# Some Management Aspects and Constraints in the Lake Kariba Fishery

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## Introduction

The management of the Lake Kariba fishery (Table 1) is aimed at maintaining optimum sustainable yields of fish populations by promulgating and enforcing conservation principles. All fishery and aquatic resources belong to the government and are managed by the Department of National Parks and Wildlife Management. The Kariba fishery is of two types, the traditional artisanal gill-net fishery and the industrial pelagic fishery. The sardine, *Limnothrissa miodon* is the basis of the industrial fishery, which yielded 24,000 t (in both Zambia and Zimbabwe) in 1985. This fishery is important in land locked Zimbabwe. Apart from being a major source of protein, it has generated employment and revenue. The gill-net fishery has a much smaller yield -- 2,000 t (for the Zimbabwe side only) in 1985, but is nevertheless an essential fishery, too, in this impoverished region.

The perceptions and motivations of people involved in these two fisheries are different and this entails differences in the management approach. Whereas in the gill-net fishery political and social factors are important they are much less so in the industrial fishery and a "conservationist" approach is tenable.

Optimal levels of exploiting fishery resources are often difficult to attain in tropical fisheries because of a number of constraints. These include manpower and budgetary constraints and insufficient data on which to apply fish population dynamics models. These models are not applicable to the multispecies fisheries of tropical countries since they have been developed for temperate fisheries.

While stock assessment is imperative for effective management decisions it has not been carried out for Lake Kariba. Management decisions have been based on yields over the years. This article outlines the measures taken to manage the Kariba fishery and a number of problems it involved.

## The Industrial Fishery

*Limnothrissa miodon* was introduced in Lake Kariba in 1967/1968. It is endemic to Lake Tanganyika and is the basis of the industrial fishery.

This fishery is managed by limiting the entry of fishermen and the size of the

Table 1. Main features and morphology of Lake Kariba.

| | | |
|---|---|---|
| Length | 277 | km |
| Width (mean) | 19.4 | km |
| Depth (mean) | 29.2 | m |
| Depth (maximum) | 120.0 | m |
| Area | 5,364 | $km^2$ |
| Average bottom area per 1 m depth interval between 0-15 m | 105.22 | $km^2\ m^{-1}$ |
| Total bottom area between 0 and 12 m depth | 1,263 | $km^2$ |
| Volume | $156 \times 10^9$ | $m^3$ |
| Percentage of bottom area between 0 and 15 m depth | 23.5 | % |
| Total length of shoreline | 2,668 | km |

Fishing harbor at Kariba showing the lift net (left) carried on a barge, used to catch *Limnothrissa* (see inset photo by J. Munro).

fishing gear. The fishing method used is light attraction at night and the fishing gear, lift nets. The lift net is an inverted cone with a perimeter ranging between 30 and 90 m. The minimum mesh size of the net is 10 mm. Fishing licenses are advertised in the press and are granted only to applicants who meet the requirements. Each fishing license is equivalent to one lift net and may be used only in a specific area. This ensures that a specific fishing pressure is operative in a known area of the lake and the local performance of the fishery can be monitored. License holders are strictly required to submit monthly catch returns. There have been no problems experienced in this respect as the license holders comply.

What complicates the management of the sardine fishery is that the sardine stocks are not known and have not been assessed. In the absence of such assessment, catch-per-unit effort is taken to give an indication of the performance of the fishery. This is tricky, however, as catches from light attraction may not give an accurate basis. Even when the stocks are decreasing, catches may still be high and may continue to be so until the stocks are depleted.

Industrial fishing started in 1973 with three licenses; this number has gradually increased to the current 210. There is no evidence of overfishing yet.

### The Artisanal Gill-Net Fishery

This fishery is based on 40 indigenous fish species in the inshore waters of the lake. There are about 600 fishermen with over 4,000 dependents, living in fishing camps along the shore (Fig. 1). The surrounding land is marginal agriculturally, is infested with tsetse and has very low rainfall. Risk in agriculture is high and the fishery resource is viewed with importance.

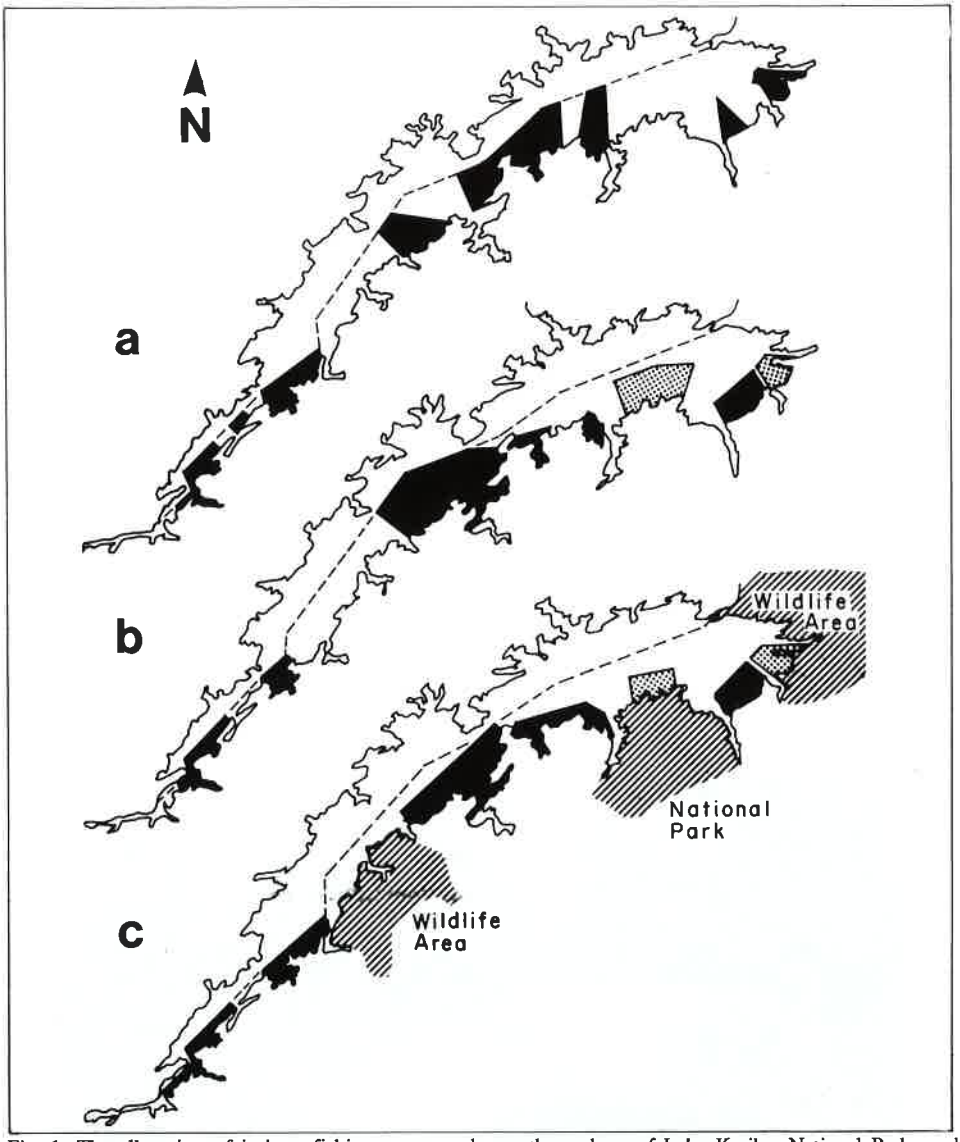


Fig. 1. The allocation of inshore fishing areas on the southern shore of Lake Kariba. National Parks and Wildlife areas have been omitted from (a) and (b) for clarity. (a) 1962-July 1972; (b) August 1972-November 1976; (c) from December 1976. Stippled areas are those allocated to concessionaires, solid areas those allocated to local fishermen.

Lake Kariba is also the home of the annual International Tiger Fishing Tournament. At the 25th event in 1986, over 440 boats took part; the wakes of some can be seen here racing from the starting line at dawn on the opening day. They caught over 100 tonnes of tiger fish *(Hydrocynus vittatus)* in three days.

The average annual yield in this fishery is only 2,000 t. The resource base is low and with the large number of fishermen dependent on it, pressure on the resource is clearly very high. The profits accruing to each fisherman are low and the situation gets worse in particularly dry years as more locals engage in fishing. The capital outlay in the gill-net fishery is much lower than in the industrial fishery and thus attracts more people.

A number of management regulations have been designed to enhance recruitment in the stock by reducing the fishing mortality of fecund individuals and

juveniles. Some of these are outlined below.

*Protective reserves (closed areas).* These areas include National Parks and Wild Life land, rivers and river mouths (see Fig. 1c). There is a total of about 600 km of shoreline on the Zimbabwe side of the protective reserve. This measure has been found promising in coral reef fisheries. However, the advantages and disadvantages of this reserve for Lake Kariba are not obvious and have not been evaluated. Establishment of reserves is aimed at preserving stocks through: (1) maintenance of abundance and species richness in the long term; (2) enhancement of recruitment through reduced disturbance; and (3) formation of fish reserves that colonize depleted areas through adult and larval migrations.

The fecundity of the cichlids *Tilapia rendalli*, *Oreochromis mortimeri* and *Seranochromis codringtoni* in fished areas is much lower than in unfished areas. This may be a sign of stock depletion in the fished areas. Will these areas be stocked by fish from reserves? Clearly this depends on territorial behavior and dispersal patterns of these fishes and studies on these are necessary.

*Limitation on the number and size of fishing gear.* The minimum gill-mesh size allowed is 10 cm. Each fisherman is restricted to a maximum of 250 m of net. The multispecies nature of the fish stocks makes it difficult to determine the proper minimum mesh size of the gear. Although the 10 cm has been found to be optimal for *Hydrocynus vittatus* and for the cichlids *Tilapia rendalli*, *Oreochromis mortimeri* and *Serranochromis codringtoni*, it is not for *Eutropius depressirostris*. Mature *E. depressirostris* are too small to be caught in 10 cm gill-net meshes. For this and similar sized species other catching methods, e.g., traps and baskets, need to be evaluated.

Blasting, as it is a destructive and indiscriminate technique, is not allowed. Spear fishing is permitted only for sport fishing but not for commercial fishing. Hooks and lines are permitted but not much utilized. Active gill-netting, e.g., beach seining is not possible on the Zimbabwean side of Lake Kariba because of rough lake bottoms and the existence of many submerged trees.

*Limitation of the number of fishermen.* Currently, the exact number of fishermen for optimum production and profitable gains is not known. The 600 fishermen are restricted to areas marked $C_1$ to $C_7$ in Fig. 1. It seems that the number of fishermen in this fishery may not be high, judging from the competition for more fishing grounds and the alarming rate of poaching. This points to decreased catch-per-unit effort (CPUE). Measures to reduce the number of fishermen are politically unacceptable, for these same fishermen had already been resettled in a much harsher environment to make way for the formation of Lake Kariba.

*Extension services.* Extension services to the fishermen are inadequate due to shortage of funds and manpower. Yet, extension activities are needed to help fishermen appreciate the implications of trading off short-term benefits for long-term ecological advantages.

*Enforcing laws and regulations.* The measures outlined above would not be effective if the authorities are unable to enforce them. Policing is carried out by the Lake Kariba Fisheries Research Institute. However, what is needed is a strong anti-poaching unit with the sole responsibility of policing the big lake. The situation is not helped by the fact that the poachers are not scared of court action because the small fines they often have to pay are easily recovered from continued poaching.

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**NYAMINYAMI THE RIVER GOD**

*Lake Kariba, although a recent impoundment, is not without folklore. One story concerns the filling of the lake and its effect on the Zambezi River god:*

Here is the story to be told about NYAMINYAMI the river God. He has a body like a snake and a head like a fish. And OH! no one knows how big he is, for he never showed himself in full display. But very big he is that's all we can say.

All the people of the Zambezi Valley were very happy to have their incestrial SPIRIT GOD (MUDZIMU) BECAUSE he did ALL that the people asked for and IN return to their ELLEGIANCE to him.

For many years NYAMINYAMI and his wife stayed safely at KARIBA the spot which was their home and near that spot, that's where it all began. One season when NYAMINYAMI's wife has gone down the mighty KARIBA GORGE to other people of the Valley to answer their prayers and bless her people, the white man came to build a wall.

It took five long years to see it through because NYAMINYAMI DID not want to be disturbed. He caused some floods and loss of life, but at last he was to be kind enough to let the wall to be all complete. It is also believed that the occasional EARTHTREMOR felt in the lake surroundings is caused by this SPIRIT.

It was the work of the Tonga elders and their medium Spirits to persuade the NYAMINYAMI to allow the Zambezi to be tamed. But Shame! NYAMINYAMI was separated from his wife.

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## Conclusion

Researching to get baseline data is a strong tool in formulating management strategies. Current research covers the population dynamics of commercial species, gear technology, social and economic aspects of the fishermen and energy production. Stock assessment is planned to commence soon. More effort in this direction will go a long way in facilitating fishing at sustainable levels. ●