Fishes of the Crater Lakes of the Northwestern Cameroons

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CONTENTS

INTRODUCTION

This is primarily a report on the fishes collected in the Cameroons during two expeditions led by Professor Eisentraut in 1954 and 1957/58, and is also the first report on fishes collected in the same lakes in 1948 by the late Mr. P. I. R. Maclaren, then Fisheries Development Officer Nigeria.

Fishes have now been collected on six expeditions to the crater lakes of the Northwestern Cameroons. The first collection, by a Swedish resident in the country, Gunnar Linnell, was described by Lönnberg (1903 and 1904), and the material was distributed between the museums of

Stockholm, Göteborg, Uppsala and London. The second was evidently made by Dr. K. A. Haberer in 1907–8, although the visit does not seem to have been recorded; the evidence for it is the presence in the Vienna Museum of certain species, collected by him, from "Kamerun" without more precise locality, which have otherwise been found only in Lake Barombi-ma-Mbu. They were described by Holly (1927, 1930). The third collection was that of Dr. J. Hylton Pasqual, who brough fishes alive from "Lake Kumba" (= Barombi-ma-Mbu) to Victoria, Cameroons, and sent some to the Edinburgh zoo, where they bred; some of the offspring were sent to the British Museum (Natural History) in 1945 for identification and proved to be one of the species described by Holly from Haberer's collection. The fourth collection was made in 1948 by Mr. P. I. R. Maclaren; his fishes were deposited in the British Museum (Natural History) and are now described for the first time. Mr. Maclaren visited all three lakes and obtained both known and unknown species.

Finally the fifth and sixth collections were made by Professor Eisentraut's expeditions to Barombi-ma-Mbu (Elephant Lake) in 1954 and to Barombi-ba Kotto in 1958. These included two species not collected by the earlier expeditions as well as further material of the species already known.

Two siluroid fishes were also collected in a stream about one mile south of Lake Barombi-ba-Kotto by Professor Eisentraut's 1957/58 expedition.

The fish-faunas of the Rivers Meme and Mungo, into which flow the outlets from the lakes, are not well known; but Linnell also collected in the Meme, and the British Museum has recently received a few fishes taken by Mr. J. Deveson, from the lower tributaries of the Mungo.

Acknowledgments

I am very grateful to Professor Eisentraut for giving me the opportunity to study and report on the collections made by him and Dr. Steinbach and for presenting them to the British Museum (Natural History). This report would not have been possible without examination of the collections of the earlier expeditions of Linnell and Haberer, on which the excellent reports of the late Professor E. Lönnberg and of Dr. M. Holly still left some critical points to be elucidated. I was able to study the Swedish collections in Göteborg and Stockholm in 1951, thanks to a grant from the Swedish National Museum, and the facilities provided by Professor O. Nybelin and Professor H. Rendahl. Dr. P. Kähsbauer gave me similar facilities in Vienna in 1954 during a study visit financed through the Trustees of the British Museum (Natural History), and I am grateful to him also for a sketch of the pectoral spine of *Auchenoglanis ahli*. Paratypes of *Tilapia kottae* Lönnberg and *T. linnellii* Lönnberg are in the British Museum. The radiographs from which vertebral and fin-ray counts were obtained were made by Mr. A. C. Wheeler in the British Museum (Natural History); and the photographs are the work of the Museum photographers and are reproduced by permission of the Trustees. The comparative background was provided by the rich African collections of the museums of Paris and London, where over decades I have been able to study particularly the Cichlidae described by Sauvage, Pellegrin, Günther,

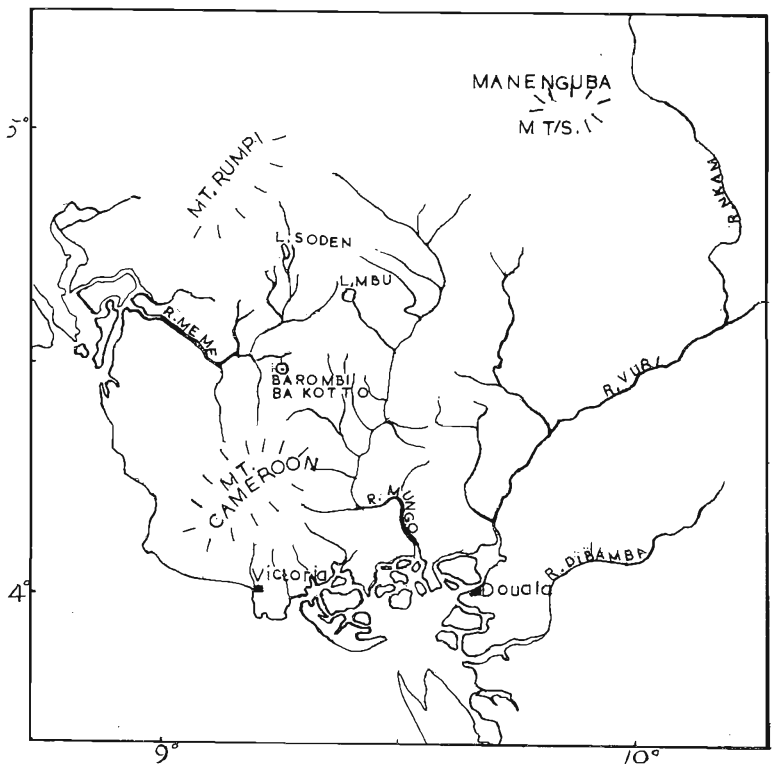
Boulenger and Regan, as well as later acquisitions provided by numerous collectors. I have also seen in Leiden the type specimens of Bleeker's remarkable report of 1863, and would thank Dr. Brongersma for facilities provided there.

I should like to pay tribute here to the memory of that good naturalist, Mr. P. I. R. Maclaren, who used his opportunities as fisheries officer to add to the collections of the British Museum. In 1957 he met his untimely death as the result of an encounter with a crocodile.

Topography of the lakes

Published Sources

Lönnberg quoted a report by the Swedish engineer Dusen (1894) on the topography and geology of the lake basins, but a fuller account was published in 1912 by Hassert, and his information was critically incorporated in Gèze's fine paper of 1943 on the physical geography and geology of the whole northwestern district of the Cameroons, which is illustrated by numerous photographs and by geological maps and sections and includes a full bibliography, with references to large-scale charts. From these works the following details have been abstracted.



Sketch-map of North-Western Cameroons

Names of the Lakes

The lakes have received both African and European names. Barombi (Balombi) is the name of the ethnic group of Bantu-speaking Africans who inhabit the region and fish the lakes. Kotto (Koto, Kotta) is a village on the central island of the lake to which it has given its name. T. J. Comber, the first European to visit it (in 1877) named it Rickards Lake, but it is now known as L, Barombi-ba-Kotto.

Elephant Lake (Elefanten-See) was so named by the Pole, Tomczek, in 1883, but it is also known as Barombi-ma-Mbu, Mbu being the Barombi word for lake' and also the name of the village near its northwestern shore; a third designation is Lake Kumba, from the neighbouring station of Kumba or Johann-Albrechtshöhe.

The third lake, named Lake Soden in 1890 by its Swedish discoverer, Valdau, after the German governor of that time, is 80—100 m. below the settlement of Lisoni, whose inhabitants refer to the lake simply as Mbu.

Description of the Lakes

The following table is taken from Hassert (1912) with some data from Gèze (1943).

Table I

Lake	Barombi-ba-Kotto	Barombi-ma-Mbu	Soden
Hectares (100 Ha. = 1 Km^2)	330	453	133
Depth (m.) max.	6.2	111	80.9
Depth (m.) av.	3.8	69	53
Volume in thousands of m^3	12.48	312	70.5
Mean gradient	0.9°	8.8°	12°
Circumference (m.)	7,200	8,300	4,200
Diameter (m.)	2,000—2,200	2,500	1,250
Altitude (m.)	110	290—308 according to different estimates	440—462 according to different estimates

Lake Barombi-ba-Kotto is believed to have been formed by a volcanic gaseous explosion which penetrated the sedimentary substratum and ancient overlying basalt. Later a small volcano formed the cone in the middle of the lake (now a wooded isle) and spread its ejecta in the basin, being thus responsible for its feeble depth. The day-time surface temperature is 29—30° C. The bottom is covered by a soft, humus-rich mud which is easily distributed through the whole lake by the wind. The water is described as mud-coloured (Ross) or bottle-green with turbid streaks

(Hassert). Fish, turtles and water-birds abound. Fishing is by cast-nets and traps.

The few in-flowing streams dry up in the dry season. An outlet from the N. E. corner joins the River Nkundung-Kotto, affluent of River Meme, but is also dry or greatly reduced in the dry season.

Lake Barombi-ma-Mbu, at 9°22'E, 4°38'N, 25 Km. in a direct line from Barombi-ba-Kotto, is a rounded basin, 80—100 m. below the summit of the surrounding cliffs, which are interrupted to the S. E. by a gorge 90 m. wide into which the overflow of the lake escapes over a shallow sill and then flows over a rocky bed to join the River Mungo. The Mungo then descends by a series of rapids a total height of 80 ft. before continuing its course to its delta (Keane, 1895). Dusén considered that the lake formerly drained through a now dry river bed to the Meme, but the isolation of its fish population from both rivers seems now virtually complete, at least as far as Cichlidae are concerned.

The surrounding tuffs are stratified and Gèze considers that they were laid there before the explosion which produced the lake-crater. A stream of basalt entering the lake from the N. E. was more recent.

Soundings brought up soft, brown mud from the bottom, but it is too deep to be stirred by the wind and the water is clear green. The surface temperature is as in Lake Kotto. Fishing (in 1912) was conducted by torchlight from dugout canoes with lines and nets, but mainly by fence-traps and basket-traps set in the swampy parts of the shore-line.

Lake Soden, about 15 Km. from Barombi-ma-Mbu at the S. E. foot of Mount Rumpi, is approximately circular and is surrounded by abrupt wooded slopes its bank accessible only from the South. An outlet to the South-west drains its overflow to the River Uwé (Meme system). It is believed to have originated by a violent gaseous explosion, not very old. Fishing in 1912 was by traps set round the edge and reached by the fishermen astride logs which they paddled with their legs.

List of Fishes Known from the Three Lakes and Rivers Meme and Mungo

Lake Barombi-ba-Kotto

Epiplatys sexfasciatus Gill.	Sierra Leone to Congo.
Hemichromis fasciatus Peters.	Senegal to Angola; R. Okovango; in fresh and brackish water.
Pelmatochromis loennbergi sp. n.	Endemic.
Tilapia kottae Lönnberg	(Record from Suoth Cameroons not checked)
Tilapia mariae dubia Lönnberg	Endemic subspecies. Species range: Ivory Coast to R. Kribi. Related to *T. haegi* (R. Ogowé).

Tilapia galilaea (L.).	Palestine, Nile, Lake Albert, Lake Rudolf, Senegal to Niger, Chad basin, Cameroons, Stanley Pool.
Barombia maclareni gen. et. sp. n.	Endemic.

Lake Barombi-ma-Mbu

Barbus batesii Boulenger.	Cameroons, Ogowe, Stanley Pool.
Clarias maclareni sp. nov.	Endemic.
Epiplatys sp. near *E. sexfasciatus*	Endemic?
Tilapia eisentrauti sp. n.	Endemic.
Tilapia steinbachi sp. n.	Endemic.
Tilapia lohbergeri Holly.	Probably endemic.
Tilapia linnellii Lönnberg.	Probably endemic.
Stomatepia mariae (Holly).	Probably endemic.

Lisoni (stream or Lake Soden?)

Clarias maclareni (?), sp. nov.
Barbus c. f. *gruveli.*

A brook (River Sao) near Lake Barombi-ba-Kotto (about one mile south, not connected with the Lake).

Clarias walkeri Günther.	Sierra Leone to Congo.
Auchenoglanis ahli Holly.	Cameroons.

R. Meme and "River at Sanye" *) (Lönnberg 1903)

Marcusenius brachyistius Gill.	Sierra Leone to Luculla River.
Isichthys henryi Gill.	Sierra Leone to Ogowe.
Alestes nurse (Ruppell).	Nile, Senegal to Old Calabar, Shari, Chad.
Nannaethiops unitaeniatus Gthr.	Nile, Portuguese Guinea to Gaboon
Clarias buthupogon Sauvage (River at Sanye).	Old Calabar to Congo System; L. Bangweulu.
Parauchenoglamis guttatus (Lönnberg).	Cameroons (Kribi, Nyong, Ja), Stanley Pool.
Epiplatys sexfasciatus Gill (as *infrafasciatus*), at Sanye.	Sierra Leone to Congo.
Eleotris vittata Dumeril (as *E. büttikoferi* Stdr.).	Gambia to Portuguese Congo.
Pelmatochromis guntheri (Sauvage) (as *P. boulengeri* Lönnberg).	Sierra Leone to Benito River.
Tilapia lata (Gthr.).	Ghana (?), Lagos, Lower Niger to Gaboon.
Tilapia mariae mariae Boulenger (as *T. microcephala* Bleeker).	Ivory Coast to R. Kribi.

*) I have not been able to find "Sanye" on the available maps. It may be on one of the short rivers near the mouth of the Meme.

River Mungo (tributaries of coastal part).

Marcusenius brachyistius Gill.	Sierra Leone to Luculla R.
Barbus batesii Boulenger.	Cameroons to Congo.
Pelmatochromis guntheri (Sauvage).	Sierra Leone to Benito R.
Ophicephalus obscurus Günther.	Nile, Chad basin, Senegal to Congo.

Some synonyms and corrected identities are to be noted in Lönnberg's and Holly's accounts, and will be justified in the taxonomic section: —

Paratilapia mariae Holly cannot be retained in *Paratilapia* and is made the type of a new genus.

Tilapia lata var camerunensis Lönnberg ist not a distinct subspecies (see under *T. kottae* below).

"*Tilapia microcephala* Bleeker" of Lönnberg = *T. mariae* Boulenger.

"*Tilapia macrocephala* (Bleeker)" of Lönnberg = *T. galilaea* (L.).

Tilapia caroli Holly = *T. linnellii* Lönnberg.

Pelmatochromis Boulengeri Lönnberg = *P. guntheri* (Sauvage).

"*Pelmatochromis longirostris* Boulenger" of Lönnberg = *P. loennbergi* n. sp.

Barbus linnellii Lönnberg is here considered a synonym of *B. batesii* Blgr.

Taxonomic section

Methods and Abbreviations

S. L. = standard length, i. e. length excluding caudal fin.

The length of head is measured with one point of the callipers on the mid-anterior point of the snout, (excluding any projection of the lower jaw), the other at the most posterior point of the opercular edge (excluding any skinny flange), except in Siluroidea, in which it is measured to the end of the occipital process.

In Cichlidae the depth of the preorbital bone is measured from the middle of its orbital rim along a line continuing the radius of the eye at that point.

A gill raker at the joint between epi- and cerato-branchial is not included in the count of rakers on the lower part of the arch.

In Cichlidae every fin-ray is conted, even a small simple ray at the posterior end of dorsal or anal fin, if it is distinct throughout; but in Cyprinidae the two last rays are counted as one if their bases are adjacent, to bring the counts into line with those of most workers in this group.

In Cichlidae the longitudinal series of scales counted is that including the upper lateral line. In practice the count is transferred to the lower lateral line by moving obliquely downwards and forwards from the last scale of the upper lateral line.

CYPRINIDAE

Barbus batesii Boulenger

Boulenger, 1903 : 25, pl. iii fig. 2; 1911: 43, fig. 24.

Barbus linnellii Lönnberg, 1904: 138.

Material examined.

One specimen, S. L. 123 mm., L. Barombi-ma-Mbu, Professor Eisentraut, 1954. One specimen, S. L. approximately 230 mm. (distorted), L. Barombi-ma-Mbu, Maclaren 1948. One specimen, S. L. 117 mm., Essoasso R. at Tiko, Deveson. Type of *B. batesii*, S. L. 205 mm., R. Kribi, Bates, and four, S. L. 74.5, 161, 314, 283 mm., R. Kribi, Bates.

Notes on the synonymy

I have not examined Lönnberg's specimen, but the characters on which he relied for the separation of his Barombi-ma-Mbu fishes from *B. batesii* are probably within the range of variation or accountable to size.

They are:

i. Larger head. Unfortunately the specimen of ca. 230 mm. is so much twisted that I cannot get a reliable measurement of the Standard Length. Professor Eisentraut's specimen has a relatively larger head than any *T. batesii* which I have measured; it is contained $3^1/_2$ times in the S. L., a figure given by Lönnberg for one of his large specimes. In six river specimes of S. L. 74—314 mm. I find it 3.7—4 times with no recognisable allometry.

ii. Longer snout. I find no difference here.

iii. Larger interorbital width. The two Elephant Lake specimens give ratios respectively below and above two extremes of the combined ranges given by Boulenger and Lönnberg for *B. batesii* and *B. linnellii*.

iv. Barbels small relative to diameter of eye. In six river fishes I find the posterior barbel 1.1—1.8 times the eye-diameter, in the two lake fishes 1.3 and 1.6. Boulenger gives "nearly twice" for *B. batesii*, Lönnberg $1^1/_3$ for *B. linnellii*. It is clear that no difference is established.

v. The dorsal is lower. Since Boulenger gives the length of the rigid part of the spinous ray as "$^1/_2$ to $^2/_3$ length of head (nearly as long as head in young)" and Lönnberg gives 55 %, it is already apparent that this is no real difference. Measurements suggest a negative allometry in which the lake fishes fit into series with the river samples.

vi. The anal is higher. The Kribi sample shows for this character a range of variation which includes the lake fishes.

vii. The scales are fewer. Lönnberg's range of "20—27" is probably a misprint, properly corrected, as in Boulenger's 'Catalogue', to 26.—27. Boulenger gives 27—30 for *B. batesii*, but I find 26—28 if one or two scales on the caudal fin are axcluded.

Thus the only one of Lönnberg's distinguishing characters which receives any confirmation from the new material is the size of the head, and the material is to scanty too allow this to be eccepted as significant.

B. linnellii Lönnberg 1904 is therefore probably a synonym of *B. batesii* Boulenger 1903. Opinion on the relationship between this and *B. compinei* (Sauvage 1878) must await further exploration of R. Ogowe, which yielded the type and only known specimen of this species, a stuffed fish of

730 cms. Sauvage's figure suggests that it had a smaller mouth and shorter snout, like most other West African *Barbus* of the *bynni* group. In *B. batesii* the lower jaw falls short of the upper anteriorly, the lower lip is continuous, sometimes forming a very short blunt lobe in the middle, the cleft of the mouth is part of an ellipse and the length of the lower jaw is 37—46 % of the length of head.

Of other species of *Barbus* with parallel striae on the scales recorded from the Cameroons (see Holly 1930), *B. habereri* Steindachner differs in lacking an anterior pair ob barbels, *B. brevispinis* Holly has a larger eye and smaller scales, *B. mbami* Holly has a shorter snout and the lower lip is broadly interrupted. Measurements in mm. of Professor Eisentraut's specimen are: depth of body 36; length of head 35, of snout 12.7, of anterior barbel 8.7, posterior 10.0; diameter of eye 7.7, interorbital width 11.0; length of lower jaw 13.0; length of rigid part of dorsal spine 27.5.

There are 26 scales in the lateral line, 4½ between origin of dorsal fin and lateral line, 2½ between the latter and the origin of the pelvic fins. D 4/10; A 3/5.

The pharyngeal tooth-formula is 2.3.5—5.3.2. Of the row of 5, numbers 2 and 3 from the anterior end are stout but have well-developed, curved, pointed crowns. The pharyngeal teeth of the specimen from Tiko are exactly similar.

Barbus sp.

A specimen of 151 mm. S. L. collected at Lisoni by Mr. Maclaren in 1948.

This fish is not well preserved; it is distorted and the dorsal fin is broken. It is near *B. batesii* but differs from it in the shorter posterior barbel (= diameter of eye) and in having only 3½ rows of scales between the lateral line and the origin of the dorsal fin. The lower lip is continued across the middle line by a short, truncate lobe. There are 25 scales in the lateral line, 2 between this and the pelvic fin.

The snout, cheeks and interocular surface of the head are covered with numerous small, low tubercles ("pearl-organs").

B. gruveli Pellegrin 1911 (type locality French Guinea) has the same number of scales, but has the lower lip restricted to the sides. Variation in development of the lower lip is well known in *Barbus* and has been mentioned from Günther's "Catalogue" (1868: 87 and 104) onwards.

The British Museum collection of this species includes some specimens from Sierra Leone, all somewhat smaller than the Lisoni fish, and one of them has tubercles on the head. How common this may be in the large *Barbus* is unknown.

BAGRIDAE

Auchenoglanis ahli Holly

Holly, 1930 : 201, pl. i. fig. 9.

One specimen, 77.5 mm. in standard length, collected in a brook about one mile from L. Barombi-ba-Kotto.

A. ahli was described from six specimens from the Bakoko highlands, and was characterised by Holly thus: —

Occipital process and interneural plate inconspicuous, hidden beneath the skin, not in contact with each other; maxillary barbel 1.0 to 1.15 times length of head; eye 7 to 7²/₃ times in length of head; dorsal spine more than half length of head, pectoral spine as long as dorsal, with coarse serrae on its posterior edge.

The present specimen agrees in the first character, but the maxillary barbel is only 76.5 % of the length of head (measured to end of occipital process). The eye is contained 7.8 times in the length of head; the pectoral spine is more than half the length of head and is coarsely toothed (fig. 1); although the dorsal spine is shorter than in Holly's description (but agrees with his figure).

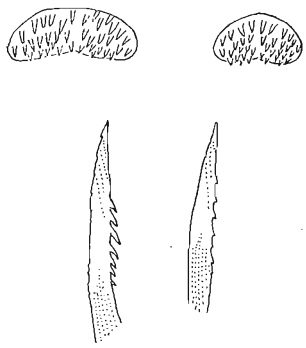


Fig. 1. Premaxillary teeth and pectoral spines of, left, *Auchenoglanis ahli* (coll. Eisentraut) and, right, *A. ballayi* (topotype).

The range of proportions due to individual variation and allometry has never been established in this genus, but it must be increased by the range of postmortem positions of the very mobile mouth. I am inclined to place the greatest emphasis on the coarseness of the serrations of the pectoral spine, and in this the present specimen contrasts with four specimens of *A. ballayi* Sauvage in the British Museum (Natural History). One of these is a topotype from Ngomo, Ogowe, one the type of its synonym *A. pulcher* Blgr. (Lindi R., Congo), the others are from R. Ta. A sketch kindly made for me by Dr. Kähsbauer of the pectoral spine of the type of *A. ahli* shows the same coarse serrations as the Eisentraut specimen.

There seems also to be a difference in the shape of the premaxillary toothband as between *A. ballayi* and *A. ahli* (fig. 1), although this may be partly due to the mobility at the symphysis of the two premaxillary bones.

CLARIIDAE

Clarias (Gronovius) Scopoli

Although David (1935) did much to bring order into the chaotic taxonomy of this genus by paying attention to the development of the casque and of the suprabranchial organ, it is still difficult to estimate the taxonomic value of the characters. Nevertheless it may be significant that although I have come to no satisfactory conclusion about the three specimens from the crater-lakes, I have no hesitation in determining the stream fish as *C. walkeri*.

Clarias walkeri Günther

Günther. 1896 : 274, pl. xiv, fig. B. (Ogowe).

A specimen of S. L. 180 mm. was collected by Professor Eisentraut in a stream about one mile from Lake Barombi-ba-Kotto, in 1958.

The type of *C. walkeri* is a specimen of 150 mm. S. L. Fig. 2 shows that the postorbital and dermosphenotic meet with parallel edges and that the suprabranchial trees are quite well developed (Fig. 2).

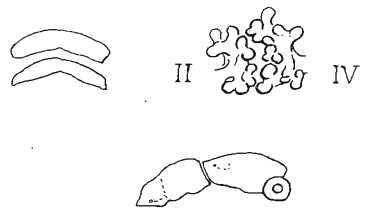


Fig. 2. *Clarias walkeri*, type (S. L. 151 mm.). Shape of premaxillary and vomerine tooth-patches; suprabranchial trees of branchial arches II and IV: outline of eye, postorbital and dermosphenotic.

Professor Eisentraut's specimen has the condition of the cheek bones as in the type; the suprabranchial tree of the second arch is very similar to that of the type, but that of the fourth arch has developed more and longer branches; the band of vomerine teeth has become a little broader in the midline than laterally and many of its teeth have become blunted. A radiograph shows 58 vertebrae, 75 dorsal and 58 anal rays. There are 11 gill gill rakers on the lower part of the first arch.

The length of head is ¼ of the Standard Length. The nasal barbel is 62 % of the head-length, the maxillary 113 %, the outer mandibular 92,5 %, the inner mandibular 58.5 %. The diameter of the eye is contained 7 times in the interorbital width, which is nearly half the length of head.

The species ranges from Sierra Leone to the Congo.

Clarias maclareni **sp. nov.**

Fig. 3

Two specimens, holotype (222.5 mm. S. L.) and paratype (202 mm. S. L.) collected in L. Barombi-ma-Mbu in 1948 by Mr. Maclaren [B. M. (N. H.) 1959. 8. 18. 174-5]. One specimen, juv., 110 mm. in S. L. collected by Mr. Maclaren at "Lisoni", near L. Soden, in 1948 [B. M. (N. H.) 1959. 8. 18. 173].

Description of the types (figures for holotype first)

Length of head 25.8 or 26.8 % of S.L., 1.3 times its width. Diameter of eye 8.15—9.7 % of length of head, 5.5 or 5 times in interorbital width, which is 43.7 or 46.2 % of length of head. Eye superolateral.

Nasal barbel 46 or 39 % of length of head, maxillary 86.5 % (extending to about halfway along pectoral spine), outer mandibular 69.3 or 70.0 %, inner 45 or 49 %.

Occipital process approximately equilateral, with the posterior fontanel encroaching on it. Top of head nearly smooth. Postorbital and dermosphenotic bones nearly meeting, but not in a suture with closely parallel edges.

Suprabranchial trees rather well developed but not as in *C. walkeri* of similar size. Premaxillary and vomerine teeth pointed, except some vomerine with the crowns broken off. Premaxillary band about 5.5 times as long as wide, nearly twice as wide as the vomerine, which is narrowest in the mid-line. Gill rakers on anterior arch 2+1+13.

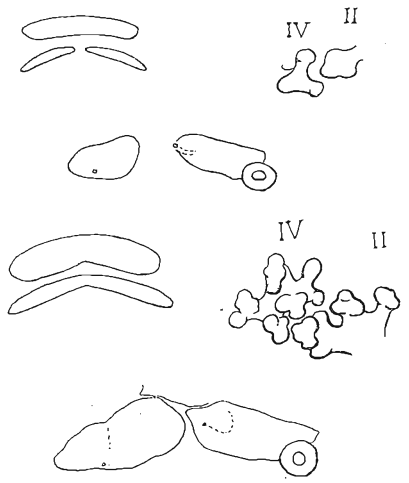


Fig. 3. Above, *Clarias* sp. (juv.) from Lisoni. Below, *Clarias maclareni* type (S. L. 222 mm.) In each case outlines of premaxillary and vomerine tooth-patches, suprabranchial trees; and sketch showing shapes and relations of eye, postorbital and dermosphenotic. The scale for the Lisoni fish is one-and-a-half times that for the type of *C. maclareni*.

Origin of pelvics 1.2—1.3 times as far from caudal base as from tip of snout. Pectoral spine about $^2/_3$ length of fin, with tubercles (not serrae) on its outer edge. Distance from occipital process to origin of dorsal fin 35.6 or 40.0 % of length of head.

D.67 (in both). A.53 (? or 54) or 54. Vertebrae 58 or 55 (56 neural spines, two on one of the centra) (Radiograph). Colour very dark above, greyish ventrally.

Description of the Lisoni specimen

Measurements in mm. (and, in brackets, % of S.L. or of length of head as for the types): S.L. 110; caudal 14.7; depth of body 16 (14.5 %); length of head 29.5 (26.8 %); width of head 23 (21.8 % S.L. 1¼ in its length); diameter of eye 3.0 (10.2 % head, 4.4 in interocular width); interocular width 13.2 (44.7); occipital process to dorsal fin 11.5 (39 % of head), dorsal to caudal 4.2; snout to origin of pelvics 52; origin of pelvics to caudal 70 (1.35 times its distance from tip of snout).

Barbels: nasal 27 (91.5 % head), maxillary 43 (146 % head, extending beyond tip of pectoral), outer mandibular 37.5 (127 %), inner ca. 22 (51 %).

Suprabranchial organ rudimentary (juvenile condition).

Head nearly smooth; postorbital and dermosphenotic bones separated by a considerable gap.

Width of premaxillary tooth-band 1.5 mm., length 10.8; width of each vomerine band 1.0 mm, left and right bands separated by a median gap (fig. 3). Vomerine teeth not granular, but many are cylindrical with blunt tips, others pointed.

Gill-rakers on first arch 1+14.

Outer edge of pectoral spine tuberculate; rigid part of spine a little more than half length of fin.

D 71. A 51. Vertebrae 57. (Radiograph).

Affinities

In placing the Lisoni specimen with the types I am assuming that the following changes occur with growth: a pair of vomerine tooth-patches unite to form one narrow band; the barbels become relatively much shorter; the suprabranchial organ develops; the postorbital and dermosphenotic expand until they nearly meet. These assumptions require testing by the examination of growth stages from both lakes; we have no similar study of a related species for comparison, although Greenwood (1959) notes a general negative allometry in the barbels of *Clarias*.

C. maclareni belongs to the group of *Clarias* species with few gill-rakers on the anterior arch, and among them with those species tending towards the subgenus *Allabenchelys*, with the bones of the lateral

part of the casque present but not closely knit. It is distinguished from all of these by the larger eye and the very narrow band of vomerine teeth (divided in the young, if the Lisoni specimen is typical). *C. walkeri* Günther and *C. cameronensis* Holly appear to have longer barbels in the adult. The type *C. poensis* Boulenger is a larger specimen (S.L. 257 mm.) which also has a narrow vomerine tooth-band, but its much smaller eye (8.3 times in interocular width) and shorter head (21.1 % of the S.L.) do not seem sufficiently explained as due to negative allometric growth, and the development of its casque and suprabranchial organ are comparable with those of *C. walkeri*. These three "species" are however rather close to *C. maclareni*. I doubt the synonymy, advocated by Pappenheim (1914) and David (1935), of *C. liocephalus* Blgr. of the Rift Valley with *C. submarginatus* Peters. The type of the latter, from the River Tooxlong (presumably in the Cameroons) is too little known to judge its degree of affinity with *C. maclareni*.

Unsatisfactory as it is to add to the nominal species of *Clarias*, it has seemed the only course to follow in the present state of our knowledge.

CYPINODONTIDAE

Epiplatys sexfasciatus Gill

Gill, 1862 : 136.

Haplochilus infrafasciatus Günther, 1866 : 313 (Old Calabar); Lönnberg, 1903 : 39 (River at Sanye).

(For other synonyms see Poll, 1951, and Lambert, 1961.)

This species, abundant in suitable habitats throughout its range, from Sierra Leone to the Congo, is represented in Prof. Eisentraut's collection by one specimen of S.L. 51 mm from Lake Barombi-ba-Kotto, and we have eight collected by Mr. Deveson in the Matute River, a lower tributary of the Mungo. It was reported (as *H. infrafasciatus*) by Lönnberg from the „River at Sanye", but until now it has not been reported from the crater-lakes.

A single specimen, 50 mm in S.L., of a species of *Epiplatys* was also collected by Prof. Eisentraut in Lake Barombi-ma-Mbu. The caudal fin is broken off. It agrees with *E. sexfasciatus* in positions of fins and numbers of rays and scales (D 11, A 16, P 17, 30 scales in a longitudinal series, 21 around the body before the pelvics). In colour-pattern it differs from typical *E. sexfasciatus* in having more and narrower vertical bars, four of which extend upwards and slightly backwards from the base of the anal fin. Poll (1951) and Lambert (1961), maintaining that *E. multifasciatus* (Boulenger) is at most a subspecies replacing typical *E. sexfasciatus* in the upper reaches of the Congo basin, record considerable variation in the number of dark bars, and Lambert also gives evidence of slightly lower ranges and modes of numbers of scales and fin-rays in *E. s. multifasciatus*.

The present single specimen from each lake can only serve to draw attention to the interest that would attach to the examination of good samples.

CICHLIDAE

Hemichromis fasciatus Peters

Peters, 1887, Mon. Berlin Acad. : 403. See Boulenger, 1915 : 428 fig. 293.

This very successful and widespread species, a predator, was collected in Lake Barombi-ba Kotto by Linnell (Lönnberg 1904) and by Maclaren and in R. Matute, tributary of R. Mungo, by Deveson.

Pelmatochromis Steindachner

The species in L. Barombi-ba-Kotto requires a new name and description. Rivers Meme and Mungo harbour *P. guentheri* (Sauvage), to the synonymy of which must be added *P. boulengeri* Lönnberg. Since Boulenger's accounts of *P. guentheri* and *P. kingsleyae* did not clearly define the two species I add notes on their synonymy and distinguishing characters.

Pelmatochromis loennbergi **sp. n.**

P. longirostris (nec Boulenger), Lönnberg, 1904 : 135 (record only).

Diagnostic Characters. *A Pelmatochromis* with a hanging pad on the roof of the pharynx and with tuberculate gill-rakers on the lower parts of the arches; with rounded, subtruncate caudal fin; with small black spots on spinous and (especially) soft dorsal and on upper half of caudal fin; inner teeth in one short series, or with a few teeth of a second; interorbital width 22.0—22.6 % of length of head; vertebrae 14+13=27 (counted in two).

Description of the type, a male of 81+21 mm. collected by Mr. P.I.R. Maclaren in 1948 [B.M. (N.H.) 1959, 8, 18, 178] and the allotype, a female of 76.5+21 mm. collected by Professor Eisentraut's expedition in 1958 [B.M. (N.H.) 1961) 10. 18. 6], both from Lake Barombi-ba-Kotto. Numbers for the male are given first.

Proportions in hundredths of standard length: Depth of body 38.3, 37.8, equal to length of head; length of pectoral fin 24.0, 26.1; length of caudal peduncle 9.9, 9.1, less (0.7, 0.6) than its depth.

Proportions in hundredths of length of head: Length of snout 40.2, 41.3; diameter of eye 22.6, 24.2; depth of preorbital bone 22.6, 22.1; interorbital with 22.6, 22.1; length of lower jaw 40.3, 38.0, of premaxillary pedicels 25.8, 26.6; width of lower pharyngeal bone 29.5 (in the allotype).

Maxillary extending to between nostril and eye. Teeth conical (some with crowns worn off), in two series, very few in the inner series, especially in the upper jaw, 34 in outer series of upper jaw. Lower pharyngeal bone arrowhead-shaped, with few pointed teeth, about 7 in each median series.

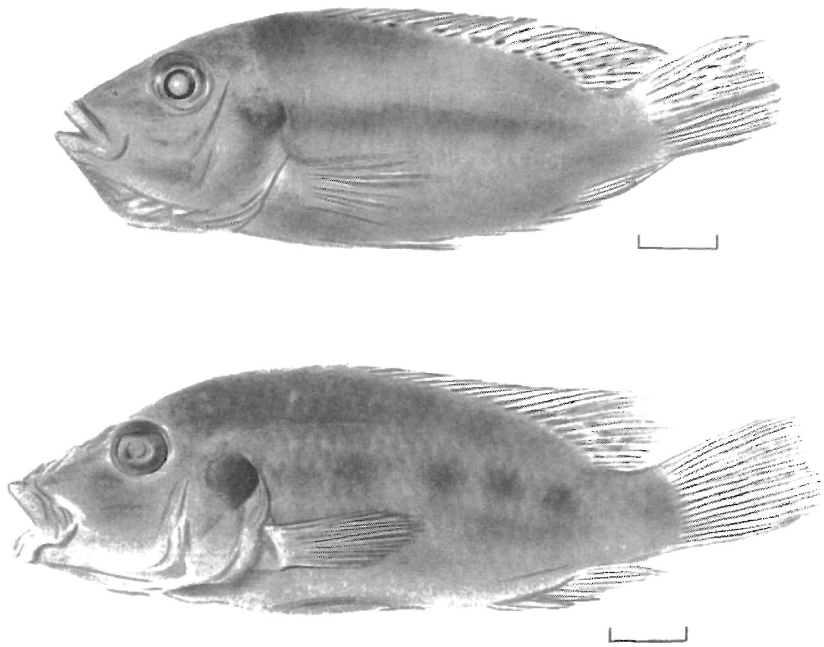


Fig. 4. *Pelmatochromis loennbergi,* allotype (above) and holytype.

Cheek with 4 horizontal series of scales, the lowest row of only one or two scales. Gill rakers each with an oblique, tuberculate edge, (8 or 7) + (0 or 1) + (12 or 11) on the anterior arch.

Scales cycloid, 28, 29 in a lateral-line series (excluding one or two on caudal fin), 3 between origin of dorsal and lateral line, 1 or 1½ between dorsal and posterior end of upper lateral line, 4 between bases of pectoral and pelvic fins.

D XV 11, XVII 10; last spine 15, 16 % of the standard length.

A III 7; third spine a little shorter and stouter than last dorsal.

Pectorals rounded. Pelvics extending to vent, or prolonged (in the female, which is ripe) as a short filament a little beyond it.

Colour in Alcohol. A well-marked opercular spot; four faint black blotches along the middle of the side, the first below anterior part of spinous dorsal, the last below posterior end of dorsal. Some small black spots on the spinous dorsal, becoming more numerous posteriorly and on the soft dorsal; black spots on upper half of caudal. Anal immaculate. Pelvic with spine and outermost ray dusky in male, faintly dusky with white

outer edge in the (ripe) female. Upper edge of spinous and soft dorsal and of caudal black, conspicuously so in the female.

In this male the testes have not reached their full size, but the eggs of the female, about 1 mm. in diameter, are loose in the ovary.

Distribution. Lake Barombi-ba-Kotto.

I have seen the specimen determined as *P. longirostris* Blgr. by Lönnberg, also from L. Barombi-ba-Kotto. It is 68 mm. in S.L., closely resembling the types of *P. loennbergi* and like them differing from *P. longirostris*. The latter is a more slender species, with spots arranged in vertical series over the whole depth of the caudal fin, which is more prolonged in the middle („subacuminate" in Boulenger's word). In *P. longirostris* also the gill-rakers are fewer (8—10), and the teeth are smaller and more numerous. In Lönnberg's specimen proportions of jaws and interorbital width are as in the types of *P. loennbergi*, the preorbital bone is a little narrower, eye relatively larger and snout relatively shorter as is to be expected in a smaller specimen.

Affinities. This species is near *P. guentheri* and *P. kingsleyae*, differing from the former in the narrower interorbital space and in having spots on the dorsal fin in both sexes (female only in *P. guentheri*) and from *P. kingsleyae* in having more dorsal fin-rays, and a pattern of blotches on the flank; in *P. kingsleyae* there are spots all over the caudal fin, but only on the posterior half of the soft dorsal (and anal).

P. guentheri (Sauvage)

Hemichromis guntheri Sauvage, 1882 : 317, pl. v fig. 1. (Assini).

Hemichromis voltae Steindachner, 1887 : 60, pl. i. fig. 3 (R. Volta).

Pelmatochromis guentheri Boulenger, 1898 : 150 (redescr. of type); Pellegrin 1904 : 279 (redescr. of type).

Hemichromis tersquamatus Günther, 1899 : 717, pl. xlii, fig. B. (R. Kotchwah, Gold Coast).

Pelmatochromis pellegrini Boulenger, 1902 : 328 pl. xxix fig. 2. (Sapelle, L. Niger).

Pelmatochromis boulengeri Lönnberg, 1903 : 39 (R. Meme, Cameroons).

Material Examined. I have examined the type of the species (Paris Mus. 4421 A) and the types of all the nominal species except that of *H. voltae*, the description and figure of which are in agreement with *P. guentheri*. All except *P. boulengeri* were included by Boulenger (1915) in *P. guentheri*. Since Boulenger's list, further specimens have been received at the British Museum (Natural History), including a good sample from Sierra Leone, which extends the known distribution towards the North. In additon to specimens listed by Boulenger under *P. guentheri* I include the two Niger specimens listed by him as *P. kingsleyae* (q. v.). The data on which I characterize the species in table II are from 28 specimens, including the examined types and a specimen collected by Mr. J. Deveson in the R. Pungo (Mungo system). Three syntypes of *P. boulengeri* were examined by me in Stockholm.

Distribution. Rivers of West Africa from Sierra Leone to the Benito R., Spanish Guinea.

Boulenger gives Gaboon as the southern limit of distribution, perhaps relying on Pellegrin's record of 1909 for R. Ogowe. Pellegrin, however, gives no description and his specimen (with young in the mouth) may have been *P. kingsleyae*, which occurs in the Gaboon. The record should be checked, but in both species the young are carried in the mouth, and in *P. guentheri* both parents are known to share the task of guarding the young when they can swim.

P. kingsleyae (Boulenger)

Hemichromis schwebischi (non Sauvage) (part.), Günther 1896 : 273.

Chromidotilapia kingsleyae Boulenger, 1898 : 151, pl. xix. fig. 2 (Gaboon, Ogowe).

Pelmatochromis kingsleyae, Pellegrin, 1904 : 278 (one syntype; Congo specimen not checked).

Pelmatochromis kingsleyae (part.), Boulenger, 1915 : 398 fig. 269. (Ogowe and Gaboon specimens only).

Table II

	P. guentheri	*P. kingsleyae*	*P. loennbergi*
S. L. of specimens described	80-125	72—103	68—81
Interorbital width (% head)	25. 6—30. 2 (30.9 Lönnberg)	22.5—25.0	22.1—22.6
Lower jaw (% head)	40.0—45.5	35.7—41.7	38.0—40.3
Gill-rakers on lower part of lst arch	10—13 mode 12	9—11 mode 10	11 (2) or 12 (1)
Dark spots on spinous dorsal	1—2 series, ♀ only, rising obliquely backwards	none	scattered more numerous posteriorly; both sexes
Dark spots on soft dorsal	none, or few, and vague	posterior part only; conspicuous in both sexes	over whole soft fin; both sexes
Dark spots on anal	none, or few faint	on posterior rays, conspicuous	none
Dark spots on caudal	no conspicuous spots	over whole fin	on upper half of fin only

Syntypes and Lectotype. Günther's first description of the species under the (queried) name of *H. schwebischi* included Mary Kingsley's specimens from Azumine Creek, Niger Delta, but Boulenger's (1898) proposal of the specific name mentions only „Gaboon, Ogowe" as localities. He was therefore wrong in listing the Azumine Creek specimens in the Catalogue (1915) as (syn)types, and these are in fact specimens of *P. guentheri.*

From Boulenger's syntypes I select as lectotype No. 3 of Boulenger's ‚Catalogué, B. M. (N. H.) 1896. 5. 5. 36, probably a male, 90 + 27 mm, from R. Ogowe, collected by Mary Kingsley.

Material Examined. The characterization of the species given here is based on seven specimens, nos. 3—9 of Boulenger's Catalogue. Nos 10—26 (from Chiloango) do not belong to this species. I have also seen in Paris two specimens collected in the Gaboon by Monsieur Charles Roux; one of these had young in the mouth, like the Ogowe specimen listed by Pellegrin (1909) as *P. guentheri,* which may prove to be *P. kingsleyae* too.

Distribution. Known reliably only from Rivers Gaboon and Ogowe and from Sette Kama in Gaboon territory.

Tilapia kottae Lönnberg

Lönnberg 1904 : 135; Boulenger, 1915 : 200, fig. 127.

Description of nine specimens from L. Barombi-ba-Kotto, comprising two syntypes of *T. kottae* (S.L. 92 and 100 mm.) in the Göteborg Museum, two syntypes (S.L. 100 and 108 mm.) in the B.M. (N.H.) (1904. 2.15. 1—2), two specimens (72 and 105 mm.) collected by Maclaren and three (71, 73 and 95 mm.) collected by Eisentraut.

Proportions in hundredths of S.L.: Depth of body 38—42.5; length of head 33.7—37,0; length of pectoral fin 30.2—33.3; length of caudal peduncle 10,5—13.5, less than (0.8) its depth.

Proportions as hundredths of length of head: Length of snout 35.4—40; diameter of eye 25.7—32.0; depth of preorbital 20.0—24.3; interorbital width 29.0—35.3; length of lower jaw 35.5—39.6, of premaxillary pedicels 25.0—28.0; width of lower pharyngeal bone 30.0—33.3.

The profile descends straight and steeply from the occiput to the tip of the snout, at an angle of about 40° with the horizontal and the mouth is nearly horizontal (cleft about 20°). The maxillary does not reach the vertical from the anterior edge of the eye.

Three or two horizontal rows of scales on the check. Gill-rakers on lower part of anterior arch 8—10, usually 9.

Teeth in 3 or 4 series, 34 to 50 in outer series of upper jaw; inner tricuspid, outer bicuspid, the major cusp often emarginate. Pharyngeal teeth rather coarse, the lower posterior with a major and two much smaller minor cusps; blade of lower pharyngeal bone shorter than the dentigerous area, the latter indented behind and concave on the sides.

Scales 29 in the lateral line series (26 in a mid-lateral series), 3 or $3^1/_2$ between origin of dorsal and upper lateral line, 3 or 4 between bases of pectoral and pelvic fins.

D XIV 12, XV 12—13 or XVI 10—12; totals 26 (f. 2), 27 (f. 4) or 28 (f. 3). The 28th ray, where present, is small, simple and close to the penultimate. Last spine 13—16 % of S.L. A III 8—9; 3rd spine about as long as last dorsal and stronger.

Caudal truncate or slightly emarginate; upper and lower rays scaly for two-thirds of their length, middle rays only at base.

A "Tilapia-mark" on the dorsal fin present in all, almost square in most, not surrounded by a clear area; vertical bars on the body present or absent; sexually ripe specimens with lower parts of head, chest and belly dusky.

Of the three collected by Professor Eisentraut the largest (95 mm. S.L.) is a male with narrow inactive gonads; it is a very pale fish in which even the Tilapia-mark and opercular spot are faint and the only conspicuous colour is that of the crowns of the teeth. The other two are ripening females with much melanic colouring; in one of these the yellow eggs, loose in the ovary, measure 1.9 × 1.4 mm. as preserved.

From this it is clear that the species may in this lake breed at a standard length of about 70 mm.

Distribution. Pellegrin (1929 a & b) listed this species as occurring in the Nyong and Ntem Rivers, southern Cameroons, but he gave no indication of the characters on which he relied for identification.

Affinities. This population falls into the *T. zillii* group of the *T. zilliimelanopleura* complex on the relatively low numbers of dorsal fin-rays and the steep profile. The distinction given in Boulenger's key (1915) does not hold, but it differs from both *T. zillii* and *T. melanopleura* in the more slender lower pharyngeal bone and in this it resembles *T. tholloni* Sauvage, of the Ogowe and Lower Congo. The types of *T. tholloni* however have a densely scaled caudal fin and the mid-lateral band or series of blotches in this species is nearly always prominent. (*T. ogowensis* Gunther 1895 is probably a synonym of *T. tholloni.*). At present, therefore, I maintain the specific rank of *T. kottae*. *T. discolor* Günther of L. Bosumtwi in Ashanti also has a rather lighter-built pharyngeal bone than *T. zillii,* but stouter than *T. kottae* and *T. tholloni,* and it has more soft rays and a highter total of rays in the dorsal fin.

Either *T. kottae* or *T. tholloni* is probably present in Rivers Meme and Mungo, but neither has so far been collected there. Lönnberg described *T. lata.* var. *camerunensis* from the Meme, distinguishing it from *T. lata* (Günther) by the lower number of scales. Lönnberg, however counted the

mid-lateral series, and in his type, wich I have examined, there are 29 in the series including the upper lateral line. *T. lata* is not, in my opinion, a synonym of *T. melanopleura (pace* Boulenger, 1915) from which it differs in having a smaller head and mouth. The Meme River fish has the same characters (head 32 % of S.L., lower jaw 30.8 % of head), and is a true *T. lata.* Although this species is clearly a member of the *zilli-melanopleura* complex, it co-exists with *T. guineensis* or *T. zillii* in some Nigerian localities, and may do so with *T. kottae* (or *tholloni)* in the Meme.

Tilapia mariae mariae Boulenger

Tilapia mariae Boulenger 1899 : 122, pl. xi fig. 1 (Niger Delta); 1915: 186, fig. 120.

Tilapia microcephala (nec Bleeker), Lönnberg, 1903 : 41 (R. Meme).

Tilapia meeki Pellegrin, 1911 : 185; 1914 : 63, pl. ii fig. 2 (Ivory Coast); 1928 : 9 (R. Sanaga, Cameroons).

Tilapia heudeloti (part.), Boulenger, 1915 : 175 (no. 34 only, R. Meme).

Material examined: The types of *T. mariae,* B. M. (N. H.) 1896. 5. 5. 49—50; the types of *T. meeki,* Paris Museum 11. 53—54; two specimens from R. Meme, identified in 1903 by Lönnberg as *T. microcephala* and later by Boulenger as *T. heudeloti,* one Stockholm Museum no. 10 425, the other B. M. (N. H.) 1903. 2. 28. 1; several other specimens in the British Museum from Ghana, Nigeria and R. Kribi and the two specimens in the Paris Museum (27/280, 281) from R. Sanaga.

Tilapia mariae dubia Lönnberg

Tilipia dubia Lönnberg, 1904 : 137; Boulenger, 1915 : 189 (Lake Barombi-ba-Kotto) ? Tilapia haegi Pellegrin, 1911 : 273, fig.; Boulenger, 1915 : 178, fig. 114. (Ogowe).

Material examined: The type of *T. dubia* in the Göteborg Museum. S. L. 65 mm.; two specimens of S. L. 73 and 92.5 mm., collected by Eisentraut in L. Barombi-ba-Kotto; the type and paratype and two other specimens of *T. haegi.*

The subspecies differ in the interorbital width; and perhaps in the number of scales and length of pectorial fin, thus:

T. m. mariae (19 specimens from Ivory Coast to R. Kribi; S. L. 52—157 mm.); interorbital width 38.5—48.8 % of length of head, 40 cr. more in all but two specimens; scales in lateral line series 28 or 29 (30 in two); pectoral fin 32—38 % of the standard length.

T. m. dubia (3 specimens): interorbital width 34.0—37,4 % of the length of head; scales in lateral line series 30; pectoral 39.5—41 % of S. L.

The two R. Meme specimens agree emphatically with typical *T. mariae* in these characters.

Lönnberg's low-scale-count for *T. dubia* was obtained on the mid-lateral series; the usual method gives 30 in his type. Other differences between this and *T. mariae* noted by Lönnberg come within the range of variation now recognized for the species.

The synonymy of *T. meeki* and *T. mariae* has been demonstrated by Mr. R. A. Whitehead (in the press). The smaller of the Eisentraut specimens has the barred body of typical *T. mariae,* the larger is very pale, almost uniform, but the ‚*mariae*' bars can be discerned.

In all other characters — proportions, the spoon-shaped, notched teeth, the dentition and proportions of the pharyngeal bone and the fin-ray numbers — the subspecies *dubia* agrees perfectly with *T. mariae.*

Like *T. m. dubia, T. haegi,* also differs from *T. m. mariae* in the narrower interorbital space, and the four specimens which I have examined all have 30 scales in the lat. line series. In them however the pectoral fin is 30.5—34.5 % of S. L.

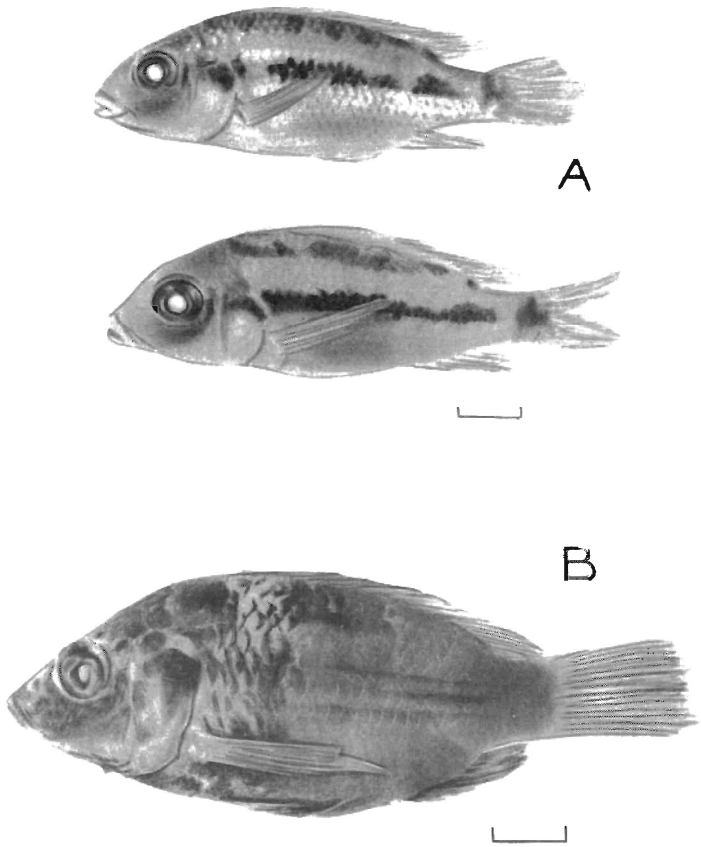


Fig. 5. *Tilapia eisentrauti,* A. holytype (below) and paratype, B. dubious specimen of 109 mm. S. L.

Tilapia eisentrauti **sp. n.**

Figs. 5 A, 6 A, a and b

Diagnosis. A *Tilapia* probably of small size with decurved profile, small, horizontal mouth and narrow interorbital region (24—27 % of length of head); with 14—17 gill-rakers on the lower part of the anterior arch; and with the dentigerous area of the lower pharyngeal bone longer than the anterior blade in the young (? shorter in adult) and of characteristic shape, with a narrow anterior apical portion. Vertebrae 29 (14+15) (counted in five).

Description of five specimens, the holotype, a male of 65 mm. standard length, and four paratypes, females, 58—63 mm. S.L. from Lake Barombi-ma-Mbu (Elephant Lake) [B. M. (N. H.) 1961. 10. 18. 11—14 and Bonner Museum].

Proportions as percent of standard length: depth of body 34.4—37.3; length of head 35.5—38.0; length of pectoral fin 33.0—34.7; length of caudal peduncle 14.5—15.3, about 1.1 times its depth.

Proportions as percent of length of head: length of snout 31.2—35.5; diameter of eye 30.6—37.7; depth of preorbital 15.0—19.0; interorbital width 24.0—27.0; length of lower jaw 29.5—34.0, of premaxillary pedicels 20.0—22.2; width of lower pharyngeal bone about 28.

Maxillary not quite reaching vertical from anterior edge of eye. Teeth in three regular series 45—54 in outer series of upper jaw. Outer teeth with obliquely spatulate crowns divided by a notch into two almost equal lobes (rather than cusps), the inner with three almost equal, blunt cusps. Pharyngeal teeth rather numerous and slender, not densely crowded behind, about 15 in each of the two median series.

Two series of scales on the cheek. Gill rakers short, the lower very short, (3 or 4) + (0 or 1) + (14—17) on the anterior arch. Roof of pharynx in front of and at the sides of the upper pharyngeal teeth rather richly provided with a swollen, grooved (probably glandular and sensory) epithelial area, but not with a hanging pad as in some *Pelmatochromis* and other genera.

Scales cycloid, 30—32 in the series including the upper lateral line, 3½—4 between origin of dorsal and lateral line, 4 between pectoral and pelvic fin-bases.

D XV 11 (in 4) or XVI 10; last spine 12.3—15 % of the standard length.

A III 8 or 9; third spine about as long as last dorsal, and stronger. Pelvics with outermost soft ray longest, extending nearly or quite to anus, in ♂ to genital papilla. Caudal fin damaged in all specimens, in one apparently slightly emarginate; scaly at the base and about half way along the upper and lower rays.

Colour in alcohol: a longitudinal series of dark blotches, sometimes united, between dorsal fin and upper lateral line; a black band from operculum along the middle of the side, interrupted on the caudal peduncle, the part behind the gap extending upwards to the top of the caudal peduncle. Outer edge of pelvic white. No "Tilapia mark" on the dorsal fin.

Affinities. This is a very isolated species of *Tilapia*, differing from all others in its narrow interorbital region. The shape of the lower pharyngeal bone is intermediate between that in the subgenus *Tilapia*, with short blade, and that in the subgenus *Sarotherodon* in which a toothless anterior blade exceeds in length the dentigerous area. In young *T. eisentrauti* the triangular shape of the bone is pinched in front as if to add to the length of the blade, but the dentigerous area is not restricted to the posterior part. The mode of parental care is unknown.

In the emphasis of the longitudinal elements of the basic colour-pattern this species resembles *T. lohbergeri*, but even more *Stomatepia mariae* (Holly), both also inhabitants of Elephant Lake. It differs from both in the dentition.

Description of a larger specimen, a maturing male of 109+17 mm. colleced in Lake Barombi-ma-Mbu in 1948 by Mr. Maclaren. (Fig. 5 B, 6 B, c and d.)

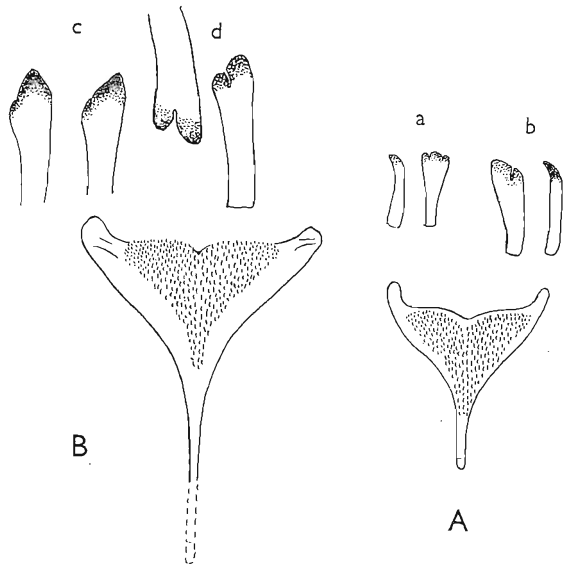


Fig. 6. *Tilapia eisentrauti*, Lower pharyngeal bone and teeth from the jaws in, A. one of the paratypes, 62 mm. in S. L., B. the dubious specimen of 109 mm. S. L. Pharyngeal bones both to the same scale (x 3), teeth all x 20. The broken lines show the blade at the measurement made when the specimen was first examined; it has since been broken. a. two views of one of the inner teeth, b. two views of an outer tooth of the paratype, c. two lateral teeth of the lower jaw and d. upper and lower teeth near the middle line of the 109 mm. fish.

Depth of body = length of head = 39.4 % of the standard length; length of pectoral fin 34 %, of caudal peduncle 13.8, epual to its depth. Length of snout 32.6 % of the length of head, diameter of eye 28, depth of preorbital 22, interorbital width 26.5, length of lower jaw 35,5, of premaxillary pedicels 24.5; width of lower pharyngeal bone about 25 %.

The maxillary is hidden beneath the preorbital when the mouth is closed, and does not extend to below the eye. The lower jaw is weak and flat, with no symphyseal depth. The teeth are small, the outer flexible and bilobed, the inner equally tricuspid; 60 in outer series of upper jaw. Lower pharyngeal bone with the blade a little longer than the dentigerous area, with slender teeth, simple or with a weak shoulder, not very numerous.

Gill-rakers on first arch short, 4+1+15. Two series of scales on the cheek.

Scales 30 in the lateral-line series, 4 between origin of dorsal and lateral line. D XV 12. A III 11.

Black blotch between dorsum and upper lateral line dense and continuous. Gular region and pelvics black.

This specimen, so much larger than the type and paratypes, resembles them in colour-pattern and in the dentition of the jaws; and in the large eye and narrow interorbital region. It differs in the shape and proportions of the lower pharyngeal bone, but this may be an ontogenetic change, comparable with but more extreme than that observable in *T. lohbergeri* and *T. linnellii*. It differs also in the oblique mouth and longer premaxillary pedicels.

Individual variation may account for the additional soft rays in dorsal and anal fins and the presence of only one inner series of teeth. The uniformity of the type and paratypes in these characters suggests that they may be members of one brood.

It is with hesitation that I include this specimen in *T. eisentrauti*, and only the examination of more specimens can decide its status and reveal the ontogenetic changes that characterise the species.

The fish has the same standard length as the type of *Stomatepia mariae*, and the following measurements (in mm.) will show the differences between the two (in addition to the different dentition) Table III:

Table III

	S. mariae	*T. (?) eisentrauti*
Depth of body	34.5	43
Length of head	43	43
Length of snout	15	14
Length of lower jaw	18	15.2
Diameter of eye	10.5	12
Interorbital width	9	11.3
Length of premaxillary pedicel	10.0	10.5

A similar comparison between the young of both species gives a rather different result (Table IV). In both comparisons the narrower interorbital and longer lower jaw of *Stomatepia* are clearly shown, but in the 109 mm. fishes the relative length of head and trunk are identical whereas in the young approximately the same standard length is made up of a longer head and shorter trunk in *Stomatepia* than in *T. eisentrauti;* in the young, too, a difference is evident in the length of the premaxillary pedicels, which is absent or slightly in the opposite sense in the larger fishes. This pair of comparisons thus casts additional doubt on the conspecificity of the 109 mm. fish with the types of *T. eisentrauti.*

Table IV

	T. eisentrauti	*S. mariae*	*T. eisentrauti*
Standard length	57.7	60	61
Length of body without head	35.7	35	39.4
Depth of body	20.5	21	21
Length of head	22	25	21.6
Length of snout	7.2	8	7.2
Length of lower jaw....	7.5	10	7.0
Diameter of eye.....	7.5	7.5	6.7
Interorbital width	5.3	4.5	5.6
Length of premaxillary pedicel	4.3	6.0	4.8

Tilapia lohbergeri Holly

Fig. 7

Holly, 1930 : 203 pl. ii fig. 10

Diagnosis. A *Tilapia* in which the teeth of the jaws are small, numerous, with slender shafts and curved crowns, the outer spoon-shaped with a notch; the lower pharyngeal bone has the anterior blade much longer than the dentigerous area, which bears setiform teeth; there are 14—18 short gill-rakers on the lower part of the anterior arch. Scales 30 or 31 in the lateral line series; vertebrae 29 (16+13, 15+14 or 14+15). A dark mid-lateral band extends from the gill-opening to the caudal base, usually interrupted on the caudal peduncle.

Material examined. Type (Vienna Museum No. 13951) 89 + 23 mm., coll. Haberer, Cameroons, without more precise locality data.

Four specimens from Prof. Eisentraut's collection, respectively 48, 62, 65.5 and 96 mm. in S.L., from Elephant Lake (= Barombi-ma-Mbu), 21. I. 1954. [B.M. (N.H.) 1961. 10, 18, 15—17 and Bonn Museum.]

Six specimens sent to the British Museum (Natural History) in 1945 by Dr. A.C. Stephen, then of the Royal Scottish Museum. They were the offspring of specimens brought to the Edinburgh Zoological Gardens by Dr. J. Hylton Pasqual, who had collected them in „Lake Kumba" (= Barombi-ma-Mbu).

Description of the five wild specimens. Proportions in hundredths of S.L.: Depth of body 37—45; length of head 35.4—38.4; length of pectoral fin 31.0—36.3; length of caudal peduncle 13.2—14.5, about equal to its depth.

Proportions in hundredths of length of head: Length of snout 32.0—42.0; diameter of eye 20.6—28.2; depth of preorbital 17.8—23.5; interorbital width 29.4—33.8; length of lower jaw 26.5—31.7, of premaxillary pedicels 22.2—24.1; width of lower pharyngeal bone 29.4—31.6, its length 33—38.

The profile is straight, or slightly and evenly convex, the jaws meeting evenly or the lower with its outer row of teeth slightly in advance; lower jaw without a mental prominence; maxillary ending between nostril and eye. Teeth in 5—7 series in upper jaw, 5 or 6 in lower, very small, with slender shafts, the outer spoon-shaped with a distal notch, the inner tricuspid; a few posterior outer teeth of the upper jaw may be tricuspid; 50—86 in this outer series. Pharyngeal teeth very slender, crowded, forming a broad posterior band of dark brown-tipped teeth and an anterior apical zone of sparser, paler-tipped teeth, all unicuspid with a weak shoulder; anterior blade of lower pharyngeal bone from 1.08 (at S.L. 62 mm.) to 1.6 (at 92 mm.) times the median length of the dentigerous area.

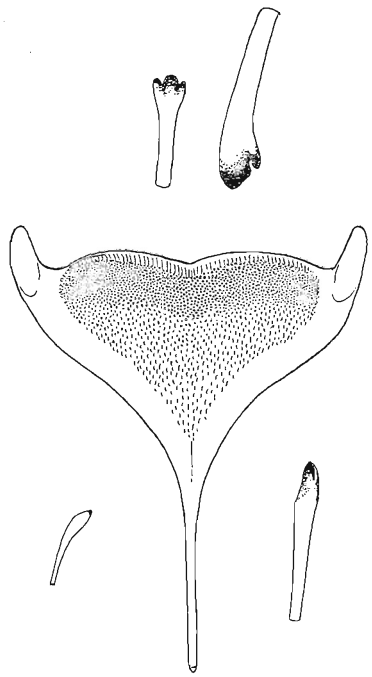


Fig. 7. *Tilapia lohbergeri*, specimen of 95 mm., lower pharyngeal bone, x 4, and inner and outer jaw teeth, x 20.

Gill-rakers (2—4)+(0 or 1)+(14—16) on the anterior arch; short, conical.

Scales 30 or 31 in the lateral line series, 3—4 between origin of dorsal and lateral line, 4 or 5 between bases of pectoral and pelvic fins.

D XVI 11 (in four) or XVI 12 (one).

A III 9 (in four) or 10 (one); third spine as long as or longer than last dorsal, 2.4—2.9 times in the length of head.

The caudal is slightly emarginate (in the type; damaged in others), scaled only at the base.

In all except the smallest there is a dark band along the back at the base of the dorsal as well as the mid-lateral band. There is no *Tilapia*-mark on the dorsal fin, the lappets of which are black.

Aquarium Specimens

The offspring of the specimens collected by Dr. Pasqual had grown to a standard length of 80—106 mm. in the Edinburgh zoo and one (91 mm.) was a partly spent female. In comparison with the wild fishes the head is smaller (32.1—34.8 % of S.L.), the lower jaw 30—33 % of the length of head. In the larger specimens (91—106 mm.) the teeth are damaged, many are lost or broken (from digging a 'nest'?), and there are fewer series (3—4). Scales 29—31. D XVI 11 or XVII 10. Gill-rakers 14—18 on lower part of anterior arch.

Dr. Pasqual, in a note Mr. W. B. Dowson, then Fisheries Development Officer, Nigeria, described these fishes (which he provisionally identified as *T. dubia* Lönnberg) as "good community species, vegetarian, docile and tolerant of other fish. In two years grew from about 2" to 3" and at that stage reproduction took place".

"Courting and spawning were not observed; the sexes remained identical in appearance. They are mouth-breeders, both parents apparently taking part in conveying the fry in gular pouches. Whether the ova are so carried was not discovered. In captivity average family six."

Distribution. Confined to L. Barombi-ma-Mbu, if we may assume that the type "Kamerun, ohne weitere Fundortangabe" was also collected there.

Affinities. This species seems nearest to *T. heudeloti* resembling it in the shape of the teeth and of the pharyngeal bone and in the number of gill-rakers. The teeth are, however, even smaller and there are usually more scales (in *T. heudeloti* 27—30, usually 28 or 29) and a different colour-pattern (no lateral band in *T. heudeloti*). If Dr. Pasqual's

observations on the parental care are confirmed this provides another difference, but although in *T. heudeloti* buccal incubation is normally practised by the male, the female may do it occasionally, at least in captivity (Aronson).

T. bilineata Pellegrin 1900 (R. Alima, Congo) has a similar colour pattern, buth with a second well-marked band above the mid-lateral. It has fewer gill-rakers (9—11 on the lower part of the first arch), a smaller head and different proportions and shows no special relationship to *T. lohbergeri*.

Tilapia linnellii Lönnberg

Fig. 8 + 9

Tilapia (Gephyrochromis) linnellii Lönnberg, 1903, Ann. Mag nat. Hist. (7) 12 : 42.

Tilapia linnelli, Boulenger, 1915, Cat. Afr. Fish. III: 159, fig. 104.

Tilapia caroli Holly, 1930, Sitz Ber. Akad. Wien, 139 204, pl. ii fig. 11.

I have examined the types of *T. caroli* Holly in the Vienna Museum and a paratype of *T. linnellii* in the British Museum [B.M. (N.H.) 1903. 2. 28. 2], five specimens collected by the late Mr. P. I. R. Maclaren and three adults in Professor Eisentraut's collection, as well as 16 young of 24—53 mm. S.L. (Eisentraut collection) which probably belong to this species.

The adults examined range from 94 to 148 mm. S. L.. Two of 147 and two of 148 mm. are males and there are females of 94, 99, 140, 141 and 145 mm. In all the males all or most the outer teeth are simple and at least some of the second row are simple; inside these are 1—4 series of mainly tricuspid teeth. In the upper jaw the band of teeth is widest anteriorly, in the lower it is narrow (2—3 series) in front, broadening to 4—5 series laterally, with a single series towards the posterior end of the jaw.

In even the largest of the females the outer teeth are bicuspid, sometimes with a few tricuspid, very small, close-set and nearly straight; the inner are tricuspid. I did not determine the sex of the types of *T. caroli*. In both the outer teeth are simple, occasionelly with a vestigial cusp, and the inner are tricuspid.

In both sexes the teeth are very small; in the eleven adults examined there are 74—124 in the outer series of the upper jaw.

These adults are characterized by the very large head, its length 43—45 % of the standard length, long snout and large mouth (for a *Tilapia*; lower jaw 30.7—33.2 in ♀♀, 33.5—37.4 in ♂♂). The lower pharyngeal bone has a very long blade and a rather short dentigerous area with very slender teeth, crowded posteriorly; the median length of the dentigerous area is contained 3.4—3.8 times in the median length of the bone. The gill-

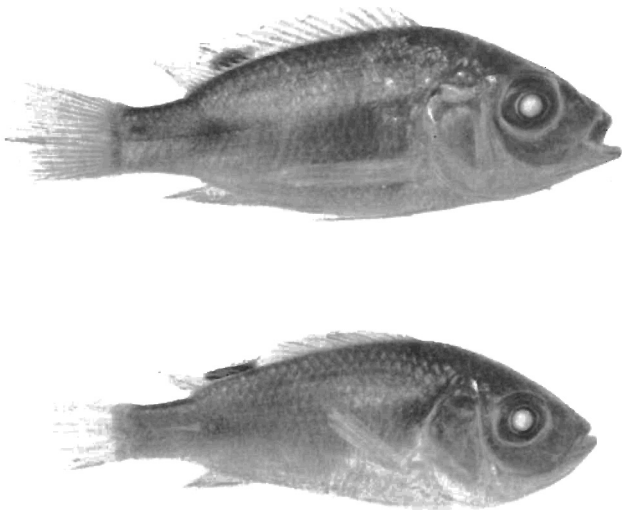


Fig. 8. *Tilapia linnellii*, two juvenile specimens of S. L. 53 and 59 mm. respectively.

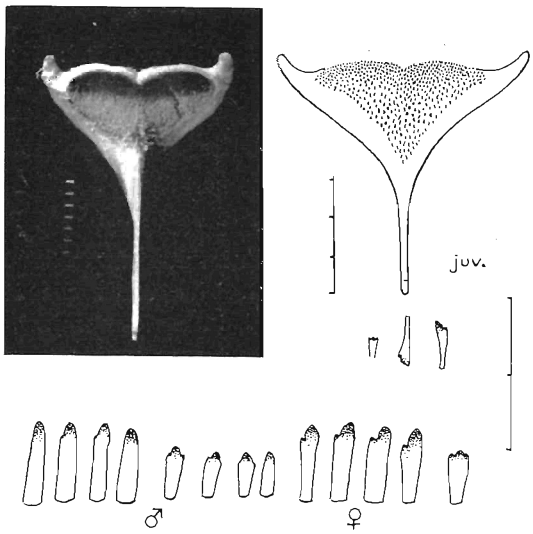


Fig. 9. *Tilapia linnellii*, lower pharyngeal bones of a paratype, ♂, 147 mm. in S. L. and of a young specimen of 50 mm. S. L. Below, four outer and four inner teeth of the jaws of the same ♂, showing degress of simplification; most outer teeth lack any trace of a minor cusp; four outer and one inner of a ♀ of 140 mm. S. L.; and (much smaller) two outer and one inner of a juvenile of 45 mm. S. L. Scales in mm.

rakers are short, 15—18 on the lower part of the anterior arch. There are 30—32, usually 31 scales in the series including the upper lateral line. D XV 12 (in 7), XVI 11 (in 2) or XVI 12 (in 2). A III 10 (or 11).

Other proportions: Depth of body 37.4—45.2 % of S.L., length of pectoral fin 33.0—38.0 %. Eye 19.0—20.7 % of head, depth of preorbital 20.4—26.0 %, interorbital width 33.0—38.0 %.

Ripe ovarian eggs are large (long diameter 5—5½ mm. in two specimens). The ovaries are paired.

The young which I associate with this species are very silvery fishes with a striking, horizontally elongate "*Tilapia*-mark", extending along the base of the dorsal fin from the penultimate spine to the fifth soft ray. This mark is not present in the adults except the 140 mm. female, and a male of 148 mm., which retain a trace of it.

Some of the young show in the preserved state very faint traces of 2—3 dark blotches along the middle of the side, but these were not visible when the specimens were newly received.

A description follows of twelve of these, 46—53 mm. long; the other four are smaller and are included for counts only.

Proportions as hundredths of the S.L.: Depth of body 35—39, length of head 37.6—39.6; length of pectoral fin 31.2—36.2; length of caudal peduncle 13.0—16.0, about equal to its depth.

Proportions as hundredths of the length of head: Length of snout 26.3—33.0, diameter of eye (26.5) 29.3—35.3; depth of preorbital 16.0—18.5; interorbital width 29.0—31.6; length of lower jaw 31.4—36.0, of premaxillary pedicels 20.0—24.5; width of lower pharyngeal bone in two specimens 29.4 and 34.8.

The median length of the dentigerous area of the lower pharyngeal is contained 2.1 to 2.2 times in the median length of the bone, a much less extreme proportion than in the adult. The teeth are in two series, occasionally with a few teeth of a third, in the upper jaw, 2 or 3 in the lower; the outer are bicuspid, with a truncate major cusp and a small minor, not very much curved; 42—56 in the outer series of the upper jaw. The lower jaw projects slightly.

Gill rakers on the first arch number (3—5) + 1 + (15—18). There are 2 series of scales on the cheek.

Scales in the lateral line series 31 (32 in one), 3 or 3½ between origin of dorsal and lateral line, 3 or 4 between bases of pectoral and pelvic fins.

D XIV 12 (f.1) XV 11 (f.1), XV 12 (f.13) or XVI 12 (f.1). A III 9—11, usually 10.

Vertebrae 29 (14+15 or 15+14) in fifeteen specimens.

In assigning these to *T. linnellii* I have been influenced by the presence of the elongate *Tilapia*-mark in two of the adults; by the nature of the teeth, which though different from those of the adult are narrower and straighter than in other species; by the identical range of gill-raker numbers and modal numbers of scales and fin-rays; and by the pharyngeal bone and dentition. The changes in the elongation of the head and mouth and pharyngeal bone, with a deepening of the lower part of preoperculum and of the interoperculum evidently occur at the attainment of sexual maturity, at a standard length of about 90 mm. and upwards.

Distribution. Known only from Lake Barombi-ma-Mbu (Elephant Lake). Probably the types of *T. caroli* Holly ("Kamerun, ohne nähere Fundortangabe") are no exception to this.

Affinities. The shape of the lower pharyngeal bone suggests relationship to *T. galilaea,* but still more with *T. heudeloti* Dumèril (Senegal to Congo). The latter has the same number of gill-rakers, but a deeper preorbital bone and fewer scales (27—30, usually 28 or 29) and vertebrae (27 or 28), and the teeth are more spoon-shaped in the young and do not become simple in large specimens of either sex. *T. schwebischi* (Sauvage 1884) is another *Tilapia* of this group. Like *T. linnellii* it has a less deep preorbital bone than *T. heudeloti* and the type, a large specimen from the Upper Ogowe, has unicuspid teeth, although a pair of shoulders on some of the inner teeth show their derivation from tricuspid. It resembles *T. heudeloti,* however, in the low number of scales (29 in a longitudinal series) and differs from both this and *T. linnellii* in the higher number of gill-rakers (24 on the lower part of the anterior arch). It is perhaps the nearest relative of *T. linnellii,* and appears to be only subspecifically distinct from *T. flavomarginata.*

Tilapia galilaea (Linn. 1758)

Synonym for this region only: *Tilapia macrocephala* (nec Bleeker), Lönnberg, 1904 : 135.

I have examined the specimen from L. Barombi-ba-Kotto referred by Lönnberg to *T. macrocephala* (Göteborg Museum Pi. ex. 4), and find that this and three collected in the same lake by Mr. Maclaren are referable to *T. galilaea.* They differ, however from topotypical (Lake of Galilee) examples of the same size in having usually a lower number of scales in the lateral line and between this and the dorsal (resp. 30 and 3½ in three of the specimens, but 31 : 4½ in the fourth as in the topotypes), a lower number of dorsal fin-rays (XVI 12 or XV 13; cf. XVI 13 or 14, rarely XVII 14 or XVI 12 in topotypes) and of anal soft rays (9 or 10, cf. 11 or 12) and a slightly smaller lower pharyngeal bone. The teeth of jaws

and pharynx and the shape of the pharyngeal dentigerous area are as in *T. galilaea,* and there are 20—24 gill-rakers on the lower part of the anterior arch.

They resemble *T. g. multifasciata* (Günther) of L. Bosumtwi, Ghana, in having a slightly lower body than is typical for the species (depth 40.5—46.5 % of the S.L.), but this population has usually only 29 scales in the longitudinal series and usually XV 13—14 dorsal rays.

Until more is known about the populations of the supraspecies *T. galilaea* I prefer to leave the Barombi-ba-Kotto population without a subspecific name after examining such a small sample.

I have seen only two of the *T. galilaea* reported by Holly from Haberer's Cameroons collection probably from R. Mbam (Holly, 1927b.). These are like *T. g. multifasciata* in having only 29 scales in the lateral line series and XV dorsal spines, but the soft rays are fewer (12). Two sent by Dr. J. Daget, from R. Sanaga, have however 30 scales and D XVI 13—14, though still a lower body than topotypes of *T. galilaea.* Such differences need bigger samples for their evaluation.

All these Cameroon specimens of *T. galilaea* are between 88 and 150 mm. in standard length, and at this stage are difficult to distinguish from *T. schwebischi* (= *T. flavomarginata*). The latter, however, has 3 or 4 horizontal series of scales on the cheek, whereas in the specimens assigned to *T. galilaea* there are two oblique series, occasionally one or two scales of a third, as in topotypical specimens. Adults of the two species are easily distinguished.

Tilapia steinbachi **n. sp.**

Figs. 10 and 11.

Diagnosis. Resembling *T. galilaea* in the small mouth and slender teeth of the jaws, but distinguished by the nearly discoidal shape of the dentigerous areas of the upper and lower pharyngeal bones. Caudal fin scaly only at the base.

Description of the holotype and paratype, respectively 113 and 90 mm. in standard length [B.M. (N.H.) 1961.10.18 40—41]. Figures for the larger specimen are given first.

Proportions as percent. of the standard length: Depth of body 43, 42; length of head 34; length of pectoral fin 36.2, 38; length of caudal peduncle 14.2, 13.3, respectively 1.07 and 1.09 times its depth.

Proportions as percent of length of head: Length of snout 39.0, 34.4; diameter of eye 26.0, 26.2; depth of preorbital 23.4, 23.0; interorbital width 35.0, 32,8; length of lower jaw 26.0, 28.0; of premaxillary pedicels 23.4, 23,0; width of lower pharyngeal bone 36.8, 38.0,

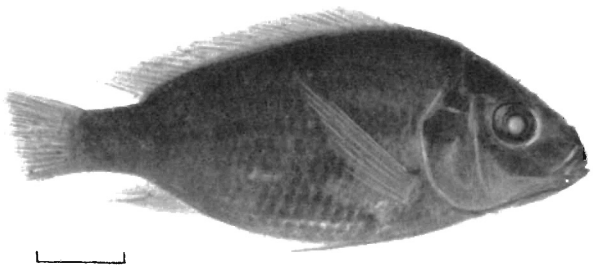


Fig. 10. *Tilapia steinbachi*, paratype.

The teeth of the jaws are very fine, with slender shafts, in two series (or with a few teeth of a third) in the upper jaw, three in the lower; outer bicuspid, inner very small, tricuspid. The pharyngeal teeth are slender and crowded, the dark brown tips of the lower posterior forming a zone at least half the dentigerous area in extent. The tips of the posterior teeth are blunt and rounded, but they are slender, quasi-cylindrical, not molariform; among them in the brown zone are many whose brown tips have been worn off, probably the older teeth; the teeth of the anterior zone slope backwards and have bevelled crowns. The posterior upper pair of toothed pharyngeals are likewise enlarged, left and right forming together an almost discoidal toothed surface.

Scales of cheek in 3 or 2 horizontal series. Gill-rakers short, 3+1+21 or 3+1+19.

Scales cycloid, 31 in the series including the upper lateral line, $3^1/_2$ between origin of dorsal and lateral line, 4 between pectoral and pelvic bases.

D XVII 11 (in the paratype a short simple 12th ray close to the 11th); last spine 14.4 % of S.L. (in both). A III 10, third spine stouter than and nearly as long as last dorsal. Caudal fin damaged, not scaly.

Colour as preserved uniform; no "*Tilapia*-mark", at this stage at least. A few vague spots on the vertical fins.

The intestine is long, with 7—9 coils, full of dark mud. The stomach contains very fine sand mixed with organic debris. The sand would

account for the wearing down of the pharyngeal teeth, between which this fine mud is probably ground to complete the comminution of the organic contents.

Affinities. This species does not appear to be closely related to the others in this lake. It belongs to the *T. galilaea* group of species, among which it is unique in the shape of the lower pharyngeal bone, which appears to have a posterior shelf added to a bone of more normal shape. This extension, which in the type extends more posteriorly than the lateral wings of the bone, in the smaller paratype does not extend so far. Probably the additional bony tissue and its teeth are added during ontogeny.

In the Congo and Ogowe the species nearest to this is *T. lepidura*, which in addition to a more normal pharyngeal bone differs in having a thickly scaled caudal fin.

The pharyngeal dentition is very similar to that of the remarkable genera *Cyclopharynx* and *Callopharynx* of the River Fwa, described by Dr. Max Poll, but these are so different in other respects that this resemblance is clearly due to convergence. Not only so, but the dentition of the jaws is so different in the Fwa genera, both among themselves and in comparison with *T. steinbachi*, that the resemblances in the pharynx can hardly be due to adaptation to a similar diet. The Tanganyika genera with similar pharyngeal dentition are equally remote phyletically.

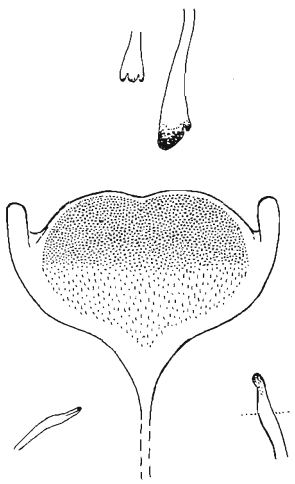


Fig. 11. *Tilapia steinbachi*, lower pharyngeal bone (x 2,5 approx.), anterior and posterior pharyngeal teeth and, above, inner and outer teeth of the upper jaw (x 20), from the type, 113 mm. in S. L. The broken lines prolong the blade of the pharyngeal bone to the relative length preserved in the paratype, but even this is not quite complete.

Chilochromis duponti, which has a similarly enlarged pharyngeal bone, has the teeth of the jaws differently developed and the teeth of the pharynx are spatulate, not knobbed. In this peculiar species, although the enlargement of the pharyngeal bones is less than in *T. steinbachi,* the apophysis for the upper bones includes a large contribution from the prootic (as Regan stated in 1922) and at the posterolateral corners even the basioccipital participates to a slight extent. In *T. steinbachi* the facets are formed by the parasphenoid alone and the sutures between this bone and both prootic and basioccipital are clearly excluded, as in *Tilapia.*

Stomatepia gen. nov.

Type *Paratilapia mariae* Holly, 1930.

Definition. A cichlid genus related to *Tilapia,* that is, with apophyses for the upper pharyngeal bones formed from the parasphenoid alone, with a pair of ventral apophyses on the third vertebra for the attachment of the air-bladder and with tricuspid inner teeth in the jaws; but differing from *Tilapia* in having the outer teeth simple or with a vestigial minor cusp in both sexes and at all known sizes (40 mm. S.L. upwards), and in the narrow interorbital region (18—22.2 % of the length of head). The produced snout and relatively large mouth are also in contrast to *Tilapia,* although the fact that these contribute to the increased length of head somewhat masks the numerical expression of the contrast.

Vertebrae 27 or 28 (13+15 in six, 13+14 in one).

Known from a single species, probably restricted to Lake Barombi-ma-Mbu (Elephant Lake), since although the type of *S. mariae* is recorded as from the Cameroons without more precise locality, the species has never been recorded elsewhere, and there is other evidence that the collector (K. A. Haberer) visited this lake (see *Tilapia linnellii* and *T. lohbergeri).*

The genus is likely to remain monotypic, since its nearest relationship seems to be with *Tilapia eisentrauti,* apparently endemic in the same lake. Both species have probably evolved there from a common ancestor in adaptation to different feeding-habits.

Derivation of the name. The name *Tilapia* was a transcription by its author, A. Smith, of a word for "fish" in one of the Bantu languages. Kirby (1940: 205) gives from A. Smith's diary a list of Baquan words for animals and supplies *tlhapi* as the (missing) word for fish. "Tl" (or til) appears to be a click prefix; and Mr. R. A. Whitehead informs me that an Ibo of Eastern Nigeria used a similar word to "apia" (the first 'a' pronounced as in English 'ape') for cichlid fishes in general. The Ibo informant wrote it "ekpiye", but the pronunciation of the 'k' was hardly apparent to a European. Mr. W. B. Dowson told me of the same word in

use at Lagos, two species of *Tilapia* being distinguished as "White Epía" and "Black Epía".

Stómatepía is thus a latinized hybrid of Greek and Bantu, referring to the large mouth of this cichlid fish.

Paratilapia, which also has unicuspid teeth and the pharyngeal apophysis of the parasphenoid alone, has this apophysis very prominent and abrupt, whereas in *Stomatepia* it scarcely bulges the ventral profile of the skull. In a skeleton of *Paratilapia polleni* (to which Regan restricted this genus in 1920) in the British Museum there is a small group of vomerine teeth, a feature unknown in African Cichlidae.

Pelmatochromis, which also differs from *Tilapia* in having conical outer teeth, has the inner teeth simple too and most of its species have a pair of hanging pads on the roof of the pharynx between the first epibranchials.

In trying to insert *S. mariae* into Boulenger's key to *Paratilapia,* Holly compared it with Lake Nyasa species now recognized as *Haplochromis* and with "*P. schwebischi* (Sauvage)". The last is an aberrant *Tilapia* related to *T. heudeloti* and not to *S. mariae.*

Stomatepia mariae (Holly)

Figs. 12 and 13

Paratilapia mariae Holly, 1930, Sitz.Ber. Akad. Wien 139 : 206, pl. ii, fig. 12.

Material Examined: The type (Vienna Mus. no. 13950), a male of 109 mm. S.L.; one, immature (♀?) 92 mm. S.L. from L. Barombi-ma-Mbu, coll. Maclaren 1948 [B.M. (N.H.) 1959. 8. 18. 188]; eight young, 41—60 mm. S.L. from L. Barombi-ma-Mbu (Elefanten-See), coll Eisentraut 1954 [B.M. (N.H.) 1961, 10, 18, 34—39 and Bonn Museum].

Description. Proportions as hundredths of S.L.: Depth of body 30.0—36.8; length of head 39—42; length of pectoral fin 28—34; length of caudal peduncle 12—14, about equal to its depth (usually 0.9—1.0 times, nearly 1.3 times in the very emaciated 92 mm. specimen).

Proportions as hundredths of length of head: Length of snout 30—35; diameter of eye 24.4 at 109 mm. S.L., 27.3—30.0 at 41—92 mm., without apparent allometry in the latter range; depth of preorbital 18.2—22.8, showing a rough positive allometry; interorbital width 18.2—22.2; length of lower jaw 36.3—42.3; length of premaxillary pedicels 22.2—26.4; width of lower pharyngeal bone (in the three largest) 25.3—30.5.

The lower jaw projects, with the lower end of the symphysis in advance. The teeth of the jaws are small, in 2—3 series above, 3 below, the outer simple, conical in the type, in smaller specimens simple or with an inconspicuous shoulder or even a minute minor cusp; the inner are almost equally tricuspid in all specimens (including the type, although

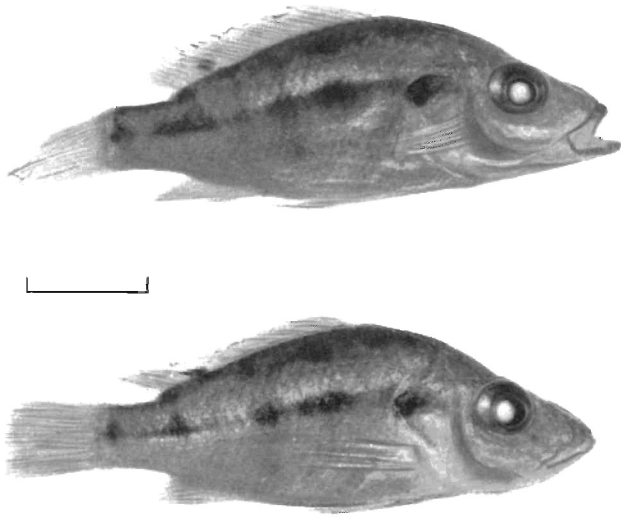


Fig. 12. *Stomatepia mariae*, young, 44 and 45 mm. in S. L. Scale 1 cm.

Holly did not mention this) 42—70 in outer series of upper jaw. The lower pharyngeal bone is rather narrow, with the dentigerous area slightly indented behind and briefly prolonged in front, barely shorter than the

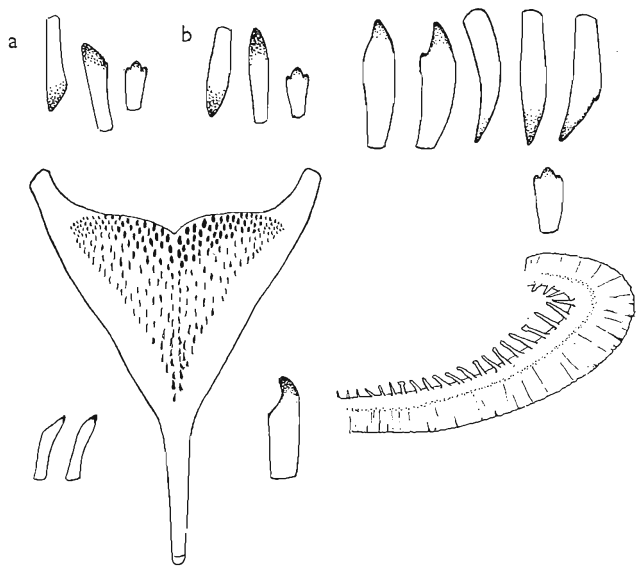


Fig. 13. *Stomatepia mariae*. Lower pharyngeal bone of specimen of 92 mm. S. L., x 4 approx.; anterior and posterior pharyngeal teeth further enlarged; left anterior gill arch, x 2 approx.; teeth of jaws (upper right) of same fish, x 20 approx.; a. and b. jaw teeth of specimens of S. L. 45.5 and 58 mm. respectively, x 20.

anterior blade; its teeth are slender, pointed, the posterior with a minute shoulder, fairly numerous but not densely crowded.

The gill-rakers on the anterior arch number (4 or 5)+(0 or 1)+(15—20); they are rather slender, sometimes a few with the tip slightly expanded and truncate. The average number on the lower part of the anterior arch is 17.3; only the two larges (with 20) have more than 18.

The canals of the lateral-line system of the head are somewhat swollen and their openings in the skin enlarged, especially in the young, and the tubules of the lateral line itself are also rather large; the otic capsule is swollen, but the sagitta, though conspicuous in the radiographs, is not noticeably larger than in other cichlids of this lake.

Scales 28—31 in the lateral-line series (excluding one or two on the caudal fin), 3 or 3½ between origin of dorsal and lateral line, 3 or 4 between origins of pectoral and pelvic fins. Two series on the cheek, occasionally one or two additional scales.

Dorsal XIII (f. 1), XIV 10 (f. 1), XIV 11 (f. 5), XIV 12 (f. 1) or XV 11 (f. 2), ginving totals of 24 (f. 2), 25 (f. 5) or 26 (f. 3). Last spine 12.4 % of S.L. in the type, 13.0—14.0 in the young.

Anal III 8—10, usually III 9. Third spine as long as or a little shorter than last dorsal.

Caudal in the type truncate when spread, damaged in all the other specimens.

Colour in preserved material: an opercular blotch; a dark band along middle of side, interrupted in the type on the caudal peduncle, in smaller specimens also in two or three other places, so that it is represented by two blotches below the spinous dorsal, one below the last dorsal rays and one at the end of the caudal peduncle. Dorsal fin with black lappets and in some also with a blotch at base of soft fin (as in the figure of the type); this blotch, in the position of a "Tilapia-mark", may be only the emphasized base of a near-vertical vague stripe.

Barombia **gen. nov.**

Pharyngeal apophysis of parasphenoid alone. Vertebrae 29(15+14), a pair of meeting ventral apophyses on the third. Teeth few; the outer firm, with incisiform or conical crowns, projecting forwards; the inner tricuspid. Lower pharyngeal bone with blade and dentigerous area subequal; pharyngeal teeth slender, firm.

Type and only known species *B. maclareni* nov.

Barombia maclareni **n. sp.**

Figs. 14 and 15

Description of the type and only known specimen, a male of 75+17 mm. collected in 1948 by the late Mr. P. I. R. Maclaren in Lake

Fig. 14. *Barombia maclareni*, holotype. Scale 1 cm.

Barombi-ba-Kotto [BM (N.H.) 1959. 8. 18. 177]. Dimensions are given in mm. and (in brackets) in hundredths of the standard length or length of head.

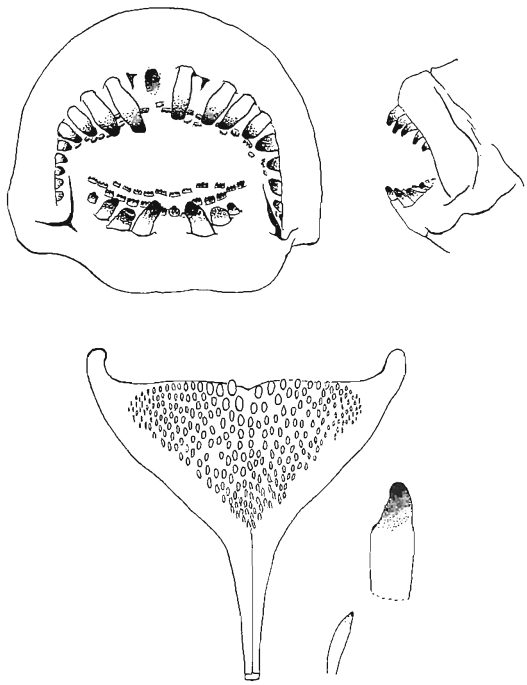


Fig. 15. *Barombia maclareni*, lips and teeth in anterior (x 5) and lateral (x 2.5) views; the teeth are shown partly embedded in the swollen mucous membrane as preserved Below, lower pharyngeal bone, x 5, with, separately, posterior and anterior teeth much enlarged.

Depth of body 28 (37.3 % of S. L.), equal to length of head. Length of pectoral fin 29 (38.6 %), of caudal peduncle 10 (13 %), a little less than its depth.

Length of snout 9 (32 % head), diameter of eye 8 (28.5), depth of preorbital 5.5 (19.6), interorbital width 7 (25), length of lower jaw 8.5 (30.3), width of pharyngeal bone 8.3 (29.6), a little more than its median length.

The mouth is small, with a short, broad lower jaw, and upper and lower teeth project and meet like the limbs of a pair of forceps. There are 18 broad simple outer teeth in the upper jaw, 7 in the lower (a cavity laterally to each medial tooth of the upper jaw may mark the position of two shed teeth); the inner teeth, arranged in two short series, are tricuspid. Two series of scales on the cheek.

Short, conical gill-rakers number 3+15 on the first arch.

Pharyngeal teeth somewhat compressed, unicuspid, the lower posterior and upper anterior with a shoulder, more marked in the upper.

Intestine with three or four coils.

There are 29 or 30 scales in the lateral line series, $3^1/_2$ between origin of dorsal and lateral line, 5 between bases of pectoral and pelvic fins.

D XVI 11, the last small and very close to the penultimate; last spine 12.5 mm. (16.6 % S.L.).

A III 9; third spine shorter than last dorsal.

First soft ray of pelvic fin the longest, the second not much shorter.

Caudal damaged, apparently truncate.

The colour-pattern is based on two longitudinal bands but in the somewhat battered specimen it is not clear how regular the markings are. Throat, chest and belly are black, the sides of the belly pale as preserved. An opercular spot; lower parts of head dark. No "Tilapia-mark". Outer pelvic rays dark.

Food. The stomach contains a pupal skin and other fragments of insects. My colleague Mr. D. E. Kimmins has kindly examined them and says that they might be trichopterous or dipterous. There are also sand-grains and vegetable debris such as might have composed the case of a trichopterous larva.

KEY TO THE CICHLID FISHES OF LAKES BAROMBI-BA-KOTTO AND BAROMBI-MA-MBU AND OF RIVERS MEME AND LOWER MUNGO.

KEY TO THE GENERA

1. Teeth all unicuspid ..... 2.
   Inner teeth of jaws tricuspid ..... 3.

2. Middle anterior pair of premaxillary teeth markedly longer than the others; upper pharyngeal apophysis of parasphenoid in middle and basioccipital at sides; no hanging pad on roof of pharynx ..... *Hemichromis fasciatus*
   Premaxillary teeth evenly graded; upper pharyngeal apophysis of parasphenoid alone; a hanging pad on roof of pharynx ..... *Pelmatochromis*

3. Outer teeth of jaws simple or with a vestigial minor cusp ..... 4.
   Outer teeth bicuspid ..... *Tilapia*

4. Outer teeth few (18 upper, 7 lower in the type), enlarged, prominent ..... *Barombia*
   Outer teeth numerous (42—120 in upper jaw), small ..... 5.

5. Interorbital width 18—23 % of length of head *Stomatepia*
   Interorbital width 33—38 % of length of head (adults only) ..... *Tilapia linnellii* (adult male).

KEY TO THE SPECIES OF *TILAPIA*

1. Gill-rakers 8—10 on lower part of anterior arch ..... 2.
   Gill-rakers 12—18 on lower part of anterior arch .... 3.
   Gill-rakers 19—24 on lower part of anterior arch .... 6.

2. Depth of body 37—42.5 % of S.L.; length of lower jaw 35—39.6 % of head; D 26—28 ..... *T. kottae*
   Depth of body 43—50 % of S.L.; length of lower jaw 30.5—34 % of length of head; D 28—30 ..... *T. lata*

3. Gill-rakers 12—15; depth of body 42 (young) —55 % of S.L.; interorbital width 34—45 % of length of head *T. mariae*

Gill-rakers 14—18; depth of body 34—45 % of S.L. .. 4.

4. Interorbital width 24—28.6 % of length of head ..... *T. eisentrauti*

Interorbital width 29—38 % of length of head ..... 5.

5. A black band along middle of side; length of head 35—38.5 % of S.L. ..... *T. lohbergeri*

No black band along the side; length of head 37.5—45 % of S.L. ..... *T. linnellii*

6. Teeth of jaws in 3 or 4 series; median length of dentigerous area of lower pharyngeal bone about half of its width ..... *T. galilaea*

Teeth of jaws in 2 or 3 series; median length of dentigerous area of lower pharyngeal bone three-quarters of its width ..... *T. steinbachi*

T. heudeloti may be expected to occur in the lower reaches of the rivers. It may be distinguished from the species in the key from division 4 onwards by the lower number of scales in the lateral line series (27—30, usually 28 or 29) and by the absence of regular markings on the body in the adult, as well as by the deep preorbital bone of the adult. *T. schwebischi* resembles *T. heudeloti* in the number of scales, but has simple teeth in the adult (male?) and 20 or more gill-rakers on the lower part of the anterior arch.

T. haugi (Ogowe), if it should, as suggested, be synonymous with *T. mariae dubia*, would confound contrast no. 3, being deep-bodied like *T. mariae* but with 12—17 gill-rakers. It retains a barred pattern throughout life, however, whereas in mature *T. m. mariae* this is replaced by a series of blotches along the side. *T. m. dubia* in L. Barombi-ba-Kotto is so far only known from small specimens.

Summary and Discussion

New collections have been described from the crater-lakes of the north-western Cameroons and from the rivers that receive their overflows; and the earlier collections have been re-examined.

The Rivers Meme and lower Mungo contain species common to them and the other West Coast rivers.

From Lake Barombi-ba-Kotto only *Epiplatys sexfasciatus* and six cichlid species have been collected. The *Epiplatys* and three of the Cichlidae, *Hemichromis fasciatus, Tilapia mariae* and *T. galilaea* occur also in the rivers, but the *T. mariae* of the lake is subspecifically destinct and is related to *T. haugi* of the Gaboon. *Tilapia kottae* may also occur in the Southern Cameroons; it represents *T. zillii* in this region and is related to *T. tholloni* of the Ogowe and Congo. *Pelmatochromis loennbergi* n. sp. is known only from this lake, and is related to *P. kingsleyae* of the Cameroons and Gaboon. The sixth species, *Barombia maclareni,* is peculiar to the lake and is generically distinct, showing convergence in its specialised dentition with genera of the Great Lakes, but related to some of the more generalized species of *Tilapia,* perhaps particularly to *Tilapia mariae.*

The known fish-fauna of Lake Barombi-ma-Mbu consists of five endemic species of Cichlidae (including one endemic genus), one species of *Clarias* which is either endemic or shared with Lake Soden, an *Epiplatys,* near *E. sexfasciatus,* and *Barbus batesii,* which also inhabits the rivers southward to Stanley Pool.

The Cichlid endemics do not form a species-flock in the sense that they all seem to be derived from a single ancestor. *Tilapia eisentrauti* and *Stomatepia mariae* seem to be related to each other, but their external relationship is obscure. If a dubious adult is correctly included in *T. eisentrauti* it points to a relationship with *T. heudeloti,* but not a very close one. *T. linnellii* is probably closer to *T. heudeloti* and also to *T. schwebischi* of the Ogowe. *T. lohbergeri* may be connected with *T. bilineata,* but it also may belong to the same group as *T. heudeloti. T. steinbachi* belongs to the *T. galilaea-* group, and is near *T. lepidura* of the Congo and Gaboon.

The only fish known from the Lake Soden basin is a juvenile *Clarias,* and we have no information as to whether this was collected in the lake or a neighbouring stream.

Gèze considers (p. 177) that the freshness of their slopes indicates a late Quaternary date for the formation of the craters. It was at a later date ("sub-actuelle", Gèze, p. 177) that the volcanic central island of L. Kotto was formed, and the present fish-fauna may date from that event. Fishes could, and at some seasons probably still can, enter from the Meme system; but the presence of one subspecies of *T. mariae* in the Meme and another in the lake, and the resemblance of the latter to *T. haugi* suggest a different origin for the lake fauna.

The relatively recent basalt flow into Lake Barombi-ma-Mbu need not have extinguished all life, but it is interesting that Hassert in 1912 found no trace of the Crustacea reported from this lake in 1903 and repeated a suggestion that subaqueous volcanic activity might have accounted for their disappearance. They were said, however to have succumbed to a disease, and the fish-fauna was evidently not disturbed during these years.

Linnell thought that the Crustacea might have been introduced by man; if so their position in the lake community would have been less secure than that of the fishes, which are less likely to have come by this means. The accounts of the present outlet of the lake to the Mungo do not suggest easy fish-access by that route, either now or in the past. The alleged former connection with the Meme may have afforded better passage. Once in the lake, however, the Cichlidae seem to have made their usual evolutionary response.

The search for faunal relationships of these lakes exposes a total lack of knowledge of the fishes of the upper parts of the Mungo and Vuri basins. To the East of our area the eruptions which produced the Manengouba Mountains dammed beyond them a late Tertiary or Quaternary lake. The break-through of the dam drained the area into R. Nkam, tributary of R. Vuri (Gèze, pp. 45 & 109). Especial interest would attach to a faunal exploration of this region.

Further work on the lakes themselves should aim at:

(i) obtaining complete series of species such as *T. linnellii* and *T. eisentrauti*, where the present tentative grouping of early and late stages requires confirmation.

(ii) obtaining and comparing growth-series of *Tilapia mariae dubia* and *Tilapia haugi* (R. Ogowe).

(iii) studying breeding habits and life-history of all the species, as well as their trophic relationship.

(iv) collecting good samples of *Epiplatys* from both lakes for comparison, and more specimens of the genus *Barombia* in Barombi-ba-Kotto.

(v) making the pioneer collections in Lake Soden.

Species collected in the lakes by Mr. MacLaren

Barbus batesii Boulenger
Barbus c.f. *gruveli* Pellegrin
Clarias maclareni sp. nov.
Hemichromis fasciatus Peters
Pelmatochromis loennbergi sp. nov.
Tilapia kottae Lönnberg
Tilapia linnellii Lönnberg
Tilapia eisentrauti (?) sp. nov.
Tilapia galilaea (L.)
Stomatepia mariae (Holly)
Barombia maclareni gen. et sp. nov.

Species collected in the lakes by Professor Eisentraut's Expeditions

Barbus batesii Boulenger

Epiplatys sexfasciatus

Pelmatochromis loennbergi sp. nov.

Tilapia kottae Lönnberg

Tilapia linnellii Lönnberg

Tilapia mariae dubia Lönnberg

Tilapia eisentrauti sp. nov.

Tilapia lohbergeri Holly

Tilapia steinbachi sp. nov.

Stomatepia mariae (Holly)

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