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THE DISTRIBUTION AND IDENTIFICATION OF MORMYRID
FISHES IN MALAWI, WITH NOTES ON THE SYNONYMY OF
MARCUSENIUS NYASENSIS AND *M. LIVINGSTONII*
(MORMYRIFORMES: MORMYRIDAE)

by

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ABSTRACT

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Electrofishing surveys throughout Malawi have increased the number of mormyrid species known to occur in the country, expanded known ranges of the species and cast doubts on some earlier records. The distribution of each of the eight recorded species is given, and a key is provided for the identification of the species. The available evidence suggests that *Gnathonemus nyasensis* Worthington, 1933 is a junior synonym of *Marcusenius livingstonii* (Boulenger, 1898) a species described from the Ruvuma River of Tanzania. Geological evidence supports fish distribution evidence that indicates links between Lake Malawi and East Coast Rivers. Some affinities are also noted between Lake Malawi and Upper Zambezi/Zaire faunas.

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THE DISTRIBUTION AND IDENTIFICATION OF MORMYRID FISHES IN MALAWI, WITH NOTES ON THE SYNONYMY OF *MARCUSENIUS NYASENSIS* AND *M. LIVINGSTONII* (MORMYRIFORMES: MORMYRIDAE)

by

D. Tweddle and N.G. Willoughby¹

Little information has been published on the distribution of mormyrid fishes in Malawi. Jackson et al. (1963) recorded the presence of *Hippopotamyrus discorhynchus*, *Marcusenius macrolepidotus*, *Marcusenius nyasensis* and *Petrocephalus catostoma* in streams running into Lake Malawi, and *Mormyrops deliciosus* and *Mormyrus longirostris* in the Lake itself. The Shire River south of Kapachira Falls has a Lower Zambezi fauna, and Ratcliffe (1972) recorded *Mormyrops deliciosus*, *Mormyrus longirostris*, *Marcusenius macrolepidotus*, *H. discorhynchus* and *P. catostoma* from this area. Kirk (1967a) recorded *Marcusenius macrolepidotus* and *P. catostoma* from L. Chilwa affluent streams and later added *H. discorhynchus* to this list (Kirk, 1967b).

As a result of extensive electrofishing surveys of the lakes, rivers and streams of Malawi, we have added three more species, *Marcusenius livingstonii* (see Tweddle (1979)), *Pollimyrus castelnaui* and *Hippopotamyrus ansorgii*, to the known mormyrid fauna. The distribution of other species has been extended, and the present work has cast doubt on some previous records.

METHODS

Surveys were conducted of the river systems of Malawi (Fig. 1) as follows:

Shire River south of Kapachira Falls, (1975-77); Shire River between Kapachira Falls and L. Malawi, (October 1975, October 1976 and July 1977); Mwanza River and tributaries, (August 1976); Ruo River and tributaries, (November 1975); Lake Chiuta and Chilwa and affluent streams, (September 1976, and July 1977); Lake Malawi (Monkey Bay), (October 1974); Lake Malawi affluent streams (Chintheche area), (October 1976); Lake Malawi affluent streams (Northern Region), (1978-81).

The electrofishing gear and techniques used for the surveys were described by Tweddle, Lewis and Willoughby (1979), Tweddle and Willoughby (1976, 1978) and Tweddle (1981). In addition mormyrids were collected on occasion by trawling and gillnetting and from fishermen's catches.

The number of specimens examined in the collections at the British Museum (Natural History) (BMNH) and the Monkey Bay Fisheries Research Unit (MFRU) are given for each species. Catalogue numbers are given for the BMNH specimens; the MFRU collection has no accession numbers at present, but all mormyrid specimens in the collection by July 1981 were examined. Collection dates are given for new distribution records. In addition, other specimens of the commoner species were examined in the field.

SPECIES

The distribution of mormyrids in Malawi is shown in Fig. 2. Estimates of abundance in the species notes are subjective, but as a rough guide 'fairly common' means a few specimens could be collected with little difficulty from an area in which the species occurs, e.g. 33 specimens of *H. ansorgii* in 12 samples (approx. 4 hrs fishing) in the Upper Ruo River and its tributaries. 'Common' means the species can often be caught in fairly large numbers, e.g. 40 or 50 *H. discorhynchus* in a half-hour trawl in the South West Arm of Lake Malawi.

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***Hippopotamyrus ansorgii* (Boulenger, 1905)**

H. ansorgii was previously known from the Okavango, Upper Zambezi, Cunene, Pungwe and Buzi Rivers (Bell-Cross, 1976). It is fairly common in the River Ruvo above Zoa Falls, a 60 m high barrier separating the Upper Ruvo fishes from the Lower Zambezi fauna.

Material examined: BMNH 1978.8.3:1-4: 4 specimens from Upper Ruvo River; Nov. 1975. MFRU: 9 specimens from Upper Ruvo River; Nov. 1975.

***Hippopotamyrus discorhynchus* (Peters, 1868)**

This species is common in the Shire River and marshes below Kapachira Falls and is also found in the Upper Shire River and Lake Malawi affluent streams. It occurs regularly in shallow water trawl catches in Lake Malawi, especially in the South West Arm.

Kirk (1967b) recorded this species from Lake Chiuta and from Lake Chilwa affluent streams, but no specimens were taken there in the present electrofishing survey which covered all available habitats and the majority of affluent streams much more thoroughly than did Kirk's sampling (Tweddle, 1979). Lake Chiuta (and, in the past, probably also Lake Chilwa (Lancaster, 1979; Tweddle, 1979)) is a part of the River Ruvuma drainage system, in which *H. discorhynchus* has not been recorded (Bailey, 1969). Kirk did not record *Marcusenius livingstonii*, a species that is similar to *H. discorhynchus* in appearance and colouring and which does occur in affluent streams of Lake Chilwa. It is believed, therefore, that Kirk may have misidentified this species as *H. discorhynchus*, and the record of *H. discorhynchus* in the list of Chilwa/Chiuta fishes should be considered doubtful.

Material examined: MFRU: 111 specimens from Lake Malawi trawl catches; 17 from Lake Malawi shoreline; 7 from Lake Malawi affluent streams; 8 from Middle Shire River; 2 from Lake Malombe; 9 from Lower Shire River.

***Marcusenius livingstonii* (Boulenger, 1898)**

Gnathonemus livingstonii Boulenger, 1898: 803 (type-locality Ruvuma River, Tanzania-Mozambique border);

Pappenheim, 1907: 353; Boulenger, 1909: 104, fig. 84; Bailey, 1969: 177.

Gnathonemus nyasensis Worthington, 1933: 295, fig 2 (type-locality, Lake Malawi): Jackson, 1961: 545.

Marcusenius livingstonii: Taverne, 1971: 134; Tweddle, 1979: 179.

M. livingstonii, a species originally described from the Ruvuma River, occurs in affluent streams of Lake Chilwa. One specimen was caught in the Sombani River, which drains into Chilwa from the eastern side of Mt. Mulanje and one from the Domasi River at the foot of the Zomba Plateau.

Marcusenius nyasensis was described from specimens collected from the South West and South East Arms of Lake Malawi (Worthington, 1933). It has since been recorded from the River Shire, in fast-flowing water below the barrage at Liwonde (Tweddle et al. 1979). We have also found it in small fast-flowing streams near Lake Malawi south of Chintcheche (Tweddle and Willoughby, 1978). Jackson et al. (1963) considered it more common than *M. macrolepidotus* in lagoons and sheltered estuaries, especially in the Limphasa Dambo, near Nkhata Bay. In the Karonga area it is common in catches from small-mesh gillnets set close inshore in weedy areas of the main lake. It also occurs in Lake Chiwondo, a small lake 25km south of Karonga, which was completely separated from Lake Malawi by a sandbar until this was breached in 1979 as a result of very high lake levels. The species is therefore fairly common and widely distributed around the Lake Malawi shoreline.

Material examined: MFRU: 1 specimen from South West Arm of Lake Malawi, trawled in 1973 in 18 m; 1 from a Lake Malawi affluent stream, collected in 1976; 1 from Lake Chiwondo, collected in 1978; 8 from Lake Malawi near Karonga, trawled in 11 m in Sept. 1979. BMNH 1864.7.9:30: holotype of *M. livingstonii* from Ruvuma River, collected Livingstone. BMNH 1932.11.15:25-34:26 syntypes of *M. nyasensis* from South East (Bar House) and South West Arms of Lake Malawi, collected Christy. BMNH 1978.8.3:9-10: 2 specimens, 1 from the Middle Shire River at Liwonde and 1 from a Lake Malawi affluent stream, collected 1976. BMNH 1978.3.3.2095-6: 2 from Lake Chilwa affluent streams, collected 1976.

REMARKS: Only two characters effectively separate *M. livingstonii* and *M. nyasensis* in the original descriptions; the coloration and the number of scales in a lateral series between dorsal and anal fins. *M. livingstonii* was described by Boulenger (1898) as having a dark brown vertical bar on the body below the origin of the dorsal fin, and Worthington (1933) described *M. nyasensis* as being uniform dark brown, paler beneath, small specimens being more or less marbled with dull yellow. Several mormyrids were collected from the Lake Malawi basin and two from the Chilwa basin that agreed with the description of *M. nyasensis*, but all had the vertical bar characteristic of *M. livingstonii*, (although this was less distinct in the larger specimens from Lake Malawi). Lake Chilwa was until very recently part of the Ruvuma system from which *M. livingstonii* was described, and it has a very similar fauna to that of neighbouring Lake Chiuta (Tweddle, 1979) which drains into the Ruvuma River via L. Amaramba and the Lugenda River. It is probable that the species also occurs in Lake Chiuta streams although no specimens have yet been recorded from that system.

The type-specimens of *M. livingstonii* and *M. nyasensis* in the British Museum (Natural History) were examined. All syntypes of *M. nyasensis* have the vertical bar below the dorsal origin. The holotype of *M. livingstonii* has 14 scales between the lateral line and anal fin origin, not 11 as described by Boulenger, and the *M. nyasensis* types have 14-16. There is a complete overlap in all scale counts, fin ray numbers and body proportion measurements.

Thus we consider *M. nyasensis* to be a synonym of *M. livingstonii*, though it must be stressed that only one small specimen of *M. livingstonii* from the type-locality (the holotype) was available for examination. Further collecting from the Ruvuma system is desirable for confirmation.

***Marcusenius macrolepidotus* (Peters, 1852)**

M. macrolepidotus is common in the Lower Shire River below Kapachira Falls and fairly common in slow-flowing streams, lagoons and sheltered estuaries in the Nkhata Bay — Chintheche area. It was also recorded from Lake Malawi by Worthington (1933) and by Jackson et al. (1963), who described it as an uncommon fish of rivers and lagoons rather than the open lake. This species is present also in Lake Chiuta and affluent streams of Lake Chilwa. It is easily distinguished from *M. livingstonii* as it has conical teeth (those of *M. livingstonii* are bicuspid), and it lacks the dark vertical bar that is present on the body below the dorsal fin origin of *M. livingstonii*.

Material examined: MFRU: 10 specimens from Lake Malawi shoreline and affluent streams; 3 from Lower Shire River; 1 from Lake Malombe; 8 from Lake Chiuta; 1 from Lake Chilwa.

***Mormyrops deliciosus* (Leach, 1818)**

This species is widely distributed in rivers and lakes in much of Africa. Young specimens are common on rocky shores of Lake Malawi where they hide among the rocks. Large specimens are not common in the lake, although an 8.6 kg fish was taken in a Fisheries Department trawl in the South East Arm in 1975, and Jackson et al. (1963) record them from deep water. This species is more common in sheltered environments such as lagoons and the Shire River, and is quite common in the Lower Shire. It is not found in Lake Chiuta or Chilwa.

Material examined: MFRU: 67 specimens from Lake Malawi; 2 from the Lower Shire River.

***Mormyrus longirostris* (Peters, 1852)**

M. longirostris is a common bottom-living species found in Lake Malawi and the entire Shire River, wherever there is a suitable sandy or muddy bottom habitat. In northern Lake Malawi, it is commonly caught in gillnets down to the limits of dissolved oxygen and has been trawled at a depth of 90 m off Monkey Bay. This species has also been recorded from Lake Chiuta.

Material examined: MFRU: 17 specimens from Lake Malawi; 2 from Lower Shire River; and 1 from Lake Chiuta, collected 1972.

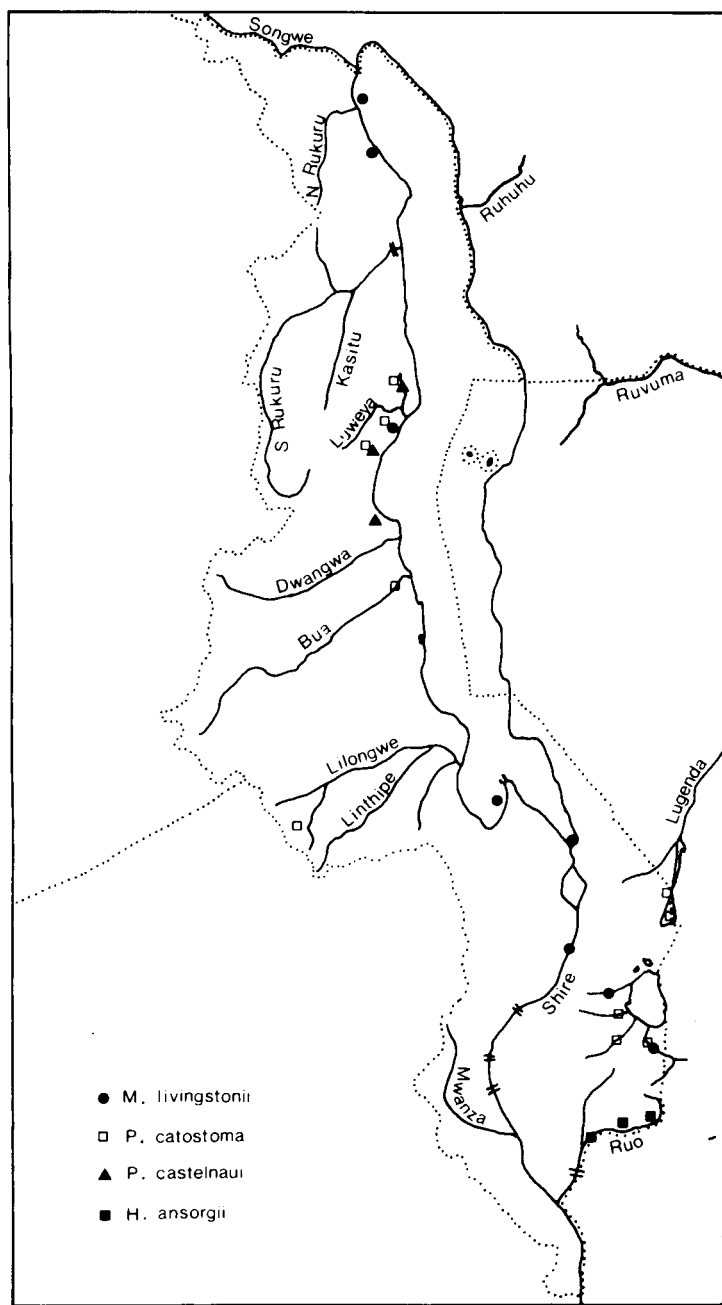


Figure 2. Distributions of four mormyrids found in Malawi. The four others, *H. discorhynchus*, *M. macrolepidotus*, *M. deliciosus* and *M. longirostris*, occur along the entire Lake Malawi coastline, in lower reaches of Lake Malawi affluent streams and throughout the River Shire and its adjacent marshes. *M. macrolepidotus* also occurs in Lakes Chilwa and Chiuta and associated streams, and *M. longirostris* occurs in Lake Chiuta. *H. discorhynchus* and *M. deliciosus* do not occur in the Chilwa-Chiuta system.

***Petrocephalus catostoma* (Günther, 1866)**

This species is common in pools and streams around Lake Malawi, and in Lake Chiuta and the affluent streams of Lake Chilwa. One specimen was recorded from a R. Ruo tributary arising in close proximity to Lake Chilwa affluent streams. Details of evidence for transfer of fishes across the Chilwa plain in wet weather were given by Tweddle (1979). *P. catostoma* is not found in the Lower Shire, where it was erroneously recorded as common by Ratcliffe (1972). Juvenile *H. discorhynchus* were being recorded as *P. catostoma* prior to the recent surveys.

Materials examined: MFRU: 17 specimens from various parts of the Lake Malawi shoreline and affluent streams; 91 from Lake Chiuta and affluent streams of lakes Chilwa and Chiuta; 1 specimen from Upper Ruo River, collected 1975.

***Pollimyrus castelnaui* (Boulenger, 1911)**

P. castelnaui is an "Upper Zambezi species" not previously recorded from Malawi, but found to be common in streams in the Nkhata Bay — Chintheche area. It has not as yet been found south of latitude 12°30'S.

Material examined: MFRU: 16 specimens from Limphasa Dambo area, 7 collected in 1962 and 9 in 1976; 6 from tributaries of lower reaches of River Songwe, collected 1980. BMNH 1978.8.3:12-19 and 1978.12.13:9-12: 12 specimens from Limphasa River and tributaries in the Limphasa Dambo, collected 1976.

Key to the Mormyrid Species of Malawi

The only previous key to mormyrid fishes in Malawi (Jackson, 1961) treats six of the eight species now known to occur. Extensive revisions of the family have since been undertaken (Taverne 1972). For these reasons a new key to the mormyrids in Malawi is given here.

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|-----|--|-------------------------------------|
| 1a. | Anal fin base longer than or subequal to dorsal fin base..... | 2 |
| 1b. | Anal fin base less than half length of dorsal fin base..... | <i>Mormyrus longirostris</i> |
| 2a. | 10-36 teeth along entire edge of each jaw..... | 3 |
| 2b. | 3-10 teeth confined to middle of each jaw..... | 4 |
| 3a. | Body elongate, depth 14-17% of standard length; mouth terminal..... | <i>Mormyrops deliciosus</i> |
| 3b. | Body oval, depth 27-32% of standard length; mouth inferior..... | <i>Petrocephalus catostoma</i> |
| 4a. | Mouth terminal, with protruding fleshy lobe on lower jaw..... | 5 |
| 4b. | Mouth sub-inferior..... | 6 |
| 5a. | Teeth conical..... | <i>Marcusenius macrolepidotus</i> |
| 5b. | Teeth bicuspid..... | <i>Marcusenius livingstonii</i> |
| 6a. | 65-75 lateral-line scales..... | 7 |
| 6b. | 48-50 lateral-line scales..... | <i>Pollimyrus castelnaui</i> |
| 7a. | Dorsal fin with 19 rays, the base shorter than anal fin base..... | <i>Hippopotamyrus ansorgii</i> |
| 7b. | Dorsal fin with 29-36 rays, the base slightly longer than anal fin base..... | <i>Hippopotamyrus discorhynchus</i> |

ZOOGEOGRAPHICAL NOTES

The distribution of mormyrids in Malawi, in particular the presence of *Pollimyrus castelnaui* in northern Lake Malawi affluent streams and *Hippopotamyrus ansorgii* in the Upper Ruo, raises some interesting zoogeographical questions.

Bell-Cross (1973) discussed the unusual distribution of *H. ansorgii*. His records from the headwaters of the Buzi and Pungwe systems in eastern Zimbabwe were the first records from east of Victoria Falls, and the species was previously known only from the Cunene and Upper Zambezi Rivers. Tweddle (1979, 1980) showed that the fauna of the Upper Ruo River has affinities with the fauna of East Coast rivers south of the Zambezi. *H. ansorgii* is apparently a fish of

fast-flowing headwaters, and the record of this species in the Upper Ruw, a highland tributary of the Lower Zambezi, suggests that its distribution is not as unusual as Bell-Cross (1973) implies. Further collecting in other Zambezi tributaries may well extend the known distribution.

Several theories have been put forward regarding the origin of the Lake Malawi fish fauna (Bell-Cross 1966, 1972) but none satisfactorily explains the presence of the "Upper Zambezi" species *Pollimyrus castelnaui* in northern Lake Malawi affluent streams. There appears to have been some faunal connection in the past between the Upper Zambezi and Lake Malawi. In attempting to explain the presence of *Serranochromis robustus* (Günther) in both systems, Jackson (1962) speculates a line of communication from the Upper Zambezi/Kafue through the Zambian Congo into the Luangwa, and from there into the headwaters of some of the northern Lake Malawi affluent rivers such as the Songwe and North Rukuru. This line of communication could also explain the presence of *P. castelnaui* in Lake Malawi, although evidence presented elsewhere (Tweddle, 1980) suggests that communication occurred through the Central rather than Northern Region rivers. Jackson (1962) stresses that it is necessary to postulate a more favourable environment in the past, because neither *S. robustus* nor *P. castelnaui* now occur in the Luangwa, a river that he classes among the sand-bank rivers of Africa whereas *S. robustus* and *P. castelnaui* prefer water in which there is a good deal of aquatic vegetation.

Bell-Cross (1976) records *Petrocephalus catostoma* from the entire Zambezi system, Lower Sabi-Lundi, Victoria Nile, Lakes Victoria and Nabugabo, Tana River, Ruvuma, Congo, Cunene, Okavango, Zambian Zaire, Lake Malawi and down the east coast as far south as the Lower Pongolo in Zululand. It is a shoaling species that can be exceedingly numerous. Its absence from the entire Shire River system is therefore most surprising. All sections of the Shire have been thoroughly sampled and it is highly unlikely that *P. catostoma* would have been overlooked if it were present.

The theory that *M. livingstonii* and *M. nyasensis* are synonymous is supported by geological evidence. The oldest sediments known to have accumulated in the Malawi rift valley, the Chiwondo beds, contain fossils indicating ages of 5 to 2.5 million years for the deposits (Crossley, 1980). The nature of the fossils and sediments, suggesting a comparatively small shallow lake bounded only by small escarpments, is consistent with the idea that the Chiwondo beds accumulated at an early stage in the subsidence of the Malawi rift valley. Links with eastern river systems as the lake grew are therefore fairly recent. The Middle Shire River is very recently formed by a continuation of rift faulting (R. Crossley, pers. comm.). As the Lower Shire valley is an ancient rift, the falls on the Middle Shire have probably always been a complete barrier to upstream fish movement, a fact confirmed by the difference between the fauna of the Upper and Lower Shire Rivers (Tweddle et al. 1979). Prior to the formation of the Middle Shire valley, Lake Malawi probably drained to the Indian Ocean via the Ruvuma River, along the valley described by Crossley and Crowe (1980) as the Ruvuma trough. Crossley and Crowe (1980) consider that the Dwanga, Bua and Lilongwe river systems formed the headwaters of the Ruvuma.

Zoogeographical evidence for more recent links between the Ruvuma system, as represented by Lakes Chilwa-Chiuta, and Lake Malawi was given by Tweddle (1979).

Headwaters of the Rufiji, in which *M. livingstonii* has also been recorded, were probably also captured by the developing Lake Malawi. The course of the lower reaches of the South Rukuru River, and its major tributary, the Kasitu River, are determined by a Mesozoic fault, the rivers eroding down through Karoo sediment. The line of this ancient fault continues on the eastern side of the lake as the Ruhuhu valley, which is also a Karoo trough. The headwaters of the Ruhuhu lie very close to the Rufiji system and it seems probable that prior to the formation of the lake the Kasitu River was one of the headwater streams of the Rufiji. The upper reaches of the South Rukuru River are beyond the scope of this paper and are considered elsewhere (Tweddle, 1981).

Of the four Malawi species not so far discussed in this section two, *M. macrolepidotus* and *M. longirostris*, have widespread distributions, including East Coast rivers and the Zambezi system (Bailey, 1969). The absence of these species from Malawi's rivers and lakes would therefore be much more noteworthy than their presence. *H. discorhynchus* also has a wide distribution, from Lake Tanganyika to southern Mozambique, but does not appear to occur in the East Coast rivers with the exception of Lake Rukwa and the Ruaha River (Bailey, 1969). The Ruaha is a tributary of the Rufiji which is believed to have formerly drained into the Rukwa trough (Haldemann, 1962). The fourth species *M. deliciosus*, occurs from West Africa through Central Africa to southern Mozambique, and Bell-Cross (1976) suggested that it probably also occurs in East Coast rivers. However it was not recorded by Bailey (1969) and we did not find it in Lakes Chilwa or Chiuta. The presence of *H. discorhynchus* and *M. deliciosus* in Lake Malawi is therefore probably a result of the Zambezi link discussed above rather than any East Coast connections.

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