18. The Fishes of Lake Nyasa (other than Cichlidæ).

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(Text-figures 1–10.)

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INTRODUCTION.

In 1925 the late Dr. Cuthbert Christy, who tragically met his death in March of this year as a result of an unfortunate encounter with an African buffalo, made a large collection of fishes from Lake Nyasa for the British Museum (Natural History). The Cichlid fishes in this collection are being studied by Dr. C. Tate Regan, F.R.S., but the rest of the collection, which comprises about 770 specimens, has been handed over to me for examination †.

The fishes of Lake Nyasa were known previously from several collections in which, though each had representatives of a number of species, there were seldom more than two or three specimens of each species. The first collection, made by Sir John Kirk, was described by Günther (1864). The list of Nyasa fishes was supplemented by Günther (1893) as a result of a collection sent to the British Museum (Nat. Hist.) by Sir Harry Johnston. Boulenger (1908) added several more species collected by Captain E. L. Rhoades, and a further

* Communicated by J. R. NORMAN, F.Z.S.

† I should like to record my thanks particularly to Mr. Norman for providing me with every facility while working in his department at the Museum, for certain advice in discriminating between the species, and for reading the MS.

collection made by Mr. R. C. Wood was presented to the Museum in 1920. In addition there is a collection of Nyasa fishes in the Berlin Museum, some of which were described by Keilhack (1908). The Cichlid fishes were revised by Regan (1921), but there is no recent publication embracing the other families except the list given by Cunnington (1920), to which a number of species are now added. Therefore I have attempted to make this paper exhaustive by including all the species which have been recorded to date.

31 species of non-Cichlid fishes had previously been recorded from the lake. This total has now been raised to 45, of which 7 are described in this paper as new to science. 12 families and 21 genera are represented. Dr. Christy's collection has proved to be of great interest, not so much in the number of new species, but in the long series of specimens (upwards of 100 in several cases) of nearly every species represented, and often a complete range from very young to very old individuals. This has enabled me to study the variation within each species in more detail than was possible hitherto. In some cases the new delineation and redescription of existing species has become necessary—as, for instance, in the large species of *Barbus*, in *Bagrus*, and in certain species of *Clarias*.

It may be claimed that the fish fauna of the shallow waters of the lake is now well known, but there may still be an unknown abyssal fauna in the deep areas. Soundings have been made down to 786 metres, but no expedition has yet been properly equipped for the detailed study of these very deep waters. The present essay in systematics has been undertaken with a view to a future expedition to Lakes Nyasa and Tanganyika, in order to investigate the fisheries and the bionomics of the deep waters.

Distribution.

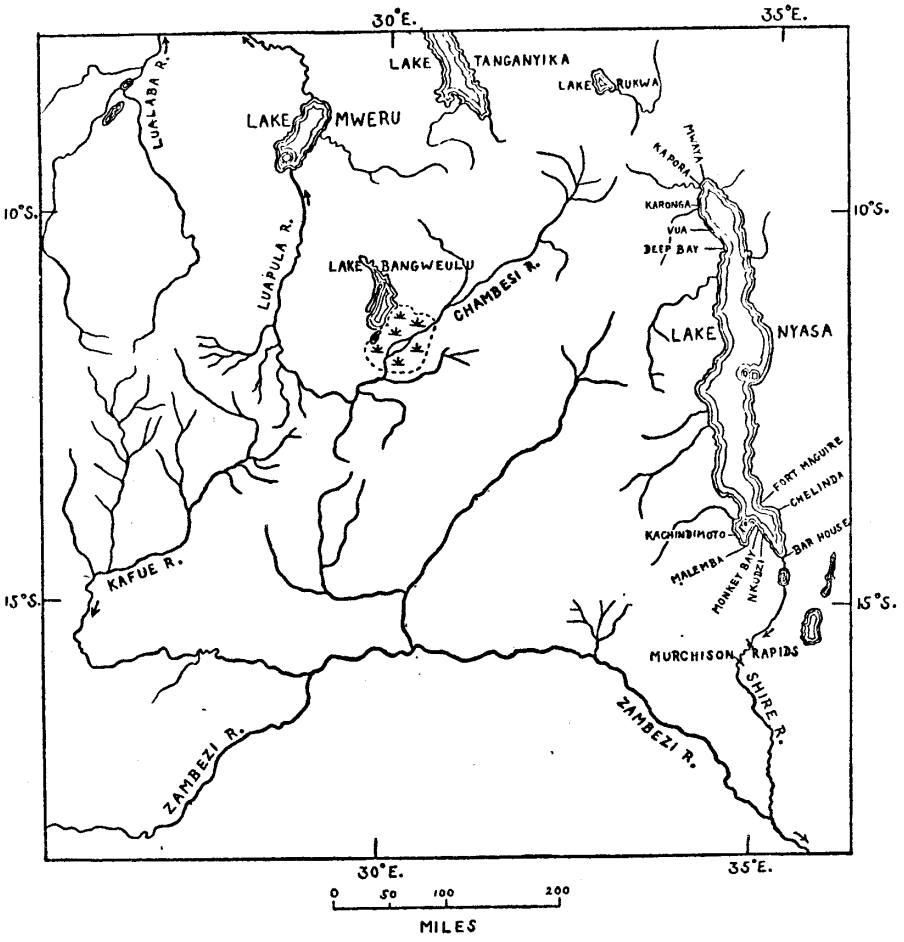
With regard to the affinities of the Nyasa fish fauna, the table of species shows that there is a fair quota of endemic forms, 20 out of a total of 45. This fact brings out the isolation of Lake Nyasa from the rest of the Zambezi system, due to the Murchison Rapids of the Shiré River. This was originally pointed out by Sir John Kirk, who, when making the first collection of fishes from this area on a journey with Livingstone up the river to Nyasa, noticed that several species common in the Lower Shiré and in the Zambezi are replaced by others in the Upper Shiré, above the Rapids, and in Lake Nyasa (Günther, 1864).

Nearly all the Nyasa endemics (apart from Cichlidæ) are either large species of *Barbus* or are members of the genera *Labeo*, *Barilius*, *Engraulicypris*, and *Bagrus*. It is significant that these are forms which require comparatively open and well oxygenated water, conditions which prevail in a large lake. Compared with these the forms which inhabit shallow swampy waters, such as some of the Mormyridæ, the Clariidæ, Anabantidæ, and the small species of *Barbus*, have a rather wide distribution in other waters. In particular Dr. Christy's Nyasa collection, together with a collection made in 1932 by Capt. C. R. S. Pitman from the rivers and swamps near Lake Bangweulu *, which drains *viâ* the Luapula River to the Congo, has brought out to a remarkable degree the close relationship between the Zambezi–Nyasa and the Bangweulu–Luapula fish faunas. The table of species shows that fifteen species are present also in the Bangweulu region.

* The non-Cichlid fishes in this collection have also been entrusted to me for examination by Mr. J. R. Norman. They will form the subject of another paper, but certain of the records have been incorporated in the table of Nyasa species herewith.

There appear to be two explanations for this unexpected similarity in the faunas of the two drainage systems. By reference to the map (text-fig. 1) it may be seen that certain small rivers entering the north-west shore of Lake Nyasa arise in close proximity to the upper tributaries of the Chambezi River, which drains into the Bangweulu swamp. It is conceivable that during periods of exceptional wet weather certain fishes have made the passage between

Text-figure 1.



Sketch-map to show the localities of Dr. Christy's Lake Nyasa collection and the drainage systems, in particular the Kafue–Luapula divide.

the Chambezi and Nyasa basins. This watershed, however, is comparatively high and steep, and therefore I think that the communication between the faunas is more likely to have taken place in quite another area, namely, across the comparatively level watershed between the Luapula tributaries to the south-west of Bangweulu and the Kafue River, which, after a tortuous course, enters the Zambezi some 300 miles below the Victoria Falls. This latter

explanation is supported by the fact that of the fifteen fishes common to Nyasa and the Bangweulu region all but four (*Barbus paludinosus*, *Barbus bangwelensis*, *Clarias mellandi*, and *Ctenopoma ctenotis*) have been recorded also from the Zambezi River.

The Luapula and Kafue tributaries arise in a tract of country in Northern Rhodesia, at an altitude of some 4000 feet. This region is intersected by a system of swamps, and during the wet seasons, when the swamps fill up and extend, it seems that there are actual water connections between the two systems. As a result I conclude that the swamp-dwelling fish can communicate from one system to the other, but at the same time the swamp acts as an absolute barrier to species which must have open and highly aerated water *.

This type of watershed, in which the headstreams of two great rivers are connected by swamps, is not confined to the Congo–Zambezi divide; it is found also in other parts of Africa. In Uganda, for instance, across the watershed which divides the basin of Lake Victoria from that of Lakes Edward and George, there is a series of rivers, the Mpanga–Katonga, Berarara–Ruizi, etc., which arise in swamps on the summit of the watershed and flow in two opposite directions, westward to Lakes Edward and George, and eastward to Lake Victoria. These rivers have been responsible for certain remarkable similarities in the faunas of Edward and Victoria.

The study of these swampy watersheds may be expected to elucidate the origin and evolution of the freshwater life of Africa as a whole, since the conditions approximate to the hypothetical condition of African drainage-systems originally advanced by Günther to account for the remarkable distribution of freshwater fishes. According to this hypothesis, which is still tenable with certain modifications in view of recent advances in geological knowledge, the main rivers of Africa at one time communicated at their headwaters in a huge swamp on the summit of the African geodome, which had become flattened by peneplanation. This swamp acted as a central breeding ground, and the main genera of African fishes evolved and filled the rivers. Subsequently a subsidence of the geodome caused the upper reaches of the rivers to be reversed and to flow into a central lake. The faunas of the different rivers, thus isolated, evolved each in its own way, with the result that to-day the different rivers have very similar faunas in so far as the genera are concerned, but, for the most part, each has its endemic species.

After the preliminary subsidence a whole series of rifting and tilting movements, with accompanying vulcanicity, caused many alterations in the earlier simple drainage systems. Lakes gathered in the rifts, and either remained in closed drainage basins or filled until they overflowed to one or other of the main rivers, thus putting their faunas in communication with different faunas (*e. g.*, Lake Tanganyika communicated with the Congo). The upper reaches of certain rivers were dammed by volcanoes and were ponded until they overflowed the previous watersheds (*e. g.*, Lake Kivu, once part of the Ruchuru River, a Nile tributary, was put into communication with Lake Tanganyika as a result of ponding by the Mufumbiro volcanoes). Again, waterfalls came into existence due to rivers bursting through new channels, with the result

* Since writing the above Capt. Pitman has informed me that he has observed a definite channel of communication between Congo and Zambesi in a different area. On the divide between the Loangwa basin (tributary of the Zambesi) and the Luapula there is a small lake which in dry weather drains only to the Loangwa, but from which another effluent runs in the opposite direction, through swamps to the Luapula, during the rainy season when the usual channel cannot take all the water.

that partial or complete isolation was effected between the faunas above and below the waterfalls (*e. g.*, the Murchison Falls on the Victoria Nile isolate Lakes Victoria and Kioga from Lake Albert and the Lower Nile). Meanwhile during the quaternary the pluvial periods filled up certain lakes and put them in communication with rivers (*e. g.*, Lake Rudolf overflowed to the Nile). Subsequently arid interpluvial periods dried up certain lakes until their old faunas were killed out. With the oncoming of other wet periods these same lakes obtained poor faunas from nearby waters which underwent rapid adaptive radiations to form endemic faunas of numerous closely related species (*e. g.*, Lake Edward and Lake Victoria). Other lakes, which have shrunk since the pluvial periods, have become so alkaline by the concentration of salts that their fauna have been affected (*e. g.*, Lake Rudolf) or nearly killed out (*e. g.*, Lakes Hannington, Nakuru, Elmenteita, and Magadi).

In fact the African freshwater fauna and flora have been influenced by a multitude of changes, and the interpretation of these changes involves a close co-operation between the sciences of systematic zoology, ecology, geography, geology, and chemistry.

In so far as the Nyasa fishes are concerned, it is impossible to say at present how far the rise and fall of lake-level during the pluvial and interpluvial periods have affected the fauna. Such changes are, however, unlikely to have influenced the very deep lakes, Nyasa and Tanganyika, nearly so much as the shallower lakes farther north, Edward, Victoria, Rudolf, etc., since the very deep lakes cannot have dried up completely, and a vast reduction in their volume would have been necessary before the dissolved salts became sufficiently concentrated to affect the aquatic organisms. It seems therefore that evolution, unaffected by changing environment, has continued longer in these deep lakes than in the shallower lakes, with the result that the faunas contain higher proportions of endemic forms, and these forms are more distinct, in the case of Lake Tanganyika so distinct that many have been given generic rather than specific rank.

Ecology.

Dr. Christy's collection of fishes contains so many well-preserved specimens that I have been able to examine stomach contents of many species, and therefore, in the light of recent field-work on the great lakes to the north, to interpret something of the ecology of Lake Nyasa. Results of these stomach examinations are given for each species separately, from which we learn that the chief predacious fishes (apart from Cichlidæ) are *Barilius microcephalus*, *Barilius microlepis*, and *Bagrus meridionalis*. Comparing these with the fishes of another lake, such as Lake Albert, the two species of *Barilius* in Lake Nyasa correspond in ecological position with the two species of *Hydrocyon* in Lake Albert. *B. microcephalus*, the smaller, is about the same size as *Hydrocyon forskalii*, whereas *B. microcephalus*, which attains a much larger size, is comparable to *Hydrocyon lineatus*, and we may assume that, like the latter, it frequents deeper water and preys on larger fishes. *Bagrus meridionalis* of Lake Nyasa corresponds ecologically with *Bagrus docmac* of Lake Albert.

Lake Nyasa contains no enormous predacious fish comparable to *Lates albertianus* of Lake Albert, and therefore we may count Nyasa as one of those great lakes which have a rather poor predacious fish fauna, and this ecological fact has undoubtedly reacted on the evolution of the smaller fishes, which have been able to multiply and evolve into numerous endemic species without being for ever harassed by large predacious forms. It is a significant fact that, on the whole, those lakes which have poor predacious fish fauna (*e. g.*, Victoria,

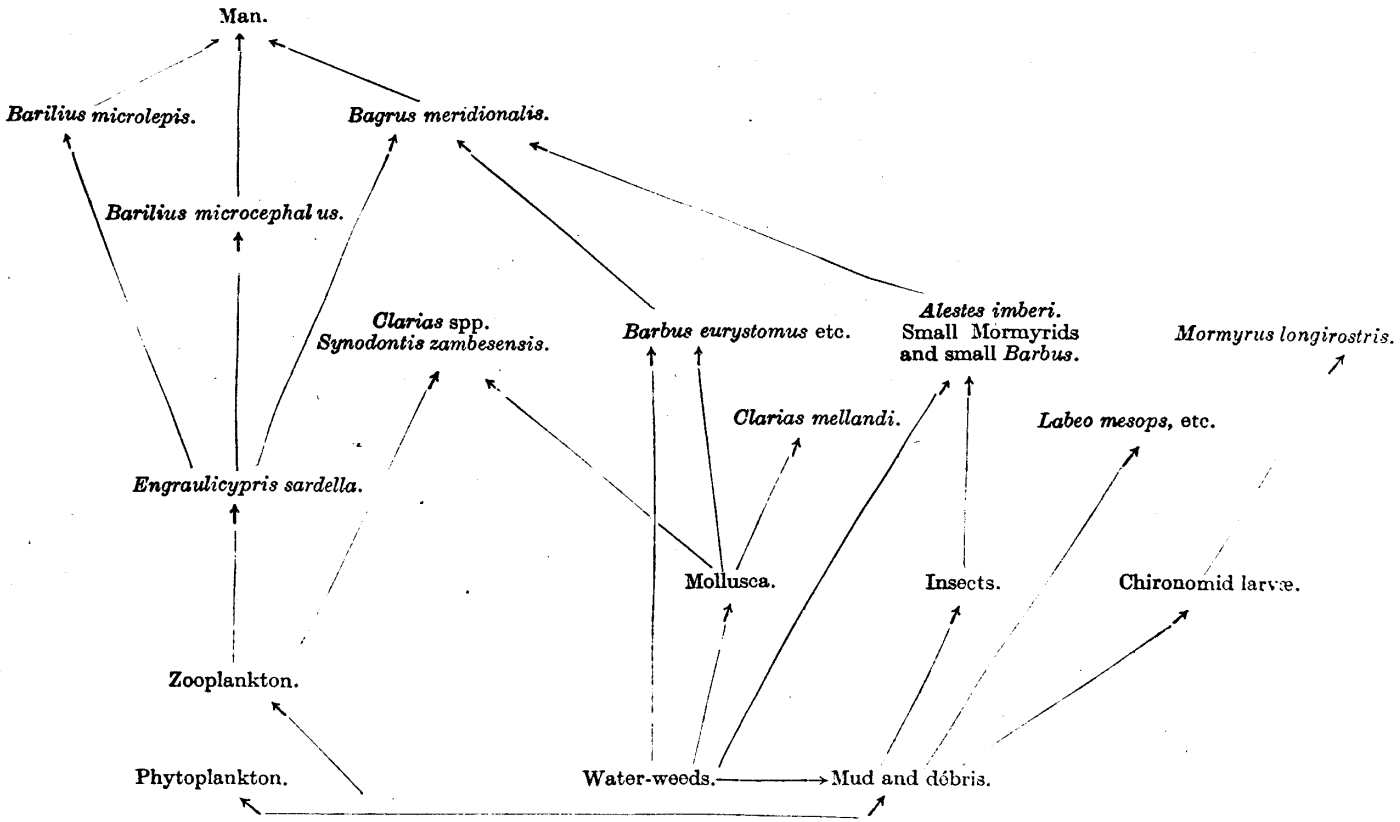


Diagram to illustrate the principal food-chains of Lake Nyasa.

Edward, Nyasa, etc.) contain multitudes of small endemic species, particularly those belonging to the family Cichlidæ, whereas those lakes with a full complement of large predacious species (Albert and Rudolf) have very few small endemic species.

In addition to the two species of *Barilius* and *Bagrus meridionalis* Lake Nyasa contains other less important predacious fishes :—*Mormyrops deliciosus* (collected by Dr. Christy from only two localities), *Clarias mossambicus*, *C. nyasensis*, *C. longibarbis* (all three partly piscivorous), and *Barbus rhoadesii*, which has a projecting lower jaw so characteristic of predacious forms. *Eutropius depressirostris*, of which only a single specimen has so far been recorded from the lake, also belongs to a typically predacious genus.

Insectivorous fishes are represented particularly by the small Mormyrids—*Petrocephalus catostoma*, *Marcusenius discorhynchus*, *Gnathonemus nyasensis*, and *G. macrolepidotus*—all of which frequent shallow muddy water. The small species of *Barbus*—*B. trimaculatus*, *B. paludinosus*, etc.—are also shallow-water, chiefly insectivorous fish, and insects form part of the diet of *Alestes imberi*, *Synodontis zambesensis*, *Varicorhinus nyasensis*, and the young of the truly predacious fishes. *Mormyrus longirostris* has a specialized diet of Chironomid larvæ which abound in the bottom ooze, and for the capture of which the long snout of *Mormyrus* is well adapted.

Mollusca form the chief food of *Barbus eurystomus* and of *Clarias mellandi*, which has particularly large flat-headed vomerine teeth well adapted for crushing shells.

Engraulicypris sardella, like the other members of the same genus in Lakes Tanganyika, Victoria, and Rudolf, is essentially a pelagic fish which feeds directly on the Crustacea of the plankton. According to several competent observers it is astonishingly abundant in the surface waters all over Lake Nyasa, and is caught by native fishermen in nets. Apart from this direct economic value *Engraulicypris* may be said to be the most important fish in the lake, since it puts the vast food-supply of the plankton into a form readily edible by the predacious fishes, particularly by the two species of *Barilius*.

On the opposite page is a scheme compiled with the object of showing the principal food-chains of Lake Nyasa. The numerous Cichlid fishes, which include phytophagous, insectivorous, molluscivorous, and piscivorous forms, are not included.

Localities of the Collection. (Text-fig. 1.)

Nearly every specimen in Dr. Christy's collection has a numbered label, so that the precise locality can be ascertained by reference to the notebook accompanying the collection. Most species of fish are represented by specimens from several or all of the collecting localities, so I have not enumerated these in most instances when considering the species individually. In order to give an idea of the types of environment from which the collection was made, however, the following has been taken, almost verbatim, from Dr. Christy's notes :—

South end of Lake Nyasa.

Bar House and surrounding region (near Fort Johnston).

All shallow water, with sandy bottom nearly everywhere. Shore consists of sandy bays bordered in most places by a fringe of tall matete reeds. Near the outlet of the Shiré River bullrushes and papyrus take the place of the reeds.

Nkudzi Bay.

Much the same as at Bar House, but bounded on the north by a rocky headland among the stones of which many small fish were collected.

Monkey Bay.

Bounded by steep rocks except at its head, where there is a sandy beach and some matete reeds. Deep water in the bay.

South-west arm of Lake.

Fairly deep water with a rocky shore from Monkey Bay to the point north of Maremba, round which the shore is sandy and a favourite fishing location.

Maremba to Kachindimoto (south-west arm).

Shallow water with muddy bottom and shore ; considerable areas of matete reeds, bullrushes, papyrus, and sudd.

Bar House to Chelinda (east shore of Lake).

Much the same as at Bar House, bays with sandy bottoms, matete reeds, and some rocks.

Chelinda to Fort Maguire.

Steeply shelving sandy beaches with no reeds or other shelter ; from Cape Ngombo northward all rocks.

North end of Lake Nyasa.

Deep Bay.

Sandy shore with some rocks, shelving steeply to deep water with rocky islets.

Vua wood-station.

Sandy shore with rocks here and there shelving to deep water. A drag-net was frequently used off a sandspit.

Karonga Camp.

Sandy shore and shallow water. A sandspit extends across the river-mouth, which becomes blocked at every storm.

Kapora Bay.

Sandy beaches and shallow water.

Mwaya.

Sandy beaches and shallow water at mouth of Mbasi River.

TABLE OF SPECIES.

Note.—P = present, but not endemic. E = endemic to Lake Nyasa and the Upper Shiré River. * = not previously recorded from Lake Nyasa. † = recorded from Lake Nyasa, but not represented in Dr. Christy's collection.

(Species recorded from the Nyasa drainage basin, but not from the lake itself, are included in the table.)

	Lake Nyasa.	Lake Bangweulu region.	Elsewhere.
MORMYRIDÆ.			
Mormyrops deliciosus	P	..	Senegal, Gambia, Niger, Chad, Congo, Zambezi, etc.
Petrocephalus catostoma	P	..	Rovuma.
Marcusenius discorhynchus .	P	P	Zambezi, Lake Tanganyika.
Gnathonemus nyasensis	E*		
Gnathonemus macrolepidotus.	P	P	Zambezi, Lake Ngami.
Mormyrus longirostris	P	P	Zambezi, Lake Mweru, Lake Tanganyika.
CHARACINIDÆ.			
Alestes imberi	P	P	Congo, Rovuma, Zambezi, Limpopo, etc.
CYPRINIDÆ.			
Labeo altilevis.....	P†	P	Zambezi.
Labeo mesops	E		
Labeo intermedius	E*		
Labeo cylindricus	P	..	E. Africa from Abyssinia to Zambezi, Lake Tanganyika.
Varicorhinus nyasensis	E*		
Barbus rhoadesii	E		
Barbus curystomus.....	E		
Barbus johnstonii.....	E		
Barbus globiceps	E*		
Barbus nyassæ	E† (?)		
Barbus trimaculatus	P	P	Zambezi, Transvaal, Zululand.
Barbus paludinosus	P*	P	E. and S. Africa from Abyssinia to Angola, Orange River, and Natal.
Barbus eutenia	P*	P	Zambezi, Angola, Transvaal.
Barbus choloensis	E†		
Barbus banguelensis	P*	P	Kafubo River (Congo).
Barbus innocens	P	..	Lake Rukwa, Wami and Mkata Rivers (Tanganyika territory).
Barbus arcislongæ	E†		
Barbus rogersi	P†	..	Upper Zambezi, Angola.
Barbus macrotænia	E*		
Barilius microcephalus	E		
Barilius microlepis	E		
Engraulicypris sardella	E		
CLARIIDÆ.			
Clarias mossambicus	P	P	East Africa from Abyssinia and Lake Victoria to Lake Tanganyika and Zambezi.
Clarias nyasensis	E*		
Clarias longibarbis	E*		
Clarias mellandi.....	P*	P	
Clarias carsonii	P†	..	Uganda.
Clarias theodoræ.....	P*	P	Zambezi, Lakes Mweru and Ngami, Natal, Zululand.

	Lake Nyasa	Lake Bangweulu region.	Elsewhere.
BAGRIDÆ.			
Bagrus meridionalis	E		
SCHILBEIDÆ.			
Eutropius depressirostris ...	P †	..	South-east Africa.
AMPHILIIDÆ.			
Amphilius platychir	P †	..	East Africa, Lake Tanganyika.
MOCHOCHIDÆ.			
Synodontis zambesensis	P	..	Zambesi and rivers of East Africa.
MALOPTERURIDÆ.			
Malopterurus electricus	P †·	P	Nile and nearly all tropical Africa.
CYPRINODONTIDÆ.			
Nothobranchius orthonotus ..	P *	..	Mozambique, Beira, Tanganyika Terr.
Haplochilichthys johnstonii..	E		
ANABANTIDÆ.			
Ctenopoma multispinis	P †	P	Zambezi, Lake Mweru, Bechuanaland.
Ctenopoma ctenotis.....	P *	P	River west of Lake Tanganyika.
MASTACEMBELIDÆ.			
Mastacembelus shiranus	E		

In the following pages each species is considered separately and the new forms are described and figured. In the case of species which have been recorded previously from the lake reference is made to specimens in the British Museum collection or to published records. This is followed by the enumeration of specimens in Dr. Christy's collection (the length of specimens in millimetres being given in brackets). The variation of the species is mentioned where it is significant, and in some cases the species are redescribed. Finally, the results of stomach examinations are recorded.

I have prepared the figures for this paper myself and can vouch that they represent the true proportions of the fishes, but not that they produce the artistic effect of professional drawings.

NOTE CONCERNING MEASUREMENTS.

" Length " is measured in all cases from the forward extremity of the upper lip to the root (not tip) of the caudal fin.

" Length of head " is measured from the forward extremity of the upper lip to the hind extremity of the opercular bones ; it does not include the flap of opercular skin which sometimes extends behind the bone. In *Clarias* length of head is measured to the hind extremity of the occipital process.

" Length of snout " is measured from the forward extremity to the anterior border of the eye.

"Length of caudal peduncle" is measured to the hind end of the fleshy part of the tail; it does not include the basal part of the caudal fin, which in some forms is clothed with scales.

"Dorsal spines" are measured from the basal articulations, not from the upper extremity of muscle or scales.

MORMYRIDÆ.

MORMYROPS DELICIOSUS (Leach).

Two specimens from Lake Nyasa in the B.M., collected by Capt. E. L. Rhoades and Mr. J. A. Williams.

Four specimens (500–610 mm. long) caught in a drag-net far out on the edge of deep water, Deep Bay and Monkey Bay.

The stomach of the largest specimen contained the bones, scales, and an eyeball of a small fish. The other specimens had been gutted.

PETROCEPHALUS CATOSTOMA (Günth.).

One young specimen from Lake Nyasa in the B.M., presented by Sir H. H. Johnston.

Fourteen specimens (55–103 mm. long) from Bar House, Monkey Bay, Deep Bay, and S.W. arm of lake show that the species grows to a much larger size than previously known. Such characters as the size of the eye in Boulenger's description (1909–16) only apply to young specimens.

Five stomachs examined were found to contain very numerous remains of dragon-fly nymphs, water-beetle larvæ, and other insects. One contained a few Hydracarina and another the scales of a very small fish.

MARCUSENIUS DISCORHYNCHUS (Peters).

Two specimens from Lake Nyasa in the B.M., collected by Mr. J. A. Williams and Mr. R. C. Wood.

Eighteen specimens (85–210 mm. long) from Bar House, Monkey Bay, Deep Bay, S.W. arm, Vua wood-station, and Karonga camp.

Five stomachs contained numerous remains of dragon-fly nymphs, small water-beetle larvæ, Caddis larvæ in sand-cases, and in one there were fragments of chewed weed.

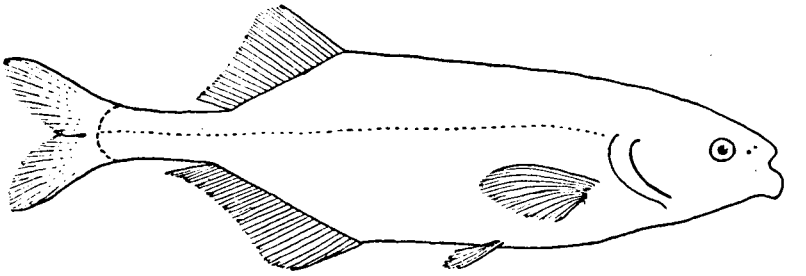
GNATHONEMUS NYASENSIS, sp. n. (Text-fig. 2.)

Depth of body $3\frac{1}{3}$ to $4\frac{1}{2}$ times in length, length of head $3\frac{1}{3}$ to $4\frac{1}{3}$ times. Head a little longer than deep, upper profile straight or feebly convex; snout $3\frac{1}{2}$ to $3\frac{2}{3}$ times in length of head, teeth notched, 2 to 6 in upper jaw, 4 to 6 in lower; chin with a globular dermal appendage; eye $1\frac{1}{3}$ (young) to $1\frac{3}{4}$ times in length of snout, about twice in interocular width. Dorsal 20 to 22, originating above 5th to 10th ray of anal, its length $2\frac{1}{3}$ to $2\frac{1}{2}$ times in its distance from head. Anal 29 to 31, nearer base of caudal than base of pelvic. Pectoral a little shorter than head, twice as long as pelvic, extending beyond base of latter. Caudal scaled in its basal half, with pointed lobes. Caudal peduncle 2 to $2\frac{1}{2}$ times as long as deep, $\frac{3}{4}$ to $\frac{7}{8}$ length of head. 58–62 scales in lateral line, $\frac{14—16}{18—20}$ in transverse series in front of pelvic, $\frac{14—16}{14—16}$ in transverse series between dorsal and anal, 12 round caudal peduncle. Uniform dark brown, paler beneath; small specimens more or less marbled with dull yellow.

Twenty-seven specimens (80–295 mm. long) from Bar House and S.W. arm of lake.

This species is nearly related to *G. leopoldianus* Blgr. from the Congo,

Text-figure 2.



Gnathonemus nyasensis, sp. n. ×½.

but can be distinguished easily by the fewer teeth, fewer dorsal rays, and greater number of scales in transverse series.

Five stomachs contained numerous remains of dragon-fly and Ephemerid nymphs, water-beetle larvæ, other insects, and chewed weeds.

GNATHONEMUS MACROLEPIDOTUS (Peters).

One specimen from Lake Nyasa in the B.M., collected by Mr. R. C. Wood.

Twelve specimens (85–260 mm. long) from Karonga camp and Kapora.

In describing *G. victoriæ* Worthington (1929), a new species from Lakes Victoria and Kioga, I pointed out that among specimens then in the B.M. which had been identified as *G. macrolepidotus* were four examples from Lake Bangweulu which differed from typical *G. macrolepidotus* from other waters. Lake Bangweulu lies in the Congo (Luapula) watershed, whereas this species is typically a Zambezi fish with one specimen known from the Rovuma River. I suggested that the Lake Bangweulu form represented a different species, but postponed describing it as such until more material was available for study.

This conclusion was apparently confirmed by a collection made in 1932 by Capt. C. R. S. Pitman in Northern Rhodesia, which contained three adult specimens from the Kafue River (tributary of the Zambezi) and a long series of half-grown and young specimens from the rivers near Lake Bangweulu. The specimens from the Luapula system could be distinguished easily from those from the Zambezi by the more numerous scales and more slender caudal peduncle. The twelve specimens in Dr. Christy's collection from Lake Nyasa referred to above, however, form a uniform series which more or less overlaps the Bangweulu and Zambezi forms, so that the conclusion is reached that *G. macrolepidotus* must definitely continue to stand as a species which is common to the Zambezi, Rovuma, and Luapula drainage systems. Nevertheless the differences between the Upper Zambezi and Luapula specimens is interesting in that it shows evolution in the making under the influence of partial isolation.

Concerning the food of this species, the stomachs of three specimens from Lake Nyasa contained dragon-fly and Ephemerid nymphs, water-beetle larvæ, a few very small Gastropods, a few Ostracods, Cladocera, and plant seeds.

MORMYRUS LONGIROSTRIS Peters.

Three specimens from Lake Nyasa in the B.M., collected by Capt. E. L. Rhoades and Mr. R. C. Wood.

Five adult specimens (360–400 mm. long) from Bar House and Monkey Bay.

These differ from previously known specimens in that the dorsal fin has 63–64 rays instead of 65–75 and the anal fin has 20–21 rays instead of 17–19. All but one specimen have very pronounced black blotches, more or less confluent, on the head and anterior parts of the body.

The food of this species consists of Chironomid larvæ, which abound in the bottom deposits of the African lakes. All the long-snouted members of this genus are admirably adapted to obtain these larvæ by burrowing in the bottom ooze.

CHARACINIDÆ.

ALESTES IMBERI Peters.

Six specimens from Lake Nyasa in the B.M., collected by Sir H. H. Johnston and Mr. R. C. Wood.

Forty-one specimens (55–170 mm. long) from every locality round the lake.

Like most other members of the genus this is an omnivorous species, as shown by the following records of stomach examinations :—several adult water-beetles ; remains of a large terrestrial Hemipterous bug ; seeds of a leguminous plant ; chewed water-weeds, sand, and one or two small crushed molluscs ; chewed water-weeds and remains of a terrestrial beetle.

CYPRINIDÆ.

LABEO ALTILEVIS Peters.

There are specimens in the B.M. from the Shiré River, but not from the lake itself.

Not represented in Dr. Christy's collection.

LABEO MESOPS Günth.

A species endemic to Lake Nyasa and the Upper Shiré River, previously represented in the B.M. by eight specimens (four skins) collected by Sir J. Kirk, Dr. C. Livingstone, Mr. A. Whyte, Sir H. H. Johnston, Dr. P. Randall, and Capt. E. L. Rhoades. (Another specimen collected by Prof. J. E. S. Moore, identified as this species by Boulenger, is now associated with *Labeo intermedius*, sp. n.)

Dr. Christy's collection contains a very long series, about 105 specimens, ranging from very young fish of 50 mm. length to adults of 330 mm., taken from nearly every locality round the lake.

These specimens exhibit but little variation from Boulenger's description (1909–16). Typically the lips have several rows of distinct conical papillæ, not fused into transverse plicæ, but one or two specimens in the series show a tendency for the papillæ to become flattened and to fuse up.

All the larger specimens had been gutted in preservation, but the stomachs of three young specimens contained mud, among which the remains of algæ were recognizable.

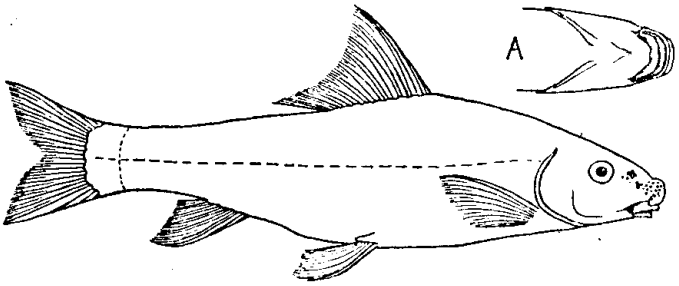
LABEO INTERMEDIUS, sp. n. (Text-fig. 3.)

Body strongly compressed, depth $3\frac{1}{2}$ to 4 times in length. Head $4\frac{1}{2}$ to $4\frac{3}{4}$ times in length, $1\frac{2}{5}$ and $1\frac{1}{2}$ times as long as broad, snout rounded, more or less covered with horny tubercles or their scars, its length $\frac{2}{5}$ to a little less than $\frac{1}{2}$ that of

head; eye perfectly lateral, $4\frac{3}{4}$—$5\frac{1}{2}$ times in length of head; interorbital width a little more than $\frac{1}{2}$ to $\frac{3}{5}$ length of head; width of mouth, with lips, $\frac{3}{5}$ to a little less than $\frac{1}{2}$ length of head; lips with small papillæ forming transverse plicæ, lower lip with a few conical papillæ behind the plicæ, rostral flap large, with a more or less denticulate edge; a minute barbel in the corner of the mouth, hidden under folds of skin. Dorsal II 10, equally distant from anterior border of eye or from nostril as from root of caudal, its upper edge concave, longest ray not quite once to $1\frac{1}{5}$ length of head. Anal III 5, not reaching root of caudal. Pectoral $\frac{4}{5}$ to a little more than once length of head, not nearly reaching pelvic, the first ray of which falls below 5th or 6th branched ray of dorsal. Caudal emarginate, crescentic. Caudal peduncle $1\frac{1}{5}$ to $1\frac{1}{3}$ times as long as deep. Scales 39–40 $\frac{6\frac{1}{2}—7\frac{1}{2}}{6\frac{1}{2}—7\frac{1}{2}}$, 4–$4\frac{1}{2}$ between lateral line and root of pelvic, 16–18 round caudal peduncle. Olive or deep grey above, pale beneath, fins greyish.

Three specimens (195 and 260 mm. long) from various localities round Lake Nyasa, collected by Dr. C. Christy (types).

Text-figure 3.



Labeo intermedius, sp. n. ×$\frac{1}{4}$.
A. Ventral view of head.

One specimen (210 mm.) collected from Lake Nyasa by Prof. J. E. S. Moore (and identified by Boulenger as *L. mesops*).

This new species is nearly related to *L. neumanni* Blgr. from S. Ethiopia, but differs in the more backward situation of the dorsal fin, smaller lips, etc. The same characters distinguish it from *L. percivali* Blgr., and it differs from *L. gregori* Günth. in having more numerous scales and smaller eyes.

In many characters this species falls midway between *L. mesops* and *L. cylindricus*, with the former of which the specimen collected by Moore was confused. The three type-specimens and the long series of both *L. mesops* and *L. cylindricus* in Dr. Christy's collection show clearly that this is a distinct species. It can be distinguished immediately from *L. mesops* by the lips, which have papillæ fused into many rows of small transverse plicæ, and by the smaller eye; and from *L. cylindricus* by the much deeper strongly compressed body and the much narrower under-lip.

The stomachs of all the specimens had been removed in preservation, but it may be presumed that the food is much the same as that of the other species of *Labeo*.

LABEO CYLINDRICUS Peters.

Three specimens from Lake Nyasa in the B.M., two adults collected by Capt. E. L. Rhoades, and a half-grown specimen collected by Mr. R. C. Wood.

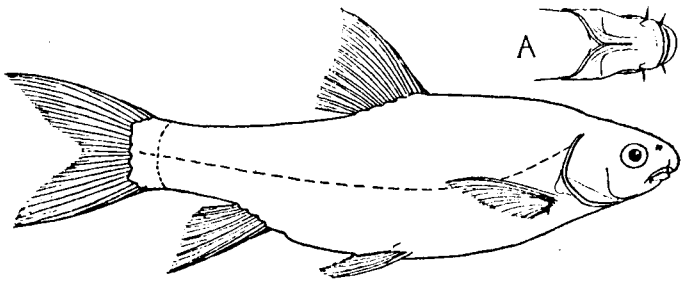
Fifty specimens (50–280 mm. long) from nearly every locality round the lake. These show very little variation from the type.

Stomachs contained mud and sand among which were the remains of Diatoms, Desmids, and other Algæ.

VARICORHINUS NYASENSIS, sp. n. (Text-fig. 4.)

Depth of body $3\frac{1}{5}$ to $3\frac{2}{3}$ times in length, length of head $4\frac{1}{5}$ to $4\frac{3}{4}$ times. Snout rounded, broader than long, not quite $\frac{1}{3}$ length of head; eye lateral, $3\frac{1}{3}$ (young) to $4\frac{1}{2}$ times in length of head, $1\frac{1}{2}$ (young) to $2\frac{1}{4}$ times in interorbital width, no tubercles on the head; mouth feebly curved, its width $2\frac{1}{3}$ to 3 times in length of head; two barbels on each side, anterior $\frac{1}{4}$ to $\frac{3}{5}$, posterior $\frac{1}{2}$ to $\frac{4}{5}$ length of eye. Dorsal IV 9, last simple ray not much enlarged, not serrated, flexible, segmented at least as far down as its basal third, $1\frac{1}{5}$ (young) to $\frac{3}{4}$ times length of head, border of fin concave. Anal III 5, not reaching root of caudal. Pectoral $\frac{3}{4}$ to once as long as head, not reaching pelvic, which is situated below

Text-figure 4.



Varicorhinus nyasensis, sp. n. ×$\frac{1}{3}$.
A. Ventral view of head.

middle of dorsal. Caudal deeply forked with pointed lobes. Caudal peduncle $1\frac{1}{3}$ to $1\frac{1}{2}$ times as long as deep. Scales 35–39 $\frac{5\frac{1}{2}-6\frac{1}{2}}{5\frac{1}{2}-6\frac{1}{2}}$, $2\frac{1}{2}$–3 between lateral line and ventral, 14 (16 in one specimen) round caudal peduncle. Back grey-brown, belly white, fins grey.

Three adults (200 to 210 mm. long) from Deep Bay, Monkey Bay, and Mwaya (types).

Four young and half-grown (97 to 140 mm. long) from Bar House, Deep Bay, S.W. arm, and Karonga (types).

Two old and very poorly conditioned fish from Deep Bay and Mwaya belong to the same species, but owing to their condition differ in the depth of the body, which measures $3\frac{3}{4}$ and $4\frac{1}{5}$ in the length, and in the caudal peduncle, which is $1\frac{3}{4}$ times as long as deep.

This new species is quite distinct from its relatives in having two pairs of barbels and the last simple ray of dorsal not enlarged and ossified (no other African species has both these characters). In general appearance it resembles *V. brucii* Blgr. from the Transvaal, but may be distinguished easily by the dorsal fin and the more numerous scales.

Concerning its food, all the specimens had been gutted in preservation except one half-grown specimen, of which the stomach contained sand and the remains of a water-beetle imago.

Barbus.

With reference to the group of species belonging to this genus, which are characterized by comparatively large size and parallel striations on the scales, several species have been described previously from Lake Nyasa. *Barbus rhoadesii* Blgr. is quite distinct in having a very large mouth, and of the small-mouthed species Boulenger (1907) described *B. johnstonii* and Keilhack (1908) is responsible for *B. nyassæ*, based on two specimens (80 and 180 mm. long), a species which was retained by Boulenger (1909–16). In addition, Keilhack allotted twenty-four others specimens from Lake Nyasa and affluent rivers to three proposed varieties of *B. intermedius* Rüpp., which he named var. *curystomus*, var. *latirostris*, and var. *brevicauda*. Boulenger, in compiling his catalogue of the African freshwater fishes, amalgamated these three varieties as *B. curystomus* Keilhack.

Dr. Christy's collection contains thirty-seven specimens of large *Barbus* with parallel scale striations (apart from *B. rhoadesii*, which is well represented). These clearly fall into three species, distinguished easily by the form and length of the barbels, the proportions of the body, and the number of rays in the dorsal fin. One of these species is *B. johnstonii* Blgr., but it has been a matter of difficulty to assign the other two to either of Keilhack's species, since *B. nyassæ* was evidently described from very young specimens and his three varieties of *B. intermedius* were incompletely described. I find the best procedure is to retain the old name of *B. curystomus*, but to redescribe the species completely in the light of Dr. Christy's large collection, and to erect a new species, which I name *B. globiceps*.

Barbus rhoadesii Boulenger (1908).

Barbus litamba Keilhack (1908).

Previously known from six specimens (types) in the B.M. from Lake Nyasa, collected by Capt. E. L. Rhoades.

Eight adult specimens (232–315 mm. long) and twenty-four young (62–165 mm. long) from various localities round Lake Nyasa. This series shows more variation within the species than was indicated by the types. In particular the length of head ranges from $3\frac{1}{2}$ to 4 times in length of body ($3\frac{2}{3}$–4 in types), the length of dorsal spine ranges from $\frac{2}{3}$ (young) to $\frac{2}{5}$ (adults) in length of head ($\frac{1}{2}$ in types); in the young the spine is serrated behind, the serrations persisting, though less obvious, in the adult. Eye from 4 (young) to $5\frac{1}{2}$ times in length of head. In some large specimens the lower jaw projects much more than in the types.

There is little doubt that the adults are truly predacious and have a fish diet, but unfortunately all the specimens had been gutted. The stomachs of five young specimens contained scales and bones of very small fish, remains of insect larvæ and imagines, and portions of chewed weed.

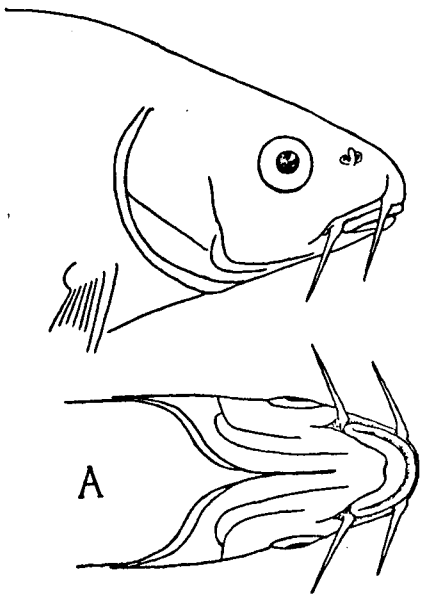
[*Barbus litamba* Keilhack (1908) and Boulenger (1909–16) was described from a single specimen (285 mm. long) in the Berlin Museum, collected from the Kiwira River by Dr. Fülleborn in 1899. In the original description the only differences from *B. rhoadesii* are the radiately striate scales, absence of anterior barbels, and rather wider interorbital width. Subsequently a specimen from Lake Nyasa in the B.M., collected by Mr. R. C. Wood, was identified as the same species by Regan, and was referred to by Norman (1925). This latter specimen proves, on re-examination in the light of Dr. Christy's collection, to be identical with B. *rhoadesii*: it has a minute anterior barbel on one side, and its scale striations are parallel on the posterior part of the body but have a tendency

to radiate arrangement on the anterior part, exactly as in the types of *B. rhoadesii*. In view of this there is very little doubt that Keilhack's type of *B. litamba* should also be referred to *B. rhoadesii*, and therefore I have omitted the former from the list of Nyasa species.]

BARBUS EURYSTOMUS (Keilhack 1908) Blgr. (1909–16). (Text-fig. 5.)

Depth of body 3 to $3\frac{3}{4}$ times in length, length of head $3\frac{3}{5}$ to $4\frac{1}{3}$ times. Snout rounded, $2\frac{2}{3}$–$3\frac{1}{3}$ times in length of head, eye 3 (young) to 7 (very old) times in length of head, interorbital width 2 to $2\frac{1}{2}$ times (slightly more in very young); mouth inferior, its width 3 to 4 times in length of head; lower jaw rather narrow in front, with a sharp edge, covered by a thin horny sheath, lips moderately developed, lower more or less continuous across the chin, barbels usually equal in length, once to $1\frac{3}{5}$ times diameter of eye (slightly less in very young).

Text-figure 5.



Head of *Barbus eurystomus* Keilhack. × ½.
A. Ventral view.

Dorsal IV 8, equally distant from root of caudal and middle or posterior border of eye (or occiput in very large specimens), last simple ray more or less enlarged and bony, its basal half not flexible, $\frac{3}{5}$ to once length of head, the bony part nearly as long as head (very young) to $\frac{1}{3}$ length of head (very old), border of fin concave. Anal III 5, not quite reaching caudal. Pectoral slightly shorter than head, not reaching pelvic, which is under middle or anterior rays of dorsal. Caudal peduncle $1\frac{1}{3}$ to $1\frac{3}{5}$ times as long as deep. Scales longitudinally striated, 36–40 $\frac{4\frac{1}{2}—6\frac{1}{2}}{4\frac{1}{2}—6\frac{1}{2}}$, $2\frac{1}{2}$–3 between lateral line and ventral, 12–16 round caudal peduncle. White beneath, olive or grey above.

Twelve young (60–190 mm. long), three adults (250–320 mm. long), and six

very large specimens (400–465 mm. long) from several localities round Lake Nyasa.

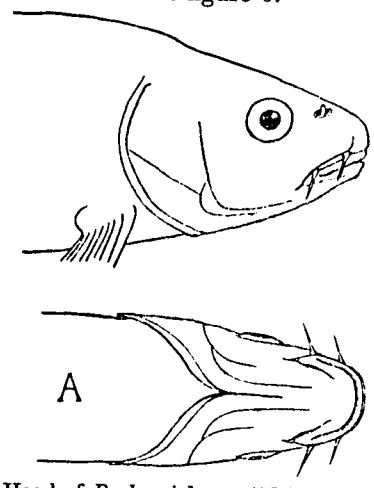
This species may be distinguished from *B. johnstonii* by the differently shaped mouth, longer barbels, larger eye (in specimens of the same size), and the dorsal fin, which has a stronger spine and eight branched rays.

The adults had been gutted, but the stomachs of four young specimens contained quantities of broken Gastropod and Lamellibranch shells and a few large Ostracods.

BARBUS JOHNSTONII Boulenger (1907)*. (Text-fig. 6.)

Depth of body $3\frac{3}{4}$ to 4 times in length, length of head 4 to $4\frac{2}{3}$ times. Snout rounded, 3 to $3\frac{1}{2}$ times in length of head, eye $3\frac{1}{2}$ (young) to 6 times in length of head, interorbital width $2\frac{1}{4}$ to $2\frac{2}{3}$ times; mouth inferior, its width $2\frac{1}{5}$ to $3\frac{1}{2}$ times in length of head; lower jaw rather wide in front, with a blunt edge, covered by a thin horny sheath, lips feebly developed, lower usually confined to the sides (rarely continuous across the chin); anterior barbel $\frac{1}{2}$ to once diameter of eye, posterior $\frac{3}{5}$ to $1\frac{1}{4}$. Dorsal IV 9 (8 in one specimen), equally distant from centre or anterior border of eye and from caudal, last simple ray flexible, not or but feebly enlarged, segmented down to the basal third,

Text-figure 6.



Head of *Barbus johnstonii* Blgr. × $\frac{1}{2}$.
A. Ventral view.

$\frac{3}{5}$ to once length of head, border of fin concave. Anal III 5, not reaching caudal. Pectoral slightly shorter than head, not reaching pelvic, which is below middle of dorsal. Caudal peduncle $1\frac{2}{3}$ to $1\frac{3}{4}$ times as long as deep. Scales longitudinally striated, 34–39 $\frac{5\frac{1}{2}-6\frac{1}{2}}{5\frac{1}{2}-6\frac{1}{2}}$, $2\frac{1}{2}$–3 between lateral line and ventral, 12–14 round caudal peduncle. Silvery white, dark grey on the back.

Previously known from three specimens in the B.M. from Lake Nyasa—Boulenger's type (160 mm. long), presented by Sir H. H. Johnston, and two specimens (170 mm. and 210 mm.), presented by Capt. E. L. Rhoades and Mr. R. C. Wood.

* Figured by Boulenger (1909–16), vol. ii. p. 91.

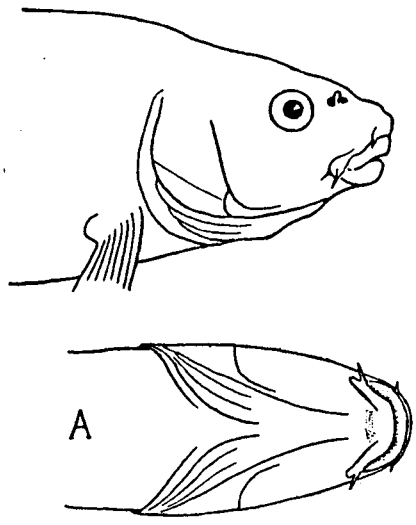
Dr. Christy's collection contains one young specimen (110 mm. long) and eight half-grown and adults measuring up to 320 mm. The above description embraces all these specimens, which exhibit but little variation from the type.

All the specimens had been gutted in preservation.

BARBUS GLOBICEPS, sp. n. (Text-fig. 7.)

Depth of body $3\frac{1}{2}$–$3\frac{2}{3}$ times in length, length of head 4 to $4\frac{1}{4}$ times. Snout rounded, swollen, 3 times in length of head; interorbital width 2 to $2\frac{1}{4}$ times; mouth inferior, its width $2\frac{3}{4}$ to $3\frac{1}{2}$ times in length of head; lower jaw rather short, transverse, with a blunt edge, covered by a thin horny sheath; lips rather large, lower discontinuous across the chin, simply continuous or enlarged into a median lobe, barbels two on each side, but usually very small and sometimes scarcely distinguishable, anterior not more than $\frac{1}{3}$ diameter of eye, posterior not more than $\frac{2}{3}$. Dorsal IV 8–9, equally distant from root of caudal and anterior border of eye, last simple ray flexible, not or but feebly enlarged,

Text-figure 7.



Head of *Barbus globiceps*, sp. n. × $\frac{1}{2}$.
A. Ventral view.

segmented down to its basal third, border concave. Anal III 5, not reaching caudal. Pectoral shorter than head, not reaching pelvic, which is below middle of dorsal. Caudal peduncle $1\frac{1}{2}$ to $1\frac{3}{4}$ times as long as deep. Scales longitudinally striated, 36–41 $\frac{5\frac{1}{2}-6\frac{1}{2}}{5\frac{1}{2}-6\frac{1}{2}}$, 3–$3\frac{1}{2}$ between lateral line and origin of pelvic, 12–16 round caudal peduncle. Silvery white, dark grey on the back.

Eight specimens (190–270 mm. long) from various localities round Lake Nyasa (types).

This species is quite distinct from the two preceding in the very short barbels and the shape of the mouth and head. The latter has a swollen appearance, a character which I have used for the specific name.

All the specimens had been gutted in preservation.

BARBUS NYASSÆ Keilhack (1908).

This species was described from two very small specimens (80 and 118 mm. long) collected from the north end of Lake Nyasa by Dr. Fülleborn. Its characters, as given by Keilhack, lead me to believe that it may represent the young of one of the three preceding species, but it has not yet been possible to examine the type. For this reason I have queried the record in the table of species.

Not represented in the B.M. or in Dr. Christy's collection.

BARBUS TRIMACULATUS Peters.

One specimen from Lake Nyasa in the B.M., presented by Sir H. H. Johnston.

Twenty-one specimens (48–80 mm. long) from Bar House, S.W. arm, and Vua wood-station. These are typical, except that the majority of them have rather long posterior barbels, up to nearly twice diameter of eye, compared with once to $1\frac{1}{2}$ times in Boulenger's description (1909–16).

This species is distributed over the Zambezi–Luapula watershed, but specimens from the Lake Bangweulu region differ from Nyasa specimens in having longer dorsal spines, just more than once length of head compared with $\frac{2}{3}$ to $\frac{3}{4}$.

Four stomachs of Nyasa specimens contained small dragon-fly nymphs, adult water-beetles, and plant-seeds.

BARBUS PALUDINOSUS Peters.

A widely distributed species, previously known from the Zambezi system but not from Lake Nyasa.

Forty-two specimens (38–100 mm. long) from Bar House. All of these differ from the species as found in other waters in having rather smaller heads, $4–4\frac{1}{2}$ instead of $3\frac{2}{3}–4$ times in length of body. This, however, is the only character in which they differ from typical examples.

Stomachs contained quantities of mud, with a few Ostracods. Several specimens had very large tape-worms in their guts.

BARBUS EUTÆNIA Blgr.

Previously known from the Zambezi system but not from Lake Nyasa.

Two specimens (44 and 55 mm. long) from Deep Bay.

A single specimen (41 mm. long) collected from the Bangweulu region by Capt. Pitman in 1932, shows that this species also is distributed over the Zambezi–Luapula watershed, but the Bangweulu specimen has seven instead of eight branched rays to the dorsal fin.

Stomachs not examined.

BARBUS CHOLOENSIS Norman (1925).

Described from twelve specimens (55–130 mm. long) from the Nswadzi River, Cholo, 2700 feet (Nyasa drainage basin), in the B.M., collected by Mr. R. C. Wood.

Not represented in Dr. Christy's collection.

BARBUS BANGUELENSIS Blgr.

Previously represented in the B.M. by only two specimens, the type (79 mm. long) from Lake Bangweulu, collected by Mr. F. H. Melland, and an adult from the Kafubo River, Katanga, collected by Dr. Stappers. In addition

a young and a half-grown specimen, collected from the Bangweulu region by Capt. Pitman in 1932, are typical, except that the scales in lateral line range from 26–28 (28 in type) and there are 7–8 branched rays in the dorsal (7 in type).

Dr. Christy's Nyasa collection contains eighteen examples (40–80 mm. long) from Bar House and Deep Bay. These all undoubtedly belong to this species, but differ from the Bangweulu specimens in having always 8 branched rays and a rather longer dorsal spine, a little longer instead of a little shorter than the head.

Two stomachs contained quantities of very large Ostracods and a Dipterous fly imago.

BARBUS INNOCENS Pfeff.

Five specimens from Lake Nyasa in the B.M., collected by Sir H. H. Johnston and Mr. R. C. Wood.

Twenty-six specimens (33–72 mm. long) from Bar House, Deep Bay, S.W. arm, Vua wood-station, and Karonga.

Four stomachs contained insect-remains, chewed weed, and vegetable débris.

[*Note.*—Two other specimens (33 and 40 mm. long) resemble *B. innocens*, but have barbels shorter than the eye and fewer scales, 25–28 instead of 29–33, in lateral line. These may represent a distinct species, but their state of preservation is not sufficiently good for description as types.]

BARBUS ARCISLONGÆ Keilhack (1908).

Originally described from three specimens from Lake Nyasa, collected by Dr. Fülleborn, as a variety of *Barbus trispilopleura* Blgr., but promoted to specific rank by Boulenger (1909–16).

Not represented in Dr. Christy's collection.

BARBUS ROGERSI Blgr.

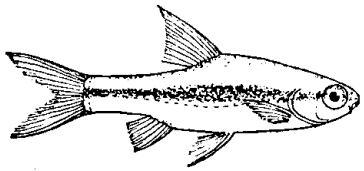
Two specimens (40 and 42 mm. long) from Lake Nyasa in the B.M., collected by Mr. R. C. Wood.

Not represented in Dr. Christy's collection.

BARBUS MACROTÆNIA, sp. n. (Text-fig 8.)

Depth of body $3\frac{1}{2}$ times in length, length of head $3\frac{3}{4}$ times. Snout shorter than eye, which is $2\frac{2}{3}$ times in length of head and equals interorbital width;

Text-figure 8.



Barbus macrotænia, sp. n. Nat. size.

mouth very small, terminal; lips feebly developed; two barbels on each side, posterior the longer, about $\frac{1}{3}$ diameter of eye. Dorsal III 8, equally distant from eye and from caudal, border concave; last simple ray not enlarged,

not serrated, as long as head. Anal III 5, not reaching caudal. Pectoral $\frac{3}{4}$ length of head, not reaching pelvic; base of latter under anterior rays of dorsal. Caudal peduncle $1\frac{2}{3}$ times as long as deep. Scales radiately (but indistinctly) striate, $28\frac{4\frac{1}{2}}{4\frac{1}{2}}$, $1\frac{1}{2}$ between lateral line and pelvic, 12 round caudal peduncle. Brown above, yellow beneath, a very prominent broad black band extending from tip of snout through the eye to the caudal, but not prolonged on to the caudal fin, fins pale.

A single specimen (36 mm. long) from Bar House (type).

This species falls into Boulenger's group, which is characterized by the base of pelvic being below anterior rays of dorsal and posterior barbel not more than $\frac{3}{5}$ diameter of eye. Apart from the obvious colouring, it can be recognized by the very short barbels and the scaling. In some respects this species resembles *B. rogersi* Blgr., a species with only one minute barbel, which has been recorded from Lake Nyasa.

BARILIUS MICROCEPHALUS (Günth.).

A species endemic to Lake Nyasa and the Upper Shiré River, previously represented in the B.M. by fourteen specimens (three of them skins).

Dr. Christy's collection contains seventy-six specimens, including very young specimens (20 mm. long) and adults up to 280 mm. Sixty-seven of these agree almost exactly with Boulenger's description, but, as might be expected in so large a series, a few specimens exhibit some degree of variation from the type. The varieties are not sufficiently marked, however, to warrant new names or full descriptions, but the variant characters are mentioned briefly below.

Of the nine specimens which exhibit variation three have rather large heads, $3\frac{3}{4}$ times in length compared with 4–$4\frac{1}{2}$ times in other specimens. In three specimens the branched rays of the dorsal number 8 instead of 9–10. In several specimens the scales in the lateral line number 43–45 instead of 47–52, and in one they number 57.

With regard to the food of this fish, which is evidently very abundant in Lake Nyasa, unfortunately all the adult specimens had been gutted at the time of preservation. In the mouth of one adult, however, was found the remains of a fully grown *Engraulicypris sardella*. A young *Barilius* (105 mm.) had eaten an *Engraulicypris* which must have measured fully half as long as the devourer, and in the stomachs of three still smaller *Barilius* were found pupæ and adults of Cironomid flies, some large Ostracods, and the remains of land-spiders and insects, including in one case a weevil, an ant, and a bee. We may conclude, therefore, that *Barilius microcephalus* is an actively predacious fish, and it seems probable that the pelagic *Engraulicypris sardella* affords a good proportion of the diet. As is the case with most predacious fishes, the young *Barilius* eat Crustacea and insects until they are large enough to pass on to a fish diet.

BARILIUS MICROLEPIS (Günth.).

This is another endemic species, very similar to the preceding, but recognizable at a glance by the much smaller scales and larger mouth. It grows, moreover, to a much larger size. It was previously represented in the B.M. by fourteen examples, which measured up to about 450 mm. in length.

The new collection contains twenty-one specimens, ranging from young (50 mm. long) to large adults which measure up to half a metre. This series exhibits very slight variation from the type.

All the adult and half-grown specimens had been gutted, but there can be no doubt that this is a predacious species like the last. Stomachs of small specimens (150 mm.) contained fish-scales, and four still smaller individuals had eaten pupæ and adults of Chironomidæ, very small fishes, Ostracods, water-beetles, and land-insects such as beetles and ants.

ENGRAULICYPRIS SARDELLA (Günth.).

A species endemic to Lake Nyasa and the Upper Shiré River, previously represented in the B.M. by thirteen specimens up to about 90 mm. in length. There are fifty-five specimens (35–95 mm. long) in Dr. Christy's collection, collected from several localities. A number of fish with fully developed gonads are included. In structure they are all quite typical. According to Captain E. L. Rhoades, who collected most of the previous specimens, this fish is "general all over the lake, caught in great quantities in nets, also used by natives as a bait for catching other fish."

Stomach examinations of Dr. Christy's specimens have shown that this is a plankton-eating fish; the stomachs contained quantities of small Crustacea, among which a species of *Cyclops* was greatly predominant; planktonic Diatoms and Blue-green Algæ were also recognized.

I conclude that this is probably the most abundant and, from the ecological point of view, the most important fish in Lake Nyasa. Like its relatives, *E. argenteus* in Lake Victoria, *E. stellæ* in Lake Rudolf, etc., it undoubtedly leads a pelagic existence, abounding all over the surface waters.

CLARIIDÆ.

CLARIAS MOSSAMBICUS Peters.

One specimen from Lake Nyasa in the B.M., collected by Mr. R. C. Wood. Several specimens from Lake Nyasa in the Berlin Museum.

In Dr. Christy's collection there is a series of twenty-seven specimens ranging from very young fish (51 mm. long) to adults of 540 mm. All of these undoubtedly form a natural species showing a certain amount of variation, but, according to the form of their vomerine teeth (one of the chief characters used by Boulenger in the distinction of the species), about half of them should be called *Clarias gariepinus* (Burchell). The gill-rakers on the anterior arch (which increase in number with the growth of the individual) range from 25 (specimens of 51 mm.) to 86 (specimens of 540 mm.); for *C. mossambicus* Boulenger gives 25 (young) to 110 (specimens over 600 mm.), and for *C. gariepinus* he gives 25 (young) to 80 (specimens of nearly 600 mm.).

In identifying these fish as *C. mossambicus* rather than *C. gariepinus* I follow Dr. Regan, who identified the previous specimen from Lake Nyasa collected by Wood.

The species *Clarias lazera* Cuv. & Val., *C. mossambicus*, *C. gariepinus*, and *C. capensis* Cuv. & Val. form a rather closely related series, separable chiefly on the width of the band of vomerine teeth, and their distribution in an interlocking series down East Africa from north to south is interesting. In Syria, the Lower Nile, Lakes Albert, Edward, and Rudolf, the predominant species is *C. lazera*, which has the vomerine band of teeth more than $1\frac{1}{2}$ times as wide as the premaxillary band. *C. mossambicus*, whose vomerine band is 1 to $1\frac{1}{2}$ as broad as the premaxillary band, extends from Abyssinia and Lake Victoria to Lake Tanganyika and the Zambezi. *C. gariepinus*, with a vomerine band narrower than the premaxillary band, comes next, and extends from Lake

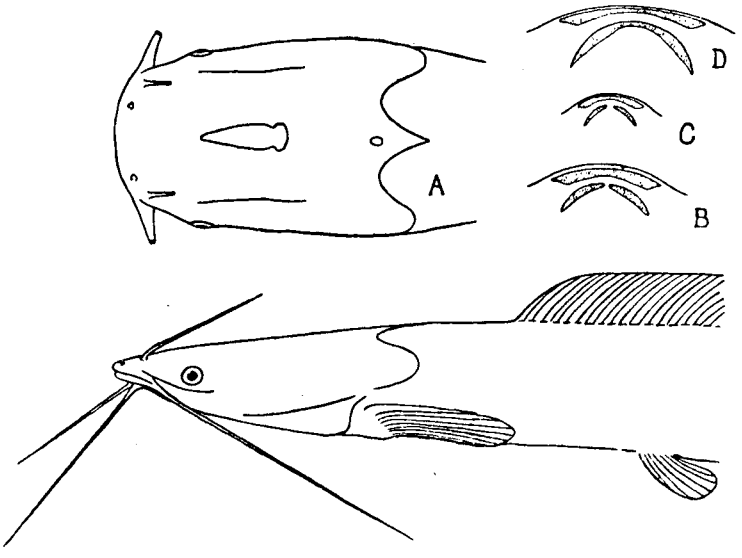
Bangweulu and the Upper Zambezi to the Orange River. Finally, *C. capensis*, with a narrow interrupted band of vomerine teeth, is known only from Natal.

In Lake Nyasa, which falls in the southern range of distribution of *C. mossambicus* and the northern range of *C. gariepinus*, the distinction between these two species does not exist, since the specimens combine the characters of both. I would not suggest that the two species be amalgamated, however, since the distinction holds fairly true in the case of other waters.

CLARIAS NYASENSIS, sp. n. (Text-fig. 9.)

Depth of body $6\frac{3}{4}$ to 8 times in length, length of head 3 to $3\frac{1}{2}$ times. Head $1\frac{3}{5}$ to $1\frac{4}{5}$ times as long as broad, its upper surface coarsely granulate; occipital process acutely angular; frontal fontanelle knife-shaped, $3\frac{1}{2}$ to 5 times as long as broad, $3\frac{1}{3}$ to 5 times in length of head; occipital fontanelle small, in advance of occipital process; eye $2\frac{1}{4}$ to 3 times in length of snout, 6 to 8 times in interorbital width; width of mouth equal to or a little less than interorbital width, which is $1\frac{4}{5}$ to 2 times in length of head; distance between origins of nasal

Text-figure 9.



Clarias nyasensis, sp. n. $\times\frac{1}{3}$.

A. Dorsal view of head. B. Ventral view of premaxillary and vomerine teeth. C & D. Premaxillary and vomerine teeth of two other specimens (also $\times\frac{1}{3}$).

barbels $2\frac{3}{4}$ to $3\frac{1}{4}$ times in length of head; band of premaxillary teeth 8 (young) to 15 times as long as broad; vomerine teeth mostly pointed (some granular), forming a crescentic band about as wide as premaxillary band, narrowly or widely interrupted in the middle (not interrupted in three specimens); nasal barbels $\frac{1}{3}$ to $\frac{3}{5}$ length of head; maxillary barbel $\frac{4}{5}$ to $1\frac{1}{3}$ length of head, extending to posterior extremity of pectoral fin in specimens 320 mm. long; outer mandibular barbel $1\frac{1}{2}$–$1\frac{3}{4}$ times as long as inner, which measures $\frac{1}{3}$ to $\frac{3}{5}$ length of head. Gill-rakers very long, 118 to 220 on anterior arch. Clavicles hidden under the skin. Dorsal 57–63, its distance from occipital process $3\frac{1}{2}$ to

6 times in length of head, its distance from caudal once to 3 times diameter of eye. Anal 43–54, separated from caudal by a distinct interspace. Pectoral $\frac{2}{5}$ to $\frac{3}{5}$ length of head, the spine serrated on the outer border and $\frac{2}{3}$ to $\frac{4}{5}$ length of fin. Pelvics equally distant from end of snout and root of caudal, or a little nearer the former. Caudal $\frac{2}{5}$ to $\frac{1}{2}$ length of head. Olive or blackish above, more or less pale beneath; hind part of body and dorsal, anal, and caudal fins sometimes spotted with black.

Eight specimens (275 to 630 mm.) from various localities round Lake Nyasa (types).

This species differs from all others in the particularly wide front part of the head, as shown by the interorbital width and the distance between the nasal barbels compared with the length of head. Other characters in which it differs from *C. mossambicus* and *C. gariepinus* are the longer barbels, the very narrow band of premaxillary teeth, the more numerous gill-rakers, and fewer dorsal and anal fin-rays. It differs from *C. capensis* in the head being longer and narrower as well as being much broader in front, in the teeth, gill-rakers, and fins.

Keilhack (1908) examined thirteen specimens of *Clarias* from Lake Nyasa, among which he found three specimens with interrupted bands of vomerine teeth, on account of which he named them *C. capensis* forma *mossambicus*. It seems probable that some at least of Keilhack's specimens are referable to this new species, but since he gives no description of them it is impossible to be certain until there is an opportunity for their re-examination.

All but two of the specimens had been gutted, but the stomach of a large specimen contained scales and bones of a fish and a dipterous fly, and a medium specimen had eaten two small Cichlid fishes, portions of weed, and many small Crustacea (chiefly *Cyclops* and *Diaptomus*). *Clarias mossambicus* in Lake Victoria and *Clarias lazera* in Lake Rudolf have been found to feed at times on planktonic Crustacea, by filtering them from the water with their gill-rakers. There can be little doubt that this method of feeding is adopted also from time to time by *Clarias nyasensis*, whose particularly long and closely set gill-rakers are admirably adapted to it.

CLARIAS LONGIBARBIS, sp. n. (Text-fig. 10.)

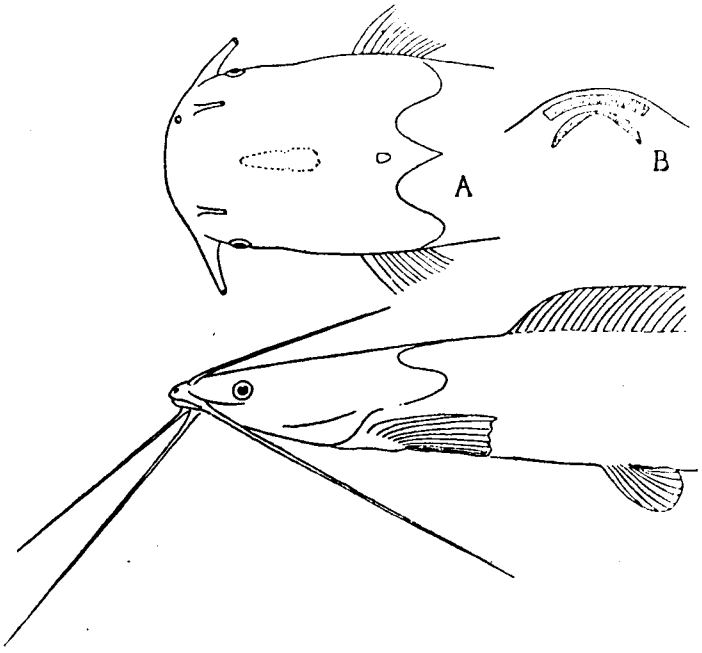
Depth of body $7\frac{1}{2}$ times in length, length of head $3\frac{1}{2}$ times. Head $1\frac{2}{5}$ times as long as broad, its upper surface coarsely granulate; occipital process acutely angular; frontal fontanelle knife-shaped, its length $3\frac{1}{2}$ (?) times in length of head; eye 3 times in length of snout, $8\frac{1}{2}$ times in interorbital width; width of mouth considerably less than interorbital width, which is $1\frac{2}{3}$ times in length of head; distance between origins of nasal barbels $2\frac{2}{3}$ times in length of head; band of premaxillary teeth 9 times as long as broad; vomerine teeth mostly pointed, forming a band which is $\frac{4}{5}$ as wide as premaxillary band and is not interrupted in the middle; barbels all extremely long, nasal $\frac{5}{6}$ length of head, maxillary $1\frac{1}{3}$ times length of head, reaching well beyond extremity of pectoral, outer madibular nearly $1\frac{1}{2}$ times as long as inner, which is about $\frac{4}{5}$ length of head. Gill-rakers closely set, not nearly so long as in *C. nyasensis*, about 145 on anterior arch. Clavicles hidden under the skin. Dorsal 65, its distance from occipital process $4\frac{1}{2}$ times in length of head, its distance from caudal 2 diameters of eye. Anal 56, separated from caudal by a distinct interspace. Pectoral not quite $\frac{1}{2}$ length of head, the spine feebly serrated on the outer border and $\frac{2}{3}$ to $\frac{3}{4}$ length of fin. Pelvics a little nearer end of snout than root of caudal. Caudal $\frac{2}{5}$ length of head. Black above, grey beneath, the

whole ventral surface and the fins mottled with very numerous small irregular black markings.

A single very large specimen (760 mm. long) from Lake Nyasa (type).

This is a very distinct new species. It resembles *C. nyasensis* in the wide front to the head, but differs in the broader hind part of the head, fewer and shorter gill-rakers, broader band of premaxillary teeth, more numerous fin-rays, and extremely long barbels. Since the barbels of *Clarias* grow in a disharmonic

Text-figure 10.



Clarias longibarbis, sp. n. × ⅛.
A. Dorsal view of head. B. Ventral view of premaxillary and vomerine teeth.

ratio to the body and head (becoming proportionately smaller as the individual grows up) it may be concluded that smaller specimens of *C. longibarbis* have barbels which are still larger compared with the length of the head. From *C. mossambicus* and *C. gariepinus* this species may be distinguished at a glance by the barbels and the shape of the head. For these reasons I have had no hesitation in describing a new species from a single specimen.

The stomach had been removed in preservation.

CLARIAS MELLANDI Blgr.

Not previously recorded from the Zambezi system.

Eight specimens (255–290 mm. long) from Bar House, Malembo, Bar to Fort Maguire, and Vua wood-station, all of which are quite typical.

Three stomachs contained quantities of crushed molluscs and a few portions of chewed weeds. The wide patch of particularly large flat-headed vomerine teeth, which is the best diagnostic character of this species, is admirably adapted to a mollusc diet.

CLARIAS CARSONII Blgr.

Two half-grown specimens from Lake Nyasa in the B.M., collected by Dr. W. A. Cunnington.

Not represented in Dr. Christy's collection.

CLARIAS THEODORÆ Weber (1897), Boulenger (1909–16).

Clarias fouloni Boulenger (1905, 1907, and 1909–16).

Dr. Christy's Lake Nyasa collection and Capt. Pitman's 1932 collection from the region of Lake Bangweulu show that *C. fouloni* from Lake Bangweulu is the same as *C. theodoræ* from Natal, Zululand, Lake Ngami, and Rhodesia. The distinguishing characters given by Boulenger (1909–16) are :—

C. theodoræ : distance between pelvic and caudal $1\frac{1}{2}$ times that between pelvic and end of snout. Maxillary barbel as long as or a little longer than head. Dorsal 80–90. Anal 67–73. 14 gill-rakers on anterior arch. Pectoral spine feebly serrated on outer side.

C. fouloni : distance between pelvic and caudal $1\frac{3}{4}$ times that between pelvic and end of snout. Maxillary barbel a little shorter than head. Dorsal 83. Anal 68. 20 gill-rakers on anterior arch (re-examination of the type revealed the presence of only 17). Pectoral spine not serrated on outer side (re-examination of the type revealed the presence of serrations on the proximal half of the spine).

The recent acquisitions to the B.M. collection consist of :—

Nine specimens (75–88 mm. long) from Bar House, Lake Nyasa (coll. Dr. Christy).

Two specimens (213–220 mm. long) from Bar House, Lake Nyasa (coll. Dr. Christy).

Ten specimens (55–110 mm. long) from Lutali River, Mumbwa, N. Rhodesia (coll. Capt. Pitman).

These specimens combine the characters of *C. theodoræ* and *C. fouloni* in such a way that the retention of both species is needless and muddling. *C. theodoræ*, which takes precedence, is therefore shown to have a distribution in South Africa and the Zambezi system, extended over the Zambezi–Luapula watershed into Lake Bangweulu, and therefore affords an interesting parallel to other shallow-water and swamp-dwelling fishes, such as *Clarias mellandi*, *Gnathonemus macrolepidotus*, and the small species of *Barbus*.

Three stomachs of Nyasa specimens contained dragon-fly and Ephemerid nymphs, other insect-remains, and mud.

BAGRIDÆ.

Previously two species had been recorded from Lake Nyasa and the Upper Shiré River (the lake's effluent) :—*B. meridionalis* Günther (1893), known only from a single stuffed and poorly preserved specimen from the Upper Shiré, presented by Sir Harry Johnston, and *B. orientalis* Boulenger (1902), a species originally described from the Pangani River, East Africa, but to which two small specimens from Lake Nyasa, collected by Capt. E. L. Rhoades and Prof. J. E. S. Moore, were assigned later by Boulenger.

A long series of *Bagrus* in Dr. Christy's collection shows that the two Nyasa specimens assigned by Boulenger to *B. orientalis* are really immature specimens of *B. meridionalis*. They differ only in the relatively longer barbels (particularly the maxillary barbels) and the relatively larger adipose dorsal fin, characters which grow with a disharmonic ratio to the growth of the whole fish. Thus

there is only one species of this genus—*B. meridionalis*—in Lake Nyasa. *B. orientalis* is distinct, and stands as a species endemic to the Pangani River.

Since Boulenger's descriptions (1909-16) are misleading, it is necessary to redescribe both these species :—

BAGRUS MERIDIONALIS Günther (1893), Boulenger (1902 and 1909–16).

Depth of body $5\frac{1}{2}$ to $6\frac{1}{2}$ times in length, length of head $3\frac{1}{3}$ to $3\frac{1}{2}$ times. Head depressed, $1\frac{3}{4}$ to twice as long as broad, smooth or finely striated above ; occipital process long and narrow ; snout not or but little projecting beyond lower jaw, $1\frac{3}{4}$ (very young) to 3 times as long as eye, which is $5\frac{1}{2}$ times (very young) to nearly 9 times in length of head, and $1\frac{1}{2}$ times (very young) to $2\frac{1}{2}$ times in interorbital width. Premaxillary band of teeth 5 to $6\frac{1}{2}$ times as long as broad, nearly as broad as the band of vomerine teeth. Nasal barbel $\frac{2}{5}$ (specimens of less than 100 mm.) to $\frac{1}{7}$ (specimens of more than 500 mm.) length of head ; maxillary barbel more than twice (young specimens) to about once (large adults) times length of head, reaching to extremity of pelvic or beyond (specimens less than 200 mm.) to extremity of pectoral (specimens from 300 to 500 mm.) or hardly beyond gill-opening (specimens more than 500 mm.) ; outer mandibular barbel $\frac{3}{4}$ (very young) to $\frac{2}{5}$ length of head ; inner mandibular $\frac{1}{2}$ (very young) to $\frac{1}{5}$. Gill-rakers rather long, widely set, 10 to 12 on lower part of anterior arch. Dorsal I 9–10, last ray above or just in front of first ray of ventral ; spine smooth, feeble, $\frac{1}{2}$ to $\frac{1}{3}$ length of head. Adipose dorsal 5 times (young) to about 11 times (specimens more than 600 mm.) as long as deep, nearly twice as long as rayed dorsal, from which it is separated by a space equal to $\frac{2}{3}$ to once the base of the latter. Anal 14–15 (10–11 rays branched). Pectoral $\frac{2}{5}$ to $\frac{3}{5}$ length of head, its spine smooth or very slightly serrated behind. Pelvic a little nearer caudal than end of snout. Caudal deeply forked with pointed lobes, its peduncle a little longer than deep. Brown or olive above, pale beneath, black dots or blotches (more prominent in young specimens) scattered irregularly on the back, on the adipose dorsal and caudal fins, and sometimes also on the rayed dorsal.

The description is based on the following specimens :—

One specimen 550 mm. long, stuffed (Günther's type). Upper Shiré (Sir H. H. Johnston).

One specimen 330 mm. long. Lake Nyasa (Capt. E. L. Rhoades).

One specimen 205 mm. long. Lake Nyasa (Prof. J. E. S. Moore).

And the following in Dr. Christy's collection from Lake Nyasa :—

One specimen 85 mm. long.

Five specimens from 100 to 200 mm. long.

Four specimens from 200 to 300 mm. long.

Four specimens from 300 to 400 mm. long.

Three specimens from 400 to 500 mm. long.

Three specimens from 500 to 600 mm. long.

One specimen 660 mm. long.

This is a predacious species. Stomach examinations showed that a medium-sized specimen had eaten a Cichlid of 10 mm. length and other small fishes. Three young specimens had all eaten small fish.

BAGRUS ORIENTALIS Boulenger (1902).

Differs from *B. meridionalis* in the following particulars :—Depth of body 5 times in length, length of head $3\frac{1}{2}$ times. Head $1\frac{2}{3}$ times as long as broad ; snout projecting beyond lower jaw, $2\frac{2}{3}$ times as long as eye, which is 8 times

in length of head and $2\frac{1}{3}$ times in interorbital width. Nasal barbel about $\frac{1}{3}$ length of head, maxillary $1\frac{2}{3}$ to 2 times, reaching pelvic, outer madibular $\frac{2}{3}$ to $\frac{5}{6}$, inner mandibular $\frac{2}{5}$. Gill-rakers 12–14 on lower part of anterior arch. Dorsal I 10. Adipose dorsal 4 times as long as deep, nearly twice as long as rayed dorsal, from which it is separated by a space equal to $\frac{2}{5}$ the base of the latter. Pectoral $\frac{2}{3}$ length of head. No black dots on back or fins.

Two specimens (275 and 300 mm.). Pangani River (Sir L. Playfair).

Schilbeidæ.

Eutropius depressirostris (Peters).

A species known from several rivers in East and South-east Africa, and recorded from Lake Nyasa by Mr. R. C. Wood, who collected one specimen for the B.M.

Not represented in Dr. Christy's collection.

Amphiliidæ.

Amphilius platichir Günth.

Two specimens from between Kondowe and Karonga, Lake Nyasa, in the B.M., collected by Mr. A. Whyte and Sir H. H. Johnston.

Not represented in Dr. Christy's collection.

Mochochidæ.

Synodontis zambesensis Peters.

Seven specimens from Lake Nyasa in the B.M., collected by Mr. J. A. Williams, Prof. J. E. S. Moore, and Dr. W. A. Cunnington.

Twenty specimens (60–180 mm. long) from most localities round the lake. Some of these specimens differ from typical examples of the species in having rather shorter maxillary barbels and in having fairly pronounced serrations on the anterior side of the pectoral spine. In the latter character these specimens approach *S. melanostictus* Blgr., which is recorded from the Upper Zambezi. There is no doubt, however, that all the Nyasa specimens should be identified as *S. zambesensis*.

Three stomachs were examined: one contained a great mass of planktonic Crustacea, another contained the remains of water-beetles and other adult insects, and the third small beetle-larvæ and Ostracods.

Malopteruridæ.

Malopterurus electricus Lacep.

Two specimens from Lake Nyasa in the B.M., collected by Mr. R. C. Wood.

Not represented in Dr. Christy's collection.

Cyprinodontidæ.

Nothobranchius orthonotus (Peters).

A species formerly recorded from Mozambique, Tanganyika Territory, and Beira.

Six specimens (45–50 mm. long) from Bar House and Monkey Bay. These are all very similar to the type of the species from Mozambique, except for the colouring (in spirit), which is brown above, pale beneath, edges of scales lined with brilliant carmine, pectoral grey, dorsal and anal marbled with carmine,

caudal carmine. In this colouring the Nyasa specimens resemble an example from Beira, Portugese E. Africa, identified as this species by Mr. J. R. Norman.

Stomachs not examined.

HAPLOCHILICHTHYS JOHNSTONII (Günth.).

Previously known from eight specimens (types) from Fort Johnston (probably from Lake Nyasa), presented to the B.M. by Sir H. H. Johnston, and one specimen from Zululand, presented by Dr. E. Warren.

Thirty-three specimens (26–46 mm. long) from Bar House and Monkey Bay, and about twenty very young specimens (10–15 mm. long) from Bar House. All are very similar to the types.

Stomachs not examined.

ANABANTIDÆ.

CTENOPOMA MULTISPINIS (Peters).

Two specimens (83 and 95 mm. long) from Lake Nyasa in the B.M., collected by Mr. R. C. Wood.

Not represented in Dr. Christy's collection.

CTENOPOMA CTENOTIS (Boulenger, 1920).

This species was described by Boulenger (1920) from two specimens collected by M. Dhart de Bie from near the west shore of Lake Tanganyika. It differs from the closely related *C. nanum* (Günth.) from the Congo system in having an anal fin formula of X 7–8 instead of VII–IX 9–11, and in having a rather shorter pelvic fin and more denticulations on the gill-cover (8–10 serræ above opercular notch, 5 or 6 below).

I have also referred to this species three specimens (33 to 42 mm.) from the Lake Bangweulu region, collected by Capt. Pitman, on account of their opercular spines; I would mention, however, that the anal fin formula of these Bangweulu specimens is VIII–IX 9–11—that is, as in *C. nanum*.

A single specimen of 36 mm. in Dr. Christy's Nyasa collection must be referred to this same species, although the opercular spines are less well developed, six above and three below the opercular notch; the anal fin formula is X 9.

On account of the above facts it seems very probable that further collections from this part of Africa will show that *C. ctenotis* is a variety of *C. nanum*, and does not merit specific rank.

MASTACEMBELIDÆ.

MASTACEMBELUS SHIRANUS Günth.

Endemic to Lake Nyasa and the Upper Shiré River, and the only member of the genus known from the lake. Eight specimens in the B.M. collected by Mr. A. Whyte, Dr. Percy Rendall, and University Mission.

Ten specimens (125–285 mm. long) from Bar House, Deep Bay, Monkey Bay, and Malembo. All typical.

Stomachs not examined.

SUMMARY.

Introduction.—The identification of a large collection of fishes (other than Cichlidæ) made by the late Dr. C. Christy from Lake Nyasa in 1925 raises the previous total of thirty-one species recorded from the lake to forty-five. This

paper is made exhaustive by including all those species recorded from the lake, whether represented in Dr. Christy's collection or not.

Distribution.—Of the forty-five species twenty are endemic, showing that the partial isolation of Lake Nyasa from the rest of the Zambezi system by the Murchison Rapids of the Shiré River (the lake's effluent) has had its effect on evolution. Nearly all the endemics are forms which require comparatively open and well oxygenated water compared with the shallow-water and swamp-dwelling forms, most of which have a comparatively wide distribution in other waters. A collection made in 1932 by Capt. Pitman from the neighbourhood of Lake Bangweulu has shown that fifteen of the Nyasa species are present also in or near Lake Bangweulu, which drains *viâ* the Luapula River to the Congo. As an explanation of this it is suggested that certain shallow-water and swamp-dwelling fishes can communicate across the watershed which divides the headstreams of the Kafue (tributary of the Zambezi) and certain tributaries of the Luapula, a watershed which is intersected by a system of swamps at an altitude of about 4000 feet. Similar watersheds are found elsewhere in Africa—for instance, in Uganda—and it is considered that their study will throw light on the origin and evolution of the African freshwater fauna as a whole. Some of the recent geological changes which have influenced the evolution of African fishes are outlined.

Ecology.—The examination of stomachs of Dr. Christy's fishes has made possible an outline of the food-chains of Lake Nyasa, in the light of field-work recently carried out on the great lakes to the north. The presence or absence of large predacious fishes has had considerable effect in influencing the evolution of small endemic forms in the African lakes.

Systematic.—Each species is considered in turn, reference being made to specimens previously in the British Museum (Nat. Hist.) and in Dr. Christy's collection. The large number of specimens in the new collection has shown that in many cases variation within the species is more pronounced than was formerly recognized. The following species are described as new to science :—*Gnathonemus nyasensis, Labeo intermedius, Varicorhinus nyasensis, Barbus globiceps, Barbus macrotœnia, Clarias nyasensis, Clarias longibarbis*; and the following are redescribed :—*Barbus eurystomus, Barbus johnstonii, Bagrus meridionalis, Bagrus orientalis. Clarias fouloni* Blgr. proves to be the same as *Clarias theodoræ* Günth., and several of those species which are common to the Zambezi and Luapula drainage-systems are shown to exhibit certain minor differences in the two areas, which shows evolution in the making under the influence of partial isolation.

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