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CICHLID FISHES FROM LAKE TANGANYIKA: ADDITIONS TO THE ZAMBIAN FAUNA INCLUDING TWO NEW SPECIES

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Among the world's lacustrine habitats, Lake Tanganyika, deepest and second largest of African lakes, is second only to Lake Malawi (Nyasa) in the richness of its described fish fauna (Poll, 1953, 1956; Fryer and Iles, 1972; Barbour and Brown, 1974). Lakes Victoria, Malawi and Tanganyika all harbor extensive species flocks of cichlid fishes that exceed all other local species, both in diversity and in percentage of endemism (Greenwood, 1964; Fryer and Iles, 1972). The cichlids of Lakes Victoria and Malawi are dominated by species of *Haplochromis* which alone number over 100 in each lake. Lake Tanganyika cichlids are more diverse structurally and are classified in more genera (Trewavas, 1949; Fryer and Iles, 1972), but no genus contains more than 40 local species.

In his monograph of Tanganyika Cichlidae, Poll (1956) described 126 species in 36 genera from the lake. Seven additional species were found exclusively in tributaries to the lake, but one of these (*Tilapia nilotica*) has since been collected in the lake in Burundi by one of us (D.J.S.). Since 1956 there have been substantial changes in knowledge of the cichlid fauna of Lake Tanganyika. Thirteen new species have been described, as follows: *Tropheus duboisi* Marlier (1959); *Tropheus brichardi* Nelissen and Thys van den Audenaerde (1975); *Petrochromis orthognathus* Matthes (1959b); *Petrochromis famula* Matthes and Trewavas (1960); *Ophthalmochromis nasutus* Poll and Matthes (1962); *Haplochromis benthicola* Matthes (1962); *Xenotilapia*

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spilopterus Poll and Stewart (1975); *Hemibates bellcrossi* Poll (1976); *Perissodus eccentricus* Liem and Stewart (1976); *Julidochromis transcriptus* Matthes (1959a); *Julidochromis dickfeldi* Staeck (1975); *Chalinochromis brichardi* Poll (1974); and *Lamprologus schreyeni* Poll (1974). Two subspecies have been named: *Ophthalmochromis ventralis heterodontis* Poll and Matthes (1962) and *Lamprologus leloupi melas* Matthes (1962). Two forms have been elevated from subspecies to specific status: *Lamprologus brichardi* Poll (1974) was previously *savoryi elongatus,* the latter name a junior homonym, and *Lamprologus pulcher* Trewavas and Poll was earlier ranked as a subspecies of *savoryi* (Poll, 1974).

Two more species are described in this paper, bringing to 144 the number of lacustrine species in the basin. We know of at least five more species that are currently being described, and further discoveries are predictable, especially from the little-worked deeper waters which yielded one of the species described herein and the recently named *Hemibates bellcrossi* and *Perissodus eccentricus.* A few Tanganyika species currently regarded as polytypic may prove to be complexes of two or more species. Thus, the lake is probably inhabited by over 150 cichlid species classified in 36 genera (*Triglachromis* Poll and Thys van den Audenaerde, 1974, and *Chalinochromis* Poll, 1974, have been described since 1956, and *Plecodus* and *Xenochromis* were synonymized under *Perissodus* by Liem and Stewart, 1976). Seven other species, including *Pseudocrenilabrus philander* (Bell-Cross and Kaoma, 1971), and three genera (*Pseudocrenilabrus, Orthochromis,* and *Astatoreochromis;* the former *Haplochromis straeleni* was transferred to *Astatoreochromis* by Poll, 1974) occur in Tanganyika tributaries. Of 39 genera and 151 species recorded from the basin, 33 genera and 148 species are endemic. (Non-endemic Tanganyikan genera are *Astatoreochromis, Haplochromis, Lamprologus, Pseudocrenilabrus, Tilapia,* and *Tylochromis.*)

MATERIALS AND METHODS

Our collecting activities were compressed into five days and were not exhaustive. Nevertheless, they were varied, including use of ichthyocides applied at shore stations and to a depth of 14 m, scuba, experimental gill nets set on the bottom at depths

from near shore to 90 m, dipnets fished with night lights, electrofishing gear and ichthyocides in two tributary streams, and sampling of commercial fishing catches. Our own collections were supplemented by fish taken by staff of the Zambian government's fishery station both prior to and following the time of our visit.

Measurements for the most part follow standard procedures, which for cichlids have been described and illustrated by Thys van den Audenaerde (1964). Our head, standard, and total lengths, however, are taken from the tip of the upper jaw instead of the anteriormost part of the head. Caudal peduncle length was measured parallel to the body axis from the base of the last anal ray to a vertical through the caudal base (not to the center of the caudal base as is our customary practice). Preorbital distance is the minimum measurement between orbit and lower margin of lachrymal. Pectoral fin-ray counts include all elements.

In most specimens of the three taxa described herein, the last elements of the soft dorsal and anal fins are well separated from the respective penultimate rays, and are sometimes branched. We counted all elements, thus following the procedure we judge Poll (1956) employed. The counts are, therefore, one higher than derived by the customary practice of defining the last ray as double at the base.

Scale count in lateral series is the sum of upper lateral-line count and lower lateral-line count between caudal base and the diagonal row that extends downward and forward from the last pored scale of the upper line (i.e., "Ligne longitudinale" defined by Thys van den Audenaerde, 1964:7). Circumpeduncular scale row count includes pored lateral-line scales. Gill-raker count is taken on the lower limb of the first arch, excluding one at the angle.

Vertebral counts include the hypural complex. As counted the first caudal vertebra bears a well-developed haemal spine that is subequal in length with those behind.

ACKNOWLEDGMENTS

It was our privilege to visit Lake Tanganyika and make a substantial collection of fishes during the period 30 October to 3 November 1970. This opportunity was afforded by the

Department of Wildlife, Fisheries and National Parks, Ministry of Lands and Natural Resources, Zambia, through Mr. Aaron B. E. Mabaye, and the Food and Agricultural Organization of the United Nations, through Mr. Leonard Joeris, under the auspices of which we were engaged as consultant and research assistant, respectively, on a research project contracted to The University of Michigan under the supervision of Dr. Karl F. Lagler. At Lake Tanganyika our host was Dr. Robert L. Kendall, then Fishery Research Officer of the Zambian Department of Wildlife, Fisheries and National Parks, who, with Mrs. Kendall, generously opened their home to us, provided transportation, field assistance, and unlimited courtesies. Others in the party, all of whom participated in the field work included Dr. Eugene K. Balon, Dr. Igor Cech, Miss Carolyn Ellis, Mr. and Mrs. James M. Kapetsky, Mrs. Holly Troxel, and several resident staff members of the Zambian Government's Lake Tanganyika research unit. To all of them we are indebted for their genuine interest and enthusiastic cooperation.

Dr. P. Humphry Greenwood, British Museum (Natural History), Drs. Max Poll and D. F. E. Thys van den Audenaerde, Tervuren Museum, have provided loans, furnished use of facilities during visits to their laboratories, and have always been friendly and cooperative. Dr. Don Cameron, University of Michigan, assisted in selecting the name *Lamprologus prochilus.* Part of this study was facilitated by a National Science Foundation Summer Research Assistantship in Systematic and Evolutionary Biology, Grant No. GB-25986, 1971, to Dr. N. G. Hairston, Museum of Zoology, University of Michigan.

Plates 1-3 and Figure 2 were drawn by Carole Wrigley, formerly staff artist for the Museum of Zoology, and Figures 1 and 3 were prepared by Mark Orsen, current staff artist, Figure 1 with assistance from Robert L. Kendall. We sincerely appreciate their contribution.

Limnochromis bellcrossi (Poll)

Plate 1; Fig. 2A,B

Hemibates bellcrossi.—Poll, 1976:1017-1020, fig. 1. Off Mutondwe Island, southern Lake Tanganyika [Zambia]. Holotype in Tervuren Museum.

When this paper was drafted, the above species was described as new, but Poll's publication preceded ours. *Hemibates bell-*

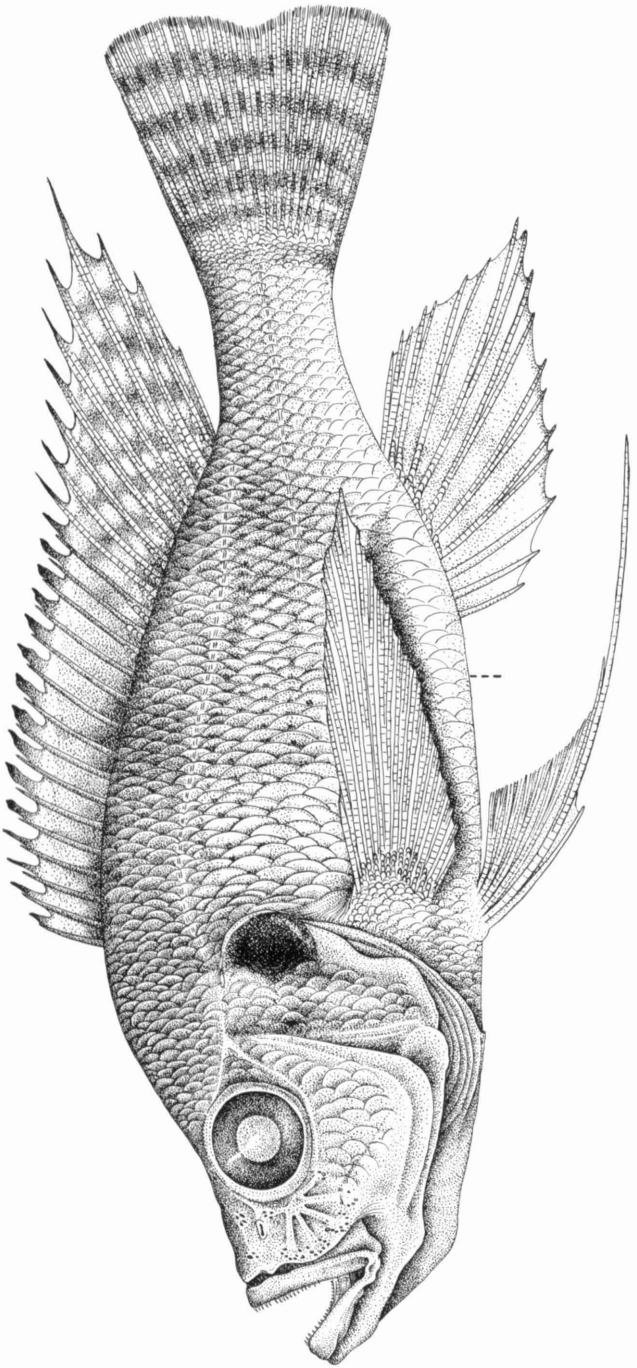

PLATE 1. *Limnochromis bellcrossi* (Poll), UMMZ 196099, 147 mm standard length, male.

crossi was based on two specimens received by Poll from Mr. Graham Bell-Cross. We preserve our description and illustrations under the name *bellcrossi* but retain our original generic assignment to *Limnochromis.*

Generic placement.—Poll (1976) called attention to several similarities between *bellcrossi* and *Hemibates stenosoma* (Boulenger) and classified them as congeneric, noting also some resemblance to *Haplotaxodon* Boulenger. Poll did not mention *Limnochromis,* which shares most of the same characters and which we believe to be the correct generic allocation.

Regan (1920) described *Limnochromis* with *Pelmatochromis auritus* Boulenger as designated type species. The osteological parts of the definition, however, were drawn from a single skeleton, presumably *auritus,* in the British Museum (BM 1906.9.6:71). Reexamination of this skeleton revealed that it is some other as yet undetermined species. *L. auritus* has some molariform pharyngeal teeth and the pharyngeal apophysis includes both parasphenoid and basioccipital; the skeleton in question has conical pharyngeal teeth and the basioccipital is excluded from the apophysis. *L. bellcrossi* agrees with *auritus* in having the basioccipital included in the apophysis.

Regan (1920) assigned four species to *Limnochromis* and seven have since been added. Poll and Thys van den Audenaerde (1974) erected the new genus *Triglachromis* for *otostigma,* and Poll (1974) transferred *pfefferi* to *Haplochromis.* The remaining nine taxa are somewhat generalized cichlids loosely united on the basis of their multiserial, entirely conical jaw teeth, a character shared by *bellcrossi* (and various other cichlids). *Limnochromis* remains poorly defined and is perhaps polyphyletic (Poll and Thys van den Audenaerde, 1974). *L. microlepidotus,* with small scales (63 to 71 in lateral series), slender body, numerous gill rakers (21 to 24 on lower limb of first arch), numerous soft rays in dorsal (15 to 18) and anal (12 or 13) fins, and well-forked caudal fin, seems of especially dubious status. *L. nigripinnis* and *L. leptosoma* are intermediate in some characters between *microlepidotus* and other species of *Limnochromis. L. bellcrossi* agrees with the six other species in having fewer gill rakers (18 or fewer), deeper body, relatively fewer soft rays in dorsal (8 to 11) and anal (7 to 9) fins, and a more or less truncate caudal fin. These seven species also have a long pectoral fin, that extends beyond the vertical from the anal origin, and the outer pelvic ray is filamentous and much produced. Two

species, *auritus* and *staneri,* are specialized in having some molariform teeth in the inferior pharyngeal; the others, including *bellcrossi,* have conical teeth only.

Limnochromis is in need of thorough study, but we are confident the relationships of *bellcrossi* lie with the group of species (including *dhanisi, permaxillaris, christyi,* and *abeelei*) discussed above. Among them, *christyi* seems the most closely related.

As judged from Poll's work, scale size provides a notable distinction between *bellcrossi* and the other species of *Limnochromis,* and one judges that his association of *bellcrossi* with *Hemibates stenosoma* depended heavily on that character (*stenosoma* has from 63 to 72 scales in lateral series). A couplet in Poll's key (1956:598) separates *Limnochromis* from *Hemibates* on the basis of 42 or fewer scales for *Limnochromis.* Yet in the same work, he recorded *L. microlepidotus* as having 63 to 71 scales (pp. 187, 604). *L. christyi,* not described by Poll, was credited with 44 to 49 scales by Trewavas (1953) and specimens from Zambia examined by us have 45 to 50. *L. bellcrossi* has 51 to 58 scales (51 and 55 in two specimens examined by Poll, 1976; 52 to 58 in 13 specimens counted by us). It is apparent that scale size in *Limnochromis* is highly variable (32 to 71 in the species currently assigned to it) and carries no weight in the exclusion of *bellcrossi* from that genus.

Limnochromis bellcrossi differs abruptly from *Hemibates stenosoma* in soft fin-ray counts (dorsal 9 to 11 vs. 13 to 15; anal 7 or 8 vs. 13 to 15), gill rakers on lower limb (16 to 18 vs. 27 to 31), vertebrae, 31 (32) vs. 35 (34 in one of 5 counted), a truncate instead of a well-forked caudal fin, the pectoral fin exceeding level of anal origin and the filamentous outer pelvic soft ray extending well back on anal fin, and other characters. Especially notable is the relatively uniform pigmentation of *bellcrossi* (Plate 1), marked mainly by a dark opercular spot as in several other species of *Limnochromis. Hemibates stenosoma,* in contrast, is highly sexually dimorphic in color pattern, the males gaudily marked with black spots, bars, and stripes (Poll, 1956, fig. 73 and Pl. VII, fig. 2) that are reminiscent of the bold markings of the several species of *Bathybates* (Poll, 1956: figs. 74-80).

In Poll's (1956) key to the Tanganyika cichlid genera, *bellcrossi* encounters conflicts because of its small scales and large eye, but otherwise agrees with *Limnochromis.* If *bellcrossi* had

uniserial jaw teeth, it would key to *Haplotaxodon;* the same is true of *L. microlepidotus. L. bellcrossi* is at least superficially similar to *Haplotaxodon microlepis* Boulenger and seems partially to bridge the gap between some species in *Limnochromis* and *H. microlepis.* The types of *Haplotaxodon tricoti* Poll (1948) were reexamined; they have two rows of teeth in each jaw rather than one as indicated in the original description. As the genera are currently defined, *tricoti* should perhaps have been placed in *Limnochromis,* where it most closely approaches the group of elongate species that includes *L. microlepidotus.* Thus, our assignment of *bellcrossi* is provisional; revision of both *Haplotaxodon* and *Limnochromis* is in order.

Material.—All specimens were collected with gill nets by Robert L. Kendall in Zambian waters of Lake Tanganyika in 1972 (see Fig. 1). Mwela, lat. 8° 43.65′ S, long. 30° 57.55′ E:

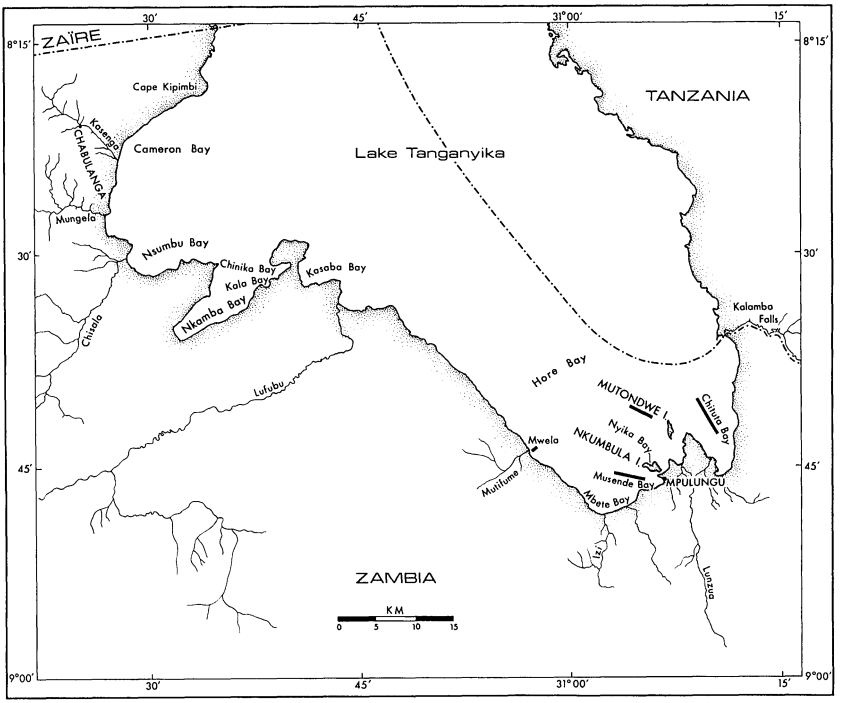

FIG. 1. Zambian part of Lake Tanganyika, showing sampling localities. Bars indicate approximate positions of transect lines for Dr. Kendall's gill-net survey. Each set extended from 40 m depth at the near-shore end to 100 m depth. The bottom was rocky and steeply sloping along the Mwela and Mutondwe transects. Mud and mollusk shells covered the bottom along the more gently sloping Musende Bay and Chituta Bay transects.

UMMZ 196099, 147 mm in standard length (total length 185 mm) and UMMZ 196100, 93 mm s.l., 100 meters water depth, 12 May; UMMZ 196042, 132 mm, 80 or 100 m, 17 Aug. Musende Bay, UMMZ 196040, 151 mm, 100 m, 2 Aug.; 195993, 143 mm, 100 m, 14 Sept.; 195994, 153 mm, 100 m, 12 Dec.; 195995 (2), 141 and 145 mm, 100 m, 21 Nov.; and 195996, 117 mm, 80 m, 26 Sept. Near Mpulungu, UMMZ 196117 (3), 118-131 mm; 196118 (3), 145-150 mm. Chituta Bay, UMMZ 196038, 144 mm, 100 m, 23 Aug.; 196039, 123 mm, 80 m, 16 June; 196041, 115 mm, 100 m, 16 June; and 195992 (3), 142-150 mm, 100 m, 26 Sept.

Diagnosis.—A species of *Limnochromis* with 51-58 scales in lateral series, 16-18 gill rakers on the lower limb of the anterior arch, and eye diameter greater than snout length; together these characters readily separate *bellcrossi* from its nine congeners. *L. bellcrossi* differs further from *leptosoma, nigripinnis,* and *microlepidotus* in its relatively deep body (30.0-36.7 percent of s.l.), and from *auritus* and *staneri* in its conical pharyngeal teeth.

Differences between *bellcrossi* and *Hemibates stenosoma* are discussed above. In *bellcrossi* the teeth are multiserial whereas those of *Haplotaxodon* are uniserial or biserial.

Description.—Proportional measurements are presented in Table 1. For the following meristic data, frequencies are given in parentheses.

Dorsal spines, XIV (9), XV (4); dorsal soft rays, 9 (1), 10 (6), 11 (6); anal spines, III (13); anal soft rays, 7 (1), 8 (12). Profile of spinous dorsal fin relatively level posterior to fourth spine. Soft dorsal and anal fins with filamentous extensions which may reach a point midway between base and tip of caudal fin. First soft ray of pelvic fin of both sexes long and filamentous, reaching at least beyond midpoint of anal-fin base in females and beyond anal-fin base in males. Pectoral fin extends at least to second soft anal ray, sometimes to beyond midpoint of fin base. Pectoral fin rays, 15 (12), 16 (1). Caudal fin emarginate, with corners pointed or slightly rounded. Caudal peduncle length divided by peduncle depth 1.27-1.71.

Scales in lateral series, 51 to 58; upper lateral line, 33 to 39; lower lateral line, 24 to 32 (some counts include a few nonpored scales). Circumpeduncular scale rows, 23 (1), 24 (10), 25 (2). Three scale rows between upper and lower lateral lines in the region of overlap. Cheek scales well-developed and extending forward to the lachrymal in 3 (rarely 4) rows. Scales on nape,

TABLE 1

MORPHOMETRIC CHARACTERISTICS OF *LIMNOCHROMIS BELLCROSSI* EXPRESSED IN THOUSANDTHS OF STANDARD LENGTH. SPECIMEN NUMBERS ARE FROM UMMZ CATALOGUE NUMBERS, AS FOLLOWS: 1, NO. 196099; 2, 3, 4, NO. 196118; 9, 11, 12, NO. 196117; 5, NO. 196040; 6, NO. 196038; 7, NO. 196100; 8, NO. 196042; 10, NO. 196039; 13, NO. 196041.

Measurement	Specimen Number												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Standard length, mm	147	149	146	146	151	144	93	132	131	123	121	120	115
Sex	♂	♂	♂	♂	...	...	...	♀	♀	♀	♀	♀	♀
Head length	374	362	349	363	358	354	355	364	356	374	355	358	348
Body depth	354	349	349	336	325	333	333	326	336	309	331	367	322
Caudal peduncle depth	116	121	123	123	113	118	118	121	115	114	116	125	113
length	184	188	185	192	192	187	183	159	168	171	190	158	191
Snout length	107	99	96	103	99	101	97	98	101	99	93	102	102
Premaxillary pedicel length	102	94	103	103	99	97	97	98	99	98	99	100	92
Upper jaw length	139	138	137	138	131	131	132	133	138	138	134	130	139
Lower jaw length	163	161	164	164	153	153	151	159	160	163	157	150	157
Preorbital distance	61	66	62	62	66	60	55	61	58	59	54	52	61
Orbit length	110	114	110	118	105	106	113	120	112	118	109	108	117
Interorbital bony width	61	59	61	62	58	58	57	61	56	54	51	57	56
Last dorsal spine	126	127	132	121	125	124	129	114	127	128	123	129	124
Highest dorsal soft ray	322	372	375	355	303	310	308	...	338	319	296	328	276
Last anal spine	117	119	128	123	126	107	137	117	...	138	140	127	135
Highest anal soft ray	265	284	292	305	258	245	265	252	...	266	242	257	224
Pectoral fin length	415	383	425	397	404	403	387	371	412	407	405	383	391
Pelvic fin length	510	564	473	500	517	389	441	...	473	472	479	400	417

breast, and pectoral-fin base smaller than those on the flanks. Nape scales extend forward to between eyes. Vertebrae, counted from radiographs, precaudal 14 (6), caudal 17 (5), 18 (1), total 31 (5), 32 (1).

Buccal teeth are all relatively small, evenly spaced, conical, and slightly curved; most have brown tips. Teeth in the outer row are larger than those in the inner rows and the more anterior teeth are larger than those farther back on the jaws. There are 74 to 94 teeth in the outer row of the upper jaw (counts include missing teeth indicated by empty sockets). Inner teeth are in one or two rows and tend to extend farther posteriorly on the upper jaw than on the mandible. Lower pharyngeal teeth entirely conical and the pharyngeal tooth plate is relatively thin and fragile (Fig. 2A,B). Gill rakers, 16 (2), 17 (9), 18 (2), long, slender, and sometimes branched or forked.

Body deep and laterally compressed. Frontal profile steep and slightly concave. The infraorbital series is complete and well-ossified. Both sexes attain sizes over 145 mm, the largest specimen examined was 151 mm. Females of 121 and 131 mm were gravid and the larger specimen had just over 200 ova, most or all of which were in a single ovary. The ova were uniformly 2.0 to 2.5 mm in longest dimension.

Distribution.—Endemic to relatively deep water (80-100 m) in Lake Tanganyika.

Color.—Based on Kendall's field notes, color of live or fresh female specimens (UMMZ 196039, 123 mm; 196041, 115 mm) is as follows. Body olive dorsally and silver below with three horizontal rows of blue-white nacreous spots which are located: (1) just below soft dorsal fin, (2) just below upper lateral line, and (3) just below lower lateral line. Posterior third of opercle covered by a black spot. Dorsal fin black at margin, clear submarginally and with irregular, somewhat oblique rows of clear spots on membranes between rays. Caudal fin yellowish with clear vertical bands which are more distinct on dorsal half; tips of caudal rays tend to be dark gray. In some large specimens the black margin and clear submargin of the dorsal fin are continued on upper edge of caudal fin. Anal fin white proximally with yellowish bands distally. Pelvic yellowish with filamentous first soft ray white. Pectoral yellowish.

Color pattern of preserved specimens in ethanol (Plate 1) is essentially similar for both sexes. Branchiostegal membranes are

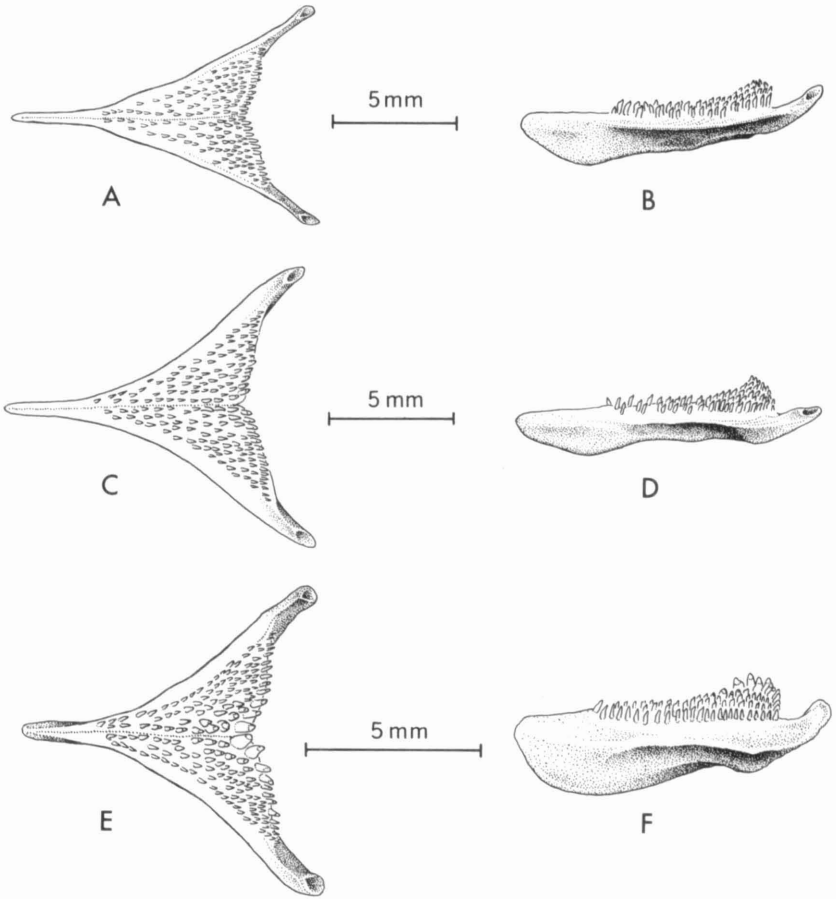

FIG. 2. Inferior pharyngeal arches of three cichlid fishes from Lake Tanganyika, Zambia. Figures on left (A, C, E) are dorsal views, anterior to left; those on right (B, D, F) are lateral views of the same bones, anterior to left. A, B. *Limnochromis bellcrossi,* UMMZ 196038, 144 mm standard length. Greatest length of arch 18.4 mm. C, D. *Leptochromis centropomoides,* holotype, UMMZ 199809, 135 mm s.l. Length of arch 13.9 mm. E, F. *Lamprologus prochilus,* holotype, UMMZ 199957, 97 mm s.l. Length of arch 10.0 mm.

often dusky gray. Anal fin has a dusky margin and narrow, clear submargin. Large males may have more intense or discrete markings and some males have small, irregularly spaced, ocellated spots on the anal fin.

Leptochromis centropomoides, new species
Plate 2, Fig. 2C,D

Generic assignment.—This species is placed in the heretofore monotypic genus *Leptochromis* Regan (1920), with which it shares the following characters: all jaw teeth small and conical, in more than one row with outer teeth slightly larger but not directed forward; outer pelvic-fin ray at least twice length of inner ray; body depth less than 250 per mille of standard length; three anal spines; ctenoid scales; and pharyngeal apophysis composed of parasphenoid and basioccipital. *L. centropomoides* and *calliurus* have similar gill-raker and anal fin-ray counts, conical pharyngeal teeth, large almost superolateral eyes with narrow interorbital, and virtually identical color patterns. All evidence points to close relationship of the two species, with *calliurus* being the more generalized.

In Poll's (1956) key to Tanganyika cichlid genera, *centropomoides* leads to near *Boulengerochromis* because of its small scales. If scale size is ignored at couplet 10, *centropomoides* keys out to *Leptochromis*.

Material.—All specimens were collected with gill nets in Lake Tanganyika, Zambia (see Fig. 1). Holotype, UMMZ 199809, a female, 135 mm (total length 168 mm), 3-4 km W Mpulungu, lat. 8°46′ S, long. 31°5′ E, 60 m water depth, R. L. Kendall and R. M. Bailey, 2-3 November 1970 (field number B70-31). Paratypes: near Nsumbu, lat. 8°30′ S; long. 30°30′ E: UMMZ 199744, 105 mm, C. Ellis, Sept. 1970. Near Mpulungu: UMMZ 196115 (3), 134-145 mm, Kendall, 1971 or 1972. Mwela: UMMZ 196036, 138 mm, 100 m, Kendall, 17 Aug. 1972. UMMZ 195988, 137 mm, 100 m, Kendall, 28 Nov. 1972. Chituta Bay: UMMZ 196037, 136 mm, 80 m, Kendall, 23 Aug. 1972. UMMZ 195991 (4), 138-151 mm, 100 m, Kendall, 26 Sept. and 15 Nov. 1972. Musende Bay: UMMZ 195990, 133 mm, 40 m, Kendall, 14 Sept. 1972. UMMZ 195989, 141 mm, 100 m (from gut of *Lates angustifrons*), Kendall, 21 Nov. 1972.

Diagnosis.—A species of *Leptochromis* distinguished from all other Tanganyika cichlids by its extremely produced, broadly flattened snout and distinctive spinous dorsal fin. The second and third dorsal spines are about a third longer than the last spine and often have filamentous extensions. *L. centropomoides* differs further from *calliurus* (Table 2) in its smaller scales, fewer

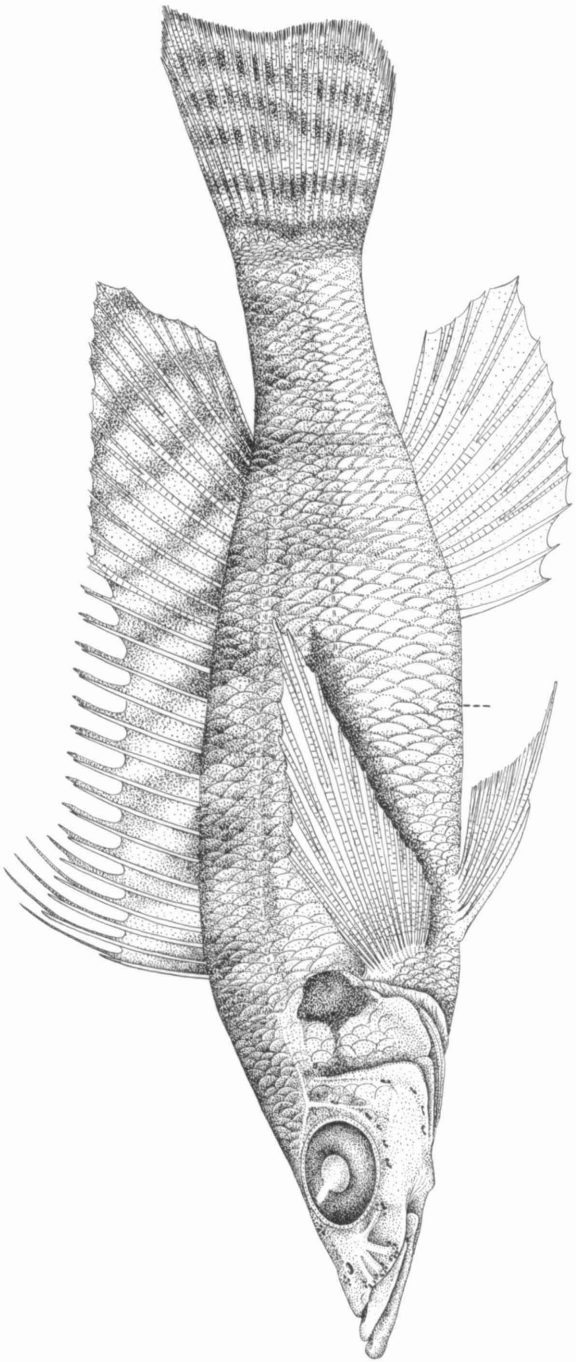

PLATE 2. *Leptochromis centropomoides*, holotype, UMMZ 199809, 135 mm s.l., female.

TABLE 2

COMPARISON OF TWO SPECIES OF *LEPTOCHROMIS;* DATA FOR *CALLIURUS* BASED LARGELY ON POLL (1956: 253-255) AND UMMZ 196166, SIX SPECIMENS FROM BURUNDI.

Character	*calliurus*	*centropomoides*
Anterior dorsal spines	Not elevated, without dermal tabs or filaments	Elevated, with dermal extensions or filaments
Predorsal contour	Notably convex	Flat
Anterior part of head	Little produced, narrow, rounded in cross section; mandible not or scarcely produced	Produced, broad, flattened ventrally; mandible strongly projecting
Dorsal fin:		
Spines	16-18	(14) 15 (16)
Total rays	(27) 28 (29)	(25) 26 (27)
Vertebrae	34 or 35	33 (34)
Scales:		
Lateral series	37-39	51-59
Upper lateral line	27-29	37-45
Lower lateral line	9-19	27-44
Rows between lateral lines	2	3 (sometimes 2 posteriorly)
Around caudal peduncle	18-20	26-29
Below eye	2-5 rows	None
Head length (percent of s.l.)	Shorter; 30.3-34.5	Longer; 33.8-36.4
Pectoral fin (percent of s.l.)	Shorter; does not reach anal origin; 26.7-30.3	Longer; reaches origin of anal; 31.4-37.7
Buccal teeth	Larger, arranged in rows, outer teeth enlarged, brown tipped, 2 or 3 inner rows	Smaller, in bands, outer teeth neither enlarged nor brown tipped
Pigmentation of spinous dorsal fin	Uniformly gray, sometimes dark edged	About 5 diagonal dark bars
Branchiostegal membrane	Silvery white	Dark

dorsal spines, fewer total dorsal rays, longer head and pectoral fin, strongly projecting mandible, differently colored dorsal fin, and numerous other characters. There are always two scale rows between upper and lower lateral lines in the region of overlap in *calliurus; centropomoides* has three rows except at the posterior end of upper lateral line where there may be only two rows.

Cheek scales in *centropomoides* are confined to posterior third of the cheek and never extend forward to the lachrymal as they do in *calliurus.*

Description.—Proportional measurements are presented in Table 3. For the following counts, frequencies are given in parentheses and those for the holotype are marked by asterisks.

Dorsal spines, XIV (1), XV* (11), XVI (1); dorsal soft rays, 10 (1), 11* (12), 12 (1); anal spines, III* (13); anal soft rays, 8* (8), 9 (5). Anterior dorsal spines two to five noticeably longer than those behind and generally with filamentous extensions or tassels. Soft dorsal and anal fins, when depressed, extend to just beyond caudal-fin base. Pelvic and pectoral fins may extend to just beyond anal-fin origin; pectoral-fin rays, 15 or 16, a mode of 15 on each side. Caudal fin slightly emarginate with corner of lower lobe rounded and that of upper lobe pointed and longer. Caudal peduncle length divided by peduncle depth 1.51-1.83.

Scales in lateral series, 59*, 51 to 59; upper lateral line, 45*, 37 to 45; lower lateral line, 32*, 27 to 44 (most counts include a few nonpored scales). A few mid-lateral pored scales were often present anterior to the series counted as the lower lateral line; these widely-separated, anterior scales were not counted. Circumpeduncular scales rows, 26 (5), 27 (4), 28* (3), 29 (1). Three scale rows between upper and lower lateral lines in the region of overlap, but sometimes reduced to two at posterior end of upper lateral line. Cheek scales present behind eye and variously extending down onto posterior third of cheek. Scales present on nape, breast, and pectoral fin base are smaller than those on the flanks. Anterior and lateral breast scales are smaller than scales on median part of breast and pectoral base. Vertebrae, precaudal 15* (8), caudal 18* (7) or 19 (1), total 33* (7) or 34 (1).

Buccal teeth are all small, conical, and whitish without orange-brown tips. The teeth are irregularly spaced and arranged into bands on the jaws; the bands are interrupted in the center of each jaw. In some specimens the outer teeth are more evenly spaced and aligned in a row. Teeth bands on the anterior part of the mandible are exposed and visible from above when the mouth is closed. Lower pharyngeal teeth are entirely conical (Fig. 2C,D). Gill rakers, 13* (6), 14 (7).

Body slender and slightly compressed laterally. Underside of snout, head, and breast extremely broad and flattened. Frontal

TABLE 3

MORPHOMETRIC CHARACTERISTICS OF *LEPTOCHROMIS CENTROPOMOIDES* IN THOUSANDTHS OF STANDARD LENGTH. CATALOGUE NUMBERS ARE IN UMMZ AS FOLLOWS: 1, HOLOTYPE, NO. 199809; 2, 3, 9, 10 NO. 195991; 4, 7, 12 NO. 196115; 5 NO. 196036; 6 NO. 196037; 8 NO. 199744; 11 NO. 195988; 13 NO. 195990.

Measurement	Specimen Number												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Standard length, mm	135	151	147	145	138	136	134	105	141	138	137	136	133
Sex	♀	♂	♂	♂	♂	♂	♂	♂	♀	♀	♀	♀	♀
Head length	348	340	364	352	348	353	351	343	353	359	364	338	361
Body depth	230	234	239	214	217	221	209	210	204	237	220	235	229
Caudal peduncle depth	104	103	105	110	101	110	104	105	96	112	106	110	107
length	178	174	178	172	181	176	172	171	177	168	172	169	169
Snout length	115	110	112	115	109	110	107	111	109	112	121	108	120
Premaxillary pedicel length	178	165	165	172	159	169	164	171	167	174	180	162	183
Upper jaw length	125	123	133	130	125	121	123	120	127	127	139	125	129
Lower jaw length	178	172	186	179	174	176	172	171	184	182	191	176	187
Preorbital distance	29	33	35	35	37	40	38	34	29	33	34	32	34
Orbit length	98	94	99	99	94	98	97	97	110	104	102	95	101
Interorbital bony width	42	40	40	38	39	38	40	36	38	40	38	42	38
Third dorsal spine	133	147	173	193	...	169	...	...	...	170	201	154	202
Highest dorsal soft ray	203	240	238	257	249	234	243	...	218	225	237	228	242
Last anal spine	110	120	118	121	125	129	116	131	130	126	118	126	135
Highest anal soft ray	172	225	203	202	208	193	221	194	182	221	188	196	202
Pectoral fin length	319	348	329	352	333	331	358	314	346	364	377	353	373
Pelvic fin length	267	270	316	290	290	287	284	267	246	285	272	279	259

profile straight, sloping evenly from dorsal-fin origin to premaxilla. Eyes almost superolateral. Infraorbital canal discontinuous, with one or two infraorbitals missing immediately behind the lachrymal. The largest male is 151 mm, largest female 141 mm. In females larger than about 130 mm, the ovaries were active (R. Kendall, letter of 20 March 1972), and a 138 mm female (Table 3, no. 10) had an estimated 100 to 200 ova of varying sizes ranging up to about 2.8 mm along the long axis. All eggs were in one ovary.

Distribution.—Endemic to Lake Tanganyika where it has been found only in deep water (40 to 100 m) in Zambia. All *Leptochromis* at the British Museum (Natural History) and Tervuren Museum were reexamined; all agreed with the types of *calliurus.*

Color.—The color pattern of specimens preserved in alcohol (Plate 2) is almost fully developed in the smallest specimen available (105 mm); no sexual dichromatism is apparent. Upper surface of the body and head are a dusky olive-brown; the body is lighter-colored ventrally. Branchiostegal membrane is dusky or blackish submarginally, sometimes with a narrow light edge.

Etymology.—Named *centropomoides* because of the superficial resemblance of head and body (but not the dorsal fin) to the American snooks, genus *Centropomus.*

Lamprologus prochilus, new species
Plate 3, Fig. 2E,F

Generic assignment.—This species is assigned to the genus *Lamprologus* Schilthuis (1891) with which it shares the following diagnostic combination of characters: anal spines more than three, jaw teeth all conical, enlarged into canines in front, scales ctenoid, and dorsal spines 21 or fewer. The dorsal spine count separates *Lamprologus* from *Chalinochromis* and most species of *Julidochromis,* all of which have modal counts of 22 or more.

Regan (1920) separated *Lamprologus* from *Julidochromis* primarily on the basis of infraorbitals being ossified in the former and not ossified in the latter. However, he examined only one dried skeleton of the type species for each genus, *L. congoensis* and *J. ornatus.* Of over 25 species of *Lamprologus* that we have examined, *congoensis* and *moorei* are the only species found to have a completely ossified infraorbital series in the adult. Nearly

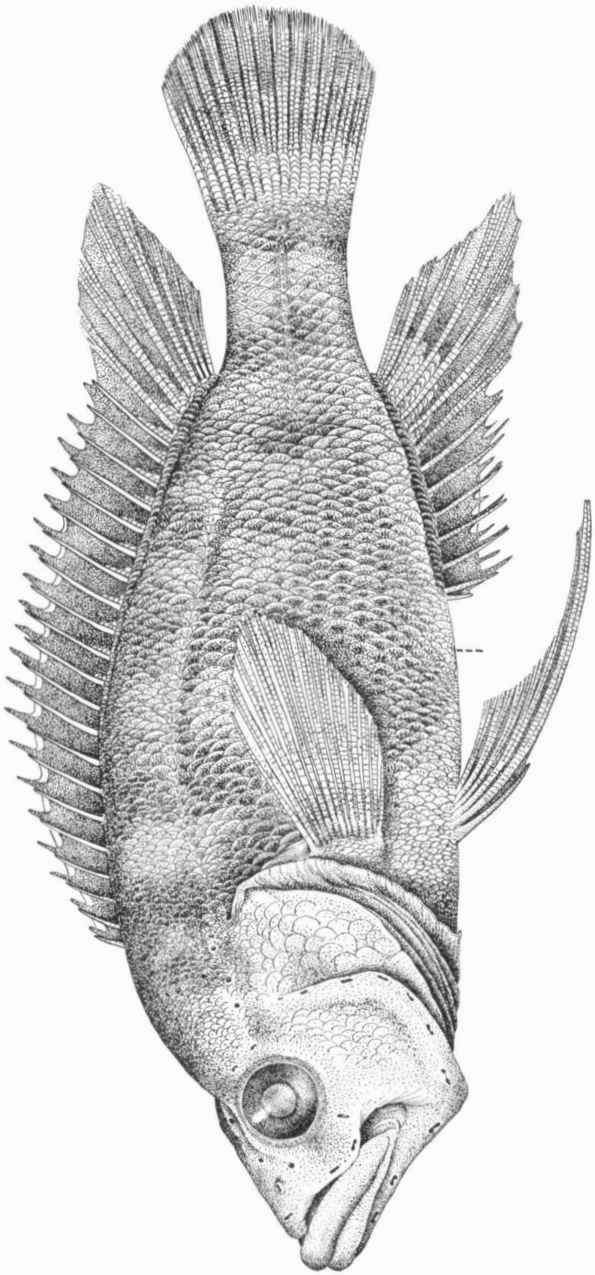

PLATE 3. *Lamprologus prochilus*, holotype, UMMZ 199957, 97 mm s.l., male.

all species have only a lachrymal; the infraorbital branch of the lateralis system connects a series of integumentary neuromasts which extend from the posterior lachrymal pore to a pore on the pterotic. This is a specialized condition which distinguishes the new species and most other species of *Lamprologus* from most other cichlids. *L. prochilus* also has a pharyngeal apophysis composed of parasphenoid and basioccipital as do most forms of *Lamprologus* examined.

Material.—Holotype, UMMZ 199957, a male 97 mm (total length 118 mm), and paratopotypes, UMMZ 199958, 54: 25-99 mm (including one alizarin preparation), Nyika Bay on N side of Nkumbula Island, 2 km N of Mpulungu, lat. 8° 38′ S, long. 31° 9′ E, steep, rock-rubble slope, depth to 5 m, rotenone, R. M. Bailey, D. J. Stewart and others (see acknowledgments), 31 October 1970 (field no. B70-25A). Paratype, Tervuren Museum 76-4-P-259, a male 103 mm, Sud Lac Tanganyika, Cap. Chipimbi (=Kipimbi), Zambia, P. Brichard, 15 January 1976.

Diagnosis.—A species of *Lamprologus* with premaxillary pedicels that reach to above back of the pupil and measure 50-57 percent of head length (187-214 per mille of s.l.), proportionately longer than in other species. The combination of 48-57 scales in lateral series, rounded caudal fin, and body depth 2.7-3.3 in s.l. (304-374 per mille of s.l.) separates *L. prochilus* from its congeners. In Poll's (1956:610) key, *L. prochilus* emerges closest to *hecqui.* It is distinguished from that species, in addition to above characters, by its dorsal fin counts (XX-XXI, 6 or 7, mode XX, 7, rather than XVIII-XIX, 8-10, mode XVIII, 9). *L. prochilus* appears most closely related to *niger,* which also has relatively long premaxillary pedicels (135-153 per mille of s.l., n=10); *prochilus* differs further in having conical pharyngeal teeth as contrasted with the submolariform teeth of *niger. L. niger* also differs from *prochilus* in having a discrete black mark on the pectoral fin base and light-colored spots posteriorly on the flank and caudal peduncle. Light spots occur also on the soft-rayed dorsal and anal fins and the caudal fin where they are larger and more noticeable than in male *prochilus.*

Description.—Proportional measurements are presented in Table 4. For the following counts, frequencies are given in parentheses and those for the holotype are marked by asterisks.

Dorsal spines, XX (14), XXI* (1); dorsal soft rays, 6 (1), 7* (14); anal spines, VII* (8), VIII (7); anal soft rays, 6 (9), 7* (6).

TABLE 4

MORPHOMETRIC CHARACTERISTICS OF *LAMPROLOGUS PROCHILUS* IN THOUSANDTHS OF STANDARD LENGTH (UMMZ 199957, 199958).

Measurement	Holotype	Paratypes													
Standard length, mm	97	99	97	87	76	56	55	48	76	72	68	66	62	61	48
Sex	♂	♂	♂	♂	♂	♂	♂	♂	♀	♀	♀	♀	♀	♀	♀
Head length	371	394	371	391	382	393	382	375	395	375	382	379	387	377	375
Body depth	330	374	340	322	329	304	309	312	316	333	324	333	339	311	312
Caudal peduncle depth	113	121	124	126	132	125	127	125	118	125	118	121	129	131	125
length	136	131	134	138	132	125	145	125	145	125	132	136	129	131	146
Snout length	124	131	113	126	120	111	109	125	125	114	121	117	123	128	115
Premaxillary pedicel length	206	202	196	207	197	214	200	187	197	208	206	197	194	213	208
Upper jaw length	167	165	171	169	164	159	149	154	167	169	162	168	158	161	158
Lower jaw length	196	202	196	207	211	196	200	187	197	208	191	197	194	197	208
Preorbital distance	43	51	45	49	42	37	49	44	46	40	43	41	42	46	44
Orbit length	82	91	85	92	95	104	93	102	93	103	99	91	95	103	106
Interorbital bony width	82	81	80	91	86	71	76	73	82	75	75	79	79	82	81
Last dorsal spine	103	120	127	116	112	116	125	119	111	108	113	120	106	115	121
Highest dorsal soft ray	211	222	225	160	216	193	180	185	178	183	199	198	182	210	196
Last anal spine	110	115	113	118	128	137	116	135	118	131	116	129	119	116	129
Highest anal soft ray	249	239	232	175	243	196	201	217	195	210	210	211	202	230	225
Pectoral fin length	237	242	237	230	237	232	236	250	237	250	250	258	242	230	250
Pelvic fin length	361	323	309	287	355	304	309	292	289	319	294	333	323	328	354

Profile of spinous dorsal relatively level posterior to about the fifth spine. Soft dorsal and anal fins, when extended back, may reach a point midway between base and tip of caudal fin and in mature males they extend slightly farther back than in females. Pelvic fin generally extends beyond the anal-fin origin in adults of both sexes. Pectoral fin reaches at most the level of the anal-fin origin and is generally slightly shorter; pectoral fin rays, 14* (9), 15 (1) with the first or upper ray small and affixed to the second. Caudal fin symmetrical with corners of both lobes rounded. Caudal peduncle length divided by peduncle depth, 1.00-1.18.

Scales in lateral series, 48 to 57*; upper lateral line, 34*, 28 to 47; lower lateral line, 13*, 4 to 17 (most counts include a few nonpored scales). Circumpeduncular scales, 23 (4), 24 (8), 25* (3). Scales absent on anterior half of cheek, usually at least a few present on posterior half of cheek and behind eye. Scales on breast, pectoral base, and nape smaller than those on flank. Vertebrae, 31 (6), 32 (41), 33 (3), usually 14 + 18, occasionally with 13 precaudal or 19 caudal.

Buccal teeth entirely conical; teeth of the outer row larger, usually with five or six canines on the front on each jaw. The canines are frequently broken, missing, or in various stages of replacement. Inner teeth arranged in a dense band behind the outer row. Lower pharyngeal teeth entirely conical (Fig. 2E,F). Gill rakers, 7 (1), 8 (4), 9* (8), 10 (2).

Body relatively deep and laterally compressed. The largest male is 103 mm (123 mm total length); the largest female is 76 mm.

Distribution.—Endemic to Lake Tanganyika where it is known from the type locality and Cape Kipimbi, Zambia. Collections taken a short distance away from the type locality lacked this species. A restricted ecological distribution is suggested.

Color.—Color pattern of preserved specimens in alcohol (Plate 3) is essentially similar for both sexes; all are colored in shades of brown ranging from olive-brown to nearly black. The smallest specimen (25 mm) has seven sharply contrasting vertical bars on the body, each wider than the interspaces. Slightly larger specimens have these markings more diffuse and similar to those in adults. Mature males often have small, light-colored spots arranged in rows parallel to the fin rays on membranes of the caudal fin and soft-rayed portions of the dorsal and anal fins.

Etymology.—The name *prochilus* is an adjective, latinized from the Greek πγό, forward, and χεῖλος, lip, in reference to the notably protractile mouthparts.

ADDITIONS TO THE CICHLID FAUNA OF ZAMBIA

Seventy-five cichlid species were recorded from Zambian waters of Lake Tanganyika by Bell-Cross and Kaoma (1971) and five have been reported since: *Xenotilapia spilopterus* Poll and Stewart (1975), *Julidochromis dickfeldi* Staeck and *J. regani* Poll (Staeck, 1975), *Perissodus eccentricus* Liem and Stewart (1976), and *Limnochromis bellcrossi* (Poll, 1976, discussed above). In addition to the two new species described herein, our collections and those received through Dr. Kendall include 18 other species, bringing to 100 the number of cichlid fishes known from Lake Tanganyika, Zambia, i.e., about two-thirds of the cichlids of the lake. The added species are discussed briefly below, following the sequence adopted by Poll (1956). Most specimens were taken with gill nets; exceptions are indicated.

Lestradea perspicax Poll. UMMZ 196167 (2), 102-106 mm in standard length, Lake Tanganyika.

Limnochromis auritus (Boulenger). UMMZ 195997, 87 mm, Musende Bay, 100 m, Kendall, 1972; UMMZ 196016, 100 mm, Chituta Bay, 80 m, Kendall, 1972.

Limnochromis abeelei Poll. UMMZ 196043, 195 mm, 80 m, UMMZ 196044, 165 mm, 100 m, and UMMZ 196047, 183 mm, 100 m, Musende Bay, Kendall, 1972; UMMZ 196045, 101 mm, 80 m, Mutondwe Island, Kendall, 1972; UMMZ 196046, 100 mm, 80 m, Mwela, Kendall, 1972; UMMZ 196119 (3), 161-171 mm, near Mpulungu, Kendall, 1971 or 1972; UMMZ 199745, 178 mm, near Mpulungu, C. Ellis, 1970.

Limnochromis christyi Trewavas. UMMZ 196101, 80 mm, 40 m, UMMZ 196048 (3), 81-85 mm, 80 m, and UMMZ 196050 (15), 83-109 mm, 80 m, Mutondwe Is., Kendall, 1972 (3 sent to Tervuren Museum); UMMZ 196049, 103 mm, 100 m, Musende Bay, Kendall, 1972; UMMZ 196121, 96 mm, and UMMZ 196120 (3), 88-104 mm, near Mpulungu, Kendall, 1971 or 1972.

Limnochromis christyi was previously known only from the three type specimens. Kendall caught this taxon regularly in gill nets set in deep water (40-100 m). Trewavas (1953) gave the eye diameter as 3.9-4.3 in head length for *christyi*. We found eye size to vary considerably in adults, with the largest 3.3 times in head length. In other respects, our material agrees with the original description. Vertebral counts for UMMZ 196120 are 14 + 17 = 31 in two, and 14 + 18 = 32 in one.

Limnochromis staneri Poll. UMMZ 196052 (2), 86 and 91 mm, 80 m, and UMMZ 196053 (4), 104-144 mm, 60 m,

Chituta Bay, Kendall, 1972; UMMZ 196054 (4), 98-142 mm, 100 m, Musende Bay, Kendall, 1972; UMMZ 196122 (5), 88-145 mm, near Mpulungu, Kendall, 1971 or 1972.

Vertebral counts for UMMZ 196122 are 14 + 18 = 32 in one, 15 + 17 = 32 in four.

Limnochromis leptosoma (Boulenger). UMMZ 195998 (2), 63, 71 mm, 80 m, and UMMZ 196102, 98 mm, 40 m, Mwela, Kendall, 1972; UMMZ 196051 (17), 95-108 mm (3 sent to Tervuren Museum), 40 m, and UMMZ 196103 (2), 95, 105 mm, 60 m, Mutondwe Is., Kendall, 1972.

Xenotilapia ornatipinnis Boulenger. UMMZ 196083 (3), 84-93 mm, pelagic purse seine, Chituta Bay, Kendall, 1972.

Xenotilapia longispinis longispinis Poll. UMMZ 196079 (6), 98-107 mm, pelagic purse seine, and UMMZ 196080 (4), 90-101 mm, 40 m, Chituta Bay, Kendall, 1972.

Trematocara marginatum Boulenger. UMMZ 196064, 66 mm, Lake Tanganyika, Zambia. The vertebrae number 12 + 17 = 29 (Table 5).

Trematocara kufferathi Poll. UMMZ 196063, 43 mm, 100 m, Mutondwe Is., Kendall, 1972; UMMZ 196105, 41 mm, 80 m, Chituta Bay, Kendall, 1972. The vertebrae number 12 + 18 = 30 (Table 5).

Trematocara macrostoma Poll. UMMZ 196106 (5), 38-89 mm, 100 m, and UMMZ 196108, 83 mm, 80 m, Chituta Bay, Kendall, 1972; UMMZ 196107 (7), 87-95 mm, 100 m, Mwela, Kendall, 1972; UMMZ 196123, 81 mm, near Mpulungu, Kendall, 1971 or 1972; UMMZ 199794 (11), 78-90 mm, 72-80 m, 4 km WNW Mpulungu, Kendall and Bailey, 2 Nov. 1970.

TABLE 5

FREQUENCY DISTRIBUTION OF COUNTS OF TOTAL NUMBER OF VERTEBRAE FROM SEVEN SPECIES OF *TREMATOCARA* FROM LAKE TANGANYIKA.

		Vertebrae			
Species	Area	28	29	30	31
marginatum	Zambia		1		
nigrifrons	Zambia		4	1	
kufferathi	Zambia			2	
unimaculatum	Zambia		1	5	
macrostoma	Zambia			1	15
variabile	Burundi		9	3	
stigmaticum	Burundi	1	7	1	

This species, previously known only from the two juvenile type specimens, was collected regularly by Dr. Kendall in deep-set gill nets (72-100 m), and a good series of adult specimens is available for the first time. Except for coloration and dorsal-fin profile, our material agrees well with the types, which Dr. M. Poll kindly made available to us. The juvenile types of *macrostoma* lack dark markings on the dorsal fin and body; adults have striking and diagnostic black markings. The spinous dorsal fin becomes relatively much higher with age.

Two features of the color pattern of preserved specimens are diagnostic in both sexes. (1) There are two ocellated black spots at the base of the spinous dorsal fin (Fig. 3). These lie between the fourth or fifth and sixth and the seventh and ninth to eleventh spines, respectively. Other species of *Trematocara* have one or no dorsal fin spot. Some species of *Trematocara* have a narrow (*marginatum*) or broad (*nigrifrons*) dark marginal band on the dorsal fin, and *caparti* has a broad dark submarginal band; *macrostoma* has neither marginal nor submarginal band. In three species (*kufferathi, variabile, stigmaticum*) a blotch or darkened area extends from the anterior border back to the

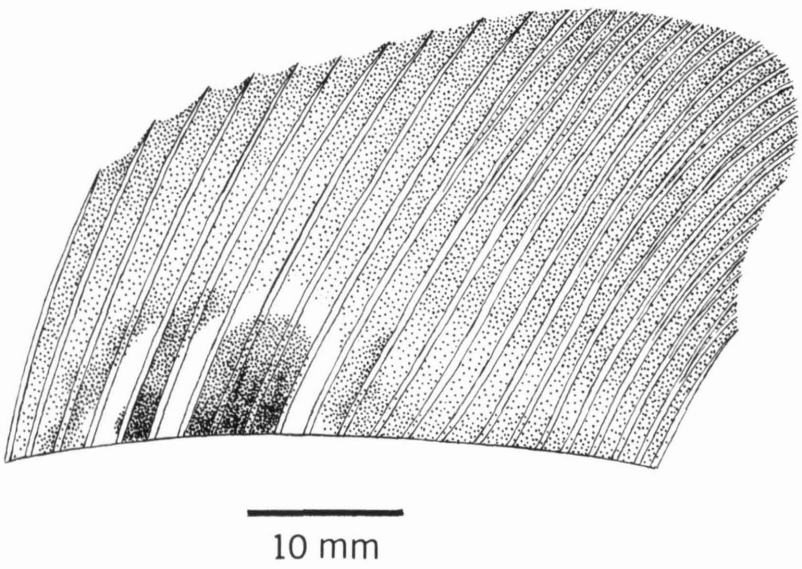

FIG. 3. Dorsal fin of *Trematocara macrostoma*, UMMZ 196106, an adult male 88.5 mm in standard length.

third to sixth spine. In *unimaculatum,* which most closely simulates *macrostoma,* there is a single large ocellated dark spot between the ninth and eleventh spines. (2) Adults of *T. macrostoma* have a single, black, ventrolateral stripe low on the side that extends from pectoral fin base to caudal base. Other species of *Trematocara* have three (*kufferathi, unimaculatum, variabile*—the upper sometimes faint), two (*marginatum, nigrifrons, caparti*), or no dark lateral stripes on the body. The stripe of *macrostoma* is most pronounced posteriorly and separates an essentially unpigmented venter from the dusky, olive-brown upper parts of the body.

The dorsal fin of mature males may be twice as high as that of females, and the pelvic fin usually extends to or beyond the anal-fin origin whereas in females the pelvic does not reach the anus. The shape of the pelvic fins in *macrostoma* may also be diagnostic; the third branched ray is the longest in both sexes. Only *variabile* among other species of *Trematocara* has similarly shaped pelvics. Maximum size in our material is 96 mm for males and 90 mm for females. Sexual dichromatism is also well developed.

In males the dorsal fin and lateral stripe are more darkly pigmented than in females, the caudal fin has a blackened ventral margin, the anal fin has black mottlings with a clear basal band, and the pelvic fin is black. The branchiostegal membranes are black with the lower edge light; anterior to the angle of the jaw the black pigment separates and extends along both sides of an otherwise unpigmented chin. An anterolateral extension of the mental pigment is hidden in a fold under the ventral rim of the mandible when the mouth is closed; this pattern is similar to that of male *nigrifrons* (Poll, 1956, fig. 66).

In females, the caudal fin lacks a darkened ventral margin, the anal fin is dusky on the soft-rayed part, sometimes darkened as a submarginal band. The pelvic fins and branchiostegal membranes are unpigmented.

The dorsal fin has X (20 specimens) or XI (3) spines and 12 (6) or 13 (17) soft rays (counting all elements). It becomes tremendously elevated with growth, especially in males (Fig. 3). The spines are very slender and fragile, the tips often imperceptibly broken so that measurements are probably minimal. In nine adult males the last spine is 242 to 365 thousandths of the standard length, mean 309. In five adult females that spine is

127 to 175, mean 159. In a juvenile male 38 mm long it is 188. In Poll's (1956) figure of a 45 mm specimen, the last spine is 124. The anal fin has III (22) spines and 10 (16) or 11 (6) soft rays.

The gill rakers are slender and rather long; the total count is 23 (2), 24 (4), 25 (11), 26 (5), 27 (1), and the lower limb has 17 (2), 18 (3), 19 (13), 20 (5). The upper lateral line consists of 2 to 7 pored scales, mean 4.0 in 15 specimens; the lower lateral line is obsolete. Scales in lateral series number 29 (1), 30 (4), 31 (3), 32 (9), mean of 17 counts 31.2. Vertebral number in *Trematocara macrostoma* is higher, 13 + 17 = 30 (1), 13 + 18 = 31 (15), than in other species of the genus counted (Table 5).

Among the species of *Trematocara, macrostoma* is unique in having the dentigerous area expanded so that minute, conical teeth cover the outer surfaces of both jaws (see Poll, 1956, fig. 71). The mouth is large, the maxilla extends to below pupil, and the lower jaw is much the longer.

All species of *Trematocara* have the infraorbital series interrupted behind the eye and more or less widely separated from the supraorbital canal. In addition, all species have some, at least, of the infraorbital bones much enlarged to form bony chambers that shield sensory structures. *T. macrostoma, T. unimaculatum,* and *T. marginatum* have the separation narrow and all bones of the infraorbital series enlarged to form about eight (*marginatum*) or nine apertures. At the other extreme enlarged chambers and pores may be limited to three on the lachrymal, as in *T. kufferathi,* followed by several flat, unpored infraorbitals. Other species are variously intermediate.

Trematocara macrostoma is thus seen to be a highly distinctive species, apparently well equipped for life at considerable depths. The adaptive significance of the peculiar dentition, the striking sex dimorphism in color and fin configuration, and the structure of the cephalic sensory system merit thorough investigation. Similarities in dorsal-fin pigmentation and in infraorbital specialization, both distinctive and probably synapomorphic, lead to alignment of *Trematocara macrostoma* and *T. unimaculatum* as intimate relatives.

Julidochromis ornatus Boulenger. UMMZ 199943 (34), 31-62 mm, Nyika Bay, Nkumbula Is., 0-3 m, rotenone, Bailey, Stewart, et al., 31 Oct. 1970; UMMZ 199870 (8), 39-68 mm, north end Nkumbula Is., 0-4 m, rotenone, Bailey, Stewart, et

al., 1 Nov. 1970; UMMZ 199832 (2), 27, 43 mm, Nyika Bay, Nkumbula Is., 14 m, scuba and rotenone, Bailey, Stewart, et al., 2 Nov. 1970.

Chalinochromis brichardi Poll. UMMZ 196156, 75 mm, 2-3 m, Kala Bay (near Kasaba Bay, see Fig. 1), Kendall, April, 1973.

Poll (1974) described *Chalinochromis brichardi* from Burundi, where it is abundant only on sponge-encrusted sandstone cliffs and ledges near Magara. The lake-wide distribution of this taxon is affirmed by Dr. Kendall's collection of two large adults in a gill net set in shallow water (2-3 m) in Kala Bay, Zambia, in April, 1973. One specimen remains in a reference collection in Mpulungu and the other, which agrees completely with Poll's (1974) description, is UMMZ 196156.

Lamprologus furcifer Boulenger. UMMZ 199873 (6), 46-119 mm, north end of Nkumbula Is., 0-4 m, rotenone, Bailey, Stewart, et al., 1 Nov. 1970.

Lamprologus ocellatus Steindachner. UMMZ 199839 (35), 15-42 mm, Nyika Bay, Nkumbula Is., 14 m, scuba and rotenone, Bailey, Stewart, et al., 2 Nov. 1970.

Lamprologus wauthioni Poll. UMMZ 199843 (4), 41-46 mm, Nyika Bay, Nkumbula Is., 14 m, scuba and rotenone, Bailey, Stewart, et al., 2 Nov. 1970.

Lamprologus ornatipinnis Poll. UMMZ 199838 (19), 25-51 mm, Nyika Bay, Nkumbula Is., 14 m, scuba and rotenone, Bailey, Stewart, et al., 2 Nov. 1970.

Lamprologus niger Poll. UMMZ 199948 (38), 37-57 mm, Nyika Bay, Nkumbula Is., 0-3 m, rotenone, Bailey, Stewart, et al., 31 Oct. 1970.

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