East African Fisheries Research

by R. S. A. Beauchamp

There are many hundreds of thousands of tons of fish in the rivers, swamps and lakes of East Africa. All these fish, which belong to many different species, are edible and form a valuable reserve of protein food that can never be completely exhausted. Though the numbers of these fish are now significantly less than they were in the early years of the century, they can never be brought to the point of extinction as so nearly happened to some of the game animals in Africa.

The survival of these fish is assured not because the demand for them is low, but because man finds them increasingly difficult to catch as their population density decreases. The existence of this automatic safety factor helps to explain the sometimes irresponsible, yet at the same time optimistic attitude, of fishermen who continue to fish in the hope of making an exceptional catch when they know that the stocks of fish are reaching a dangerously low level. Because of this persistence on the part of fishermen, it is usual to find fisheries reduced to such a low level that they are regulated by the economics of the industry rather than by any biological rules for their proper management.

Once a population of fish is subject to heavy exploitation it becomes increasingly difficult for the research workers to assess what basic ecological factors are of particular importance in determining their numbers.

There is one generalisation worth bearing in mind and that is that any biological complex of plants and animals, if left to itself, develops so as to produce (within the limits set by the physical environment) the greatest possible number of living organisms. This principle was well illustrated in Africa by dense forests, plains covered with game and lakes teeming with fish, crocodiles and hippos. It is equally true to say that man's interference or exploitation of any part of such a biological complex is likely to upset the natural balance between these communities and lead not only to a reduction in the exploited stocks, whether trees, game or fish, but also to a general reduction in the fertility of the habitat.

Research on fecundity and growth rate have shown that the annual rate of production of fish in the lakes of East Africa is lower than might have been expected from these tropical lakes and it now seems certain that the dense populations of fish that used to be in them were due to the accumulation of old fish which were not subject to a high mortality rate. Thus the lakes contained adult fish belonging to a wide range of age groups. The point to appreciate is that an abundance of fish in a lake is not necessarily an indication of a high annual production rate, as the same result can be brought about by a low rate of production if the mortality rate is also low. Any lake with a low rate of production will be very susceptible to intensive fishing and slow to recover once overfished.

When Europeans first came to East Africa the level of the fishing effort was very low. There were far fewer people living in the area than there are now and so the general demand for fish was slight. Because the waters were well stocked with fish, this low demand was easily met even by the simple and often inefficient method of fishing used at that time. I think it can safely be said that the few fish captured by men in those days caused very little disturbance to the biological regime of these
lakes. However, as the human population increased so did the demand for fish and, as transport was developed, fish were taken for sale to towns more and more distant from the lake. Thus there was an almost explosive increase in the demand for fish and at an early stage in this period of expansion more efficient fishing gear was introduced, notably the gill net.

A gill net is made of very fine twine and is hung overnight in the water and maintained in an upright position by floats along the head rope and by a sufficient number of weights along the foot rope just to sink it. Fish swimming at random in the neighbourhood of these nets are liable, if they swim through them, to be caught by their gills. Whether or not a fish gets caught depends upon its size and the size of the mesh of the net. Particular sizes of fish can thus be caught by using nets of appropriate mesh.

It is clearly desirable to regulate a gill net fishery so that the fish have a chance to grow to the size at which they start to breed before they are liable to capture. However, this simple requirement is not easily applied to a mixed population of fishes belonging to several species.

Gill nets catch fish according to their girth measurements, thus the shape of fishes of different species as well as their varying sizes at maturity have to be taken into consideration when determining which type of net to use. This has made it difficult to frame suitable legislation and of course in these matters there is always room for more than one opinion on what is strictly necessary.

Over the past thirty years certain restrictions have been in force but in spite of this a gradual decline in the numbers of fish caught per unit of fishing effort has occurred. But over this period of time there has been a very great increase in the total fishing effort—such that the total annual yield of fish has remained at a roughly similar value. This situation provides the opportunity for further discussion: some saying that the decline in the catch per net is a danger signal while others argue that there is no cause for alarm so long as the total annual yield can be maintained.

The great demand for fish at the present time has swayed opinion towards those who believe that the limits of economic exploitation have not yet been reached and further exploitation is, quite naturally, encouraged by those who are interested in the sale of nets and outboard motors.

Only in recent years have canoes in Africa been adapted to take outboard motors. These have greatly increased the range of the fishermen, who can now travel much greater distances from their markets and utilize areas that were previously inaccessible. Some of these areas include regions where access is restricted under the Sleeping Sickness Regulations. In passing, it is of interest to note how tssetse flies and their parasites have in the past helped to protect both game and fish from the depredations of the hunter and the fisherman.

If we remember that man's exploitation of any natural resource is likely to lead to its deterioration, we should be able to draw the necessary distinction between utilizing and developing a natural resource. Biological research is always seeking ways and means whereby the damage done by human predation to naturally accumulated stocks of fish may at least in some measure be compensated for or restored. Restocking is an obvious example in cases where there are known to be restrictions on spawning or conditions which lead to an excessive mortality of fry. In the East African lakes the most frequent fishes commercially are the several species of *Tilapia*. These fish spawn frequently and protect their eggs and young by carrying them in their mouths. At first sight there would seem to be little need for a policy of restocking, because such care is taken of the very young fish. However, there are grounds for believing that in Lake Victoria the declining fish population is caused by a shortage of suitable spawning substrate in the sand and mud in which to spawn. In the East African papyrus swamps in the bays and littoral areas, the substrate is suitable for nest building and a significant improvement in the fish population is to be expected if these swamps are protected and preserved as nursery grounds for fry. At the present time there exist many of the fish taken by crocodiles or otters are so small that it would be wise to try and manage other predators and so relieve the pressure on the fish. It is possible that Nile Perch is established. It may prove advantageous to introduce *Tilapia* hybrids. If fish, crocodiles or otters are so small that it would be wise to try and manage other predators and so relieve the pressure on the fish. It is possible that Nile Perch is established. It may prove advantageous to introduce *Tilapia* hybrids. If fish, crocodiles or otters are so small that it would be wise to try and manage other predators and so relieve the pressure on the fish. It is possible that Nile Perch is established. It may prove advantageous to introduce *Tilapia* hybrids.
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reased so did the demand for fish and, or sale to towns more and more distant populous increase in the demand for fish. These fisheries require a net scraped in the sand and mud in which to spawn and fertilize their eggs. Areas in which the substrate is suitable for nest building are restricted by the growth of extensive papyrus swamps in the bays and littoral regions of the lake.

If fish, crocodiles or otters are seeking the same species of fish as the fishermen, it would be wise to try and manage the fishery so as to reduce the number of these other predators and so relieve the pressure on the exploited fish. Extensive studies have been necessary to determine the true relationship that exists between predator and predator and before one can attempt to estimate the probable effect of disturbing the balance that exists between them. Casual observations may be very misleading; it would seem logical to say that as crocodiles eat fish it would be sensible for fishermen to kill crocodiles. However, it has been shown that very many of the fish taken by crocodiles belong to predatory species which feed on other fish. Thus it is possible to argue that to kill crocodiles is injurious to the stocks of fish. However, in such matters the natural dislike for crocodiles and the value of their uses are more convincing grounds for their destruction than any arguments in favour of their preservation based on the exact ecological position they may occupy.

The crocodile is now becoming comparatively scarce, except where it is preserved in the National Game Parks. Before leaving the crocodile in these reserves it is interesting to note that when quite small they feed largely on the giant water bug which itself feeds on young fish. So again it can be argued that crocodiles may help to control the maintenance of fish stocks. These remarks about crocodiles may serve to indicate how involved are the effects of predation by one animal on another.

At the present time there exists some difference of opinion regarding the advisability or otherwise of introducing Nile Perch into Lake Victoria. Nile Perch are predatory fish which grow to a very large size. Those in favour of their introduction argue that they may, by eating up large numbers of small species of fish, convert shoals of these fish, which are of little commercial value, into a few large fish of value both to the commercial fisherman and to the angler. On the other hand they might eat up the Tilapia on which the main fishery depends. Studies on the habits and ecology of Nile Perch have been started.

It is possible that Nile Perch may be of use in certain fish farms where Tilapia are reared. Under certain pond conditions these fish mature at a very small size and then grow no bigger. After a short while a dense population of very small fish is established. It may prove advantageous in such ponds to introduce a predator.

After protracted studies and some experimental introductions in ponds, it was agreed to introduce Tilapia zilli from Lake Albert into Lake Victoria. It was thought that these fish which feed largely on higher plants would not compete with the two indigenous species of Tilapia, which feed mainly on plankton and other algae. It was hoped that once established this third species of Tilapia would provide a valuable addition to the commercial fisheries. So far the introduction has proved quite successful and large numbers of fish are being caught by the commercial fishermen; whether a satisfactory balance between these three species will be maintained and a significant improvement in the fisheries result still remains to be seen.

Recent studies on the growth of male Tilapia kept in ponds without females have shown the value of maintaining a fixed number of fish in these ponds and regulating their numbers to suit the size and fertility of particular ponds. Another way to control running in ponds may develop from recent work on the production of hybrids.

Fisheries research in East Africa covers a much wider field than has been indicated.
in this short article and many of the investigations carried out on the invertebrate fauna, on parasites and the vectors of parasites and on the chemistry of the waters and bottom deposits have been of value and interest to those working on related subjects in the medical, agricultural and veterinary sciences.