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## Description of a Genus and Three Deep Water Species of Fishes (Teleostei: Cichlidae) from Lake Malawi, Africa

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**A genus and three new species of fishes are described from Lake Malawi. The genus is characterized by a small mental prominence at the symphysis of the dentaries; body marked with 6–8 black vertical bars; and enlargement of the lateral line tubules.**

CICHLID fishes present an outstanding case of explosive radiation in extant vertebrates. The rift valley lakes of Africa contain an extremely diverse fish fauna due primarily to the speciation of endemic haplochromine cichlids (Regan, 1921; Trewavas, 1935; Greenwood, 1979). The genera *Docimodus* Boulenger (Eccles and Lewis, 1976), *Lethrinops* Regan (Eccles and Lewis, 1977, 1978, 1979), *Labidochromis* Trewavas (Lewis, 1982) and a group of species of *Petrotilapia* Trewavas (Marsh, 1983) which inhabit Lake Malawi have recently been revised. However, the phylogenetic interrelationships and generic status of most of the endemic cichlids in Lake Malawi are unknown (Stiassny, 1981) Regan (1921) although stating that the Lake Malawi (Nyassa) “species are a natural group” placed a large number of Lake Malawi species into the genus *Haplochromis*. Recently, Greenwood (1979) restricted the genus *Hap-*

*lochromis* to five species of cichlids occurring in lakes Victoria, Edward, George, and Kivu. This revision is not completely accepted, as some individuals (Barel, 1984; Hoogerhoud, 1984) prefer to maintain the nomenclature prior to 1979 for the Lake Victoria cichlid flock. No disagreement, however has been expressed concerning the removal of the Lake Malawi cichlids from the genus *Haplochromis*.

Greenwood (1979) suggested that the temporary formal name *Cyrtocara* be used for “*Haplochromis*” species of Lake Malawi, but in a later publication he referred to these forms under “*Haplochromis*” (Greenwood, 1983:228). However, he did not imply that any of these species have a true phyletic relationship to the type species, *Cyrtocara moorii* Boulenger. We have used *Cyrtocara* for earlier descriptions of Lake Malawi cichlids (McKaye and McKenzie, 1982; Stauffer and McKaye, 1985) and will refer to

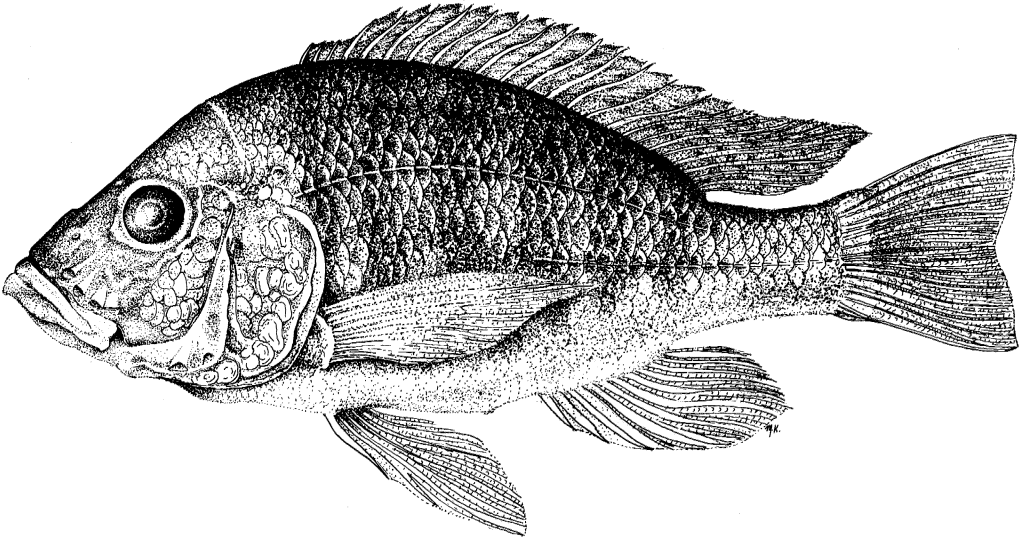


Fig. 1. Holotype (male) of *Alticorpus mentale*, USNM 288851.

species previously placed in *Haplochromis* as *Cyrtocara* in this paper.

During the course of our studies we have discovered three previously undescribed deep water haplochromine cichlid species that appear to be closely related to each other and to *Trematocranus peterdaviesi* Burgess and Axelrod and *C. macrocleithrum* Stauffer and McKaye. Rather than include these three species in the genus *Trematocranus* with distantly related species, we have decided to place these three species into a new genus. The purpose of this paper is to describe a new genus, the three new species, and discuss the rationale for erecting this new genus of Lake Malawi cichlids.

#### METHODS

Specimens were collected by trawls. External counts and measurements follow Barel et al. (1977). Scales in the lateral line series omit those in the overlapping portion of the lower line. Morphometric values are expressed as thousandths of standard length (SL) and thousandths of head lengths. Radiographs were taken of the holotypes and paratypes to determine the number of abdominal and caudal vertebrae. The holotypes were deposited in the U.S. National Museum of Natural History (USNM). Some paratypes were deposited in the USNM and some in the British Museum (Natural History) (BMNH).

#### *Alticorpus* n. gen.

*Type species*.—*Alticorpus mentale*, n. sp.

*Description*.—This genus comprises a series of five species (Cichlidae) endemic to Lake Malawi, Africa. All of the species within the genus exhibit the following characteristics: ventral protuberance at the symphysis of the dentaries; body marked with 6–8 black vertical bars; and the lateral line tubules of the preopercular infraorbital bones are enlarged, and the bones of that series deepened, so that there are 2–4 scale rows on the cheek.

*Etymology*.—The name indicates that all of the forms are characterized by a relatively deep body, from the Latin *altus* meaning deep and *corpus* for body. The gender is neuter.

#### *Alticorpus mentale*, n. sp.

*Holotype*.—USNM 288851 (Fig. 1), adult male 188.0 mm SL off Monkey Bay, Lake Malawi (longitude, 34°52'E, latitude, 13°56'S), Malawi, Africa, at 75 m, 3 Sept. 1983. Collected by McKaye and Stauffer, field collection number JRS-83-146.

*Paratypes*.—USNM 288852 (3 females 136.7, 141.4, 192.6, mm SL). BMNH 1987.4.14:6–9 (1 female 174.6 mm SL and 3 males 140.7, 181.8, 184.2 mm SL). Field data as for holotype.

TABLE 1. PRINCIPAL MORPHOMETRIC AND MERISTIC CHARACTERISTICS OF *Alticorpus mentale* (N = 8 AND INCLUDES HOLOTYPE).

	Holotype	Mean	Standard deviation	Range
Standard length, mm	188.0	167.4	23.7	136.7–192.6
Head length, mm	68.5	61.2	9.4	49.3–74.1
Thousandths of head length				
Horizontal eye dia.	251	258	19	240–292
Vertical eye dia.	225	244	22	225–286
Snout length	371	360	30	290–382
Postorbital head len.	418	408	25	353–432
Preorbital depth	239	238	16	215–262
Premaxillary pedicel	219	237	17	219–270
Lower jaw length	467	470	16	449–495
Interorbital width	223	242	16	223–268
Cheek depth	288	270	15	250–291
Symphysis depth	69	66	6	58–77
Thousandths of standard length				
Head length	364	365	10	349–385
Head depth	372	364	12	348–385
Snout to dorsal	420	407	11	391–420
Snout to pelvic	419	421	12	409–440
Body depth	402	393	13	372–407
Least caudal peduncle length	212	192	14	167–212
Least caudal peduncle depth	113	110	3	105–114
Pectoral-fin length	383	376	14	356–394
Pelvic-fin length	288	252	39	209–302
Dorsal-fin base length	485	509	15	485–532
Lateral line scales	34	33.4	1.2	31–35
Scale rows on cheek	4	3.8	0.5	3–4
Dorsal-fin spines	15	15.6	0.5	15–16
Dorsal-fin rays	9	9.5	0.5	9–10
Pectoral-fin rays	13	13.4	0.5	13–14
Anal-fin rays	9	9.1	0.4	9–10
Gill rakers on ceratobranchial	10	10.4	0.9	9–12
Gill rakers on epibranchial	4	3.8	0.5	4–4
Teeth on left side of lower jaw	23	21.4	2.7	17–25

*Description.*—This description is based upon the holotype (Fig. 1), and seven paratypes. Principal morphometric ratios and meristics are presented in Table 1. The body is moderately compressed with a well arched back.

The jaws are isognathous, with the mental process projecting. Teeth on both the lower jaw and the premaxillae are in three rows and are unicuspid and slightly recurved. The holotype has 23 teeth in the outer row of the left lower jaw.

*Fins.*—The pectoral fins are long, extending to a vertical line about half-way along the base of

the anal fin. In males, the dorsal-fin rays extend over the anterior third of the caudal.

*Squamation.*—There are 31–35 scales in the lateral line series.

*Gillrakers.*—There are 9–12 gill rakers on the ceratobranchial of the first arch. The anterior six gill rakers on the ceratobranchial of the holotype are simple filaments, while the posterior four are bifid.

*Coloration.*—Freshly collected male specimens have black sides with blue, pink, and yellow

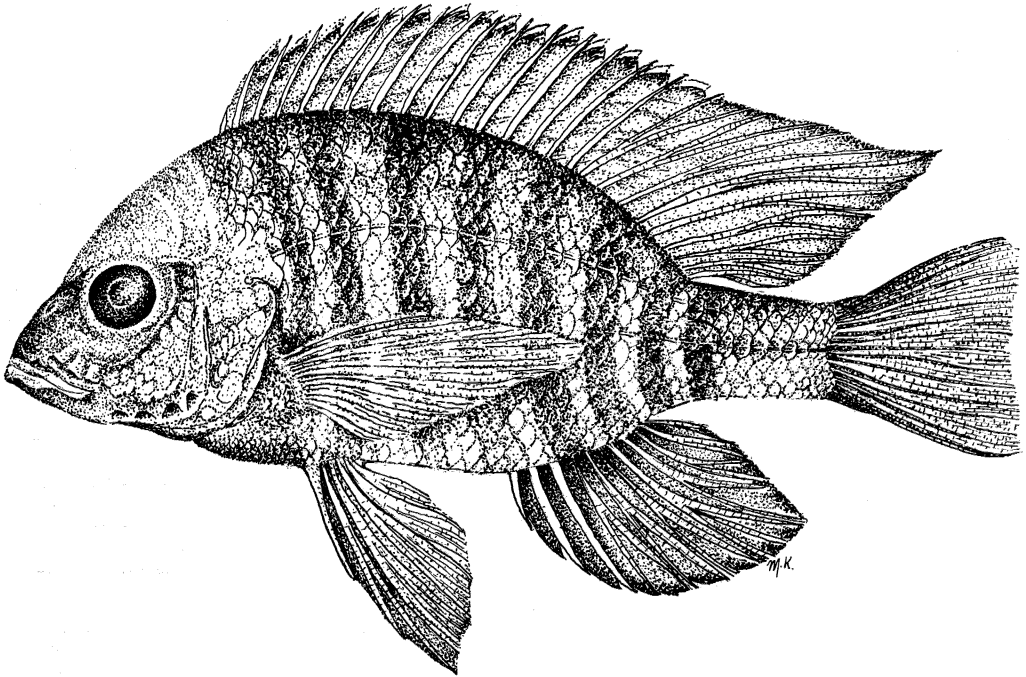


Fig. 2. Holotype (male) of *Alticorpus pectinatum* USNM 288853.

highlights. They have six black vertical bars. Opercle is black with a purple sheen. Head is black with fluorescent blue iridescent highlights. The dorsal is slate gray, and the membranes are interspersed with clear spaces. The membranes between the rays are yellow distally and black proximally. The anal fin has two yellow-orange spots posteriorly. Anteriorly the anal-fin membrane is slate gray to black. The females are silver laterally with black vertical bars. The membranes of dorsal, pectoral, pelvic, and anal fins are clear.

*Etymology.*—The name was chosen to reflect the prominent mental process from the Latin *mentum* for chin.

*Alticorpus pectinatum* n. sp.

*Holotype.*—USNM 288853 (Fig. 2), adult male 121.6 mm SL, off Monkey Bay, Lake Malawi (longitude, 34°52'E, latitude, 13°56'S), Malawi, Africa, at 75 m, 3 Sept. 1983. Collected by McKaye and Stauffer, field collection number JRS-83-146.

*Paratypes.*—USNM 288854 (three males 115.9, 124.3, 124.9, mm SL). BMNH 1987.4.14:3-5

(2 males 126.6, 133.5 mm SL). Field data as for holotype.

*Description.*—This description is based upon the holotype (Fig. 2), and five paratypes. Principal morphometric ratios and meristics are presented in Table 2. The body is moderately compressed with well arched back.

The jaws are isognathous with the chin slightly protruding (Barel et al., 1977: fig. 40). The mental protuberance is small but definitive. Teeth on the lower jaw of the holotype are in four rows, those on the premaxillae are in three. For the most part, the teeth are unicuspid and slightly recurved. The holotype has 27 teeth in the outer row of the left lower jaw, five of which are bicuspid.

*Fins.*—The pectoral fins are long, extending to a vertical about half-way along the base of the anal. In males, the tip of the dorsal rays extend above at least one-half of the caudal fin. The holotype has 13 abdominal and 18 caudal vertebrae. Three specimens had 13 and 17, one had 12 and 18, and one 12 and 17 abdominal and caudal vertebrae, respectively.

*Squamation.*—There are 31–33 scales in the lateral line series.

TABLE 2. PRINCIPAL MORPHOMETRIC AND MERISTIC CHARACTERISTICS OF *Alticorpus pectinatum* (N = 6 AND INCLUDES HOLOTYPE).

	Holotype	Mean	Standard deviation	Range
Standard length, mm	121.6	124.5	5.8	115.9–133.5
Head length, mm	39.1	40.3	1.5	38.6–42.5
Thousandths of head length				
Horizontal eye dia.	312	300	11	284–312
Vertical eye dia.	294	288	13	265–303
Snout length	333	333	11	318–348
Postorbital head len.	414	402	12	386–417
Preorbital depth	235	237	4	231–241
Premaxillary pedicel	243	252	7	243–264
Lower jaw length	422	431	16	405–450
Interorbital width	258	244	11	228–258
Cheek depth	286	272	12	256–286
Symphysis depth	46	47	3	44–51
Thousandths of standard length				
Head length	322	324	6	319–333
Head depth	338	355	13	338–373
Snout to dorsal	368	370	9	360–386
Snout to pelvic	364	380	11	364–388
Body depth	410	401	12	378–410
Least caudal peduncle length	220	201	13	182–220
Least caudal peduncle depth	116	117	4	110–122
Pectoral-fin length	364	396	27	363–442
Pelvic-fin length	312	333	27	304–373
Dorsal-fin base length	565	563	12	541–579
Lateral line scales	33	32.0	0.6	31–33
Scale rows on cheek	3	3.0	0	3
Dorsal-fin spines	16	15.0	0.5	15–16
Dorsal-fin rays	9	9.7	0.5	9–10
Pectoral-fin rays	14	13.2	0.8	12–14
Anal-fin rays	9	8.7	0.5	8–9
Gill rakers on ceratobranchial	21	18.5	2.1	16–21
Gill rakers on epibranchial	6	6.1	0.8	5–7
Teeth on left side of lower jaw	27	29	2.7	26–32

*Gill rakers.*—There are 16–21 gill rakers on the ceratobranchial of the first arch. The anterior gill rakers on the ceratobranchial of the holotype are simple filaments, while two of the posterior ones are bifid. One of the paratypes has a trifid posterior gill raker on the ceratobranchial.

*Coloration.*—Freshly collected male specimens have silvery lateral sides with yellow and pink highlights. They have six or seven black vertical bars. Head is speckled with fluorescent blue highlights. The dorsal fin is yellow/brown. Distally there is a thin black band followed by an outer yellow band. The membranes between

the rays contain orange spots. The anal fin is slate gray with yellow spots. Distally it is black.

*Etymology.*—The name was chosen to reflect the comb-like gill rakers from the Latin pecten for comb.

*Alticorpus profundicola*, n. sp.

*Holotype.*—USNM 288855 (Fig. 3), adult male 123.7 mm SL, off Nkota Kota, Lake Malawi, Malawi, Africa, at 159 m, May 1978. Collected by Malawi Department of Fisheries.

*Paratypes.*—USNM 288856 (2 adult male specimens 112.7, 110.3 mm SL). BMNH

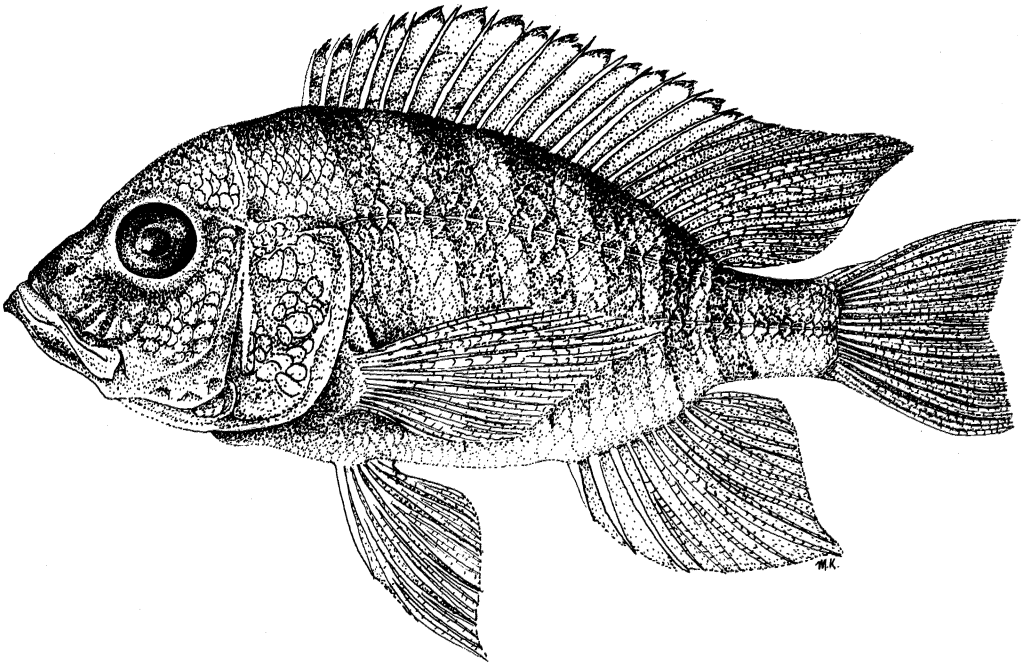


Fig. 3. Holotype (male) of *Alticorpus profundicola* USNM 288855.

1987.4.14.1-2 (2 male 115.8 mm SL and 1 female 100.7 mm SL). Field data as for holotype.

*Description.*—This description is based upon the holotype (Fig. 3) and four paratypes. Principal morphometric ratios and meristics are presented in Table 3. The body is moderately compressed.

The jaws are isognathous, with the mental protuberance small and projecting. Teeth on the premaxillae are in two rows, while those on the lower jaw in three. The outer most teeth are unicuspid and tricuspid. The holotype has 36 teeth in the outer row of the left lower jaw, 30 of which are tricuspid.

*Vertebrae.*—Two specimens, including the holotype had 13 abdominal and 16 caudal vertebrae. One specimen had 13 and 17, one 12 and 16, and one 12 and 17 abdominal and caudal vertebrae, respectively.

*Squamation.*—There are 29–31 scales in the lateral line series.

*Gill rakers.*—There are 14–16 outer gill rakers on the ceratobranchial of the first arch. The anterior seven gill rakers on the ceratobranchial of the holotype are simple, while four of the

posterior rakers are simple, two are bifid, and one is trifid.

*Coloration.*—Preserved specimens have yellow/brown sides with 6–7 dark brown vertical bars. Operculum is dark brown. Head is brown. The dorsal is light brown with a black submarginal band and white lappets. The pectoral fin is clear. The pelvic and anal fins are black.

*Etymology.*—The name was chosen to reflect the deep water existence of this species from the Latin profundus meaning deep and cola for dweller.

*Alticorpus peterdaviesi*  
(Burgess and Axelrod)

*Holotype.*—USNM 210693, adult male 122.7 mm SL, Monkey Bay, Lake Malawi, Malawi, Africa, at 80 m, May 1973. Collected by Burgess and Axelrod (1973).

*Paratype.*—USNM 210714, adult male 119.7 mm SL, Monkey Bay, Lake Malawi.

*Description.*—This redescription is based upon the holotype. It was determined that the paratype was a different species based on head shape.

TABLE 3. PRINCIPAL MORPHOMETRIC AND MERISTIC CHARACTERISTICS OF *Alticorpus profundicola* (N = 5 AND INCLUDES HOLOTYPE).

	Holotype	Mean	Standard deviation	Range
Standard length, mm	123.7	112.6	8.4	100.7–123.7
Head length, mm	46.2	41.7	3.4	36.6–46.2
Thousandths of head length				
Horizontal eye dia.	318	314	8	301–320
Vertical eye dia.	277	285	11	277–303
Snout length	301	305	8	297–317
Postorbital head len.	411	409	11	396–427
Preorbital depth	234	218	14	197–234
Premaxillary pedicel	206	212	10	204–228
Lower jaw length	476	449	22	423–476
Interorbital width	195	187	16	167–204
Cheek depth	288	262	25	230–288
Symphysis depth	56	48	6	41–56
Thousandths of standard length				
Head length	374	370	4	364–374
Head depth	381	366	21	333–381
Snout to dorsal	391	390	11	375–406
Snout to pelvic	433	410	18	388–433
Body depth	413	388	25	351–413
Least caudal peduncle length	172	179	5	172–187
Least caudal peduncle depth	112	112	6	101–118
Pectoral-fin length	357	367	16	353–391
Pelvic-fin length	301	292	24	260–325
Dorsal-fin base length	527	523	5	515–527
Lateral line scales	30	30	0.7	29–31
Scale rows on cheek	4	3.6	0.5	3–4
Dorsal-fin spines	14	14.6	0.5	14–15
Dorsal-fin rays	10	9.8	0.8	9–11
Pectoral-fin rays	14	13.8	0.4	13–14
Anal-fin rays	9	8.4	0.5	8–9
Gill rakers on ceratobranchial	14	14.6		14–16
Gill rakers on epibranchial	5	5.0	0	5
Teeth on left side of lower jaw	36	36	0	36

Principal morphometric ratios and meristics are presented in Table 4. The body is moderately compressed. The jaws are isognathous and the mental process is small.

Teeth on both the lower jaw and the premaxillae are in three rows. The majority of the teeth are unicuspid and slightly recurved; a few are bicuspid. The holotype has 31 teeth in the outer row of the left lower jaw.

*Fins*.—The pectoral fin is shortest (275 thousandths of SL) of all of the species in *Alticorpus* (353–442 thousandths of SL).

*Vertebrae*.—The holotype had 12 abdominal and 18 caudal vertebrae.

*Squamation*.—There are 31 scales in the lateral line series.

*Gill rakers*.—There are 18 gill rakers on the ceratobranchial of the first arch of the holotype. The holotype has six gill rakers on the epibranchial and the paratype has five. The anterior four gill rakers on the ceratobranchial of the holotype are simple and the posterior 14 are bifid.

*Coloration*.—Preserved specimens have yellow/brown sides with eight black vertical bars. Opercle is yellow with brown shading. The dorsal fin is clear with a black submarginal band. The

TABLE 4. PRINCIPAL MORPHOMETRIC AND MERISTIC CHARACTERISTICS OF *Alticorpus peterdaviesi*.

	Holotype
Standard length, mm	122.7
Head length, mm	40.5
Thousandths of head length	
Horizontal eye dia.	306
Vertical eye dia.	291
Snout length	336
Postorbital head len.	398
Preorbital depth	237
Premaxillary pedicel	225
Lower jaw length	420
Interorbital width	220
Cheek depth	257
Symphysis depth	44
Thousandths of standard length	
Head length	330
Head depth	356
Snout to dorsal	363
Snout to pelvic	389
Body depth	395
Least caudal peduncle length	198
Least caudal peduncle depth	106
Pectoral-fin length	275
Pelvic-fin length	295
Dorsal-fin base length	579
Lateral line scales	31
Scale rows on cheek	3
Dorsal-fin spines	14
Dorsal-fin rays	11
Pectoral-fin rays	14
Anal-fin rays	9
Gill rakers on ceratobranchial	18
Gill rakers on epibranchial	6
Teeth on left side of lower jaw	31

pectoral fin is clear. The pelvic and anal fins have black membranes.

*Material examined.*—*Trematocranus peterdaviesi* Burgess and Axelrod (1973).

*Alticorpus macrocleithrum*  
(Stauffer and McKaye)

*Holotype.*—USNM 268457, adult male, Lake Malawi, Africa.

*Description.*—See Stauffer and McKaye (1985).

*Material examined.*—*Cyrtocara macrocleithrum* Stauffer and McKaye (1985).

## DISCUSSION

When Trewavas (1935) described the genus *Trematocranus*, she stated "Otic region of skull slightly swollen; muscus-cavities of suborbital bones not greatly swollen; cheek with 2 to 4 series of scales." With the increased knowledge of the cichlids of Lake Malawi, it is plain that the definition of *Trematocranus* given by Trewavas (1935) is insufficient. The enlargement of the lateral line cavities of the head is known to characterize bottom-dwelling fishes of several genera and families, and by itself is not an indication of phyletic relationships. For example, *Aulonocara* from Lake Malawi, and *Aulonocranus* and *Trematocara* from Lake Tanganyika all have moderately enlarged or enlarged lateral line cavities of the infraorbital bones. In fact, in proposing the genus *Trematocranus*, Trewavas (1935) admitted that *Trematocranus auditor* Trewavas was probably not closely related to the type species. Furthermore, when describing the type species of the genus, *T. microstoma* Trewavas, she indicated that *T. microstoma* is closely related to both *C. placodon* (Regan) and *Aulonocara rostrata* Trewavas. Therefore, there was no a priori reason for including the deep-water species considered here in the same genus as the other Malawian species exhibiting the same degree of enlargement of the lateral line cavities.

We have thus considered their remaining shared characters as a possible guide to relationships. Among them, the pigment pattern of vertical dark bars on the body is present in many haplochromines and tilapiines, but less common as the sole pattern expressed. In Lake Malawi, it characterizes some species of *Lethrinops* (Eccles and Lewis, 1977, 1978, 1979). Furthermore certain *Lethrinops* spp. resemble the *Alticorpus* spp. in that they have long pectoral fins. The combination of long pectoral fins and vertical bars are characteristic of species that spend much of their time hovering, rather than swimming swiftly in pursuit of prey. However, *Lethrinops* spp. with the above characters lack mental prominence in the lower jaw and the outer row of teeth curve behind the second row (Eccles and Lewis, 1977, 1978, 1979). Beyond the genus *Alticorpus*, however, we do not know of a Malawian species that combines these features with a mental prominence. Such a protuberance at the synthesis of the dentaries is generally found in piscivorous species with strong jaws and short pectoral fins, such as in *Harpagochro-*



*mis* sp. in Lake Victoria (Greenwood, 1980) and *Cyrtocara woodi* (Regan) in Lake Malawi. *Cyrtocara woodi* has a different pigment pattern (Regan, 1921: pl. ii), a more slender body, and a produced snout.

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