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A new species of *Chrysichthys* (Siluriformes: Claroteidae) from Lake Turkana, Kenya

MICHAEL HARDMAN

Laboratory of Molecular Systematics, Finnish Forest Research Institute, Jokiniemenkuja 1, Vantaa 01301, Finland, Email: m.hardman@mac.com

ABSTRACT.—Specimens previously identified as *Chrysichthys auratus* (Geoffroy Saint-Hilaire, 1809) from Lake Turkana are recognized as distinct from this and all other species of *Chrysichthys*. *Chrysichthys turkana* new species, is described and distinguished from *C. auratus* on the basis of several proportional metrics, the most notable of which is a relatively large eye. The implied endemism of *C. turkana* and of other fishes suggest that *in-situ* diversification has taken place within Lake Turkana since its Miocene-Pliocene origin and in spite of its intermittent connection with the Nile basin during the Pliocene, Pleistocene and Holocene.

New taxon: *Chrysichthys turkana* Hardman

INTRODUCTION

Lake Turkana, located in the semiarid-arid northwestern corner of Kenya, is the only Great Lake of the Rift Valley that does not have an outlet (Fig. 1). The local ichthyofauna is characterized as Sudanian (Nilotic) and similar to that of Lake Mobutu (Albert) in Uganda (Lowe-McConnell, 1987). Of the 48 species from the Lake (36/48) and Omo River basin (12/48), 30 are widespread, 8 are restricted in distribution and 10 are endemic to the pelagic or deep zones (Hopson, 1982; Hughes and Hughes, 1992; and Lowe-McConnell, 1987). The endemics include deepwater haplochromine cichlids, an offshore dwarf latid (*Lates longispinis*), deepwater (*Barbus turkanae*) and pelagic (*Neobola stellae*) cyprinids, as well as open-water tetras (*Brycinus minutes* and *B. ferox*).

According to Hopson (1982), the catfishes of Lake Turkana and the Omo River include an amphiliid (*Andersonia leptura*), a schilbid (*Schilbe uranoscopus*), two bagrids (*Bagrus bayad* and *B. docmak*), two clariids (*Clarias gariepinus* and *Heterobranchus longifilis*), a malapterurid (*Malapterurus electricus*), three mochokids (*Mochokus niloticus, Synodontis schall* and *S. frontosa*), an auchenoglanidid (*Auchenoglanis occidentalis*) and the claroteid *Chrysichthys auratus*. All of these species are believed to be either widespread throughout Africa or restricted to the Nile basin.

Although several species of *Chrysichthys* have been described from the Nile basin, only *C. auratus* (Geoffroy Saint-Hilaire 1809) and *C. rueppelli* Boulenger 1907 are considered valid today (but only *C. auratus* unanimously). Types of *C. auratus* are unknown but illustrations were provided with the original description (Geoffroy Saint-Hilaire, 1809: 322, Plate 14:3-4) (Fig. 2). Günther (1864) correctly transferred *Pimelodus auratus* Geoffroy Saint-Hilaire 1809 to *Chrysichthys* Bleeker 1858 and suspected that *Bagrus capito* Valenciennes 1840 was a junior synonym of *C. auratus*. Günther (1864) also described *Chrysichthys macrops* from the Upper Nile as a species similar to *C. auratus* but which he believed to have relatively large eyes. Risch (1986a) placed *B. capito* and *C. macrops* in the synonymy of *C. auratus* according to data and results presented in his thesis (Risch, 1986b).

Chrysichthys rueppelli was applied to a species inhabiting the lower Nile that was believed to differ from the similar *C. auratus* in terms of its smaller eyes, more rounded caudal lobes and lack of the extended dorsal-fin rays (Boulenger, 1907: 337-338). While *C. rueppelli* was considered by Risch (1986a), Mo (1991) and Ferraris (2007) to be a valid species, Paugy and Bénech (1989) and Risch (1992a) cited Risch (1986b) as justification for its placement in the synonymy of *C. auratus*.

Risch (1986a) also synonymized *Chrysichthys coriscanus* Günther 1899, *Chrysichthys filamentosus* Boulenger 1912 and *Chrysichthys kingsleyae* Günther 1899 with *C. auratus,* and recognized *Chrysichthys longifilis* Pfaff 1933 and *Gephyroglanis tilhoi* Pellegrin, 1909 as valid subspecies, all of which are from streams draining into the Atlantic Ocean. Thus, Risch (1986a, 1992a, 2003) hypothesized *C. auratus* to be a species exhibiting broad infraspecific variation in the number of gill rakers and size of the adipose fin across a wide distribution including the Nile, Lake Chad and streams of the Atlantic slope from Senegal to Angola. Agnèse (1991) examined populations of catfishes identified as *C. a. longifilis* and *C. filamentosus* from Senegal to Togo and found no evidence for the genetic separation of these taxa according to protein electrophoresis, partly supporting the notion of a "*C. auratus* complex" and the synonymy of *C. filamentosus* with *C. auratus* in West Africa.

Unfortunately, the interpretation of recent taxonomic decisions and results of comparative studies involving *Chrysichthys auratus* is complicated in that syntopic (Nilotic) material is poorly represented in morphological or not at all in genetic data sets, thus making its identity and synonymy difficult to establish. The current concept of *C. auratus* is of a highly variable and widespread species with indistinct limits, although at least in the West African part of its range Risch (2003) emphasized the variably extended first branched ray of the dorsal fin and the number of branched rays in the pectoral fin (8–9, modally 8) as diagnostic characters.

Catfishes from Lake Turkana identified as *C. auratus* have been found to be morphologically distinct from this as well as all other species of *Chrysichthys* and represent a new species to be described herein.

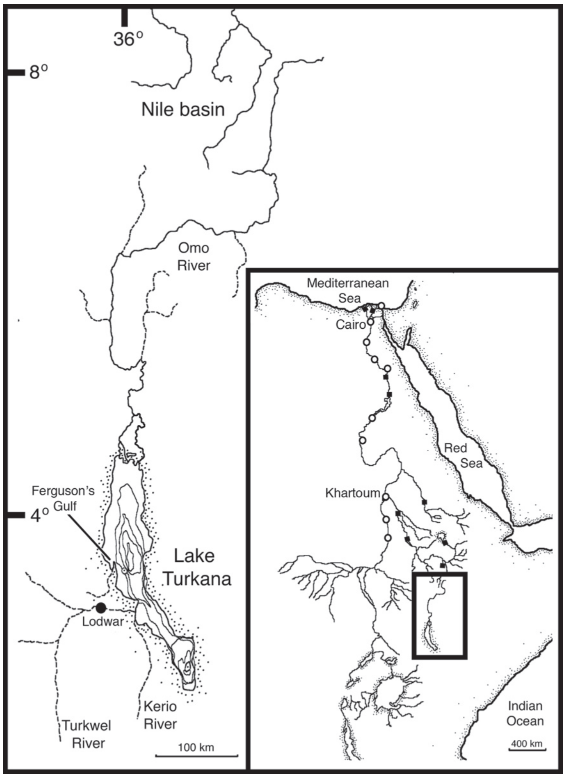

Fig. 1. Lake Turkana basin showing type locality (2 miles northeast of Ferguson's spit), juxtaposition of Omo River and tributaries of the upper Nile basin (contour lines at 20m intervals). Inset illustrates the location of Lake Turkana with respect to the Nile basin and other Lakes of the Rift Valley (filled boxes represent dams or barrages, open circles represent specimen localities of *Chrysichthys auratus* examined in this study – see Comparative Material Examined). Based on maps produced by the Map Design Unit (World Bank), Beadle (1974) and Cohen (1986).

MATERIALS AND METHODS

Characters found to be useful in the differentiation of *Chrysichthys* species include the ornamentation of the skull roof, the form and location of tooth bands on the jaw and tooth patches or plates on the palate, and the form and size of the supraoccipital and postcleithral processes (Bailey and Stewart, 1984; Risch, 1985, 1988 and 1992a,b, 2003; and Hardman, 2008). In addition to these qualitative data, counts and linear interlandmark distances were collected with hand-held callipers (DigitCal SI, TESA, Switzerland) and the aid of a stereo-zoom microscope following Hardman (2008).

While comparative material included type specimens of all but four nominal species of *Chrysichthys*, sampling was focused on specimens of *C. auratus* from the Nile basin and the types of its Nilotic (*Bagrus capito* and *C. macrops*) and Atlantic slope (*C. coriscanus*, C. *filamentosus, C. kingsleyae)* junior synonyms as well as those of *C. rueppelli* (Nile) and the subspecies *C. a. tilhoi* (Lake Chad) and *C. a. longifilis* (Niger River). None of the unseen types (*C. borressoni* Lönnberg 1924, *C. buettikoferi* Steindachner, 1894, *C. graueri* Steindachner, 1912 or *C. habereri* Steindachner, 1912) represent species or synonyms involved in the "*C. auratus* complex".

Preliminary analyses of the qualitative and quantitative data did not discriminate the type specimens of *Bagrus capito, Chrysichthys macrops* or *C. rueppelli* from samples of *C. auratus*. However, the Atlantic slope material appeared distinct from this as well as the Lake Turkana specimens and a more comprehensive treatment is required in order to ascertain their status and limits. As such, all nominal species of *Chrysichthys* from the Nile (*B. capito, C. macrops* and *C. rueppelli*) are considered conspecific with *C. auratus* following Paugy and Bénech (1989) and Risch (1992a) while the Atlantic-slope synonyms (*C. coriscanus, C. filamentosus* and *C. kingsleyae*) and subspecies *(C. a. tilhoi* and *C. a. longifilis*) require verification. On this basis, only the Nilotic (syntopic) material was used to establish the limits of *C. auratus sensu* Geoffroy Saint-Hilaire (1809) and their comparison with specimens from Lake Turkana.

Shape differences among species were compared by calculating the proportional values of distances within either standard length (SL) or head length (HL) as appropriate. A two-tailed heteroscedastic Student's *t*-test was used to identify statistically distinguishable differences among distribution means. Significantly different ($p<0.05$) means with non-overlapping standard deviations were used to

Fig. 2. *Chrysichthys auratus* (Geoffroy Saint-Hilaire, 1809). Photographic composite of figures 3 and 4 of Plate 14 in Geoffroy Saint-Hilaire (1809).

determine morphological distinction of the new species from Nilotic *Chrysichthys auratus*.

***Chrysichthys turkana,* new species**

Figs. 3, 5, Table 1.

Chrysichthys auratus Hopson, 1982: 317 and 1046. Lake Turkana, Kenya
Chrysichthys auratus auratus Risch, 1986: 14. Lake Turkana, Kenya (?)
Chrysichthys auratus auratus Mo, 1991: 148. Lake Turkana, Kenya (?)

Holotype.—BMNH 1981.2.17:794, 93.4 mm SL, 30 m deep, 2 miles north east of Ferguson spit. Lake Turkana. Kenya. 27 October 1973. A. Hopson.

Paratypes.—BMNH 1981.2.17:795–806, n=11, 71.7–91.9 mm SL, same data as holotype.

Diagnosis.—Distinguished from all other species of *Chrysichthys* by the combination of the following characters: 15–17 rakers on the first gill arch, tooth bands of the premaxillae forming a broad arc of uniform width with squared ends and a shallow notch anteromedially, prevomerine tooth patches separated at the midline and accessory tooth plates narrowing posteriorly to a sharp point along a smooth curve, mouth subterminal, postcleithral process well developed and projecting sharply posteriad, horizontal eye diameter contained 2.7–3.1 times in HL (vs. 2.9–6.4 times in *C. auratus*, see also Table 1) and interorbital width contained 3.8–7.7 times in HL (vs. 2.6–4.2 times in *C. auratus*, see also Table 1).

Description.—Morphometric data provided in Table 1 and Fig. 6. Body rather elongate, deepest at vertical through dorsal-fin-spine origin and widest across pectoral girdle. In lateral view, dorsal profile of head interrupted by soft margins of skin surrounding the free orbits, otherwise sloping smoothly from rounded snout to base of a dorsal-fin spine bearing several small, retrorse, widely separated serrae posterodistally. Dorsal-fin base short, with spine and six branched rays of gradually decreasing length, i.e., branched rays 1 and 2 *not* forming a filament. Dorsal profile between dorsal-fin-spine origin and anterior limit

Fig. 3. *Chrysichthys turkana*. Holotype. 93.4 mm SL. BMNH 1981.2.17:794: 2 miles northeast of Ferguson's spit, Lake Turkana, Kenya.

of adipose fin straight and sloping gently to tall, rounded adipose fin with free and pointed posterior lobe. Below adipose fin, dorsal profile sloping down towards caudal peduncle, beyond which procurrent rays of caudal fin slope steeply upwards to straight upper-caudal-fin lobe. Caudal fin deeply forked with pointed lobes, 7 branched rays in upper, 8 in lower, longest (usually upper) 2.8–3.3 times longer than shortest. Procurrent rays of lower-caudal-fin lobe sloping steeply upwards to join ventral profile anterior of posterior limit of adducted anal fin. Anal-fin base short and embedded in adipose tissue with 10–11 rays; fin roughly triangular, longest branched rays ca. three times shortest ones. Anal-fin origin well posterior of posterior limit of adducted pelvic fin, and directly beneath to slightly posterior of adipose-fin origin. Ventral profile between posterior limit of anal fin and anterior limit of pelvic girdle sloping gently upwards. Flame-shaped pelvic fins (i, 5) with narrow bases contained 3.3–5.4 times in pelvic fin length; longest branched rays ca. 1.5 times longer than shortest ones. Ventral profile variably distended due to stomach contents or reproductive condition. Sharply pointed pectoral fins (I, 8/9) led by stout, gently curved spine bearing

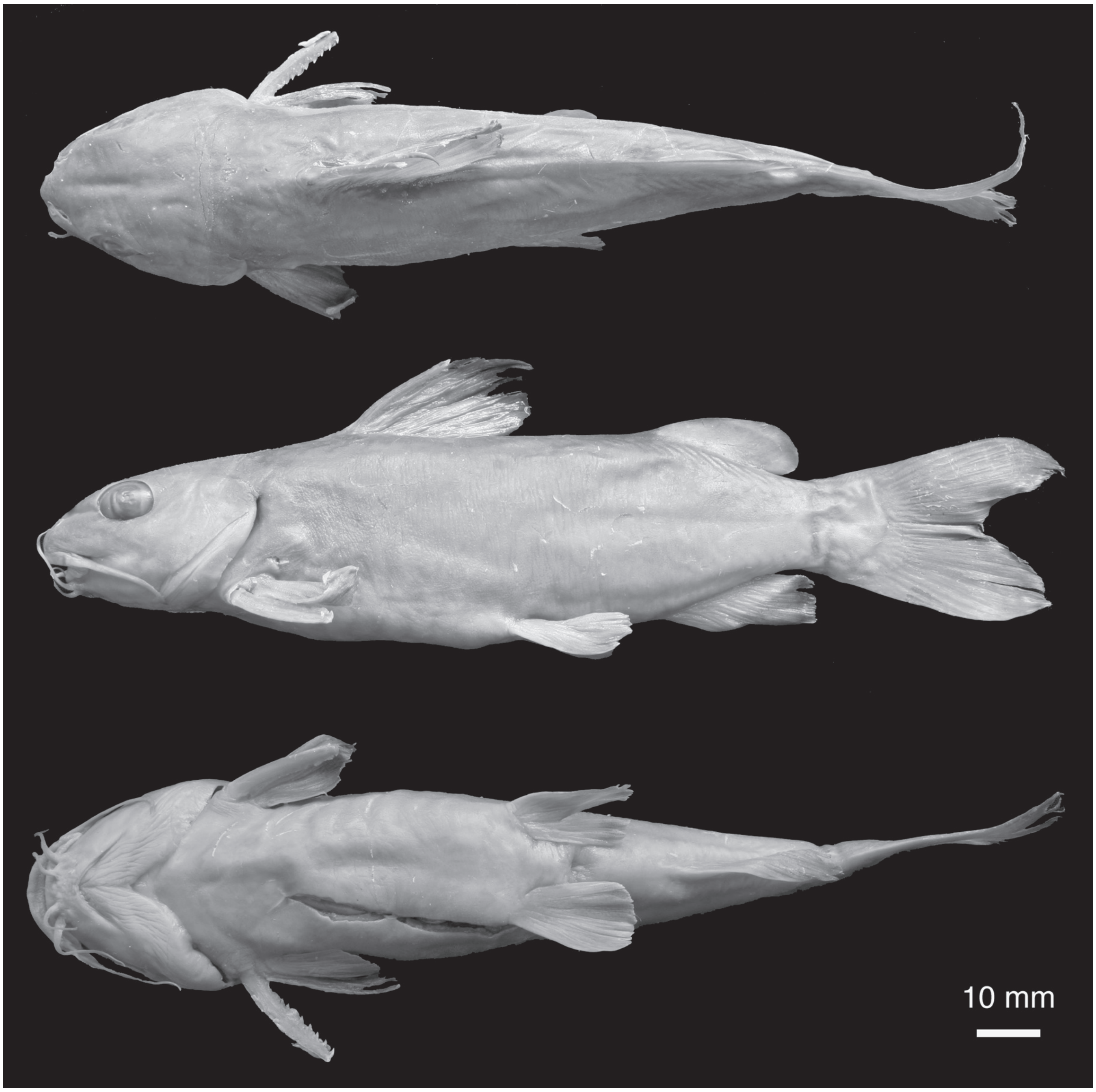

Fig. 4. *Chrysichthys auratus*. 132.0 mm SL. UMMZ 210259: Nile River above Kubri al Gam'a (University Bridge), Egypt.

9–10 retrorse serrae on posterior margin. Longest branched pectoral-fin rays ca. two times longer than shortest, with posterior limit ca. 0.75 distance to pelvic-fin origin when adducted. Ventral profile of breast and gular region straight to slightly concave. Mandibular barbels narrowly separated and originating in line or inner pair originating slightly anterior to and spaced ca. 0.5 distance between outer pair. Outer pair of mandibular barbels ca. 1.5 times longer than inner and reaching ca. 0.5 distance to pectoral-fin origin. Upper lip extending beyond lower anteriorly and laterally. Corner of mouth with thick rictal skin-fold forming base of narrow, flattened maxillary barbel that reaches to or just beyond pectoral-fin origin. Lateral profile of snout bluntly pointed. In dorsal view, head curves gradually from pectoral girdle to midline. Orbit with free margin and bulging dorsad in lateral view. Dorsum of head covered with thin skin beneath which skull roof variably ornamented with radiating ridges and lines of small rugosities converging posteromedially. Broad and deep anterior cranial fontanelle ridged anteriorly with irregular rugosities poste-

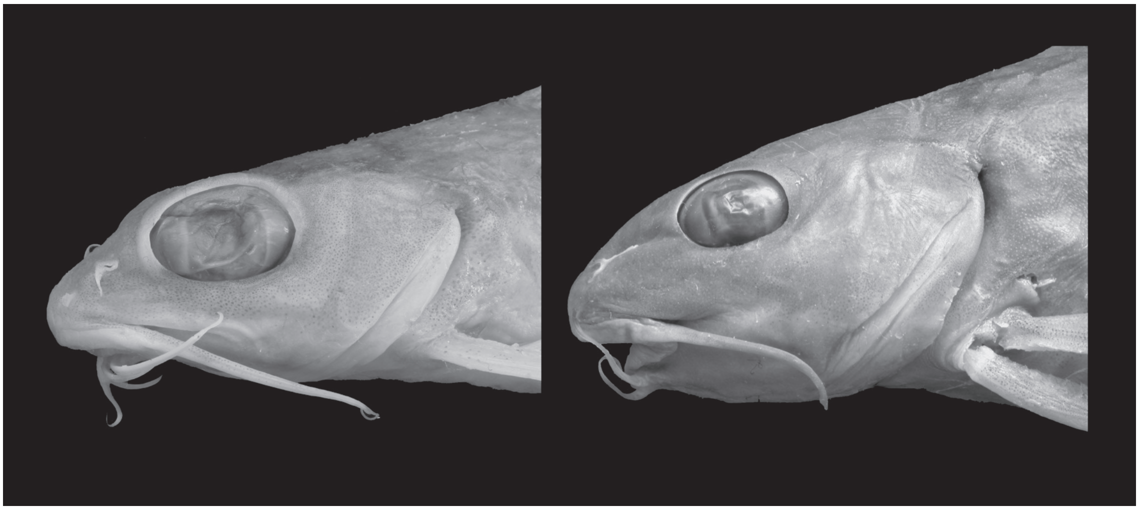

Fig. 5. Close-up comparison of the heads of *Chrysichthys turkana* (Holotype. 93.4 mm SL. BMNH 1981.2.17:794) and *C. auratus* (132.0 mm SL. UMMZ 210259) detailing the relatively large orbit of *C. turkana* (left).

riorly, extending from midway between nares to just behind the posterior limit of orbit. Dorsum of supraoccipital process narrow, covered with rugosities forming radiating lines converging posteriorly. Nuchal plate approximating a thickened Y-shape, narrowly contacting posterior limit of supraoccipital process. Anterior nares placed just behind upper lip and slightly wider apart than posterior nares. Short nasal barbels ca. 0.75 length of posterior nares. Cleithrum covered with rugosities forming irregular striae and with stout postcleithral process. Opercle broadly triangular, straight to slightly concave posterior margin with radiating and branching striae converging on anterodorsal corner. Anterolateral surface of first gill arch with 15–17 short, broad, flattened rakers with soft, fringed processes extending into the branchial cavity. Premaxillary tooth bands with small teeth of uniform size and density, each band of fairly uniform width, narrowing slightly at medial junction and following snout profile before terminating squarely and well short of mouth corner. Mandibular tooth bands separated by symphyseal septum, with small teeth of uniform size and density, bands following the anterior profile of lower jaw and narrowing distally prior to their termination at mouth corner. Tooth patches of prevomer broadly separated by median gap, rounded and smoothly arcing while narrowing to join with sharply tapering accessory tooth plates. All palatal teeth small and of uniform size and density.

Coloration in alcohol.—An unpigmented venter gives way to scattered brown chromatophores on flanks which increase in density dorsally becoming yellowish-brown. Dorsal surface of pectoral fin, maxillary barbel and nasal barbel light below and dark above. Chromatophores of dorsal fin increasing in density distally on branched rays and interradial membranes. Adipose and caudal fins uniformly pigmented with light scattering of chromatophores. Pelvic and anal fins lacking pigment.

Biology.—Hopson (1982: 317 and 1045-6) provided an account of the biology of *Chrysichthys turkana* and recorded a maximum fork length of 290 mm although he emphasized that most specimens caught in trawls and beach seines were less than 150 mm. In the lake, the onset of maturity was evident in both sexes at a minimum of 60 mm and 50% of individuals were mature at 70-80 mm in a 1:1 sex ratio. Peak gonadal condition was noticed in females between February and May, coinciding with a period of increased rainfall, although females >60 mm with ripened ovaries were found throughout the year. A single female from the type series (92 mm SL) had been partially dissected and its examination revealed ripened ovaries, confirming maturity at small size and an extended reproductive period. *Chrysichthys turkana* is demersal during the day, being locally abundant between 10 and 25 m depth zones, but migrates closer to shore at dusk to feed on chironomid larvae and ostracods. A mean daily temperature of almost 30°C (19.5—39.9°C) coupled with strong prevailing winds from the southeast evaporate approximately 2300 mm yr^{-1} and help to maintain alkaline (pH = 9.2) and moderately saline (2.5‰) conditions throughout the lake (Yuretich and Cerling, 1983).

Distribution.—The distribution of *Chrysichthys turkana* is restricted to the type locality; Lake Turkana, Kenya.

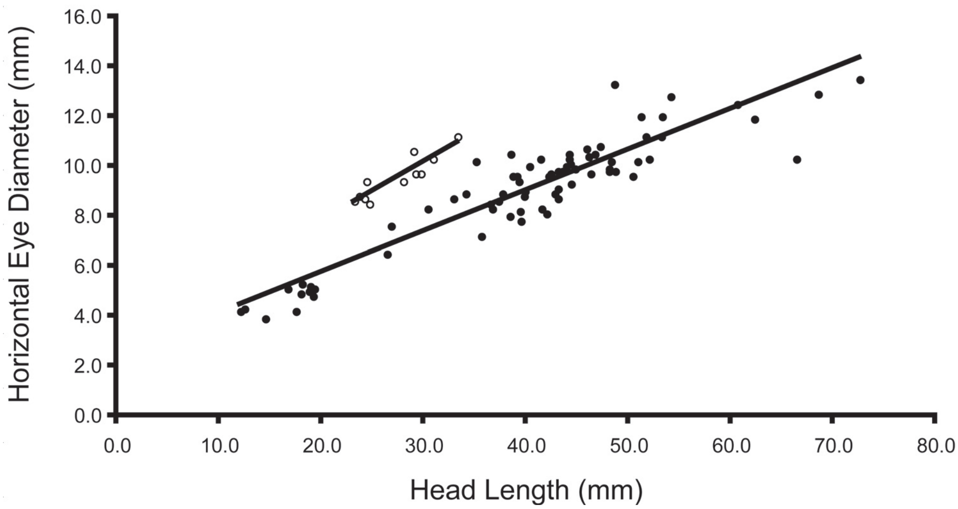

Fig. 6. Bivariate scatterplot of horizontal eye diameter and head length for *Chrysichthys turkana* (open circles) and *C. auratus* from the Nile (filled circles). Linear regression trendlines shown through each series: *C. turkana* y = 0.235x + 3.12, R2 = 0.83; *C. auratus*: y = 0.163x + 2.48, R2 = 0.85.

Etymology.—Alluding to the type locality and predominant tribe in Northwestern Kenya. A noun in apposition.

DISCUSSION

The description and implied distribution of *Chrysichthys turkana* adds another name to the list of endemic fishes of Lake Turkana. Given that the list encompasses perciform, cypriniform, characiform and siluriform fishes, it suggests that the Lake has been the site of general *in situ* diversification, most likely as a result of the lakes isolation from the ancestral drainage system and incipient fauna (Nyamweru, 1989). The Lake Turkana basin has been estimated as late Miocene-early Pliocene in age (Koobi Fora Formation 4.35 Ma: Brown et al., 1985) but fossil and sedimentological information suggest that several overflows connected and reconnected Lake Turkana with the Nile basin during the Holocene (9500—3680 BP: Harvey, 1982), Pleistocene (130000—50000 BP: Harvey and Grove, 1982) and Pliocene (4.40—1.81 Ma: Butzer, 1971). A possible explanation for the composite nature of the Lake Turkana ichthyofauna is that the Sudanian species accessed the Lake during the later (more recent) connections whereas the endemics trace their origins to the severance of earlier ones. If this explanation is accurate, Lake Turkana might offer a system to study the process of diversification through isolation during frequent reconnection with an ancestral fauna.

The onset of maturity at a rather small size (60-70 mm) and an extended reproductive period are intriguing aspects of *Chrysichthys turkana*. In Lake Agulu (Nigeria), *C. auratus* (sensu Risch, 2003) reproduces annually between April and September in response to seasonal rains and flooding (Inyang and Ezenwaji, 2004). Lake Turkana experiences low seasonal fluctuation in environmental parameters, although water level (generally) and dissolved solids (locally) vary according to rainfall in the Ethiopian highlands (Kolding, 1992). The mean annual rainfall of the lake surroundings is less than 250 mm, sporadic and unpredictable although more likely during March-May (Beadle, 1974; Hopson, 1982). Interestingly, although males are represented in the type series, none displayed the seasonal changes of cranial morphology (e.g., hypertrophied cheek muscles, expanded tooth plates and a broadened mouth) typical of *C. auratus* (sensu Risch, 2003) in West Africa (Risch, 1992, 2003; and Inyang and Ezenwaji, 2004).

Of the other Rift lakes, claroteid catfishes are also present in Lake Tanganyika (Poll, 1946; Bailey and Stewart, 1984; Risch, 1987; Hardman, 2008) where all species and three of the four genera (*Bathybagrus*, *Lophiobagrus* and *Phyllonemus*) are endemic and at least two (*Lophiobagrus* and *Phyllonemus*) practice oral incubation of eggs (Ochi et al., 2000, 2001, 2002). *Chrysichthys sianenna* has been documented as making seasonal spawning migrations up the main tributaries of the lake following heavy rains (Bailey and Stewart, 1984) and *C. grandis* form pairs protecting eggs and newly hatched larvae (Abe,

Table 1. Selected morphometric measurements and proportions (indented) for *Chrysichthys turkana* and Nilotic *C. auratus*. T-test result: * = p<0.05 ** = p<0.01, ns = non significant.

	Chrysichthys turkana (n=11)			*Chrysichthys auratus* (n=72)	
	Holotype	Mean±SD	Min.-Max.	Mean±SD	Min.-Max.
Standard length in mm.	93.4	82.48±9.74	67.8-96.5	122.60±39.28	36.9-205.0
Head length in mm.	30.9	27.3±3.41	23.2-33.3	40.34±13.0	12.1-72.6
Standard length/...					
ns Predorsal length	2.6	2.62±0.05	2.6-2.7	2.63±0.09	2.3-2.8
ns Head length	3.0	3.02±0.08	2.9-3.2	3.04±0.10	2.7-3.3
ns Interdorsal distance	4.8	4.53±0.28	4.3-5.1	4.61±0.51	3.5-5.8
ns Adipose-hypural distance	4.9	5.35±0.22	4.9-5.6	5.77±0.48	3.7-6.7
ns Caudal peduncle depth	11.1	11.69±0.65	10.8-12.8	9.87±1.08	5.3-13.7
ns Anal-hypural distance	4.9	5.25±0.33	4.7-5.7	5.80±0.57	4.7-8.4
ns Anal fin base	9.2	8.69±0.77	7.1-9.7	8.59±2.26	5.1-10.6
ns Pelvic-anal distance	4.6	4.83±0.26	4.6-5.5	4.80±0.36	4.1-6.1
ns Pectoral-pelvic distance	3.6	3.59±0.15	3.3-3.8	3.47±0.28	2.8-4.2
ns Pectoral-snout distance	4.0	3.88±0.21	3.6-4.3	3.88±0.22	3.3-4.4
* Maxillary barbel length	4.7	4.44±0.40	3.8-5.1	5.52±0.91	4.0-9.1
ns Chest width	6.1	6.1±0.63	5.5-7.9	5.50±0.40	4.5-6.3
ns Pectoral-dorsal distance	4.6	4.45±0.15	4.2-4.7	4.16±0.22	3.6-4.6
ns Pelvic-anus distance	11.5	11.37±0.76	10.4-12.6	10.7±0.81	8.5-12.8
Head length/...					
ns Snout length	3.5	3.5±0.18	3.2-3.8	2.97±0.27	2.6-4.0
** Horizontal eye diameter	3.0	2.86±0.16	2.6-3.1	4.37±0.61	2.9-6.5
* Interorbital width	3.8	4.97±1.21	3.8-7.7	3.18±0.36	2.6-4.2
ns Internares width	5.0	5.36±0.47	4.7-6.1	4.49±0.48	3.7-6.4

1997). The variation observed in reproductive biology of lacustrine *Chrysichthys* offers interesting avenues of research into what is clearly a dynamic and plastic feature of siluriform biology.

COMPARATIVE MATERIAL EXAMINED

Chrysichthys acsiorum: AMNH 236052, 1, 214.0 mm SL, holotype, Kajaga, Lake Tanganyika, Burundi. AMNH 217400, 6, 100.3–147.8 mm SL, paratypes, same as holotype. ***C. acutirostris:*** BMNH 1864.7.13.41, 1, 183.0 mm SL, holotype, Golungo Alto, Angola; USNM 42339-40, 2, 142.7–192.0 mm SL, Quanza River, Cunga, Angola. ***C. acutivelis:*** MNHN A8968, 2, 91.2–197.0 mm SL, syntypes, Gorée, Senegal. ***C. aluuensis:*** MRAC 84-20-P-1, 1, 72.2 mm SL, holotype, Omuehuechi-Aluu, New Calabar River, Nigeria. BMNH 1984.9.27:1-2, 2, 58.7–60.3 mm SL, paratypes, same data as holotype. ***C. ansorgii:*** BMNH 1911.6.1:116-124, 9, 91.4–170.0 mm SL, syntypes, Quanza River, Dondo, Angola; ANSP 37906, 1, 118.5 mm SL, syntype, Quanza River, Dondo, Angola; USNM 86636, 1, 105.9, Angola. ***C. auratus:*** BMNH 1903.6.18:20, 1, 133.2 mm SL, Nile at Cairo, Egypt; BMNH 1905.10.16:75, 1, 85.7 mm SL, White Nile between Khartoum and Sobar River, Sudan; BMNH 1905.6.28:7–10, 4, 54.6–58.5 mm SL, Nile near Cairo, Egypt; BMNH 1907.12.2:2080–1, 2, 119.3–122.9 mm SL, Near Damietta, in freshwater, Egypt; BMNH 1907.12.2:2088–95, 12, 35.8–161.0 mm SL, Nile near Sammanud, Egypt; BMNH 1907.12.2:2098–9, 2, 37.9–44.9 mm SL, Damietta west of Nile, upstream of barrage, Egypt; BMNH 1907.12.2:2100–1, 2, n.m–139.6 mm SL, Nile at Cairo, Egypt; BMNH 1907.12.2:2103–10, 8, 108.9–202 mm SL, Beni Souef, Egypt; BMNH 1907.12.2:2111-2, 2, 142.5–153.1 mm SL, Lahûn, Bahr Yûsouf, Fayoum, Egypt; BMNH 1907.12.2:2113–4, 2, 79.2–86.8 mm SL, Bahr Selah, Fayum, Egypt; BMNH 1907.12.1:2115–9, 5, 34.5–58.1 mm SL, at a generator near Luxor, Egypt; BMNH 1907.12.2:2121–2, 2, 104.9–100.8 mm SL, Wady Halfa, Sudan; BMNH 1912.12.2:2123–4, 2, 92.6–51.4 mm SL, Kosheh, Nubia, Sudan; BMNH 1907.12.2:2125, 1, 92.6 mm SL, Nue el Daim, White Nile, Sudan; FMNH 59608, 3, 147.0–159.0 mm SL, Cairo fish market, Egypt; MNHN 1907.217.218, 2, 116.2–122.6 mm SL, Nile, Egypt; UMMZ 210259, 10, 116.3–134.6 mm SL, Nile River above Kubri al Gam'a (University Bridge), Egypt; UMMZ 210272, 3, 112.4–120.9 mm SL, Nile River above Kubri al Gam'a, Giza, Egypt; UMMZ 210275, 6, 193.0–205.0 mm SL, major irrigation channels near Ksar Kavun, Fayyum, Egypt; USNM 52142, 2, 113.2 mm SL, Senff expedition, probably Sudan; USNM 61295, 1, 116.7 mm SL, Nile near Samannud, Egypt. USNM 167084, 1, 141.6 mm SL, Cairo fish market, Egypt. ***C. bocagii:*** BMNH 1911.6.1:114-115, 2, 77.6–147.0 mm SL, syntypes, Bengo River at Dondo, Angola. ***C. brachynema:*** BMNH 1906.9.6.33, 1, n.m., lectotype, Kalambo, Lake Tanganyika, Tanzania; BMNH 1906.9.6:34-35, 2, n.m., paralectotypes, Kalambo, Lake Tanganyika, Tanzania; BMNH 1906.9.6:36, 1, n.m., Usumbura, Lake Tanganyika, Burundi; USNM 176310, 1, 84.7 mm SL, Uviva, Democratic Republic of Congo. ***C. brevibarbis:*** MRAC 16, 1, 402.0 mm SL, holotype, Boma, Democratic Republic of Congo; CAS 66687, 1, 164.0 mm SL, Kinshasa market, Democratic Republic of Congo. ***C. camaronensis:*** 1871.11.20:21, 1, 435.0 mm SL, holotype, Cameroon. ***C. capito:*** MNHN B.605-606, 2, 153.2–166.0 mm SL, syntypes, Nile River, Egypt. ***C. coriscanus:*** BMNH 1896.5.5:64-65, 2, syntypes, Corisco Island, Ghana. ***C. cranchii:*** BMNH 2005.17:4, 1, 178 mm SL, holotype, Congo River, Brazzaville, Republic of the Congo; CAS 66685, 1, 121.5 mm SL, Kinshasa market, Democratic Republic of Congo; CAS 66689, 1, 128.6 mm SL, Kinshasa market, Democratic Republic of Congo; CAS 66690, 1, 197.0 mm SL, Kinshasa market, Democratic Republic of Congo. ***C. dageti:*** MRAC 90-57-P-1273, 1, 175.0 mm SL, holotype, Nanga River between N'Bouku-nassi and Lake Nanga, Brazzaville, Republic of the Congo; MNHN 1962-0150 (A-D), 10, n.m.—97.3 mm SL, paratypes, Niari, Republic of the Congo. ***C. delhezi:*** MRAC 952, 1, 240.0 mm SL, syntype, Boma, Democratic Republic of Congo. MRAC 953, 1, 76.6 mm SL, syntype, Mbandaka , Democratic Republic of Congo; BMNH 1899.6.27:49, 1, 145.8 mm SL, syntype, Upper Congo, Democratic Republic of Congo; CAS 66685, 1, 139.8 mm SL, Kinshasa market, Democratic Republic of Congo. ***C. delhezi thomasi***: MNHN 1937-0074, 1, 193.0 mm SL, syntype, Congo; MNHN 1937-0075, 1, 205.0 mm SL, syntype, Congo. ***C. duttoni:*** MRAC 1342, 1, 113.9 mm SL, holotype, Kasai River at Lusambo, Democratic Republic of Congo. ***C. filamentosus:*** BMNH 1912.4.1:440, 1, 197.0 mm SL, syntype, Luali River, Congo; BMNH 1912.4.1:442-3, 2, 126.8–137.3 mm SL, syntypes, Lebuzi River, Congo; BMNH 1912.4.1:444, 1, 128.9 mm SL, syntype, Chiloango ville, Congo; BMNH 1912.4.1:445-446, 2, n.m.—182.0 mm SL, syntypes, Loango River at N'Kutu, Congo. ***C. furcatus:*** BMNH 1864.7.22:1, 280.0 mm SL, holotype, Kuka-muno on the Lebuzi River, Niger. ***C. grandis:*** MRAC 14347, 1, 490 mm SL, holotype, Kilewa Bay (Moba), Lake Tanganyika, Democratic Republic of Congo; UMMZ 196091, 6, 163.0–207.0 mm SL, 80 m depth, west of Mutondwe Island, Lake Tanganyika, Zambia. ***C. helicophagus:*** MRAC 75-02-P-3-4, 2, n.m.—88.2 mm SL, paratypes, Zaire River near Tadi, Democratic Republic of Congo, 5°14'S 13°56'E; USNM 216366, 1, 70.0 mm SL, paratype, Zaire River mainstem at Tadi, near Kibunzi, Democratic Republic of Congo, 5°14'S 13°56'E; BMNH 1976.5.21:22, 1, 77.6 mm SL, paratype, Zaire River at Tadi, near Kibunzi, Democratic Republic of Congo, 5°14'S 13°56'E. ***C. hildae:*** BMNH 1979.3.5:402, 1, 116.2 mm SL, paratype, Buzi River. Mozambique. ***C. johnelsi:*** MNHN 1959-0146, 2, 75.6–98.0 mm SL, syntypes, Bafoulabé, Nikolo-Koba Park, Senegal. ***C. kingsleyae:*** BMNH 1899.12.23:1, 1, 175.0 mm SL, holotype, Ogowe River, Gabon. ***C. lagoensis:*** BMNH 1866.3.8:16, 1, 300 mm SL, holotype, Lagos, Nigeria. ***C. laticeps:*** MNHN 1931-159, 1, 1270 mm SL, holotype, Congo River at Brazzaville, Republic of the Congo. ***C. levequei:*** MNHN 1986-0563, 1, 164.0 mm SL, holotype, Guinea; MNHN 1986-0564, 3, 60.9–126.2 mm SL, paratypes, Conakry, Guinea. ***C. longibarbis:*** MRAC 108, 1, 207.0 mm SL, syntype, Kinshasa, Democratic Republic of Congo; BMNH 1899.2.20:18, 1, 132.8 mm SL, syntype, Kinshasa, Democratic Republic of Congo; CAS 66688, 1, 91.0 mm SL, Kinshasa, Democratic Republic of Congo; CAS 66687, 5, 145.9–175.0 mm SL, Kinshasa market, Democratic Republic of Congo. ***C. longifilis:*** USNM 224581, 1, 155.2 mm SL, Niger River at Mopti, Mali. ***C. longidorsalis:*** MRAC 153158, 1, 208.0 mm SL, holotype, Sanaga River above Nachtigal Falls near Ekongolo, Cameroon, 4°21'N 11°41'E. ***C. longidorsalis nyongensis:*** MRAC 73-29-P-1407, 1, 140.7 mm SL, holotype, Nyong River at Ebogo, Cameroon. ***C. mabusi:*** BMNH 1905.11.10:9, 1, 225.0 mm SL, holotype, Lake Bangweulu, Zambia; UMMZ 200389, 4, 238.0–282.0 mm SL, Lake Mweru, 1 mile from Kalungwishi River estuary, Northern Province, Zambia. ***C. macrops:*** BMNH 1860.11.9:125, 1, 165.0 mm SL, syntype, Lower Nile; BMNH 1862.6.17:60-64, 5, 119.3–171.0 mm SL, syntypes, Khartoum, Sudan. ***C.***

macropterus: MRAC 7118, 1, 295.0 mm SL, syntype, Bafwasende, Democratic Republic of Congo; MRAC 7577, 1, 190.0 mm SL, syntype, Avakubi, Democratic Republic of Congo; BMNH 1919.9.10:252, 1, 227.0 mm SL, syntype, Lindi River, Bafwasende, Democratic Republic of Congo. ***C. magnus:*** MRAC 14767-9, 3, 252.0–545.0 mm SL, syntypes, Kwamouth, Democratic Republic of Congo. ***C. maurus:*** MNHN 1198, 1, 178.0 mm SL, holotype, Jubelin, Senegal. ***C. myriodon:*** MRAC 325, 1, 455.0 mm SL, holotype, Kalemie, Lake Tanganyika, Democratic Republic of Congo. ***C. nigrodigitatus:*** MNHN 0108, 1, 149.1 mm SL, holotype, no locality. MNHN B-398, 3, 106.8–198.0 mm SL, Senegal; ***C. ogowensis:*** BMNH 1896.5.5:66, 1, 148.4 mm SL, holotype, Ogowe River, Kondo Kondo, Gabon; ***C. okae:*** ANSP 71909, 1, 62.9 mm SL, holotype, Oka (Okoyo), 18 miles above Eovo (Ewo) Lembesse River basin, Congo. ***C. ornatus:*** MRAC 1174, 2, 43.7–157.0 mm SL, syntypes, Banzyville (Mobayi-Mbongo), Democratic Republic of Congo; BMNH 1901.12.21:48-50, 3, n.m.—167.0 mm SL, syntypes, Monsembe, Congo River, Democratic Republic of Congo. ***C. persimilis:*** BMNH 1867.5.22:1, 1, 220.0 mm SL, holotype, Gabon. ***C. platycephalus:*** BMNH 1936.15.849-852, 4, n.m., syntypes, estuary of Ngere River, Lake Tanganyika, Zambia; BMNH 1936.6.15.853-856, 4, n.m., syntypes, estuary of Ngere River, Lake Tanganyika, Zambia; BMNH 1936.6.15.857-878, 22, n.m., syntypes, estuary of Ngere River, Lake Tanganyika, Zambia; UMMZ 196090, 2, 161.0–165.0 mm SL, west of Mutondwe Island, Lake Tanganyika, Zambia; UMMZ 199825, 2, 125.3–165.0 mm SL, at Kumbala Road, 1.7 km north of Mpulungu, neck of Nyika Bay, Lake Tanganyika, Zambia; UMMZ 199926, 2, 124.2–128.8 mm SL, at north side of Nkumbula Road, east side of Nyika Bay, Lake Tanganyika, Zambia. ***C. polli:*** MRAC 47814, 1, 99.6 mm SL, holotype, Yelelola Falls, Democratic Republic of Congo. ***C. punctatus:*** MRAC 950, 1, 92.7 mm SL, syntype, Kutu, Congo basin, Democratic Republic of Congo; MRAC 951, 1, 136.4 mm SL, syntype, Stanley Pool (Pool Malebo), Congo River, Democratic Republic of Congo; BMNH 1899.11.23:25-26, 2, n.m.—98.1 mm SL, syntypes, Stanley Pool (Pool Malebo), Congo River, Democratic Republic of Congo; CAS 66694, 2, 132.3–135.9 mm SL, Mbandaka market, Democratic Republic of Congo. ***C. rueppelli:*** BMNH 1907.12.2:2131-2, 2, 107.6–144.8 mm SL, syntypes, freshwater pool near Ghet-el-Nassara, Lake Menzaleh, Egypt; BMNH 1850.7.29:17, 1, 200.0 mm SL, syntype, Lower Nile, Egypt. ***C. sharpii:*** BMNH 1900.12.31:14 (skin), 1, 343.0 mm SL, holotype, Lake Mwero, Zambia. ***C. sianenna:*** BMNH 1906.9.8.65-66, 2, n.m., syntypes, Niamkolo, Lake Tanganyika, Zambia; BMNH 1906.9.8.67, 1, n.m., syntype, Mbete, Lake Tanganyika, Zambia; FMNH 50433, 1, 121.6 mm SL, Usumbura, Lake Tanganyika, Burundi; USNM 309904, 1, 168.0 mm SL, Ndole and Nkamba Bays, Lake Tanganyika, Zambia. ***C. stappersii:*** MRAC 14236, 1, 392.0 mm SL, holotype, Kilewa Bay, Lake Tanganyika, Democratic Republic of Congo; UMMZ 199799, 6, 131.1–171.0 mm SL, 3-4 km west of Mpulungu, Musende Bay, Lake Tanganyika, Zambia; UMMZ 199785, 1, 215.0 mm SL, 4 km westnorthwest Mpulungu, Lake Tanganyika, Zambia. ***C. teugelsi:*** MRAC 80-19-P-189, 1, 173.0 mm SL, holotype, Tai, Cavally River, Ivory Coast; MNHN 1986-0629, 2, 113.2–130.6 mm SL, paratype, Cavally River at Tai, Ivory Coast; MNHN 1986-0630, 1, 115.9 mm SL, paratype, Cavally River at Tai, Ivory Coast. ***C. thysi:*** MRAC 73-2-P-1791, 1, 141.4 mm SL, holotype, Makakou, Ivindo River, Gabon; MNHN 1886-418, 1, 107.1 mm SL, paratype, Mission de l'Ouest Africain. ***C. uniformis:*** MRAC 7477, 1, 278.0 mm SL, holotype, Poko, Uele basin, Democratic Republic of Congo. ***C. velifer:*** BMNH 1923.3.2:41, 1, 281.0 mm SL, holotype, Bandama River, Ivory Coast. ***C. wagenaari:*** MRAC 147, 1, 425.0 mm SL, holotype, Upoto (Lisala), Congo River, Democratic Republic of Congo. ***C. walkeri:*** BMNH 1899.12.22:20-22, 3, 101.0–102.3 mm SL, syntypes, Prah River, Ghana; CAS 63524, 1, 201.0 mm SlL, Atimpoku, Volta River, Ghana; CAS 63178, 3, 114.3–182.0 mm SL, near Wiawso, 9 miles from Datano junction on Tano River, Ghana.

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