

(Reprinted from *Nature*, Vol. 176, p. 470 only, Sept. 3, 1955)

Predation Pressure and Evolution in Lake Nyasa

IN papers dealing with the evolution of fishes in the Great Lakes of East and Central Africa, Worthington¹⁻³ postulates that a major contributory factor to the great adaptive radiation shown by the family Cichlidae in certain lakes, notably Victoria, Edward and Nyasa, has been the absence from their waters of active predators. The theoretical implications of this suggestion have been accepted by Huxley⁴ but have been criticized by Mayr⁵.

Worthington's supposition is that large and vigorous predaceous fishes of the genera *Lates* and *Hydrocyon* which are present in several African lakes have played an important part in restricting the adaptive radiation of the non-predaceous species. In Lake Nyasa, where these genera are not represented, he claims that their place is taken by a much less vigorous type of predator in the form of two species of *Barilius*, and as a result large-scale specific radiation has been permitted to occur.

The results of recent work by us on the ecology and feeding habits of fishes inhabiting both the inshore regions and open waters, together with the results of the 1939 fishery survey⁶ and the work of Lowe⁷, indicate that the restrictive effects of predation are not so important as Worthington suggests, as it is now clear that Lake Nyasa harbours a large number of markedly predaceous fishes, each major habitat having its complement of predators, some of which are numerically abundant. A difference in degree of predation exerted by *Lates* and *Hydrocyon* and by the Nyasan predators is not denied, but this is probably compensated for by the great numerical abundance of some of the Nyasan species.

Predaceous species of the family Cichlidae include the following: *Rhamphochromis* (at least eight species), the dentition and diet of which are similar to those of the pikes of Europe and North America; *Serranochromis thumbergi* (Castelnau), *Aristochromis christyi* Trewavas, and several species of *Haplochromis*, for example, *H. kiwinge* Ahl, *H. dimidiatus* (Günther) *H. compressiceps* (Boulenger) and *H. macrostoma* Regan. The non-cichlid piscivorous species include *Bagrus meridionalis* Günther, *Barilius microcephalus* Günther, *Barbus rhoadesii* Boulenger, and several species of *Clarias*.

Many of these species feed exclusively or almost exclusively on fishes except, of course, when very

young. In addition, many other species living in the Lake can be classed as mild predators which take fish as part of their diet. Further, it has been observed that almost any fish in the Lake, whether carnivore or herbivore, will take the eggs or fry of other fishes whenever the opportunity to do so arises.

Fishes in Lake Nyasa, therefore, do not lead lives which are relatively uninfluenced by predators as Worthington suggests. On the contrary, the percentage of predators appears to be extremely high, and as it is improbable that all the predators represent the most recently evolved species there is no reason to suppose that, except perhaps in the very early stages of colonization, the Lake has ever been without its complement of predaceous species.

The fact that we cannot agree with the suggestion that the great adaptive radiation shown by the Nyasan fish fauna has taken place largely because of the absence of predators does not mean that we adopt Mayr's view that the phenomenon can be explained on the basis of a succession of colonizations from a number of different river systems. This, while it may have played some part in the initial stages of the process, can certainly be discounted as an important cause of the state of affairs which exists to-day. The purpose of the present note, however, is not to propose new theories but to indicate that a previously widely circulated view can no longer be held.

G. FRYER
T. D. ILES

Joint Fisheries Research Organization,
Nkata Bay, Nyasaland.

¹ Worthington, E. B., *Int. Rev. Hydrob.*, **35**, 304 (1937).

² Worthington, E. B., in "The New Systematics", edit. J. S. Huxley, 287 (London, 1940).

³ Worthington, E. B., *Nature*, **173**, 1064 (1954).

⁴ Huxley, J. S., "Evolution: the Modern Synthesis" (London, 1942).

⁵ Mayr, E., "Systematics and the Origin of Species", 272, 273 (Columbia, 1942).

⁶ Bertram, C. K. R., Borley, H. J. H., and Trewavas, E., "Report on the Fish and Fisheries of Lake Nyasa" (London, 1942).

⁷ Lowe, R. H., "Report on the Tilapia and other Fish and Fisheries of Lake Nyasa" (London, 1952).