 mm, SL 328-423 mm, Lake Tanganyika, coll. Christy.

Diagnosis. – Axillary pore present; mandibular teeth 33-49; body with small or no spots; fin spines dark; 8-9 pectoral-fin rays; black triangles on bases of all rayed fins in juveniles, absent in adults; eye 16.0-26.9% snout

length; premaxillary toothpad interrupted; secondary branches on medial mandibular barbel present; occipito-nuchal shield not covered with skin; granular papillae present on skin of body; humeral-process length 172.9-255.4% of humeral process width; maximum TL 585 mm.

The presence of an axillary pore distinguishes *Synodontis tanganaicae* from *S. ilebrevis*, *S. irsacae*, *S. lucipinnis*, *S. melanostictus*, and *S. polli*. *Synodontis tanganaicae* differs from *S. granulatus* in humeral process shape (humeral-process length 172.9-255.4% of humeral process width in *S. tanganaicae* vs. 253.8-437.2% in *S. granulatus*) (Figs. 3A, 4C, D). The lack of both large spots and skin covering the occipito-nuchal process separates *S. tanganaicae* from *S. grandioops*, *S. ilebrevis*, *S. lucipinnis*, *S. multipunctatus*, *S. petricola*, and *S. polli*. Adult specimens of *S. tanganaicae* are further distinguished from the other Tanganyikan endemics by the lack of black triangles on the rayed fins.

Synodontis tanganaicae most closely resembles *S. melanostictus* and *S. dhonti*. *Synodontis tanganaicae* differs from *S. melanostictus* in the number of mandibular teeth (33-49 in *S. tanganaicae* vs. 23-36 in *S. melanostictus*), eye size (16.0-26.9% of snout length in *S. tanganaicae* vs. 31.5-38.1% in *S. melanostictus*), the granular papillae on the skin (vs. villous in *S. melanostictus*), and differences in humeral process shape (Fig. 4). The higher mandibular tooth count (33-49 vs. 22 in *S. dhonti*), well-developed adipose fin (vs. poorly developed in *S. dhonti*), and interrupted premaxillary toothpad separate *S. tanganaicae* from *S. dhonti*.

Description. – Morphometric and meristic data in Table 13. Maximum TL 585 mm, SL 490 mm. Body not compressed. Predorsal profile straight. Preanal profile convex. Skin on body forming numerous vertical folds; covered with papillae, which do not extend onto fins.

Head depressed and broad, skin covered with granular papillae. Snout with blunt margin when viewed laterally; broadly rounded margin when viewed dorsally. Occipito-nuchal shield rugose, not covered with skin; terminating posteriorly with narrow, bluntly pointed process on either side of dorsal spine; ventrally with wide, rounded process that extends to upper margin of humeral process on either side of body. Eyes dorsolateral; ovoid; horizontal axis longer. Interorbital area flat.

Mouth inferior; lips wide and papillate. Mandibular teeth 33-49, short, unicuspid; arranged in single transverse row. Premaxillary toothpad interrupted; primary, secondary and tertiary premaxillary teeth discrete; numerous; arranged in irregular rows.

Maxillary barbel with well developed basal membrane; lacking branches or crenulations; extending at least to base of pectoral fin. Lateral mandibular barbel extending to point just short of anterior margin of pectoral girdle, with 4-7 non-tuberculate branches; lacking secondary branches. Medial mandibular barbel about 1/3 length of lateral barbel; with 4-6 pairs of non-tuberculate branches; secondary branches present.

Dorsal fin II,7-8; posterior margin straight. Dorsal-fin spine long, granulous, nearly straight, terminating in short, dark filament; anterior margin of fin spine granulous; posterior margin with small serrations distally. Pectoral fin I,8-9; posterior margin nearly straight. Pectoral-fin spine roughly equal in length to dorsal-fin spine, striated, slightly curved, terminating in short, dark filament; anterior spine margin granulate; posterior margin with large retrorse serrations along entire length. Adipose fin long, well developed, margin convex. Pelvic fin i,6; located at vertical through posterior base of dorsal fin; tip of appressed fin does not reach base of anal fin. Anal fin iii-v,7-9; posterior margin broadly rounded; base located ventral to adipose fin. Caudal fin i,7,8,i; forked; lobes slightly rounded.

Humeral process triangular, granulous; ridge on ventral margin absent; dorsal margin concave; terminating in blunt point (Figs. 4C, 4D). Axillary pore absent.

Coloration in alcohol. – Dorsum gray to reddish brown (Figs. 29, 30). Belly lighter in color. Scattered, small black spots present on entire body. Maxillary and mandibular barbels white, bases sometimes with scattered dusky pigmentation. Iris copper colored. Dorsal and pectoral-fin spines dark, terminating in short, dusky filaments. All rayed fins with small, dark spots similar to those on body. Juvenile specimens with black triangles at bases of rayed fins.

Distribution. – Lake Tanganyika (Fig. 31); fairly common.

Habitat. – Littoral to benthic zones over shell, sand and mud bottoms, to a maximum depth of 130 m (Coulter 1991a).

Diet. – Gastropods, lamellibranchs, insect larvae, ostracods, and shrimps (Poll 1953; Coulter 1991a).

Reproduction. – No information exists regarding the reproduction of *Synodontis tanganaicae*.

Taxonomic Remarks. – *Synodontis serratus tanganaicae* Borodin, previously considered a subspecies of *S. serratus* Rüppell, was elevated to species status by De Vos and Thys van den Audenaerde (1998), who also placed *S. lacustricolus* Poll in the synonymy of *S. tanganaicae*. Our examination of the material available has yielded no significant morphometric or

Table 13. Morphometric and meristic counts for *Synodontis tanganaicae*. All morphometrics given in percent of base measurement. *Meristic data for lectotype. Abbreviations as in Table 3.

MEASUREMENT	LECTOTYPE	RANGE (n=17)	MEAN±SD
Body depth/SL	23.9	20.8-26.4	24.4±1.5
Head length/SL	36.5	31.5-36.5	33.1±1.4
Snout-dorsal length/SL	48.2	41.2-48.6	43.5±2.2
Adipose fin length/SL	32.8	21.9-32.8	25.8±2.8
Maxillary barbel length/SL	40.0	29.8-46.3	38.1±5.1
Dorsal spine length/SL	23.8	21.1-27.6	24.1±2.1
Pectoral spine length/SL	24.7	19.0-27.2	23.0±2.4
Head width/HL	81.9	79.4-94.1	87.5±4.0
Head depth/HL	72.0	66.1-84.1	73.7±4.0
Humeral process length/HL	42.6	38.1-55.2	46.4±5.1
Snout length/HL	57.8	51.1-60.6	55.4±2.2
Eye/HL	13.0	9.7-14.6	12.8±1.4
Interorbital width/HL	38.4	35.0-45.0	39.5±2.6
Postorbital length/HL	36.1	35.1-40.4	38.0±1.7
Mouth length/HL	45.5	30.1-47.2	43.1±4.0
Maxillary barbel length/HL	109.7	90.7-138.5	116.3±15.8
LMB/HL	42.9	36.4-66.4	52.3±7.0
MMB/HL	16.6	12.4-23.5	19.6±3.2
MMB/LMB	38.7	29.2-43.4	37.6±4.2
Dorsal spine length/HL	65.2	63.5-87.4	73.3±7.5
Pectoral spine length/HL	67.8	57.9-83.2	69.4±6.8
Eye/Snout length	22.5	16.0-26.9	23.2±3.1
Interorbital width/Snout length	66.4	60.3-83.5	71.5±6.4
Postorbital length/Snout length	62.4	59.8-78.5	68.6±5.1
Eye/Interorbital width	33.8	23.9-38.0	32.4±3.6
Eye/Postorbital length	36.0	23.3-39.6	33.2±4.4
HPL/HPD	198.4	172.9-255.4	211.4±22.5
CPL/CPD	149.4	98.6-149.8	127.8±15.0

MERISTICS	
Mandibular tooth count	38(3); 39(1); 41(2); 42(1); 43*(3); 44(1); 46(1); 47(3); 48(1); 49(1)
Dorsal fin count	II,7*(15); II,7,i(1); II,8(1)
Pectoral fin count	I,8*(4); I,9(13)
Pelvic fin count	i,6*(16); i,7(1)
Anal fin count	iii,8(1); iv,7*(2); iv,8(8); iv,8,i(1); iv,9(1); v,7(1); v,8(1); v,8,i(1)

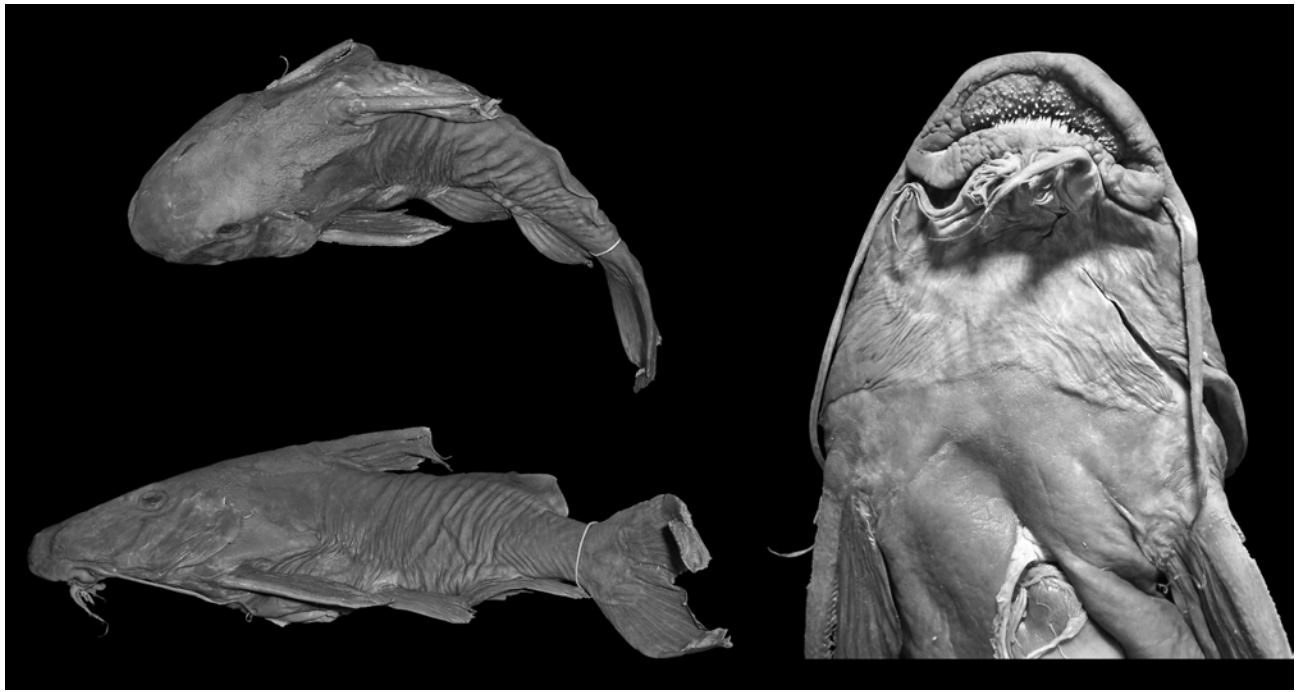


Figure 29. Lectotype of *Synodontis tanganaicae*, MCZ 32538, 416 mm TL, 321 mm SL.

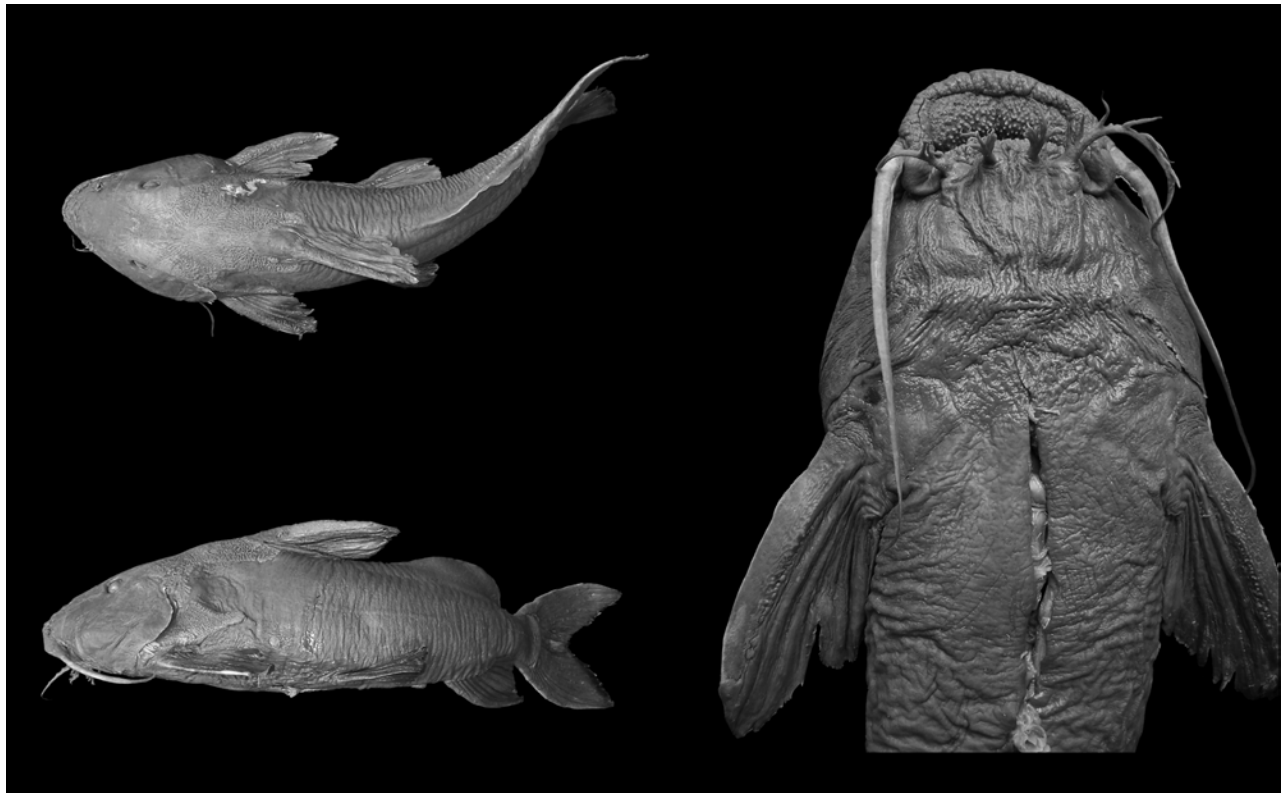


Figure 30. *Synodontis tanganaicae*, MRAC 90288, paratype of *S. lacustricolus*, 519 mm TL, 434 mm SL.

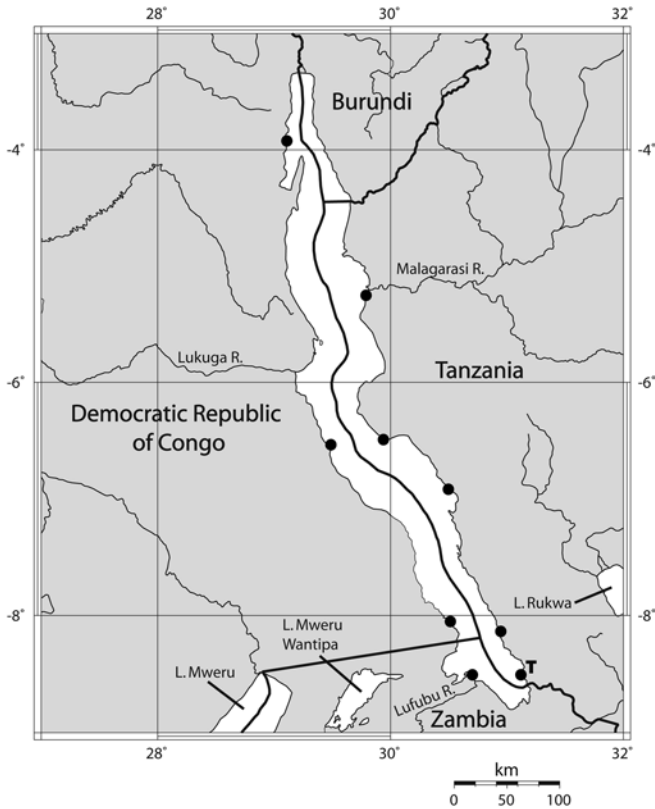


Figure 31. Known distribution of *Synodontis tanganaicae*. T denotes type locality.

meristic differences between *S. tanganaicae* and types of *S. lacustricolus*, nor do the new characters examined in this study indicate that the specimens represent two species. De Vos and Thys van den Audenaerde's decision is accepted here, though we retain the spelling of Borodin rather than using *tanganyicae*.

KEY TO THE SPECIES OF *Synodontis* OF LAKE TANGANYIKA

- 1a. Large, conspicuous axillary pore.....2
- 1b. Axillary pore absent or very small.....6

- 2a. Mandibular teeth 13-29; eye large, 21.6-31.9% head length; skin smooth; many large black spots.....3
- 2b. Mandibular teeth 22-51; eye smaller, 9.7-22.6% head length; skin covered with granula papillae; spots very small or absent.....4

- 3a. Pectoral fin I, 8; eye 44.9-62.0% snout length; maximum TL 280 mm.....*S. multipunctatus*
- 3b. Pectoral fin I, 7, eye 64.2-81.0% snout length; maximum TL 145 mm.....*S. grandioops*

- 4a. Premaxillary toothpad uninterrupted; humeral process length 253.8-437.2% humeral process width.....5

- 4b. Premaxillary toothpad interrupted; humeral process length 172.9-255.4% humeral process width.....*S. tanganaicae*

- 5a. 22 mandibular teeth; secondary branches on medial mandibular barbel; eye 23.1% snout length....*S. dhonti*
- 5b. 28-51 mandibular teeth; no secondary branches on medial mandibular barbel; eye 31.2-50.2% snout length.....*S. granulosis*

- 6a. Pectoral-fin spines white.....7
- 6b. Pectoral-fin spines dark.....8

- 7a. Very small axillary pore; black triangles on rayed fins lack light patches at base.....*S. petricola*
- 7b. Axillary pore absent; black triangles on rayed fins with distinct light patches at base.....*S. lucipinnis*

- 8a. Moderate to large spots; black triangles present on rayed fins; occipito-nuchal shield covered with skin.....9
- 8b. Small spots; black triangles absent on rayed fins; occipito-nuchal shield not covered with skin.....*S. melanostictus*

- 9a. Mandibular teeth 40-70.....10
- 9b. Mandibular teeth 15-29.....*S. irsacae*

- 10a. Body depth 20.2-27.0% SL; gut length 386.0-554.6% TL; large hindgut chamber; body and head covered with villous papillae.....*S. polli*
- 10b. Body depth 18.2-20.1% SL; gut length 78.0-136.2% TL; hindgut chamber absent; body and head covered with flattened, granulous papillae.....*S. ilebrevis*

DISCUSSION

The examination of 312 specimens of *Synodontis* from Lake Tanganyika has led to the recognition of 11 species of *Synodontis* from Lake Tanganyika. Ten of the species are endemic, and three are new to science. *Synodontis irsacae* and *S. melanostictus* are recognized as valid species.

The rayed-fin color pattern and skin folds of the endemic Tanganyikan species of *Synodontis* offer support for the monophyly of this group. Brooks (1950) suggested that, in the genera of Lake Tanganyikan fishes that are represented in the lake by a single non-endemic species and an endemic species flock (Mochokidae and Mastacembelidae), the endemic species probably arose from an ancient species due to cleavage of the lake basin, while the non-endemic species in each group, e.g. *S. melanostictus*, is likely to be a recent addition to the

lake fauna. Brichard's (1978) assertion that the species of *Synodontis* of Lake Tanganyika are probably not monophyletic is reasonable when *S. melanostictus* is included. More confusing is his apparent belief that the endemic species flock also does not constitute a monophyletic group. Two characters examined in this study (rayed-fin color pattern and skin folds) are apparent synapomorphies supporting the monophyly of the *Synodontis* species endemic to Lake Tanganyika.

A robust phylogeny for *Synodontis* will permit comparative examination of many of the unique traits found within this genus. The functional significances of the skin folds, axillary pore, and hindgut chamber have yet to be determined. A study of the axillary pore will be particularly interesting, as *Synodontis* is the only African catfish genus in which this structure has been documented. Even if this structure is found to serve an identical function to the structure found in the other families (Akysidae, Ariidae, Ictaluridae, Sisoridae), a more detailed study of the composition of its secretions will be extremely interesting, as this has yet to be examined for any species. The hindgut chamber may serve in a digestive capacity, as its gross morphology is very similar to that of a structure found in the Kyphosidae. Confirmation of the presence of fermentative gut microbes and short chain fatty acids in the chamber is needed to confirm that it serves a similar function to the fermentation chamber of kyphosids (D. German, *pers. comm.*).

Synodontis represents a group for which significant research remains to be done. Given the high diversity of species and behaviors found in this genus, its neglect by past ichthyologists is confusing. It is hoped that this study of the taxonomy of the Tanganyikan species flock will lead to future studies of these little-known fishes.

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LITERATURE CITED

- Birkhead, W.G. 1967. The comparative toxicity of stings of the ictalurid catfish genera *Ictalurus* and *Schilbeodes*. *Comparative Biochemistry and Physiology*, 22:101-111.
- Birkhead, W.G. 1972. Toxicity of stings of ariid and ictalurid catfishes. *Copeia* 1972, 790-807.
- Borodin, N.A. 1936. On a collection of freshwater fishes from Lake Nyasa, Tanganyika and Victoria in Central Africa. *Zoologisches Jahrbuch Jena (Syst.)*, 68:1-34.
- Boulenger, G.A. 1898. Report on the collection of fishes made by Mr. J.E.S. Moore in Lake Tanganyika during his expedition, 1895-1896. With an appendix by J.E.S. Moore. *Transactions of the Zoological Society of London*, XV:1-30.
- Boulenger, G.A. 1899. Second contribution to the ichthyology of lake Tanganyika. On the fishes obtained by the Congo Free State Expedition under Lieut. Lemaire in 1898. *Transactions of the Zoological Society of London*, XV:87-96.
- Boulenger, G.A. 1900. Diagnoses of new fishes discovered by Mr. J.E.S. Moore in Lake Tanganyika. 1. Cyprinidae, Siluridae. *Annals and Magazine of Natural History*, 7, (VI):478-481.
- Boulenger, G.A. 1901. Les poissons du bassin du Congo. *Publication de l'Etat indépendant du Congo*. Brussels, 8°:I-LXII, 1-532.
- Boulenger, G.A. 1901. Third contribution to the ichthyology of lake Tanganyika. Report on the collection of fishes made by Mr. J.E.S. Moore in Lakes Tanganyika and Kivu during his second expedition, 1899-1900. *Transactions of the Zoological Society of London*, XVI:137-178.
- Boulenger, G.A. 1905. On a collection of fishes from Lake Bangwelo. *Annals and Magazine of Natural History*, 7, (XVI):642-647.
- Boulenger, G.A. 1906. Fourth contribution to the ichthyology of Lake Tanganyika. Report on the collection of fishes made by Dr. W.A. Cunningham during the third Tanganyika Expedition. *Transactions of the Zoological Society of London*, XVII:537-576.
- Boulenger, G.A. 1911. Catalogue of the fresh-water fishes of Africa in the British Museum (Natural History). London, vol. 2:I-XIII, 1-529.
- Boulenger, G.A. 1916. Catalogue of the fresh-water

- fishes of Africa in the British Museum (Natural History). London, vol. 4:I-XXVII, 1-392.
- Boulenger, G.A. 1917. Descriptions of new fishes from Lake Tanganyika, forming part of the collection made by the late Dr. L. Stappers for the Belgian Government. *Annals and Magazine of Natural History*, 8, (XX):363-368.
- Boulenger, G.A. 1923. Descriptions of three new freshwater fishes from Northern Rhodesia. *Annals of the South African Museum*, 13:437-438.
- Brichard, P. 1978. *Fishes of Lake Tanganyika*. T.F.H. Publications, Inc. Hong Kong.
- Brichard, P. 1989. *Cichlids and all the other Fishes of Lake Tanganyika*. T.F.H. Publications, Inc. Hong Kong.
- Brooks, J.L. 1950. Speciation in ancient lakes. *Quarterly Review of Biology*, Baltimore, 25:131-176.
- Burgess, W.E. 1989. *An Atlas of Freshwater and Marine Catfishes*. T.F.H. Publications, Inc. Hong Kong.
- Clements, K.D., and Choat, J.H. 1997. Comparison of herbivory in the closely-related marine fish genera *Girella* and *Kyphosus*. *Marine Biology*, 127:579-586.
- Coulter, G.W. 1965-1966. The deep benthic fishes at the South of Lake Tanganyika with special reference to distribution and feeding in *Bathybates* species, *Hemibates stenosoma* and *Chrysichthys* species. *Fisheries Research Bulletin of Zambia*, 4:33-38.
- Coulter, G.W. 1991a. The benthic fish communities. *In Lake Tanganyika and its Life*, G.W. Coulter, editor. Oxford University Press, New York:151-199.
- Coulter, G.W. 1991b. Zoogeography, affinities and evolution with special regard to the fish. *In Lake Tanganyika and its Life*, G.W. Coulter, editor. Oxford University Press, New York:275-305.
- Coulter, G.W., and Spigel, R.H. 1991. Hydrodynamics. *In Lake Tanganyika and its Life*, G.W. Coulter, editor. Oxford University Press, New York:49-75.
- Daget, J., Gosse, J.P., & Thys van den Audenaerde, D.F.E. 1986. Mochokidae. *In Check-list of the Freshwater Fishes of Africa*, Vol. 2, J. Daget, J.P. Gosse, & D.F.E. Thys van den Audenaerde, editors. ORSTOM, Paris.
- Datovo, A. and Landim, M. 2005. *Ituglanis macunaima*, a new catfish from the rio Araguaia basin, Brazil (Siluriformes: Trichomycteridae). *Neotropical Ichthyology*, 3: 455-464.
- David, L., and Poll, M. 1937. Contribution à la faune ichthyologique du Congo belge. *Annales du Musée du Congo Belge (Zool.)*, (I), III, 5:198-294.
- De Vos, L., and Thys van den Audenaerde, D.F.E. 1998. Le statut taxonomique de *Synodontis serratus tanganaicae* Borodin, 1936 du lac Tanganyika (Teleostei: Mochokidae): synonymie avec *S. lacustricolus* Poll, 1953. *Journal of African Zoology*, 112:147-156.
- Friel, J.P., and Vigliotta, T.R. 2006. *Synodontis acanthoperca*, a new species from the Ogôoué River System, Gabon with comments on spiny ornamentation and sexual dimorphism in Mochokid catfishes (Siluriformes: Mochokidae). *Zootaxa*, 1125:45-56.
- Gosse, J.P. 1982. *Mutanda ichthyologica: Synodontis polli* nom. nov. et *Synodontis ornatissimus* nom. nov. *Cybiurn* (Ser. 3), 6:48.
- Halstead, B.W., Kuninobu, L.S., & Hebard, H.G. 1953. Catfish stings and the venom apparatus of the Mexican catfish, *Galeichthys felis* (Linnaeus). *Transactions of American Microscopical Society*, 52 (4):297-314.
- Hulot, A. 1950. Le régime alimentaire des poissons du Centre africain. Intérêt éventuel de ces poissons en vue d'une zootechnie économique. *Bulletin agricole du Congo belge*, 41:145-176.
- Kobayagawa, M. 1989. *The World of Catfishes*. T.F.H. Publications, Inc. Hong Kong.
- Leviton, A.E., Gibbs, R.H., Jr., Heal, E. & Dawson, C.E. 1985. Standards in ichthyology and herpetology. Part I. Standard symbolic codes for institutional resource collections in ichthyology and herpetology. *Copeia*, 1985:802-832.
- Matthes, H. 1959. Poissons nouveaux du lac Tanganyika. Descriptions préliminaires. *Folia Scientifica Africae Centralis*, 5:77-78.
- Matthes, H. 1962. Poissons nouveaux ou intéressants du lac Tanganyika et du Ruanda. *Annales – Musée royal de l'Afrique centrale. Zoology, Series in 8°*, no. 111:27-88.
- Moore, J.E.S. 1903. *The Tanganyika problem*. Hurst and Blackett Ltd., London:I-VIII, 1-371.
- Mountfort, D.O, Campbell, J., & Clements, K.D. 2002. Hindgut fermentation in three species of marine herbivorous fish. *Applied and Environmental Microbiology*, 36:1374-1380.
- Ng, H.H, and Ng, P.K.L. 2001. A revision of the akysid catfish genus *Acrochordonichthys* Bleeker. *Journal of Fish Biology*, 58:386-418.
- Pappenheim, P., and Boulenger, G.A. 1914. Fische. *Wissenschaftliche Ergebnisse der deutschen Zentral-Afrika Expedition, 1907-1908*, 5 Zool. 3:225-259.
- Poll, M. 1946. Revision de la faune ichthyologique du lac Tanganyika. *Annales du Musée du Congo Belge (Zoology)*, I:141-363.
- Poll, M. 1953. Poissons non Cichlidae. Résultats scientifiques - Exploration hydrobiologique du lac Tanganika (1946-1947), 3, 5A:1-251.

- Poll, M. 1967. Contribution à la faune ichthyologique de l'Angola. Museu do Dundo, Companhia de Diamantes de Angola, Publicações culturais, Lisboa, 75:1-381.
- Poll, M. 1971. Revision des *Synodontis* africains. Annales – Musée royal de l'Afrique centrale. Zoology, Series in 8°, no. 191:1-497.
- Reed, H.D. 1907. The poison glands of *Noturus* and *Schilbeodes*. American Naturalist, 41:553-566.
- Ricardo-Bertram, C.K. 1940. The fishes of the Bangweulu region. Journal of the Linnean Society of London, 41:183-217.
- Rimmer, D.W., and Wiebe, W.J. 1987. Fermentative microbial digestion in herbivorous fishes. Journal of Fish Biology, 31:229-236.
- Sands, D.D. 1983. Catfishes of the World. Vol. 2: Mochokidae. Dunure Enterprises, Dunure, Scotland.
- Sato, T. 1986. A brood parasitic catfish of mouthbrooding cichlid fishes in Lake Tanganyika. Nature, 323:58-59.
- Schraml, E. 2003. Fiederbartwelse aus dem Tanganjikasee. Die Aquarien und Terrarienzeitschrift. July, 2003:18-23.
- Skelton, P.H., and White, P.N. 1990. Two new species of *Synodontis* (Pisces: Siluroidei: Mochokidae) from southern Africa. Ichthyological Exploration of Freshwaters, 1:277-287.
- Sterba, G. 1963. Freshwater Fishes of the World. Viking Press, New York.
- Taverne, L., and Aloulou-Triki, A. 1974. Étude anatomique, myologique et ostéologique du genre *Synodontis* Cuvier (Pisces: Siluriformes, Mochocidae). Annales – Musée royal de l'Afrique centrale. Zoology, Series in 8°, no. 210:1-69.
- Tiercelin, J., and Mondeguer, A. 1991. The geology of the Tanganyika Trough. In Lake Tanganyika and its Life, G.W. Coulter, editor. Oxford University Press, New York:7-48.
- Worthington, E.B., and Ricardo, C.K. 1936. The fish of Lake Tanganyika (other than Cichlidae). Proceedings of the Zoological Society of London, 1061-1112.

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