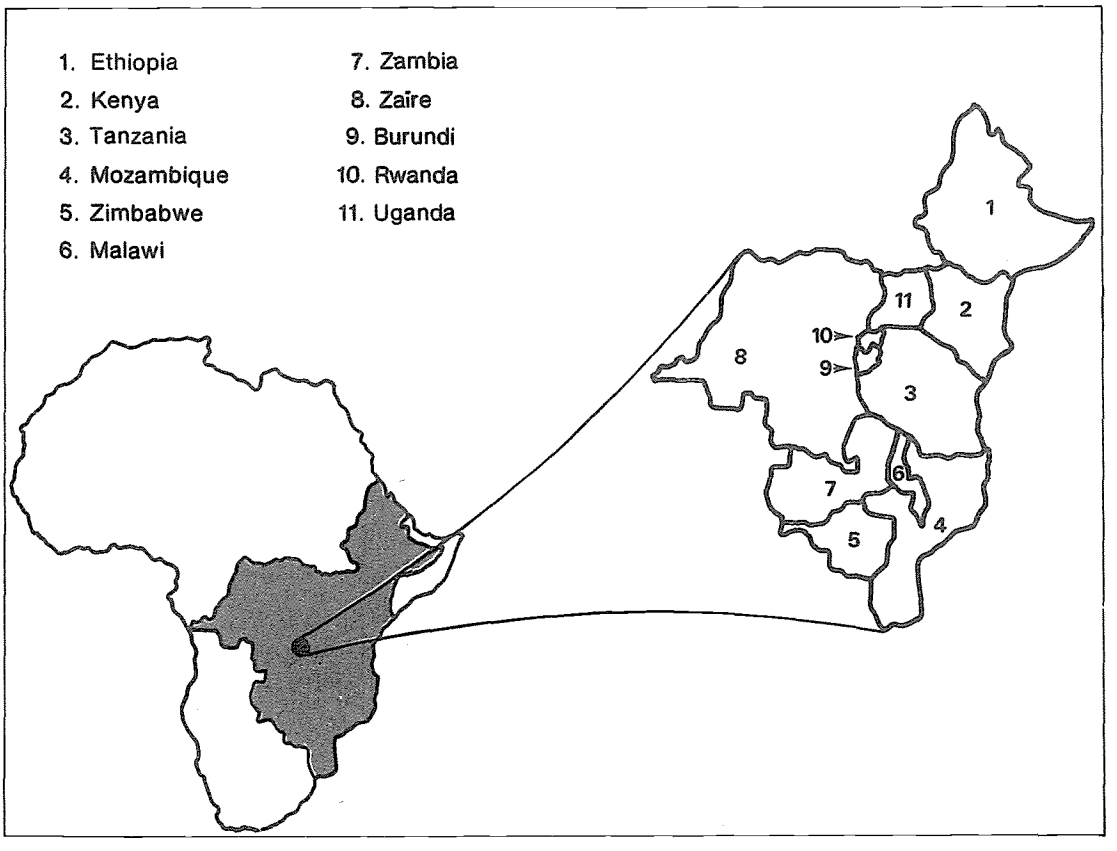
REGIONAL PROJECT FOR INLAND FISHERIES PLANNING, DEVELOPMENT AND MANAGEMENT IN EASTERN/CENTRAL/SOUTHERN AFRICA (I.F.I.P.)

IFIP PROJECT

RAF/87/099-WP/07/91 (En) July 1991

Proceedings of the Symposium on Socio-economic aspects of Lake Victoria Fisheries.

Volume 2 (unedited papers 8-12).



UNITED NATIONS DEVELOPMENT PROGRAMME

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

UNDP/FAO Regional Projěct
for Inland Fisheries Planning
Development and Management in
Eastern/Central/Southern Africa

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UNITED NATIONS DEVELOPMENT PROGRAMME
Bujumbura, July 1991

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PREFACE

The IFIP project started in January 1989 with the main objective of promoting a more effective and rational exploitation of the fisheries resources of major water bodies of Eastern, Central and Southern Africa. The project is executed by the Food and Agriculture Organisation of the United Nations (FAO), and funded by the United Nations Development Programme (UNDP) for a duration of four years.

There are eleven countries and three intergovernmental organisations participating in the project: Burundi, Ethiopia, Kenya, Malawi, Mozambique, Uganda, Rwanda, Tanzania, Zambia, Zaire, Zimbabwe, The Communauté Economique des Pays des Grands Lacs (CEPGL), The Preferential Trade Area for Eastern and Southern African States (PTA) and the Southern African Development Coordination Conference (SADCC).

The immediate objectives of the project are: (i) to strengthen regional collaboration for the rational development and management of inland fisheries, particularly with respect to shared water bodies; (ii) to provide advisory services and assist Governments in sectoral and project planning; (iii) to strengthen technical capabilities through training; and (iv) to establish a regional information base.

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The present document consists of five out of twelve papers which were presented at the Symposium on Socio-economic aspects of Lake Victoria Fisheries or prepared for the Symposium by Tanzanian researchers who due to unforeseen circumstances could not attend. The Symposium was held in Kisumu, Kenya from 25 to 27 april 1990. It was sponsored by the UNDP/FAO Inland Fisheries Planning (IFIP) project and organized in the interval of time separating the Fifth and the Sixth Session of the CIFA Sub-committee for Lake Victoria. The papers presented here are unedited and therefore do not imply the expression of any responsibility for the contents nor any opinion on the part of IFIP.

This is the third publication following from the Symposium. After the report of the Symposium (TD/10/90), the other papers presented at or prepared for the Symposium have been issued in Volume 1 (WP/05/90).

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A series of technical documents (RAF/87/099-TD) related to meetings, missions and research organized by the project.

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MARKETING AND DISTRIBUTION ASPECTS OF LAKE VICTORIA FISHERIES IN UGANDA*

by

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and

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ABSTRACT

Substantial changes have occurred over recent years in terms of the distribution, marketing, and utilisation of fish from the Ugandan portion of Lake Victoria, owing largely to the dramatic proliferation of Nile perch.

Over much of the same period, Ugandan national life has been beset by immense political, social, and economic disruption, the slow and difficult process of recovery from which is still only in its initial stages.

This paper describes the evolution of the fishery and fish distribution in and around the Lake and the present situation with regard to products, marketing channels, and prices. Major problems of fish distribution and marketing are identified and suggestions for future development actions set forth.

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1. INTRODUCTION

Uganda is a country endowed with vast freshwater resources which together cover some 18% of its 241,000 km^2 total land area. The national population amounts to approximately 17 million people (1989 estimate) of whom roughly 90% are reckoned to dwell in rural areas. Population densities vary across the country but most people live in the southern and southwestern regions, where rainfall and soil fertility are more favourable to crop and livestock production. With the exception of Lake Albert, the major water bodies of the country are also found in these regions (map, Fig. 1). Lakes Edward and George lie in the western Rift Valley, close to the Zaire border. Lake Kyoga, occupying a central position between the northern and southern halves of the country, is fed by the River Nile as it drains north from Lake Victoria. The broad expanse of Lake Victoria itself is shared with Tanzania and Kenya, with some 31,000 km^2 or about 45% of its waters lying within Ugandan boundaries (Welcomme 1972).

2. RECENT EVOLUTION OF THE FISHERY AND FISH DISTRIBUTION

2.1 Lake Victoria: New Foodbank for the Nation

The Lake has always been an important source of fish for the people living about its shoreline and within a narrow belt inland. As in the case of the other major water bodies of Uganda, an important commercial fishery based primarily on the gillnet developed on Lake Victoria during the early decades of the present century. Commercial operations on Victoria waters in fact preceded those of the other lakes.

Despite its early development, immense area, and huge potential, the Lake Victoria fishery was for many years not the main contributor to the national catch. Until recently this distinction rested with Lake Kyoga, the smaller and shallower complex of flooded river valleys into which Victoria flows. Comparison of the trends apparent in Fig. 2 (for Lake Kyoga) and Fig. 3 (for Lake Victoria) shows that Lake Kyoga production consistently outstripped that of Victoria from around the late 1960s up to the early 1980s, when the situation reversed itself. Currently (1989 figures) Lake Victoria is accounting for something like 62% of the total annual national catch, whereas Kyoga is contributing about 26%.

The factors underlying this transformation are several. From the mid-1970s, Kyoga fishermen resorted increasingly to the use of illegal gear and destructive fishing practices, owing to the severe shortage of inputs which began to develop in the country from around that time. Not only did the catches start to decline very steeply, but their compositions included higher proportions of smaller fish. The effect on the Nile perch or mputa harvests was particularly felt. Even though recent supply schemes have to some extent corrected the input shortage crisis, there continues to be a lack of larger mesh nets for bigger Lates. Compounding this situation has been an overall decline in the water level of Lake Kyoga over the past decade or so, which has reduced breeding and nursery areas, the deterioration of feeder roads providing access to and from the landings, and a severe disruption of fishing operations from several landing sites due to problems of civil insecurity (Orach-Meza et al. 1989).

Lake Victoria, in the meantime, was following a rather different course

of development. The statistical record depicts a peak in the annual catches occurring in 1969, and then a steady decrease down to a low of around 10,000 tonnes in 1980, at the time when input shortages were hampering all the country's fisheries. From that point on, the explosive increase of mputa in the Ugandan sector of Lake Victoria made itself apparent in spectacular fashion. Starting from a level of less than 1,000 tonnes in 1981, catches of Lates skyrocketed to a level of 101,257 tonnes in 1989, the last year for which returns are available. Earlier harvest levels were thus not only recovered, but were overwhelmingly surpassed. It is interesting also that over the last few years there has been a distinct improvement in tilapia catches (mostly Oreochromis). For 1989, combined Nile perch and tilapia catches accounted for 92% of the total tonnage recorded for the Ugandan sector of the Lake (UFD records). Most of the balance of the total tonnage is made up of the small pelagic Rastrineobola argentea, whose fishery has also been growing quite significantly in recent years.

From a human nutrition point of view, this sudden availability of high quality animal protein must be seen as one of the most fortunate events in the recent history of the country - a history that is otherwise largely marked by episodes of violent political upheavals lasting from the early 1970s until the mid-1980s. These latter at first crippled and then paralysed Government administrative, service, and technical departments as well as the public and private sectors of the economy. The slow and difficult process of recovery from this protracted period of national trauma is well underway, but can be regarded as still being in its initial phases given the magnitude of the task that is called for.

Food production both at farm and processing/manufacturing levels suffered heavily during the upheavals. The national livestock herd was depleted to the point where in many districts there were no animals left to provide a breeding nucleus for eventual recovery. Displacements and forced relocations of people across wide sections of the country meant the crop production was seriously curtailed and even abandoned totally during some intervals. In the midst of the general economic collapse, producer and marketing societies and boards could not cope.

Farmers were unable to obtain basic crop and livestock production inputs and support services; nor were they able to receive adequate payment for the products of their labour. As for the Civil Service, Government officers at all levels found it increasingly difficult to perform their duties. Working conditions and terms of service became untenable, and morale reached a very low ebb.

Through all this, the Lake Victoria fishery - which is to say the Nile perch fishery, basically - assumed the role of a special foodbank for the country. Its bounty proved so prodigious that it could not only compensate for the temporary loss or decline of harvests from other major water bodies, but could actually service an ever-growing demand for fish at a time when meat was becoming increasingly dear and hard to get. Fish consumption has increased to the point that it now probably accounts for 50% of the total animal protein intake of the national population.

2.2 Changes in Established Distribution Patterns

For many decades the populous central and eastern regions of the country received supplies of both fresh and cured fish from Lake Kyoga and the western lakes, in addition to some deliveries from Lake Victoria. Kampala-area markets received daily consignments of fresh tilapia and Bagrus rushed in by pick-up load from landings on Lakes Edward and George. Lake Wamala, a shallow body of water lying some 70 km west of Kampala, was also a major source of fresh fish for city consumers during the 1960s and early 1970s. Basically the pattern of fish flow in the country was such that products tended to move into the central Lake Victoria region from various peripheral points, as depicted in Fig. 4. The figure further shows that some export traffic into Zaire to the west, Sudan to the north, and Kenya to the east, was also a feature of the established pattern of fish flow.

This pattern has been radically altered of late as a result of the Nile perch succession in Lake Victoria, reversals in the fisheries of other lakes, and the political and economic disruptions of the last few decades.

As catches from Lake Victoria based mostly on Lates began to pick up dramatically in the early 1980s, the contribution of other major lakes was falling off due to a combination of factors. The situation with regard to Lake Kyoga has already been mentioned. Lake Wamala's fishery had almost completely collapsed by the mid-1970s. The lake was supposed to operate as a restricted fishery under the close supervision of Fisheries Department. But this management arrangement collapsed under the maladministration and misrule of the Amin regime and the Department was powerless to prevent the activities of legions of unlicensed operators who descended on Lake Wamala and succeeded in fishing it out in the course of only a few years.

Further to the west, the highly productive fisheries of Lakes Edward, George, and Albert in the west were also suffering disruptions. The general breakdown in road communications and the cash economy, as well as the outbreaks of war, cut them off from their traditional major markets for fresh and processed fish in the eastern and central parts of the country - especially Kampala and its environs (Reynolds and Kirema-Mukasa 1989; Reynolds 1990). Despite the fact that the situation has now stabilised and road links to the west and elsewhere have been vastly improved, the transformation in distribution and marketing patterns that were attendant upon the disruptions and the great influx on Nile perch products, both fresh and processed, remains in effect. Indeed, it has if anything intensified. The result in the case of the western lakes fisheries is an almost complete reversal of patterns of trade from the pre-Nile perch days. Lake Victoria is now the hub of supply from which fish flows north, east, and west, as depicted in Fig. 5.

3. PRODUCTS, MARKETING CHANNELS, AND PRICES

3.1 Main Products

The radical changes in catch levels and composition that heralded the beginning of the "Post-Nile perch regime" in Lake Victoria, along with disruption to production, distribution infrastructure and trading networks affecting Lake Kyoga, Lake Wamala, and the western lakes, have had far-reaching consequences for the fish trader and consumer. These have been felt in terms of both species availability and product form.

In terms of the former, the most striking development is of course the appearance of ever-increasing quantities of Lake Victoria Nile perch over the last ten years or so. The availability of other Lake Victoria species in local marketplaces has been mixed. Both the Nile tilapia O. niloticus and the small pelagic Rastrineobola have become more abundant in the marketplace. On the other hand, supplies of such popular fish as Bagrus, Clarias, and Protopterus may have dropped off to some extent, probably due to a combination of factors including a shift in fishing effort and methods by local operators wanting to concentrate more on Nile perch, and changes in stock balances attendant upon the Lates succession (Reynolds and Orach-Meza 1989).

Processing in one form or another is widely practised and has been considerably stimulated within the last ten to fifteen years due to general deterioration in communications infrastructure and the dramatic overall increase in fish harvests from Lake Victoria (TDRI 1983; FISHIN Project Field Observations 1989-1990). Forms of processing include sun-drying, salting, frying, and smoking (Ssali et al. 1990).

Sun-drying is of limited importance, being restricted mainly to the processing of the small pelagic species Rastrineobola argentea (= mukene or dagaa locally), Haplochromis (= nkejje locally), and juvenile tilapia.

Salting is a traditional mode of processing in the fisheries of western lakes, and particularly for Lake Albert. But it is a new method of processing in the Islands of Lake Victoria and is mainly applied on small sized Nile perch. Salted products are not especially popular amongst Uganda consumers, but have always enjoyed a strong demand in Zaire markets.

Frying is becoming a popular method as far as Nile perch is concerned. Fried perch, often prepared in its own oil, is widely sold in the regular municipal markets of urban centres around the lakeshore, has also become an extremely common item in the numerous informal neighbouring street markets that have become a standard feature of city life. Although the frying method is often used to process tilapia in the Lakes Edward-George area, tilapia from Lake Victoria are rarely prepared in this way.

Hot-smoking is by far the most popular processing method and is reputed to provide the best returns to the processor. At many remote island and mainland fishing communities around the Lake, virtually 100% of the catch is smoke cured, since consignments must be bulked and stored to await transport to markets (TDRI 1983; FISHIN Project Field Observations 1989-90).

In addition to these local methods of curing are those practised in the rapidly developing industrial fish processing sector. Several small-scale plants have been established to process specialised fish products. These are intended mainly for export abroad, but are supplied to premium local markets (hotels, the diplomatic and expatriate community, and others of the urban elite) to some extent as well. Items handled include fresh chilled and frozen fillets and Nile perch and tilapia, fresh chilled and frozen whole fish, cold- and hot-smoked fillets, and sun-dried Nile perch swim bladders (Reynolds and Ssali 1990).

1.2 Marketing Channels

The changes in species composition of the catches in Lake Victoria attendant upon the upsurge of Nile perch, in combination with the disruption in beef and other meat supplies which followed the breakdown in infrastructure and administration and management services during the years of turmoil experienced in the country, have promoted a marked rise in fish consumption per capita within Uganda in recent years. It is now estimated to stand at about 12 kg per year. Along the lakeshore and in major urban consuming centres, and particularly Kampala, per capita consumption reaches far higher levels, of course - probably on the order of 50-60 kg.

Tilapia and Nile perch are the most widely available fish in Uganda; fresh or processed, they are almost universally accepted and appreciated within the country's fish-eating population. Although it is probably the tilapia or ngege that is most liked of the two, Nile perch has proven to be highly popular with consumers. There is no substance whatever to allegations made in some scientific literature and many popular press accounts that this fish is not liked by local people (see, e.g. Barel et al. 1985).

The distribution of fresh fish is mostly restricted to the fringe zone around the Lake, since prevailing temperatures and conditions make it difficult to supply areas further afield. Yet because major urban centres (e.g. Kampala, Entebbe, Jinja, Busia, and Masaka) lie within this belt, a substantial proportion of the country's fish-consuming population enjoys ready access to fresh fish.

Table 1 provides an indication of the proportions of fish marketed fresh versus cured in the districts covered by the market survey conducted by the FISHIN project team during the months of July-September, 1990. It is obvious that in places where access to markets from landing sites is fairly easy, the proportion of fresh sales to processed sales is very high. In districts like Luwero (Entebbe Region) and Masaka (Masaka Region), for instance, over 90% of all fish sales entail fresh product. Where access is problematical, the reverse holds true. Thus, in Kalangala District (the Ssese Islands), fully 78% of all sales are in processed fish.

Table 2 and 3 give the respective breakdowns for all fresh and processed fish sales by species composition in the same districts, based on UFD Regional Fisheries Officers' returns for 1988-90. The pre-eminence of tilapia and Nile perch in the marketing system is obvious.

Marketing of Lake Victoria fish proceeds through a series of stages and a wide variety of sites. Usually the primary stage takes place at the landing sites, when canoes return from the fishing grounds and discharge their catches to waiting traders, processors and consumers. In some cases, however, fish can be sold directly on water to those operating collection boats.

Linkage between the producer and the consumer is mostly effected through private small-scale traders who operate to and from local landing sites on foot, bicycle, or by lorry, pick-up, taxi, or other public transport. Lake Victoria is connected with good roads to major urban centres. Domestic markets for fresh fish include Kampala, Masaka, Rakai, Jinja, Tororo, Busia, Mbale, Mityana, and Luwero. The smaller trading centres along the supply routes should also be counted as important marketing points, as indeed should most areas that lie within a radius of fifty kilometers from the landings - a

distance that can be traversed by a determined bicycle trader. Smoked and sun-dried fish reaches even greater distances and is greatly featured in the inter-regional trade with the neighbouring countries of Zaire and Kenya.

Whatever the location of domestic marketplaces, whether at landings, in small rural communities, or within formal premises operated by large municipal councils, their handling facilities and sanitary and other amenities are for the most part highly deficient. An enumeration of basic features during the 1990 FISHIN market survey yielded the results shown in Table 4. Although most marketplaces have raised display/selling platforms of some sort (stalls or tables, usually of temporary construction), at less than half the sites surveyed are those protected with any kind of shelter. Such facilities as off-loading platforms, cleaning benches, dry-storage, tap-water, and electricity facilities are found in less than 10% of the markets surveyed. Markets in larger urban areas are somewhat better equipped, but in general it is the absence rather than the presence of basic facilities and amenities that is striking to the observer.

Major Kampala supply routes were estimated some years ago to be handling about 5,500 tonnes p.a. via Masaka-Kampala, and 3,000 tonnes p.a. via Jinja-Kampala (TDRI, 1983). This was during a time when Kampala was still receiving at least some supplies from other lakes in the country. Currently it only receives supplies from Lakes Kyoga and Victoria and very occasionally from Lake Albert. Even so, records indicated that the supply to Kampala has increased substantially over the 1982/84 level, and is now in the neighbourhood of 10-12,000 tonnes per annum.

Kampala still receives a relatively small supply of fresh Nile perch from Jinja but the major suppliers to the city are the landings in Entebbe and Mukono area. Fresh fish from Lake Kyoga are almost exclusively tilapia, and constitute only about one-third of the total fresh tonnage annually delivered to the capital. The city has two wholesale markets specialised in handling fresh fish and two for smoked products. Wholesalers who transport loads from the landings sell to market-based wholesalers and retailers. Fish is then sold to consumers either direct from the market stalls or by retailers on bicycles who work neighbourhoods on a door-to-door basis. At the wholesale level fish is sold by auctioning, whereas in retail trade it is sold by size. The exception is Nile perch, which is sold by weight.

The distribution channels for processed products are generally longer since most of the smoking is done on the islands and the markets are more remote. Inter-regional trade in smoked products is dominated by the lorry and pick-up traders. Today most of the smoked fish originating around the Masaka-Bukakata area is taken to Zaire. That which originates around the Jinja area is mostly destined for Tororo, Busia and Kenya. Another route of considerable significance is the one across the water to Kenya, whereby Ugandan fishermen exchange their fish with their Kenyan counterparts for cash as well as manufactured goods (TDRI, 1983; SEC Fld Rpts. 1989/90).

The different avenues through which fish may ultimately reach the consumer, directly or indirectly, formally or informally, are diagrammed in Fig. 6.

3.3 Prices and Recent Trends

Indices of average fresh and processed fish prices in the various districts of the country derived from the recent FISHIN market study are provided in Tables 5 and 6 respectively. Several noteworthy points are brought out. For one thing, tilapia prices are uniformly higher than those for Nile perch. Also, relatively high prices for particular types and forms of fish correspond with known consumer preferences in certain districts, as for instance in the case of Bagrus in Kampala and nearby Mpigi, or of Clarias in Masaka and neighbouring Rakai. It can be seen too, not surprisingly, that places of high fish production and limited demand have correspondingly lower price levels. Fresh tilapia is cheapest in Kalangala District where it sells for only 23% of the Kampala price. Kalangala comprises the Ssese Islands, lying in the middle of some of Lake Victoria's richest fishing grounds. It is from here that many of the major mainland markets get their supplies. Prices for Rastrineobola, which now rank as the third most important commercial fish in Lake Victoria after Nile perch and tilapia, show a similar pattern of being low in production areas where an abundance exists (Jinja and Kalangala Districts), and two or three times greater in non-production/high demand areas (parts of Mukono and Kamuli Districts). The very high prices commanded by Alestes and Haplochromis would seem to make them objects of heavy consumer demand and therefore attractive targets of fishing effort. In fact the cured Alestes appearing in the Kampala markets comes from Lake Albert and is sold only in limited quantities. Dried Haplochromines from Lake Victoria and neighbouring lakes, despite their high cost when computed on a weighted basis, are generally skewered onto small sticks and offered to customers in this form. They attract only a limited clientele. The sticks are mostly purchased a few at a time, so that any one transaction actually involves very little money.

The main form of animal protein with which fish competes are beef,pork,mutton,goat meat,milk,poultry,and eggs. Based on available data (MAIF 1989; MPED 1990a),per capita annual consumption of fish is 12 kg,as compared with 3.8 kg for beef,2.7 kg for pork/mutton/goat,1.0 kg for milk(liquid measure).

Although meat and poultry products are probably on the whole more sought-after by Uganda consumers, they are also far more expensive. The comparatively low price of fish is undoubtedly the main reason that it is eaten in much greater quantities than the other forms of animal protein.For this reason fish is often referred to as the cheapest and most important source of animal protein in Uganda. Indicative Kampala area prices (Fourth Quarter ,1990) are given for all forms of animal protein in Table 7. Groundnuts, beans,and peas,all regularly used as alternative protein-rich non-meat ingredients of the sauces served as accompaniments to starchy foods,are included in the list for comparison. A protein cost index is also included in the table.Both Nile perch and tilapia perform extremely in term of these measures,with the former proving especially attractive in term of customer cost considerations.

A further point to note is that even though the cost of fish gradually increases over time, along with nearly everything else, its recent increases have not been as steep as those for meat and poultry. According to Kampala Consumer Price Index figures, from January 1989 through September 1990 prices for the latter two items went by about 52% , compared to a figure of some 28% for fish (MPED 1990).

4. DISCUSSION : PROBLEMS IN DISTRIBUTION AND MARKETING

Whereas recent development in the Lake Victoria fisheries of Uganda have been quite beneficial in terms of income,employment,and nutrition within the country, certain problems in distribution and marketing must be recognised as well. Their resolution could make it possible for the fisheries to continue to make valuable contributions to national welfare , and even to expand upon them.

4.1 Handling and Distribution Problems

Lack of adequate transport infrastructure is the single greatest obstacle to more effective fish marketing and utilisation in Uganda today. Access roads to landing and rural marketing areas are in poor condition and are often impassable during periods of rain. This confines the distribution of fresh fish within a fairly limited range around the lakeshore, usually extending inland no more than 50 km or so, or the distance that can be penetrated by bicycle traders. Bad roads also increase the marketing cost margins that transporters and wholesalers have to recover in their operations.

The poor treatment to which fish is subjected at the landings and through the distribution network is another area for concern. Fish are roughly handled from the moment they are taken from the net and thrown in the bottoms of canoes. At the landings catches may be tossed on the ground, washed and/or gutted in highly unsanitary conditions, and packed into vehicles with much crushing, bruising, and breaking. Very frequently a load of fish in the back of a pick-up destined to market is used as a cushion for other heavy items and passengers to rest upon. Once in the market place, fish is subjected to conditions which only compound the chances of product damage and spoilage. Although operators and traders could do much to improve such practices on their own, it must also be recognised that most of the handling facilities and infrastructures at landing sites and municipal markets are in extremely deteriorated condition. Maintenance of such services is usually the responsibility of local government authorities, either district or municipal, and they levy cesses and taxes on landing site and marketplace users ostensibly for the purpose of meeting this responsibility.

4.2 Developing Demand for Fish Products

Fish avoidance is found in some parts of the west and in the northwest of the country, and there are localised patterns of preference and avoidance when it comes to particular species in the central region around Lake Victoria. By and large, however, consumer acceptability of fish rates extremely high in Uganda and there are no real constraints on demand in this sense.

At the same time there exists some potential for market development with respect to certain kinds of products. In particular there is the case of the small pelagic Rastrineobola argentea or mukene. This has been a very underutilised species in Uganda even though it supports a strong and productive fishery in the Kenya and Tanzania parts of Lake Victoria. As mentioned previously, the last few years have seen an increase in mukene fishing in Uganda waters and this trend should be encouraged. Much of the catch now goes to the animal feeds industry, but there is a good market for the dried fish in northwest Uganda, eastern Zaire, southern Sudan and Kenya as well. Crushed mukene makes a good base for sauce to accompany starchy

dishes, and is increasingly being used for such around the fringes of Lake Victoria. Another way in which mukene can be popularised is as a fish powder supplement to be mixed with maize and cassava flour. The use of dried nkejje (haplochromines) in this way is a well-established practice in some localities. Porridges prepared with such a mixture have particular value as infant weaning foods.

4.3 Potential Problems of Supply

The rapid expansion of the Nile perch fishery has been marked not only by heightened activity in the artisanal sector, but by the growth of industrial processing plants as well. In Kenya this growth has been particularly vigorous, even though that country has access to a relatively small portion (6%) of Lake Victoria. One result of this has been the development of a large traffic in smuggled fish from Uganda waters to meet the raw material requirements of the Kenya plants. With several Ugandan-based processing concerns now in operation and more slated to come on line, the industrial sector demand for fresh fish is bound to increase. This has several implications for the future directions in the fishery. For one thing, it is likely that ever-greater fishing pressure is going to be placed on the resource base. Since it is not known how much further pressure this base can withstand before reaching a point of overexploitation, there is cause for concern over the rapid expansion of plant capacity.

Another aspect that must be considered is the likely effect on ex-canoe fish prices as the larger commercial concerns compete at the landings with local traders for their daily fish requirements. Assuming a fairly constant level of supplies coming out of the water, beach prices will probably escalate quite rapidly from their present levels. Local traders and processors cannot be expected to mobilise the working capital to compete very effectively in a bidding contest with firms seeking fish for the high-value export trade. Unfortunately one option to which local traders might increasingly resort under these circumstances is to concentrate on undersized or juvenile fish,i.e products that are not in high demand by the industrial sector. Juvenile tilapia and Nile perch are already being caught in appreciable quantities though the operation of illegal and destructive gear like beach seines and cast nets, as is borne out by their appearance in many rural market places.

Ultimately it is of course the domestic consumer who will have to bear the burden of higher prices.It would no doubt prove a quite distressing burden to many, given the great importance of fish in local diets and its current status as a far cheaper alternative to meat.

5. PRIORITIES FOR ACTION : RECOMMENDATIONS

Several courses of action warrant consideration as ways of helping to resolve the problems and potential problems just reviewed. Since these problems are themselves interrelated, measures taken to deal with them should not be taken piecemeal, but as part of an overall programme.

5.1 Infrastructure and Handling Practices

5.1.1 Feeder roads

High priority should be placed on rural feeder road rehabilitation and development at both ends of the fish distribution system.

More convenient and reliable access to landing sites and collection points along the shoreline of Lake Victoria would reduce the uncertainties and costs associated with the evacuation of both fresh and processed fish. In marketing areas, better roads would mean a more efficient and wider circulation of fish to areas where demand is high. In particular , it would increase the marketing radius for fresh fish, which is usually more profitable to sell and is nearly always preferred over cured products by consumers in the hinterland when there is a choice.

5.1.2 Landing sites and markets

At the same time a concerted effort needs to be put into the task of improving both the facilities and the practices associated with fish transport and handling. Projects with these same objectives have been mounted in the past or are now ongoing, with mixed results (Reynolds and Ssali 1990; Ssali et al. 1990). One problem with past projects is that they have tended to concentrate on solutions that require large outlays of capital for the acquisition of expensive and complex machinery. What is needed now is an approach that would bring about substantial improvements in fish distribution and marketing efficiency through more straightforward and less costly means.

Aside from good access roads, the immediate needs of most landings and market places are very basic: clean and sheltered receiving and handling areas; secure dry-storage space; reliable and protected supplies of water; and simple sanitary amenities. Beyond this it is more a question of encouraging good fish handling practices by fishers and traders than of elaborate physical facilities like ice plants and insulated trucks.

Short- to medium-term planning for the integrated development of the post-harvest sector of the Lake fisheries should accordingly be oriented towards the provision of basic services rather than complex and expensive installations.

This approach should be implemented on a pilot project basis at a few key market sites. The project would have to combine a scheme of infrastructural improvement with solid backstopping by fish technology and marketing officers of the Fisheries Department.

Of utmost importance for sustainability in the long term,the scheme should also involve the development of an effective system of revenue generation and accountability for the upkeep and development of market facilities. Present arrangements through local authorities are clearly inadequate.

5.2 Promotion of Rastrineobola

There is good scope to develop the fishery of Rastrineobola and this could be promoted on the marketing side through extension and demonstration efforts by Fisheries Department field staff working in conjunction with their

colleagues in Health and Agriculture. This could yield high nutritional benefits for young children in particular.

The use of dried Rastrineobola prepared in powder form as a protein supplement for mixing with common starchy staples like maize meal and cassava flour, or crushed as an ingredient in the sauces generally served as an accompaniment with such foods, should be encouraged through a major publicity and extension effort.

5.3 Commercialisation and Sustained Development

The establishment of filleting plants producing for the high-value export trade is a welcome development insofar as these large commercial concerns will generate forex earning without unduly distorting current levels of resource exploitation and the continued availability of fish at affordable prices on the domestic market. However, there is cause for concern that such distortions may well occur since plant capacity is steadily growing with no sign of tapering off.

A policy on the development of industrial processing plants needs to be delineated as soon as possible in order to avoid a situation of over-capacity. Such a policy should clearly spell out the aims and limits of industrial growth vis-a-vis the interests of small-scale traders and local consumers of fish products.

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APPENDIX 1. TABLES

Table 1. PROPORTION OF FRESH VS PROCESSED FISH PRODUCTS MARKETED WITHIN SURVEY DISTRICTS, 1990

DISTRICT	% FRESH	% PROCESSED
KAMPALA	63	37
LUWERO	96	4
MPIGI	66	34
MUKONO	36	64
ENTEBBE REG. (District Avg)	65	35
IGANGA	40	60
JINJA	20	80
KAMULI	31	69
JINJA REG. (District Avg)	30	70
TORORO REG. (Tororo Dist.)	33	67
MASAKA	91	9
RAKAI	74	26
MASAKA REG. (District Avg)	83	17
KALANGALA REG. (Kalangala Dist)	22	78
ALL REGIONS	47	53

Source: FISHIN Market Survey, 1990.

Table 2. FRESH FISH SALES BY SPECIES COMPOSITION (% WEIGHT), SAMPLED MARKETS, 1990.

DISTRICT	TILAPIA FRESH	LATES FRESH	BAGRUS FRESH	CLARIAS FRESH	BARBUS FRESH	PROT FRESH	MORM FRESH	RASTR FRESH	TOTAL %
KAMPALA	34.5	64.4	0.2	0.8	0.0	0.1	0.0	0.0	100.0
LUWERO	74.0	26.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
MPIGI	27.0	69.0	0.3	0.4	0.1	3.0	0.2	0.0	100.0
MUKONO	70.0	29.0	0.3	0.5	0.1	0.1	0.0	0.0	100.0
IGANGA	49.6	50.0	0.0	0.3	0.0	0.1	0.0	0.0	100.0
JINJA	25.0	73.6	0.4	0.6	0.1	0.2	0.1	0.0	100.0
KAMULI	67.0	29.0	4.0	0.0	0.0	0.0	0.0	0.0	100.0
TORORO	45.1	53.3	0.0	0.8	0.0	0.8	0.0	0.0	100.0
MASAKA	12.5	86.0	0.3	1.0	0.0	0.0	0.0	0.0	100.0
RAKAI	27.2	65.8	0.3	3.3	0.7	2.7	0.0	0.0	100.0
KALANGALA	10.0	77.0	2.0	3.2	0.3	0.5	0.0	7.0	100.0
TOT. LAKE VICTORIA	40.2	56.6	0.7	1.0	0.1	0.7	0.0	0.6	100.0

Source: UFD Regional Fisheries Office Reports.

Table 3. PROCESSED FISH SALES BY SPECIES COMPOSITION (% WEIGHT), SAMPLED MARKETS, 1990

	S P E C I E S									
DISTRICT	TILAPIA CURED	LATES CURED	BAGRUS CURED	CLARIAS CURED	BARBUS CURED	PROT CUR.	MORM CURED	RASTR CURED	HAP. CUR.	TOT. %
KAMPALA	64.0	27.0	4.0	0.0	0.0	0.4	0.6	3.6	0.4	100.0
LUWERO	79.0	21.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
MPIGI	12.0	80.0	0.6	0.1	0.1	0.0	0.0	7.0	0.2	100.0
MUKONO	24.0	58.5	2.5	2.0	0.0	0.0	0.0	12.7	0.3	100.0
IGANGA	2.3	82.4	0.0	0.2	0.0	0.1	0.0	15.0	0.0	100.0
JINJA	10.0	39.0	0.0	0.0	0.0	0.0	0.0	51.0	0.0	100.0
KAMULI	39.0	48.0	0.0	0.0	0.0	1.0	0.0	12.0	0.0	100.0
TORORO	22.0	63.5	0.0	0.0	0.0	0.5	0.0	14.0	0.0	100.0
MASAKA	43.0	46.7	0.4	1.1	0.0	0.0	0.0	8.1	0.7	100.0
RAKAI	5.1	61.2	0.0	4.0	0.2	0.0	0.0	24.0	5.0	100.0
KALANGALA	10.0	89.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	100.0
TOTAL LAKE VICTORIA	28.2	56.0	0.7	0.7	0.0	0.2	0.1	13.5	0.6	100.0

Source: UFD Regional Fisheries Office Reports.

Table 4. MARKET FACILITIES, SURVEY DISTRICTS, 1990

DISTRICTS	TOTAL NO.OF MKTS	NO. OF MARKETS WITH FACILITIES OF: TAP WATER	ELE- CTR.	ICE PLAN.	COLD STO.	DRY STO.	OFF- LOAD	CLEAN. TABLES	PERM. STA- LLS	TEMP. STALLS	PERM. SHEL.	TEMP. SHEL.	LOCAL KILNS	CHO- RKOR	DRY RACK	TOIL/ LAT.	TEL.
KAMPALA	54	12	7	0	0	2	2	21	6	38	10	15	4	0	0	37	1
LUWERO	7	0	0	0	0	1	0	0	0	0	0	2	2	1	0	6	0
MPIGI	57	3	7	0	0	0	1	11	3	24	8	19	3	0	0	2	0
MUKONO	34	2	6	0	0	1	3	2	5	27	5	21	2	0	1	0	0
IGANGA	49	0	1	0	0	0	2	2	1	38	2	25	3	1	2	1	0
JINJA	28	6	3	0	0	0	1	1	0	26	4	5	0	0	0	0	0
KAMULI	10	0	0	0	0	0	0	0	0	10	1	3	0	0	0	0	0
TORORO	82	3	7	1	0	5	3	3	2	66	10	31	0	1	0	4	0
MASAKA	70	2	5	0	0	2	1	0	1	39	1	31	9	0	0	16	0
RAKAI	31	0	0	0	0	1	5	0	1	29	0	7	1	0	0	21	0
KALA-NGALA	20	0	0	0	0	0	0	0	0	0	0	0	19	1	0	0	0
TOTALS	442	28	36	1	0	12	18	40	19	297	41	159	43	4	3	90	1

Source: FISHIN Markets Survey, 1990.

Table 5. FRESH FISH PRICE INDICES, SURVEY DISTRICTS, FOURTH QUARTER 1990*

DISTRICTS	TILAPIA	LATES	CLARIAS	BAGRUS	PROT.	BARBUS	MORM.
KAMPALA	100	80	115	170	65	0	0
LUWERO	75	88	0	0	0	0	0
MPIGI	115	70	100	142	60	63	88
MUKONO	85	65	88	120	32	70	0
IGANGA	67	65	105	0	40	0	0
JINJA	90	70	92	85	50	63	70
KAMULI	90	77	0	80	0	0	0
TORORO	97	80	97	0	88	0	0
MASAKA	95	77	80	70	70	0	0
RAKAI	95	75	82	82	75	75	0
KALANGALA	22	17	25	50	22	0	0

* BASE PRICE: KAMPALA TILAPIA 400Shs/kg = 100.

Source: FISHIN Market Survey, 1990.

Table 6. PROCESSED FISH PRICE INDICES, SURVEY DISTRICTS, FOURTH QUARTER 1990*

DISTRICT	TILAPIA	LATES	CLARIAS	BAGRUS	PROT.	BARBUS	RASTR.	ALESTES	HAPLO
KAMPALA	100	77	0	208	117	0	55	247	215
LUWERO	83	70	0	0	0	0	0	0	0
MPIGI	134	91	9	189	0	0	49	0	189
MUKONO	89	60	74	57	0	0	85	0	198
IGANGA	51	62	83	0	30	0	66	0	0
JINJA	79	77	0	0	0	0	36	0	0
KAMULI	102	81	0	0	38	0	98	0	0
TORORO	92	81	0	0	102	0	64	0	0
MASAKA	92	72	155	75	0	0	66	0	126
RAKAI	123	72	115	0	0	0	64	0	221
KALANGALA	53	36	0	0	0	0	28	0	0

* BASE PRICE: KAMPALA TILAPIA 530shs/kg = 100.

Source: FISHIN Markets Survey, 1990.

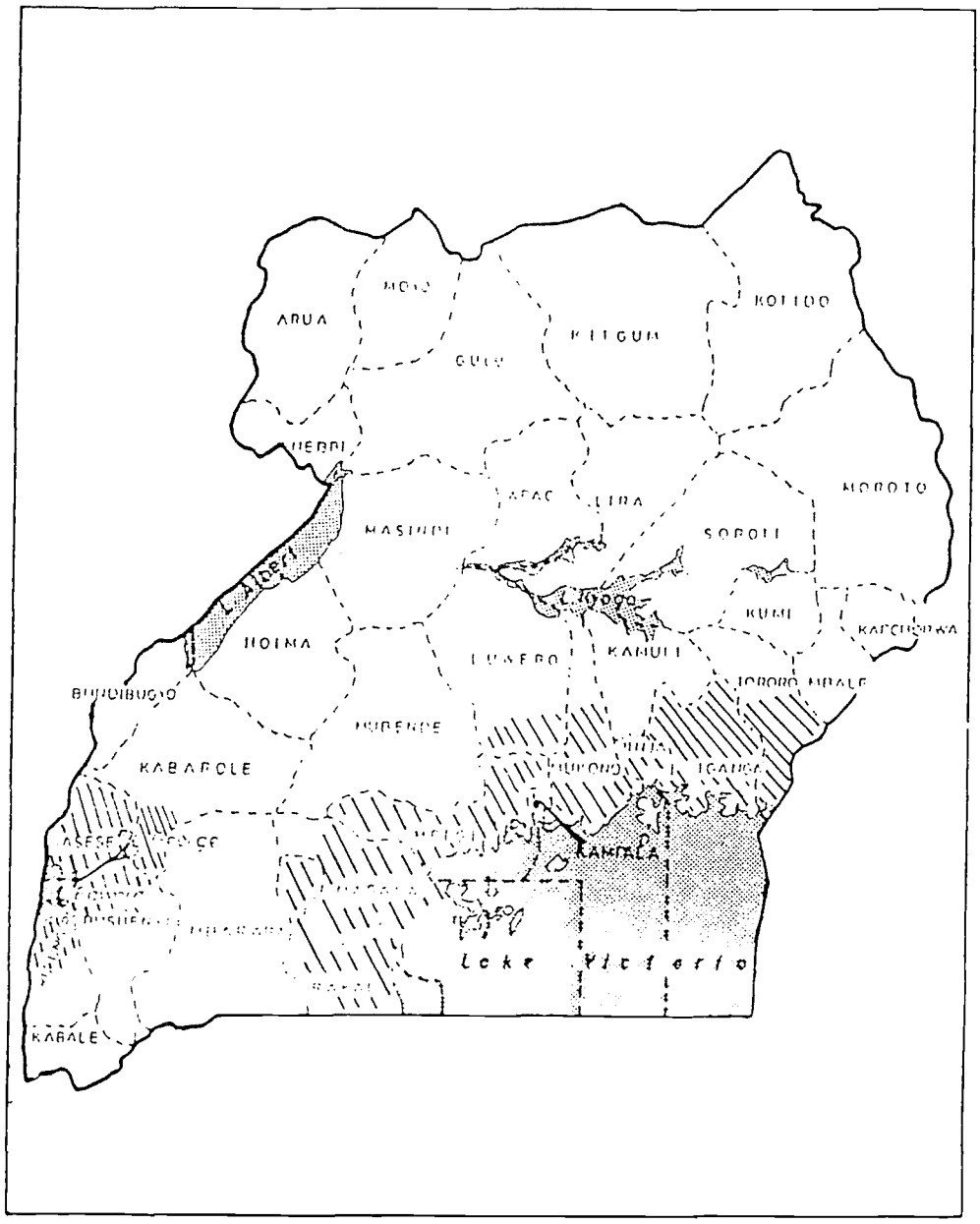
Table 7. PROTEIN COST INDICES FOR MAJOR FOOD ITEMS, KAMPALA, FOURTH QUARTER 1990

PRODUCT	PRODUCT PRICE Ushs/kg	PRODUCT % PROTEIN CONTENT	PRODUCT PROTEIN Grams/kg	PROTEIN COST INDEX Ushs/100g	PROTEIN COST EQUIVAL. TO FISH (N/PERCH)
BEEF	600	19.0	190	316	2.00
PORK	500	18.0	180	278	1.76
MUTTON	700	17.0	170	412	2.61
GOAT MEAT	700	17.0	170	412	2.61
CHICKEN	1200	18.0	180	667	4.22
MILK	200	3.5	35	571	3.62
EGGS	2880	13.0	130	2215	14.02
FISH					
TILAPIA	400			211	1.33
NILE	300	19.0	190	158	1.00
PERCH		19.0	190		
BEANS					
DRIED	150	22.0	220	68	0.43
COOKED, DRAINED	150	7.0	70	214	1.36
PEAS					
DRIED	200	23.0	230	87	0.55
COOKED, DRAINED	200	5.0	50	400	2.53
GROUNDNUT					
DRIED	300	26.0	260	115	0.73
BOILED	300	15.5	155	194	1.20

Sources: FISHIN Market Survey, 1990.
USDA 1975.

APPENDIX II. FIGURES

Figure 1. DISTRICTS OF UGANDA*



* Hatched areas are those covered by the FISHIN Markets Survey, 1990.

Source: UNICEF, 1989.

FIG. 2: EST. TOTAL ANNUAL CATCH, L.KYOGA (1961-1989)

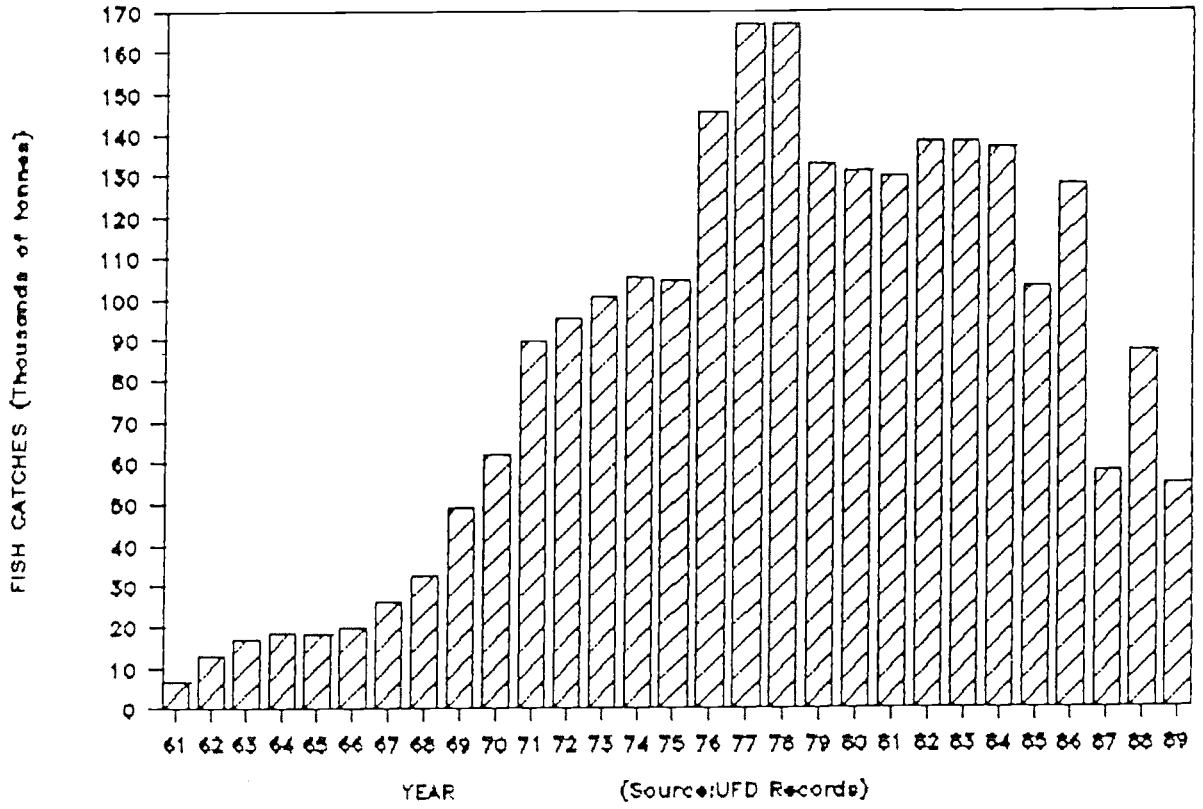


FIG. 3: EST. TOTAL ANNUAL CATCH, L.VICTORIA (1961-1989)

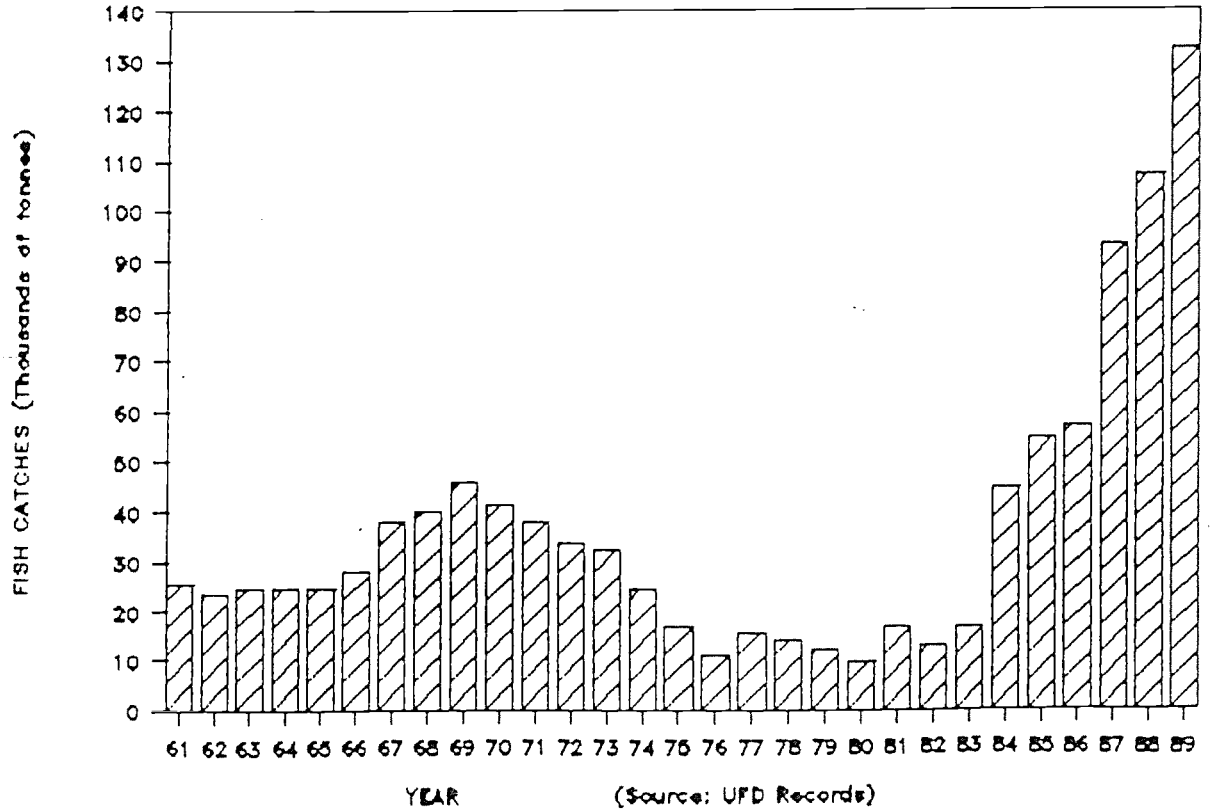
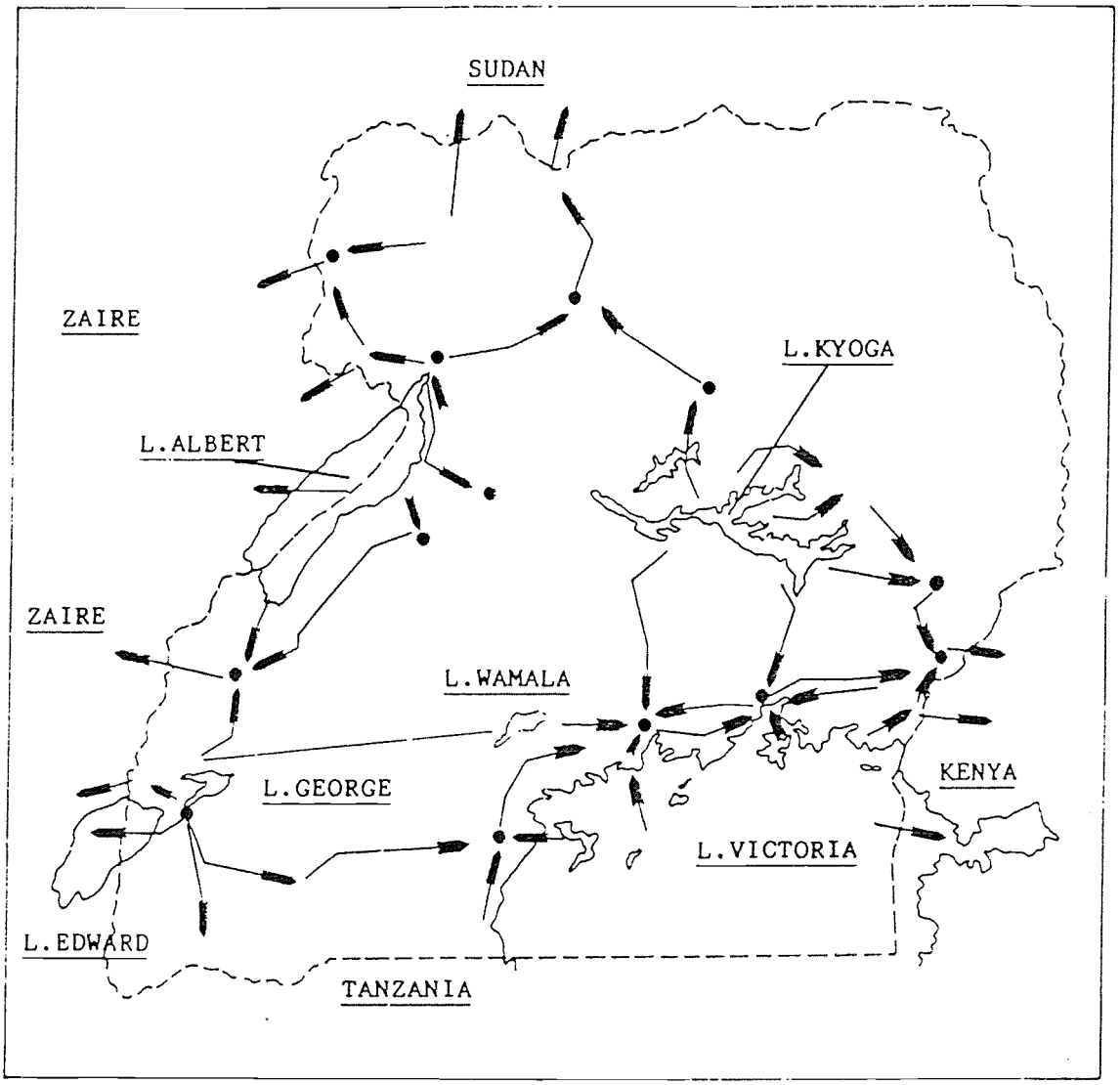
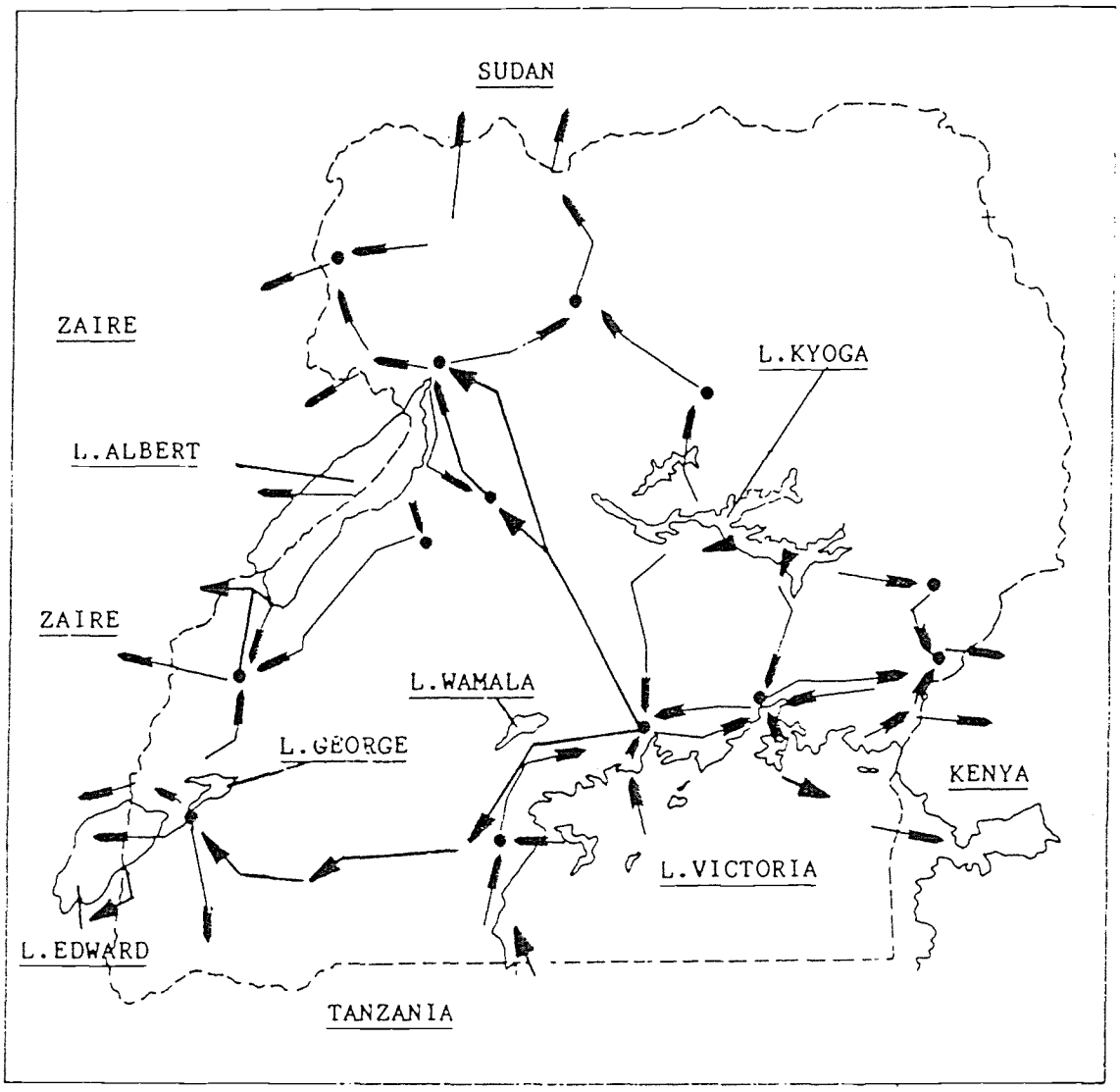


FIG. 4: FISH DISTRIBUTION PATTERNS, PRE-1983



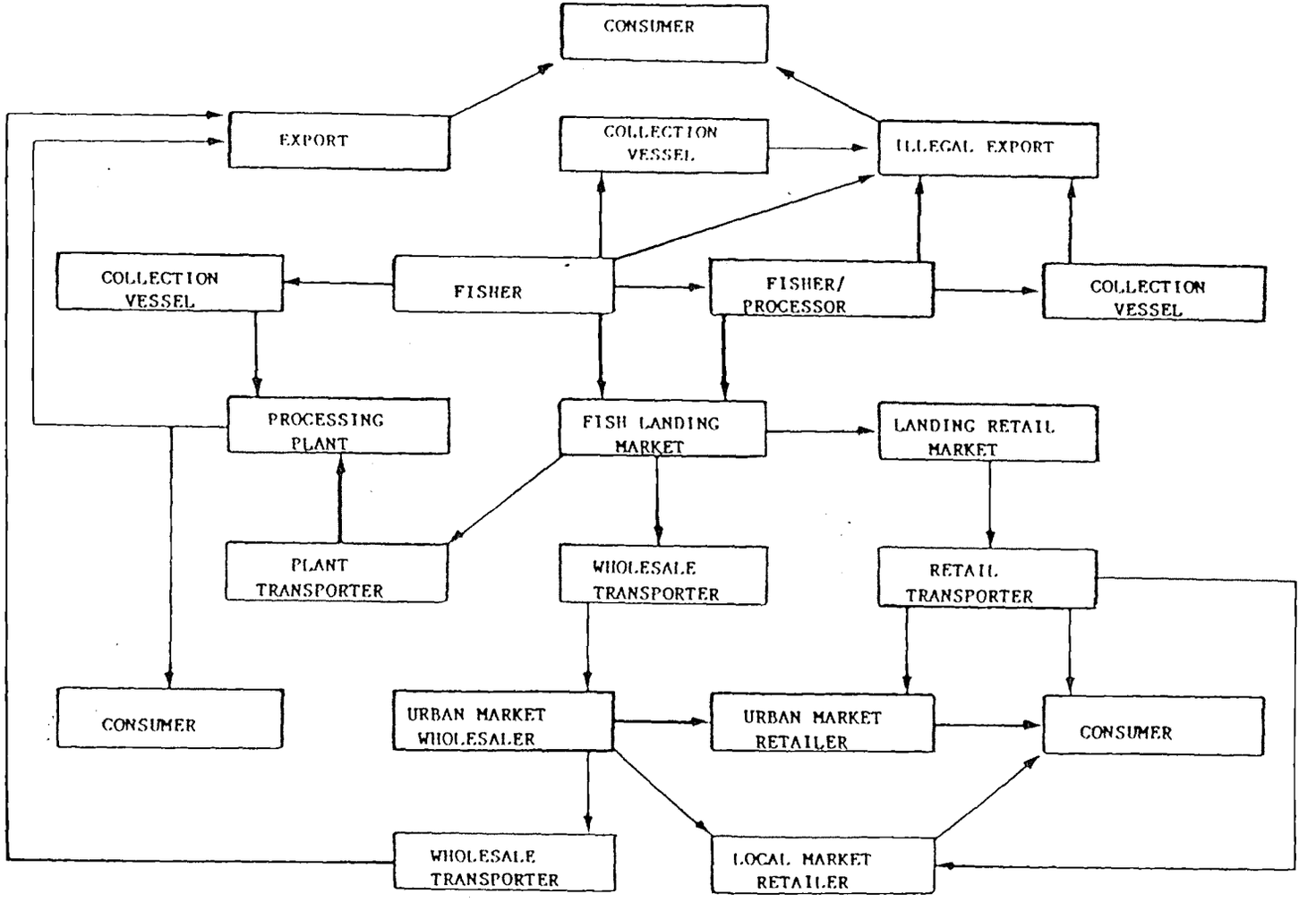
Source: Adapted from Balarin, 1985.

FIG. 5: FISH DISTRIBUTION PATTERNS, POST-1983



Source: Adapted from Balarin, 1985.

FIG. 6: FISH PRODUCER-CONSUMER LINKAGES, UGANDA 1990



Source: *Adapted from Balarin, 1985.*

HARVESTING : SOCIO-ECONOMIC ASPECTS OF THE TILAPIA, NILE PERCH AND PELAGIC FISHERIES (RASTRINEOBOLA)

by

J. S. Mbuga

ABSTRACT

Lake Victoria fisheries which are predominantly artisanal and now focussing on Nile perch (Lates niloticus), dagaa (Rastrineobola argentea) and Oreochromis species (tilapia). The socio-economic impact of these fisheries is been assessed in light of a cost-benefit analysis of each fishing unit.

The evolution of the current fishing gear and methods employed in harvesting the three commercial species is reviewed.

The growing number of merchant fish traders with at present five operational processing plants effectively exert constant pressure on standing stocks.

The new export market has helped to revitalize fishermen cooperatives and to establish a steady high demand. However the local market suffers shortages, especially of Nile perch and tilapia.

As a result of the excessive demand, if fishing effort is left unchecked, there will soon be acute overfishing that would automatically check down commercial investment and result in financial losses. Presently fishing grounds have been shifting from shallow waters into deeper areas. Size composition of the stocks in terms of age groups are declining fast, in connection with the use of smaller meshed nets.

Financing of the fishing units have remained to be the concern of individual investors who may negotiate bank, mortgage or savings and credit cooperative loans. In other cases, fishermens savings or family arrangement (where relatives live in urban areas) finance their relatives back home. It involves a socio-economic fabric that characterizes African socialism that maintains extended families without social security insurance arrangements.

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1. INTRODUCTION

1.1. State of the Fisheries

The part of Lake Victoria belonging to Kenya has always been a rich fishing ground due to the numerous drainage channels that bring abundant nutrients from the hinterlands (see Figure 1). Once a rich multispecies fisheries comprising Tilapines, Haplochromine, Rastrineobola, Bagridae, Claridae, Schilbe, Synodontidae, Protopterus, Momaridae, Alestes, Labeo and Barbus species; it is now reduced to only three major species: Nile perch (Lates niloticus) (Engraulicypris or Rastrineobola) dagaa and tilapia (Oreochromis niloticus).

The multispecies fisheries had a large standing stock of Haplochromis, tilapia and Bagrus but the latter species were over-exploited. The average catch between 1968 to 1977 (see Table 1) was 15,000 metric tons and was predominantly artisanal. However, it provided a livelihood for about 20,000 families providing artisanal employment in boat construction (see Table 2), fish processing and marketing (mainly by women), net making and repair.

A catalogue of gear used to date is given in Table 3. Some of the gear traditionally used have now been abandoned. These include 7/8" gill nets used for catching Haplochromis, 2 1/2" gill nets used for catching Synodontis, Labeo and Mormyrus and 4" gill nets, used for catching the smaller Tilapines such as Esculenta, Variabilis Zillii and Leucosticta.

In most tropical waters, multispecies fisheries usually comprise sparse stocks which are in most cases, of low economic value. However they only require generally cheap fishing equipment which can be afforded by the low income groups present[1]. Haplochromis, Rastrineobola, Synodontis, Alestes, Schilbe, Labeo and Barbus therefore used to be very popular among the poorer members of society since they were cheap to capture and buy. They also provided employment associated with the industries; their gradual decline and subsequent disappearance has had an adverse socio-economic impact on these lower income groups.

1.2. Nile Perch (Lates niloticus).

This prolific predator belonging to the family Centropomidae was introduced to the lake in the early fifties by researchers in the Ugandan part of the lake. It gradually spread clockwise just after its introduction and by the late seventies, Kenya had started landing appreciable commercial quantities.

Nile perch has aroused both negative and positive reactions among the fish eating communities, especially at the time of its sharp increase in abundance. Being the only alternative commercial fishery after the decline of the cichlid stocks, fishermen and consumers have adjusted to the situation to the extent that some now have got used to it and have grown to like it: (it is also abundant all the year round). Annual landing increased nearly ten fold and eight fold in value (between 1976 and 1988). Economically the impact among

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[1] e.g. the riverine (anadromous) species are easily captured by traps which hardly required capital.

fishermen and fish processors/traders has by far outweighed the loss of the former catch composition. It is now an important export item, which provides Kenya with foreign exchange.

1.3. Rastrineobola (dagaa).

Over intensive farming methods and the use of fertilizers have caused an increase of silt and nutrients in the lake. This has increased eutrophication: the increase in algae and plankton communities which, because of the direct links in the food chain, has also increased the populations of dagaa.

Capture methods are capital intensive and involves cost sharing i.e. more than one person owns a fishing unit. The fishing equipment consists of a net with mosquito net on the wings joined to a plankton net at the belly with sinker, float line and warp ropes, and 4 - 10 pressure lamps. The boat and fishing equipment may belong to variety of people, making the fishing unit a share-holding.

Since the advent of fish meal processing in the last decade with dagaa as the main constituent, the demand for this fish has soared up and it has become a very important fishery. It is now marketed all over Kenya in every rural and urban markets as the cheapest fish.

1.4. Tilapia - Oreochromis

Although seasonally scarce and expensive, tilapia has remained the most popular fish from Lake Victoria and has always been heavily fished.

Environmental changes and the introduction of exotic species over time has changed the species composition.

Tilapia breed in shallow sandy bays. During 1961 - 1962, the "Uhuru" or Independence Floods resulted in a significant rise in water level and most of the new shore line consisted of mud and swamp. Oreochromis esculenta, previously the most abundant and popular of the species could not withstand the new conditions and excessive fishing pressure and was succeeded by the exotic Oreochromis niloticus, introduced in the 1940s. Oreochromis niloticus have a very high tolerance to environmental variations such turbidity, oxygen deficiency and temperature and is the dominant species to date.

Oreochromis niloticus co-exists well with other fish like the voracious Lates niloticus in many systems in East Africa such as Lakes Kyoga, Albert/ Mobutu and George. Oreochromis niloticus which initially was discriminated against by traditional "esculenta admirers" soon gained popularity and is now the most valued delicacy of Lake Victoria.

At present fishing methods and gear employed are in serious danger of over exploitating the fish stocks. Gear used including beach seines and undesired gill nets and fishing in the breeding ground and nurseries have resulted in dwindling stocks in the past (see Tables 1 and 4). 4" mesh gill nets which were previously used to catch Esculenta variabilis, Leucosticta and Zillii, although still legal, have been widely replaced by nets with mesh size between 5 and 8" to catch O.niloticus and its hybrids. Stocks of O. niloticus are generally poor in the near shore waters of the Kenya fishing grounds but occasionally stocks migrate over from the richer Ugandan and Tanzanian waters.

The Oreochromis fishery is therefore subject to unpredictable fluctuations and sustains a mere subsistence gill net fishery.

The most fertile fishing grounds for both tilapines and Nile perch are around the numerous Kenyan and Ugandan islands. Powered canoes from the Kenya side are employed to exploit the resources for Kenyan markets.

1.5. The Subsistence Sector

During the period 1978 - 1988 the stocks of giant Nile perch proliferated at the expense of the smaller and traditionally commercial species. This resulted in the decline of the traditional subsistence fishery which had employed numerous low income subsistence fisherfolk. Traditional fishing methods used were: trapping, gill netting, seining and simple angling which only needed a small outlay. Even poor school children were well experienced in capturing Haplochromis using simple hand lines which they made from discarded wires (for the hooks) and sisal-fibre string (for the lines). Earth worms and food remains were used as bait. Other species such as Clarias and Bagrus were also cheaper to fish than the current predominant Nile perch. At present, gear and equipment employed in capturing Nile perch, Rastrineobola and Oreochromis (tilapia) are too capital-intensive for the traditional low income fisherman to afford. The newly evolved fishery of the last decade have attracted investment by well-to-do members of the fishing community, ultimately displacing some low income fishermen from the trade.

Evolution of share holdings in this new fishery has occurred where individual components of the fishing units can be owned by one or more family members or share-holders. Out of the two to five fishermen on each fishing vessel, every fishermen may own one or more fishing nets which are used in addition to that of the boat owners. In some cases, a boat is rented by one or more people.

This new shareholding development together with more intensified fishing now involving more vessels, gear and fishermen, has stabilised to some extent. It has facilitated a fairer accessof the fish resources among the lakeshore population. Lower income subsistence fisherfolk could nevertheless benefit from more effective loan schemes.

1.6. Commercial Situation

Lake Victoria fisheries are predominantly subsistence although there are a few cases of commercialized units owned either by individuals or by groups of individuals. Commercial operations are generally cost effective and are well planned and managed.

Some individual fishermen starting with one small fishing unit have been able to build them up into one large or several small successful units. These fishermen have been able to raise sufficient capital to finance large fishing vessels using outboard engines and operating a maximum number of fish nets and will harvest commercial quantities for higher profit margins.

These fishermen have taken advantage of the new Nile perch and tilapia fisheries found in distant fishing grounds which they are able to access using out-board engines ranging between 8 - 40 HP.

Random sampling of a few merchant fishermen has revealed some of them

possessing well over five boats with a few individuals owning over ten vessels. By local standards, this is a high capital outlay and in some cases, it has required assistance from financial institutions (including cooperative savings and credit).

These fishermen have obviously operated above the break-even point; some have re-invested their profits on other commercial ventures such as commercial and residential buildings, farm lands and general trade.

Private partnership arrangement is most common in major commercial concerns. Apart from individual entrepreneurs partnerships are also found in Non Governmental Organisation (N.G.O's) sponsored fishing concerns. The Catholic Mission sponsored 'Lake Basin Land Use' (LABALU) is currently running successful fishing projects in its eight parishes in the South Lake region. They comprise three to five christian partners who are fully financed to operate a commercial fishing units and their returns service their loans. Some rich merchant fish processors/traders also indirectly finance fishermen by providing them with a large number of gill nets. They then recover the cost of nets from daily catch landings as a percentage of the fishermen daily earnings.

2. HARVESTING METHODS

2.1 Introduction

Perhaps the most important factor that determines the success or failure of a fishery is the gear and method used in harvesting the resources. Since high populations everywhere in the world are exerting tremendous pressure on renewable resources like fish, overfishing remains a thorny issue. In the case of Lake Victoria, we have seen from time to time, sharp decline and even virtual disappearance of certain species. Due to high consumer acceptance and demand tilapines have always been the most hunted species and wherever they occur, fishermen tend to converge and apply all manner of harvesting methods, some of which are very destructive to the whole cross section of existing stocks in terms of year class or age groups. The most destructive fishing methods used to date include beach seining at breeding and nursery grounds. using undersized gill nets (below 5") which catch a lot of juvenile Nile perch and tilapia; and discriminate use of mosquito ring nets (beach seine nets with a plankton net in the belly of the net).

The following is an indepth description of the various fishing gear used:

2.1. The Nile Perch Fishery

As has been mentioned Lates niloticus became a significant commercial fishery in late seventies. At that time, it was the beach seiners who started landing assorted sizes including giant adults weighing up to over 100 kg per individual. A record 300 kg individual was landed in Uyoma Naya beach in 1976.

Initially it was not easy to determine the most suitable mesh size which could select the correct age group to enable maximum harvesting. No gill net selectivity test was done and no biometric data taken to advise managers on the most suitable mesh size to harvesting Lates niloticus without depleting

its resources. Even now the most suitable mesh size used in catching Nile perch is determined among fishermen by trial and error. The current Fisheries and Maritime Zone Act 1989 (Chapter 378 - 380) of the Kenya Laws stipulates rules concerning prohibited nets which needs updating as a result of incoherent evolution of species and fishing methods. Prior to the proliferation of Nile perch in the late seventies, Lake Victoria fishery was a complex of multi-species multi-gear fishery comprising seventeen families and large number of species, (see Table 5). The multi-species fishery was endeared for its bio-academic value as well as multi-functional employment value.

2.2 Traditional Fishery

The simplest capture methods are still employed, among the lower income groups , to harvest such fish as Haplochromine, Clarias, Bagrus, Schilbe, Synodontis, Alestes and Protopterus,. although with the evolution of the Nile perch fishery these subsistence fisheries have been very much reduced. Table 6 shows the types of fishing gear used before the emergence of Nile perch fishery while Table 7 shows the types of current gear used in relation to the type of fish caught. At the moment the most effective method employed in harvesting Nile perch is by gill netting, landing over 90% of the catch. The evolution of the fishery stock is indicated by the figures in Table 7. While the stock was still virgin, extra large sizes (> 30 kgs) were abundant and were mainly landed by beach seines. The larger sized fish have now mostly been eliminated and the current average gill net mesh size is between 7" and 8".

The most popular material for net production is twine of 21 ply polyamide. When fishing effort increased, the same number of nets could not land the same amount of fish, hence fishermen started to use thinner twine (15 to 18 ply) and a greater number of nets, (see Table 8). Presently 9 and 12 ply are also in use. To summarize, as the large virgin stock succumbed to heavy fishing pressure, the mesh size and the twine thickness was reduced correspondingly.

Due to the high cost of polyamide gill nets, fishermen since 1979 have devised a unique method of reducing input costs. They reverted to unwinding the three strands of polyethylene strings from the now standard 9 ply strand string . These hand rigged gill nets have lower catch efficiency, shorter life spans but much lower input-cost. Economically, they are an alternative for lower income groups and as they have a low catch efficiency they assist in controlling overfishing. A recent survey showed that presently over 80% of gill nets used for catching Nile perch are hand rigged polyethylene. The second most common method to harvest Nile perch is by beach seining. Although there was a circular from the Director of Fisheries banning the use of all beach seines, it has virtually become impossible to control their use.

Partly political but for mainly socio-economical reasons beach seines have continued to be used and to play a major role in landing Nile perch and tilapines, an issue that is very worrying for fisheries managers. Beach seines are widely used and about 324 are in operation in the Kenyan portion of Lake Victoria. They are very destructive, harvesting juveniles and clearly contribute to rapid depletion of Nile perch (and tilapia) stocks in Kenya.

The third method used to catch Nile perch is long lining. Some fishermen use as many as 2000 hooks per boat and when the correct type of bait is used (live fish bait), the catch rivals those of gill nets and beach seines. Long

line gear is the cheapest in terms of capital investment but requires seasoned operators. It is the most selective fishing method and as such, should be encouraged and developed as much as possible to remedy overfishing. Overfishing can only be controlled by executing stringent management and protection measures, but there is a severe lack of awareness about conservation issues.

2.2.1 Rastrineobola Argentea - Dagaa - Omena

The main method presently used only evolved since 1966. Rastrineobola (dagaa) is a tiny fish that requires more sophisticated methods for commercial harvesting. Presently dagaa is being harvested by a attraction lamps and ring/surround nets. Surround nets used in the mid water is a recent development that has been introduced by chinese fishermen. A minimum of four pressure lamps are used, set 50-100 metres apart. The surround net (approx. 36 metres length, 8 metres depth) is then hauled around the lamps using a canoe (approx 28' x LOA x 4 feet beam) manned by a 4/5 person crew. About 2 hours are spent on a single operation which is repeated 3 to 4 times each night. Hauls are restricted to the dark part of the night; during bright lunar phases it is ineffective.

2.3. The Tilapia Fishery

Lake Victoria is almost totally occupied by Oreochromis niloticus and its hybrids. Traditionally all manner of capture techniques have been employed to catch tilapia. These include traps (weirs and barricades), fish baskets and magwanja traditional beach seines made of papyrus fibre.

Gill nets and beach seines are the two most effective fishing method employed although hand lines, long lining and pole and line gear have also proved to be very effective in catching baited Oreochromis niloticus.

Gill netting however lands over 90% of tilapia caught. The largest tilapia landings come from Kenya-Uganda boarder. The commonest nets used are 4" gill nets and below although $5^{1/3}$ 6", 7- 9" are used to capture the larger individuals.

The lower part of Nyanza Gulf can now only support subsistence tilapia fishery; the most effective method of capture being beach seining. (see Fig. 2). In the rest of the remaining Kenyan waters, scanty gill nets are applied and the level of fishing is basically subsistence.

Hand lines and pole and line have recently become a very popular capture method with the younger members of fishing community. Fish caught by this method is usually very fresh and very popular with buyers for direct home consumption.

3. SUPPLY DEMAND STATUS - THE MARKET

Price-effort compensation

Apart from tilapia which is always in very high demand, Nile perch and Rastrineobola occasionally suffer from a glut of supply with both fishermen and fish traders incurring heavy losses during these periods. Nile perch is

harvested all the year round but a peak season occurs during the months of April-September.

During the rainy seasons, high catches are experienced for all three major species. During these periods, however most access roads become inaccessible consequently hindering the large scale buyers (using trucks) from reaching the various landing sites. Due to supply and demand the price of Nile perch varies between Kshs 3 - 10/kg. The remotest areas with the worst road conditions suffer the lowest prices. Fishing effort is similarly reduced and in some areas, fishermen stop fishing together. Also during the wet season Rastrineobola, which is mostly sun-dried, suffers quality loss and, apart from the small amount that is sold wet for immediate consumption, is discarded.

Limited gluts results in processing the excess by smoking, sun-drying or deep frying for later retail.

3.1. Nile Perch

Nile perch fishery is a recent development in lake Victoria. Whereas initially the fish did not have a high demand in the late seventies, it soon became popular with upcountry people in Kenya and in restaurants and hotels. Upcountry people preferred the soft bone-less flesh which was easier and safer to eat than the other species such as tilapia, Labeo, Barbus and cat fish which were more sought after by Luos and Luhyas - traditional fish eating tribes along the lake.

It is interesting to note that a rich virgin fishery with low initial market demand has now become so popular that exploitation is over its maximum sustainable yield. Whereas definite statistical record has been kept to indicate the declining catch trends, interviews with fishermen, the study of available data and personal observation has indicated fluctuation in stocks and it is therefore suggested that a frame survey be carried out to monitor catch per unit effort.

3.2. Oreochromis - Tilapia

Currently, the most predominant tilapia in Kenya waters is Oreochromis niloticus. This species and its hybrids now rank third commercially after Nile perch and Rastrineobola (see Table 4). Tilapia is much appreciated in Kenya as in other riparian states of Lake Victoria.

At the various landing points where demand is much greater than supply the fishermen set the asking price. In the major cities where more tilapia is available, consumers have a great bargaining power and the price is reduced.

Very limited storage facilities for fresh fish, a highly perishable food substance has meant that fish traders must rush their products to the nearest most lucrative markets, where all the fish can be sold.

3.3 Rastrineobola - Dagaa

Currently it is estimated that 50% of Rastrineobola landed is dried and used for animal feed while the other 50% is used for human consumption and is partly consumed wet (at near markets) or dried and sent to distant markets.

When totally cloudy days occur, especially during long rainy seasons,

Rastrineobola which is not consumed fresh face heavy post harvest losses. In remote areas 5% or less of the total landing are sold fresh and the rest is usually lost. When this weather prevails fishermen generally do not go out to fish as there are no alternative ways and means of preserving the large surpluses.

It is important to note that there is a marked difference between Rastrineobola used for human consumption and that used for animal feed; quality for human consumption has to be much higher in order to command good prices. It has to be fresh, clean and free from earth or sand or any other form of pollution. It should not have been kept for more than one week after drying before being sold even at distant markets. On the other hand, the quality required for animal feed is not so high. When the demand is high and price offered is as competitive as that offered by human consumers or even better, all grades except for those which have become rancid and petrified are accepted.

When well kept and stored, dagaa may last for up to three months before being ground and mixed with other products such as wheat or rice bran, and transformed before formulating into animal feed for poultry, pigs, and cattle feeds.

It is also important to note that occasionally there is serious price slump both in the human and livestock markets which corresponds to periodic supply gluts. A good example of this was in 1989 when the demand for livestock consumption soared to as all time high and prices shot up from Kshs 5/kg to Kshs 8.50/kg. When surplus fish meal found its way from external suppliers (in Europe and Latin America), there was suddenly a huge glut which caught most dealers unaware and eventually resulted in very heavy post harvest and real financial losses. The local surplus had to be sold to the big processing merchants at extremely low prices. This automatically checked down fishing intensity as many fishermen and traders could not make any profit in the business.

Human consumption market also fluctuates seasonally. During rainy season when there is sufficient vegetable and animal protein substitutes such as poultry, beef, mutton and the bigger species of fish, demand for dagaa falls and more is sold to the livestock feed processors.

The highest price recorded cost Kshs 1200 for 50 kg (ie Kshs 24/kg) The lowest price recorded is Kshs 2.5/kg at landing beaches in Mbita and Bondo divisions. However, Rastrineobola remains to be the most affordable fish to all social classes since it can be sold even in small batches of one shilling. Poor families and individuals buy in small batches and mix them with vegetables, groundnuts, peanuts etc to constitute a richer meal.

3.4. Summary of the Market Situation

3.4.1 Effect of Processing Plants

The advent of Nile perch processing was started in the late seventies by M/s Samaki Industries located in Mombasa and Nairobi. This Company collected Nile perch from Lake Turkana and later in 1979 from Lake Victoria. It was mainly filleted, and packed in 400 g and 3 kg blocks initially for the local tourist hotels and super markets. In the mid eighties, a number of firms joined M/s Samaki Industries in processing Nile perch mainly for the export

market. To date, we have about 24 firms engaged in processing for export. In Kisumu we have five active processors: M/s Kimble Food, Victoria Nile Perch, Tiessen, and Romason, M/s Afro Meat Company Ltd.(which was the pioneer in 1986) all located within Kisumu municipality.

The overall effect of the Nile perch processing plants installed in Kisumu has been enormous in terms of socio-economic aspects. Firstly, the majority of the fishermen who could not dispose of their daily catches can now be sure of daily buyers. Some fishermen have stepped up their fishing activities as a result of making binding contracts with the processors to supply a given amount of fish daily. In some cases, the firms even supply certain fishermen with gear and motorized boats.

Such deals are now wide spread with each firm identifying handworking fishermen at various beaches and negotiating terms of operation as necessary. This arrangement works well in most cases except where nets are stolen before the fishermen repay the loan. Gear given to a fisherman under this arrangement are regarded as a soft loan and are recovered by taking half of the daily catch as the cost of repayment.

3.4.2 Cooperative Movement

There are about 37 registered cooperative societies out of which only 18 are active. Nile perch fishery just proliferated at the right time to save certain badly managed societies. It is important to note that lake Victoria fishery remained a rich multispecies artisanal and merely subsistence fishing before the emergence of Nile perch. The landings both in quantity and value which have now increased more that tenfold were very low and could not, therefore, sustain successful cooperatives. It however employed any processors and fishmongers and the capture methods were cheap so that even the poorer communities could take part. When Nile perch started to appear in large quantities in the early eighties, a number of affluent fishing communities engaged in commercial fishing. It required substantial capital investment and sooner or later, the less fortunate fishermen who could not afford the cost of investment had to get employment as fishermen for the richer employers.

In summary, Nile perch fishery brought in more revenue to individuals and to the cooperatives and hence, it has improved performance of cooperative movement among fishermen. At present, some cooperatives are operating healthy bank accounts and are investing in various commercial ventures. Among them: Sori Bay, Wichlum, Uhanya, Luinda, Kendu Bay and Muhuru cooperatives are presently doing commendable business and are serving their members very well.

On each fishing day, processing firms deposit money with cooperatives who purchase fish in cash on their behalf. As fishermen land their catches, each fishermen is issued with a voucher indicating the amount of fish brought in and the money to be paid at the end of the day. At each "member's transaction" day, fishermen line up for their payment. Sometimes they are paid once a week when they get a reasonable accumulation of funds. These new financial arrangements together with mobile banking units now operating at large landing points have helped many fishermen to learn the importance of savings and credit.

3.4.3. Petty Traders

The merchant fish traders have dominated fish trade and have imposed stiff competition on the petty traders. Whereas merchant traders go for high quality fish, petty traders will take the rejected low quality fish which they process by deep frying and smoking. The rest of fish mongers go for fresh fish they collect from remote inaccessible landings and they mostly transport them on the head (women) and on bicycles (men) to rural and urban markets up to 50 kilometres around Lake Victoria. Sometimes they board 'matatus' and buses which can ferry them even to more distant markets. There is a general consensus that the merchant traders are currently taking the lion's share without considering the petty traders who cater in supplying fish to the locals. The result is that fish may become more expensive and scarce to the poor people of the lakeside.

4. SOCIO-ECONOMIC ASPECTS

4.1. Source of Capital

For a long time fishing was a subsistence business until Nile perch became a capital intensive commercial venture. In the 1970s, about Kshs 10,000 was enough to buy and equip a fishing boat. At present Kshs 50,000 is needed (ie. five times the amount but of course one has the amount for inflation). Source of capital was in most cases from other sources of earning or savings. A fisherman would keep cattle (livestock) and occasionally auction a few to raise funds for the purchasing and equipping of a new fishing boat. Others who were part-time farmers could also sell farm produce such as cotton, groundnuts, millet and maize to raise capital. Since banking was not common among rural folks, most prosperous fishermen reverted to buying and keeping livestock as savings for later re-investment into fishing business.

This trend is currently changing. Most of the prosperous fishermen have invested in tangible real estates such as commercial buildings, farm lands (eg. sugar plantations) and other profitable ventures. Such landlords have good earnings from their investments and run successful bank accounts. They usually draw capital from their savings to reinvest it in fishing business.

Other groups are assisted by their urban relatives who resort in investing on the fishing business to maintain dependants staying in rural homes as appropriate within the African extended families system. Such investors are usually encouraged if their investments bring good monetary rewards. In such cases, income surplus is reinvested (e.g. real estates) and also maintain dependants (paying for clothes, school fees and health amenities). The investor, a son or a brother, may also derive back part or whole of the money invested. Sometimes the investors wife and children live at the rural home and are thus taken care of by the earnings.

4.2. Charitable Financing by N.G.O.'s etc

Currently the fishing industry has attracted many non-governmental organisations (NGO's) which assist in starting up fishing projects. Diocese Kisii - Catholic Mission has started eight units for each of its parishes in South Nyanza. Each unit consists of several fishermen who were given capital to purchase a fishing boat and equip it with gear. Some operate Nile perch nets while others operate mosquito nets and beach seines. These units have

become very successful as a result of which some have re-invested their proceeds in buying new boats and gears.

Freedom From Hunger Campaign of Kenya and TERA-NUOVA of Italy have consistently assisted MBITA Multi purpose Cooperative Union in financing its fishing and fish trade enterprises. Such assistance has met both success and failure due to irregularities in financial management. Diocese of Maseno South of the Church of the Province of Kenya - Anglican has also sponsored a few units in operating fishing businesses.

4.3. Joint Ventures

Joint ventures in fishing operations are now becoming common features especially in the Rastrineobola fishery. The canoe owner, net owner and lamp owners may be all different people operating one unit in common. Where this is practised, daily earning are divided proportionally among the investors. In the Nile perch fishery also, some people prefer to hire a boat on daily or monthly basis. Where an individual may not afford to buy all the fishing equipment, it is found that two or more people may have an interest in joining forces. This arrangement has enabled lower income members of a fishing community to benefit from the new fisheries.

5. CONCLUSION

Socio-economic aspects of harvesting commercial species of Lake Victoria have been reviewed. The socio-economic impact of the new fisheries has been very important, although not sufficientlt monitored and assessed. The development of these new fisheries has occured extremely fast and socio-economic forces may affect the sustainability of the fisheries. Certain destructive methods of harvesting should be prohibited by law or through public awareness. It is evident that even the most successful fishery such as Nile perch fishery needs urgent protection before its stocks suffer a serious decline.

Poor business and financial management of fishing units and cooperative organisations needs to be investigated and aid and assistance directed in this area; handling and storage methods should be improved so as to reduce post harvest losses (for dagaa especially) at undue reliance on middlemen.

Table 1 ANNUAL LANDINGS BY SPECIES (PERCH, RAST., TILAP.) 1968-1977 + VALUE

Y E A R	T O T A L	BY 3 SPECIES ONLY
1968	16357 M.T. 14.167 Mill KES	Tilapine - 16100T - 14.167 MiLL KES Rastrineo - 732T - .595 Mill KES Nile Perch-NIL
1969	17442 M.T. 16.047 Mill KES	Rastrineo - 520T - .581 Mill KES Tilapine - 4645T - 6.581 Mill KES Nile Perch - 17T - 14 Mill KES
1970	16400 M.T. 15.482 Mill KES	Tilapine-4510T-6.581 Mill KES-6.810 KS Rastrineo-524T-.537 Mill KES Nile Perch - 28T - .019 Mill KES
1971	14918 M.T. 15.00 Mill KES	Tilapine - 3142T-5.779 Mill KES Rastrineo - 759T-.534 Mill KES Nile Perch-46T-.047 Mill KES
1972	15989 M.T. 16.825 Mill KES	Tilapine - 1369T-4.385 Mill KES Rastrineo - 1255T - 1.018 Mill KES Nile Perch-38T - 0.73 Mill KES
1973	16797 M.T. 18.127 Mill KES	Rastrineo - 1768T-1.693 Mill KES Tilapine - 1692 - 3.696 Mill KES Nile Perch-146T-.154 Mill KES
1974	17175 M.T. 21.007 Mill KES	Rastrineo-3743T - 3.698 Mill KES Tilapine-956T - 2.465 - 2.465 Mill KES Nile Perch 89T - .131 Mill KES
1975	16581 M.T 21.308 Mill KES	Rastrineo - 4548 T - 4.514 Mill KES Tilapine - 642T - 1.579 Mill KES Nile perch - 51T-.078 Mill KES
1976	18680 M.T. 24.050 Mill KES	Rastrineo - 5652T-5.211 Mill KES Tilapine - 642T - 1.581 Mill KES Nile Perch - 97T - .150 Mill KES
1977	19.332 M.T. 25.682 Mill KES	Rastrineo - 6704T - 6.891 Mill KES Tilapine - 1435T - 3.933 Mill KES Nile Perch - 203 T-.381 Mill KES

KEY
M.T. - Metric Tons
MILL KES - Million Kenya Shillings
RASTRINEO- Rastrineobola - (Dagaa)
NILE PERCH-Lates Niloticus
TILAPINE - Oreochromis

Table 2 FISHING BOATS USED :

1. Sese Canoe	- Hard chine (all) - Non-transomed - Transomed-provision for outboard power - Paddle powered - Sail (wind) powered or both - Size usually determined by cross bar eaters called MANGA
2. Mataruma	- Flat bottomed but similar in shape to sese canoe - Non-transomed in all cases - Planked and size usually determined by the number of 9" x 1" planks-like in the case of a "Mashwa" or a "Dhow" - Paddle powered or sail powered or both - Suitable for rougher areas and for Rastrineobola fishery.
3.Mashwa (Masiwa locally	- Flat bottomed like mataruma but always transomed to facilitate use of a fixed radar called "SUKA" locally - Size determined by the number of planks 9" x 1" cedar or kempher but has to be more than 4 planks and not beyond six - Always has a provision of sail (rig) power since it is bulky and suitable for long range distant fishing expeditions - Suitable for overnight fishing where the crew anchors at muddy bottoms near their set gear for a rest.
4. Dhow (JAHAZI)	- Large sized mashwa as described above - ranging from six planks and above. - Bulky with sophisticated sail rig and spacious carriage volume. - Old fashioned used for distant hunting of migratory species such as the depressed tilapia esculenta and the cyprinids. Also used for fishing Haplochromis now depressed also. - Currently mainly used for commercial transportation of goods e.g. livestock, provisions, hardware and passengers (on hire usually).

Table 2 Continued

5. Dug Out ("Mtumbwi" Kiswahili or "Mtungi" locally)	-	Traditional craft made of a single large wooden trunk chipped out like a trough and shaped after a canoe.
	-	The dug-out hence is a solid vessel that does not and would not usually experience leakages that occur in other planked vessels (1-3) above. Paddle powered or long poles used to push vessels. Over shallow grounds.
	-	Popular among the poorer fishing communities who cannot afford the more expensive crafts.
	-	Mainly used in subsistence fishing comprising inshore long lining, simple gill netting - trapping and seining. Estuarine and Riverine area fishing away from rougher waters. Few are used-now.
6. Rafts	-	Usually reeds, papyrus sponges or any other suitable buoyant wooden trunks joined together.
	-	Mainly used inshore in operating estuarine and riverine traps. Long poles are used to steer the rafts by pushing through shallow bottoms by hand, wooden spoons or small paddles are also used.
	-	Also used in marshy inland waters for fishing and cutting papyrus, reeds and sponges for various usages.

Table 3 A CATALOGUE OF FISHING GEARS USED IN LAKE VICTORIA (KENYA)

Fishing gears of lake victoria can broadly be divided into 4 categories thus:

1. TRADITIONAL GEARS
2. GILL NETS
3. SEINE NETS (including mosquito surrounding nets)
4. LINE GEARS

Each category can also be divided into specific groups conforming to fish caught as follows:

CATEGORY ONE (1)

GEAR	FISH HARVESTED
1. TRADITIONAL GEARS (TG) - OSADHI (WEIRS) - KIRA (") - OSADHI (BARRICADES) - KIRA (")	Mainly anadromous riverine species - Labeo, Barbus, Schilbe, Bagrus, Clarias and Alestes. Occasionally mixed species -Tilapine, Haplochromine, Bagrus, Nile perch etc. caught.
- BASKETS	Mixed species but mainly inshore shallow water, estuarine and - riverine species as groups "A" and "B" above.
- SEINE - MAGWANJA - (seine, papyrus, knitted)	Sluggish mixed species but not fast moving cyprinids - (Labeo and Barbus) - Tilapine, Protopterus, Clarias, Synodontis now abandoned.
- TONG (spear shaped) - BIDHI (" ")	Target species usually Protopterus and Clarias sluggish in turbid muddy inshore estuarine and riverine waters but can also pierce other species available in these areas such as tilapia, Bagrus and Nile perch. Cannot pierce smaller species.

Table 3 Continued

GEAR		FISH HARVESTED
TG	- LINE - OLOU - Traditional hook on line.	Mainly Protopterus, Clarias, Bagrus and now Oreochromis and Nile perch.
2.	GILL NETS (NG) GROUP "A - LABEO GILL NETS $2^{1/2}$ - 3" INCH NETS	Usually targeting on Labeo, Synodontis and Schilbe but can also capture tilapia nile perch, Protopterus and Clarias juveniles. In persistent illegal use by poachers (3)
NG	- HAPLOCHROMINE - GROUP "B" GILL NETS $1^{1/2}$" $1^{7/8}$" 2" INCH	Mainly Haplochromine but catches juveniles of other larger species-very destructive.
NG	- TILAPIA GILL NET (4" - 8" INCH)	Usually targets on tilapia but catches immature nile perch (i.e. 4" - 6" inch) -also catches Clarias, Barbus, Bagrus, Protopterus.
NG	- NILE PERCH GILL NET (6" - 12" inch) with 7" - 8" being most popular	Targets on nile perch but catches the larger Oreochromis, also Clarias, Bagrus and sometimes Protopterus.
3.	SG - SEINE NETS SG 3.1 - BEACH SEINE (28 mm)	Usually targets on Nile perch and tilapine of all species but lands mixed species also.

Table 3 Continued

GEAR		FISH HARVESTED
SG	- MOSQUITO NET - 10 mm & 2 mm	Targets exclusively Rastrineobola but as as beach seine it occasionally catches species such as tilapia, Nile perch etc.
SG	- SURROUNDING NET mixed WITH ATTRACTION LAMP	
SG	- BEACH SEINE WITH AND WITHOUT LAMP	
SG	- RING NET WITH AND WITHOUT ATTRACTION LAMP	
4.	- LG - HAND LINE	Captures tilapia, Nile perch, Protopterus, Clarias, Bagrus, Barbus and Labeo.
	GROUP "B"	
	LG - POLE AND LINE	Used to capture same species as in LG 4.1 but re-enforced to land even the large Nile perch that cannot be hauled on hand line.
	- LONG LINE (SET) - LONG LINE (DRIFT) MUSTAD HOOK N° 6, 7, 8 and 9	Now popular in targeting commercial catches of Nile perch Mustad N°. 8 and 9 mixed but N°s. 6, 7 are capturing large individuals preferred by local processors.
	LG - TACKLE LINE MUSTAD HOOK N°s 6, 7 and 8	Usually applied by tourist sports fishermen who go for the larger individual nile perch weighing over 20 kgs and up to and beyond 100 kgs.
	LG - TROLL LINE (S) MUSTAD HOOK N°s 6, 7, 8 and 9	Captures similar individuals as in LG 4.4 but can be applied commercially to capture all sizes up to Hook N° 9.
	BAITS USED - 1. Earthworm 2. Food remains (Ugali, meat etc) 3. Live baits - Haplochromine and Clarias. 4. Artificial baits - plastics, feathers and coloured wooden materials.	

Table 4 ANNUAL LANDINGS BY SPECIES (PERCH, RAST., TILAPIA)
(1978 - 1988 + VALUE)

Y E A R	T O T A L	BY 3 SPECIES ONLY
1978	23856 M.T. 52.066 Mill KES	Rastrineo - 8710T - 9.929 Mill KES Tilapine - 2606T - 8.356 Mill KES Nile Perch - 1066T - 1.876 Mill KES
1979	30592 M.T. 57.095 Mill KES	Rastrineo - 9321T - 21.158 Mill KES Nile Perch - 4286T - 8.872 Mill KES Tilapine 2739T - 17.273 Mill KES
1980	26914 M.T. 58.805 Mill KES	Rastrineo - 9443T - 17.308 Mill KES Tilapine - 5013T - 17.686 Mill KES Nile Perch - 4310 - 7.434 Mill KES
1981	38179 M.T. 85.346 Mill KES	Nile Perch - 22834T-45.817 Mill KES Rastrineo - 7635T - 13.284 Mill KES Tilapine - 3897T-16.508 Mill KES
1982	60958 M.T 123.40 Mill KES	Nile Perch 33134T - 60.381 Mill KES Rastrineo - 10419T - 14.121 Mill KES Tilapine 6854T-28.951 Mill KES
1983	77327 M.T. 121.403 Mill KES	Nile Perch - 52377T-72.995 Mill KES Rastrineo - 16444T-17.854 Mill KES Tilapine 4282T-21.031 Mill KES
1984	71854 M.T. 133.31 Mill KES	Nile Perch 41319T-65.914 Mill KES Rastrineo - 19437T-24.259 Mill KES Tilapine - 7478T-35.62 Mill KES
1985	88589 M.T. 190.56 Mill KES	Nile Perch - 50029T-89.308 Mill KES Rastrineo - 25866T-35.806 Mill KES Tilapine 9442T-57.515 Mill KE
1986	103163 M.T. 237.333 Mill KES	Nile Perch-56975T-114.648 Mill KES Rastrineo-34518T-47.746 Mill KES Tilapine - 10164T-65.977 Mill KES
1987	113452 M.T. 317.028 Mill KES	Nile Perch-68545T-182.469 Mill KES Rastrineo - 33145T-48.418 Mill KES Tilapine-10353T-80.948 Mill KES
1988	125071 M.T. 493.021 Mill KES	Nile Perch-61210T - 190.847 Mill KES Rastrineo-40861T - 113.539 Mill KES Tilapine-1689T-169.772 Mill KES

KEY: M.T. or T = Metric Tons; Mill Kes = Million Kenya Shillings.

Table 5 FISHES FOUND IN THE KENYA WATERS OF LAKE VICTORIA

	Order	Family	Some Representative General and Species	English	Luo	Samia
1.	Lepidosireniformes	Lepidosirenidae	Protopterus aethiopicus	Lungfish	Kamongo	Emonye
2.	Cyprinodontiformes	Cyprinodontidae	Aplocheilichthys pumilus	guppies	-	
3.	Perciformes	Mastacembelidae	Mastacembelus frenatus	Spiny eel	Okunga	-
		Anabantidae	Citenopoma muriei	-	-	-
		Centropomidae	Lates niloticus	Nile perch	Mbuta	Embuta
		Cichlidae	Tilapia spp.	Tilapia	Ngege	Engege
			Haplochromis	Haplochromis	Fulu	Efulu
4.	Mormyriformes	Mormyridae	Mormyrus kanume	Elephant snout fish	Suma	Esurubana
			Gnathonemus longibarbis	-	Obubu or	
				Ondhuri		-
5.	Cypriniformes	Cyprinidae	Barbus altianalis	-	Odhadho or fwani	Echachu
			Labeo victoriunus	-	Ningu	Eningu
			Barbus apleurogramma	-	Adel	-
			Rastrineobola argenteus	-	Omena	Omena
		Schilbeidae	Schilbe mystus	Butter fish	Sire	Esire
		Mochokidae	Synodontis victoriae	-	Okoko	Esidonge
		Characidae	Alestes jacksoni	-	Osoga	-
		Clariidae	Clarias mossambicus	cat-fish	mumi	-
		Bagridae	Bagrus docmac	cat-fish	sem	-

Table 6 - EVOLUTION OF FISHING GEAR

Year	Gill 1967 - 1977	Main Species caught
1967	Gill nets, traos-weirs and barricades, beach seine, long line, Beach seine and mosquito seine	Haplochromine, Tilapiine, Protopterus, Clarias, Labeo, Barbus, Rastrineo
1968	Same as above but more Gill nets replace traps and beach mosquito seines increase	Haplochromine, Tilapiine, Protopterus, Clarias, Bagrus, Barbus, Rastrine
1969	For mosquito mid-water attraction lamp surrounding net applied more-beach seines and more gillnets - lines	Haplo, Tilapines, Clarias, Protopterus, Bagrus, Rastrine, Labeo
1970	Intensive beach seines and mosquito seines and surrounding nets. More Gill nets and line gears	Tilapine, Haplo, Clarias, Protopterus, Bagrus, Rastrine, Barbus,
1971	Beach seines and gill nets predominant. Line gears and traps, persit. Mosquito attraction. Lamp seine & surrounding net	Haplo, Tilapines, Clarias, Protopterus, Bagrus, Rastrine, Barbus,
1972	Beach seines & mosquito attraction lamp seine surrounding nets on the increase, Line and traps persist.	Haplo, Clarias, Tilapine, Protopterus, Rastrine, Bagrus
1973	Seining intensive & gill nets and attraction lamp surrounding nets, Lines and traps	Haplo, Clarias, Rastrine, Tilapiine, Bagrus, Protopterus
1974	Seining high return period Gill nets. Attraction lamp surrounding net-Lines and traps	Haplo, Rastine, Clarias, Protopterus, Bagrus, Tilapiines
1975	Peak seining year with high landing of Haplochromine and Rastrineobola. Gill nets, Lines and traps	Haplo, Rastrines, Clarias, Protopterus, Bagrus, Tilapiines
1976	Increased activity on mosquito attraction lamp surrounding and seining nets. Beach seines, Gill nets, Lines tramps	Haplo, Rastrineobola, Clarias, Bagrus, Tilapiine, Protopterus

Table 6. Continued

Year	Gill 1967 - 1977	Main Species caught
1977	Period of change. More gill nets come in. Seining remain predominant. Attraction lamp fishing intensifies, lines few tramps	Rastrineobola, Haplochromis, Bagrus, Clarias, Tilapiine, Labeo

Table 7 EVOLUTION OF FISHING GEARS IN USE

Year	1978 - 1988 Gear Used	% FISH HARVESTED
1978	Use of large meshed thick ply gill nets begins - 7"-12"-16" 21 ply polyamide for Nile perch Gill net and seines increase	Rastrineobola-8710 MT Tilapiine 2606 MT Nile perch 1066 MT Haploch, Clarias, Labeo
1979	Seining intensifies with special modification. Thicker twine up to 36 ply x 1.5" plyamode for bag of seine to hold perch	Rastrineobola 9321 MT Nile perch 4286 MT Tilapiine 2739 MT Haplochr., Clarias Bagrus
1980	Mid water attraction lamp surrounding Dagaa net being modified in shape to make a bag while hauled-Gill-net, Line beach seines	Rastrineobola 35.05% Tilapiine 18.62% Nile perch 16.01% Haplochr., Clarias, Bagrus
1981	Nile perch nets and fishing methods developed. 21 ply 7"- 7.5" 8" 9" 10" 12" - 16" popular 7" - 10" - seining - lines	Nile perch 59.81% Rastrineobola 20 % Tilapine 18.71% Clarias, Haplochr., Bagrus
1982	21 ply gill net permits with 36 ply bag net on beach seines Dagaa nets modified to form bags-beach seine - Lines.	Nile perch 54,36% Rastrineobola 17.09% Tilapines 7.34% Mormyrus, Haplo, Clarias
1983	Thinner gill nets 18 ply 7" 7.5, 8" are used for perch polyethylene hand-made nets come in beach seine, Lines	Nile perch 52377 M.T 67% Rastrineobola 16444 M.T 21 Tilapine 4202 M.T 5.% Bagrus, Clarias, Haplochr.
1984	Traps virtually disappear 7" 7.5" 8" become more popular, seines intensify, Lines also increase for nile perch	Nile perch 57.51% Rastrineobola 27.05% Tilapines 10.40% Clarias, Mormyrus, Bagrus
1985	Beach seines shaped like trawl nets introduce larger nets required. Gill net of thinner twines up to 15 ply lines mustad nook 8, 9, 7, introduced for perch	Nile perch 56.47% Rastrineobola 29.20% Tilapines 2.66% Clarias, Protopt., Barbus
1986	Gillnets increase in number per boat, 7" 7.5" 8" dominant for nile perch. Seines and line further improved.	Nile perch - 55.23% Rastrineobola - 33.46% Tilapines - 8.88% Labeo, Clarias Protopterus

Table 7 Continued

Year	1978 - 1988 Gear Used	% FISH HARVESTED
1987	Hand rigged gillnet of polyethylene twines comprise 80% to defeat high cost of nets. Seines and line increase 12 ply introduced for nile perch	Nile perch - 60.42% Rastrineobola - 29.22% Tilapine - 9.12% Labeo, Clarias, Barbus
1988	More sophisticated seines are developed. Beach seines enlarged with longer wings of thinner twine. Bags of seines hand rigged polyethylene. Lines Gillnets 9 ply introduced. for nile perch	Nile perch - 48.94% Rastrineobola 32.67% Tilapine - 13.51% Barbus, Haplochro, Momyrus

Table 8 Nile Perch Fishery - Catch, Efficiency, Variation Time in Gill-net Mesh Size and Twine Thickness + Increased nets per boat, Lake Victoria, Kenya. Catch Value/Mesh Thickness

1978	79	80	81	82	83	84	85	86	87	88
21ply Nylon 6" 7" 7.5" 8" 9-12" -16"	21ply 6"7" 7.5" 8" 9" 10" 12"	21ply 6"7" 7.5" 8" 9" 10"	21pl 7" 7.5" 8" 9" 10"	21pl 7.5" 8" 9"	21+18ply 7" 7.5" 8" 9"	18+21ply 7" 7.5" 8" 9"	15+18ply 7" 7.5" 8" 9"	15+18+21ply 7" 7.5" 8" 8"	12+15+21 7" 7.5" 7" 7.5"	9+2+15pl 7" 7.5" 8"
Quantity on Value Landed										
1066 M.T. 1.876 MILL KES	4286 M.T. 8.872 MILL KES	4310 M.T. 7.434 MILL KES	2283 M.T. 45.81 MILL KES	33134 M.T. 60.38 MILL KES	52377 M.T. 72.995 MILL KES	41319 M.T. 65.914 MILL KES	50029 M.T. 89.30 MILL KES	56975 M.T. 114.648 MILL KES	68545 M.T. 182.46 MILL KES	61210 M.T. 190.84 MILL KES
5-10-15	15-20	20-30	20-30- 0	30-40-50	40-5	40-55-60	40-55-60-70	50-60-70	50-60-70-80	60-70-80-90-100
Number of Net per Boat										
21 ply polyamide gill nets										
Decline in Thickness					18 ply Polyamide Gill Nets					
							15 Ply Polyamide Gill Nets			
									12 Ply nets	
				HAND RIGGED POLYETHYLENE NETS						9 Ply nts

N.B. Thinner twine with high catchability efficiency hence employed in sparse fish population.

Table 9 : CATCH PER BOAT/NET/FISHERMEN COMPARED DURING 1983 AND 1988 PLUS EARNING PER FISHERMEN

3 Fishermen per Boat - 1983 (Lates niloticus)			
N°. of Nile perch Fishing Boat	Total Tons (M) Landed/Value	Catch per Boat - Kgs	Value Earnings Boat/year
3.500	52.377 T 72.995.000/KES	14.960	20.856 KES
Number OF Fishermen	Kgs Landed	Catch per Fishermen	Earnings Fishermen/year
10.500	52.377 T	4.988.285	6.951.904 KES
Number of Gill Nets	KGS LANDED	CATCH PER NET/KG	VALUE NET/YEAR
157.500	52.377	332.552	463.50 KES
4 FISHERMEN PER BOT - 1988 (Lates niloticus)			
Number of Nile perch Fishing Boats	Total Tons Landed/Value	Catch per Boat Kg	Value Earning Boat/Year
4.500	61.210 T 90.840.000 KES	13.602	42.409 KES
Number of Fishermen	LANDED M.T.	CATCH PER FISHERMEN	EARNINGS FISHERMEN/YEAR
18.000	61.210 T	3.400.6	10.602.20 KES
Number of Gill Nets	Landed M.T	catch per et Kg.	Value Net/Year
315.000	61.210	94.317	605.85 KES

The analysis deduced from above data is as follows :

1. Catch per boat decreased from 14960 Kg/Year in 1983 to 13602 Kg/Year in 1988
2. Catch per fishermen also reduced from 4988.285 Kg/Year in 1983 to 3400,6 Kg/Year in 1988.
3. Fishermen/year earning however increased to 10,602/=KES in 1988 from 6951/=KES in 1983 due to inflation and rising prices of fish.
4. Catch per unit effort has therefore fallen in real economic terms.
5. Number of boats worked with assumed to be those engaged in harvesting nile perch only.

Table 10 : Market distribution channels

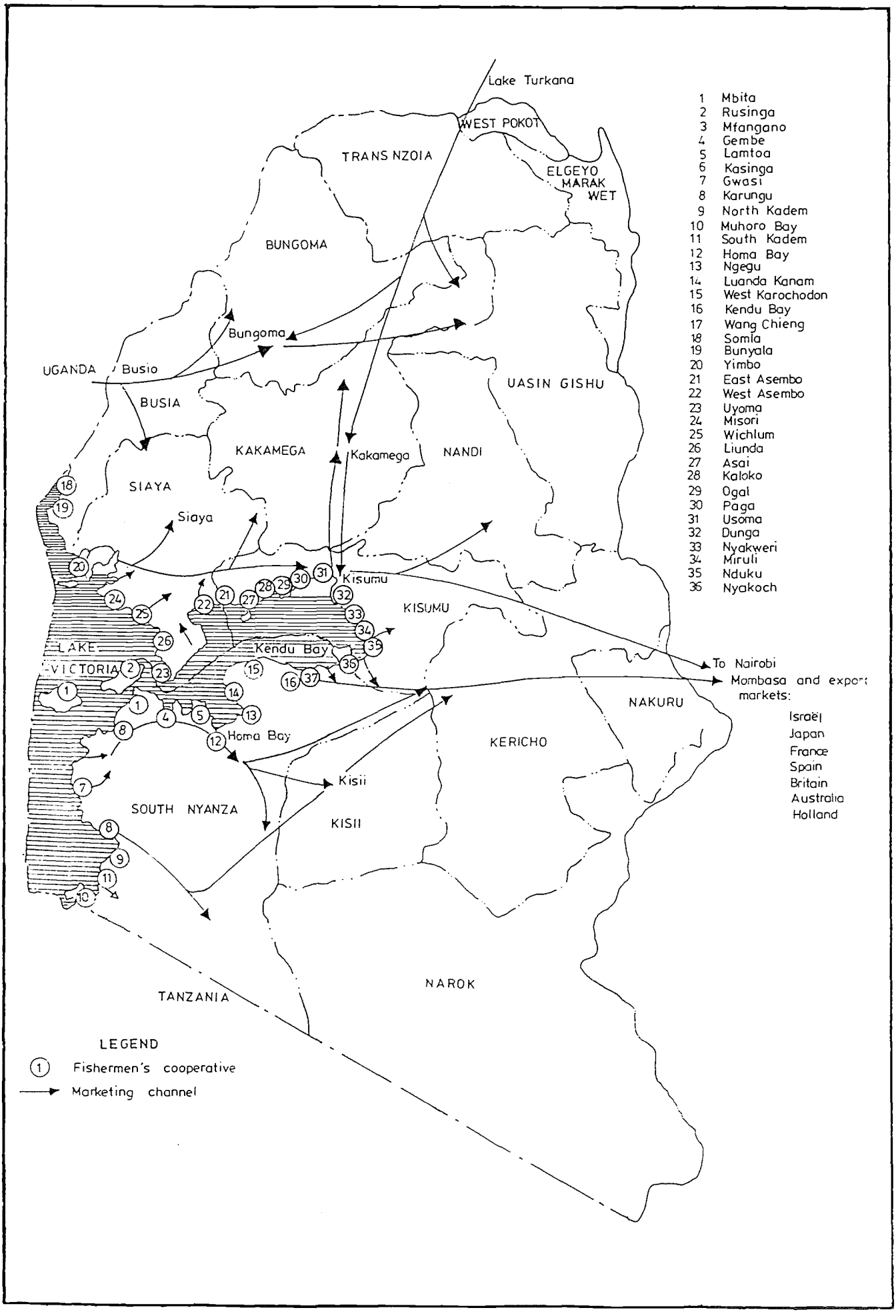


Figure 1: Lake Victoria - Catchment and drainage system

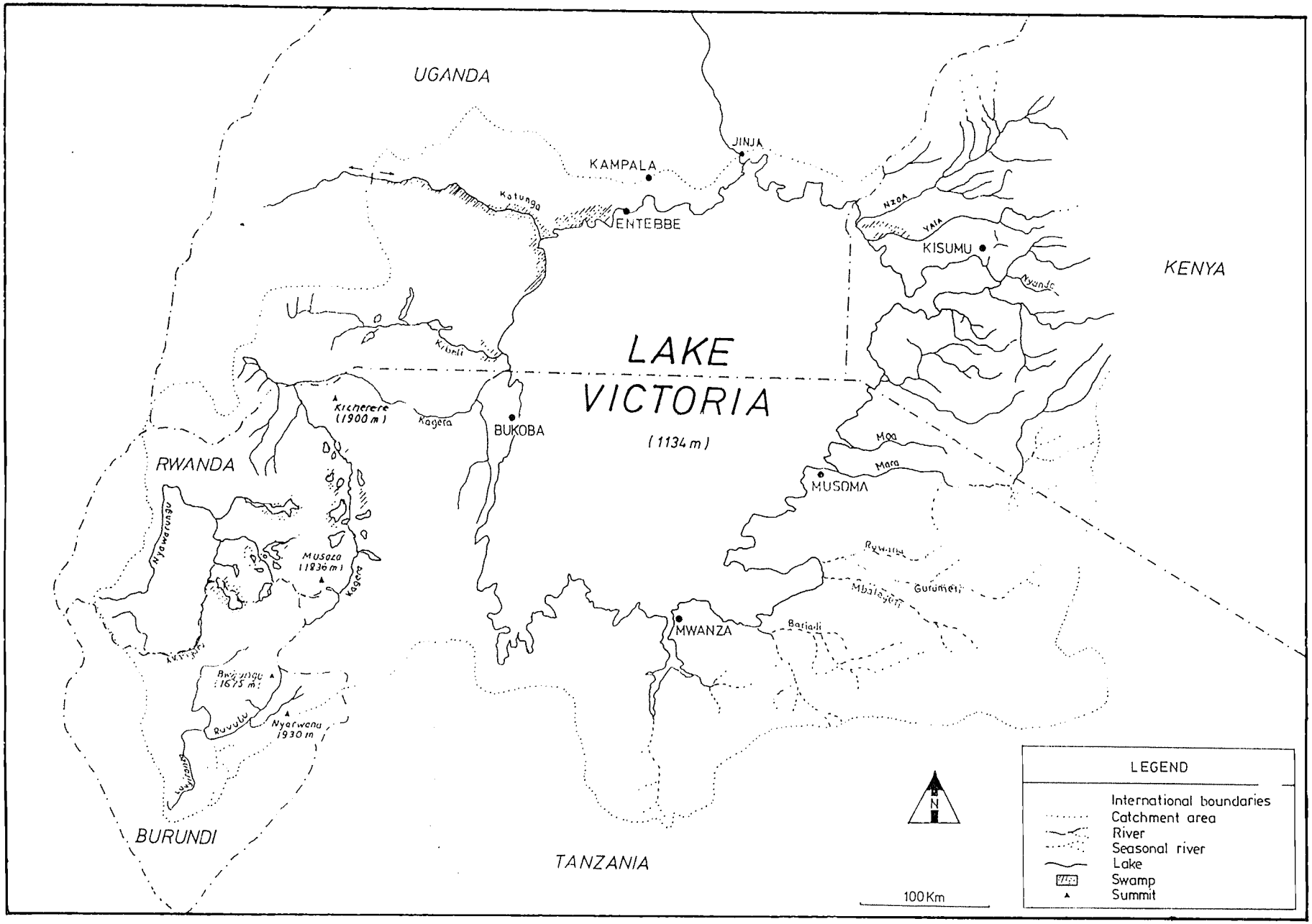
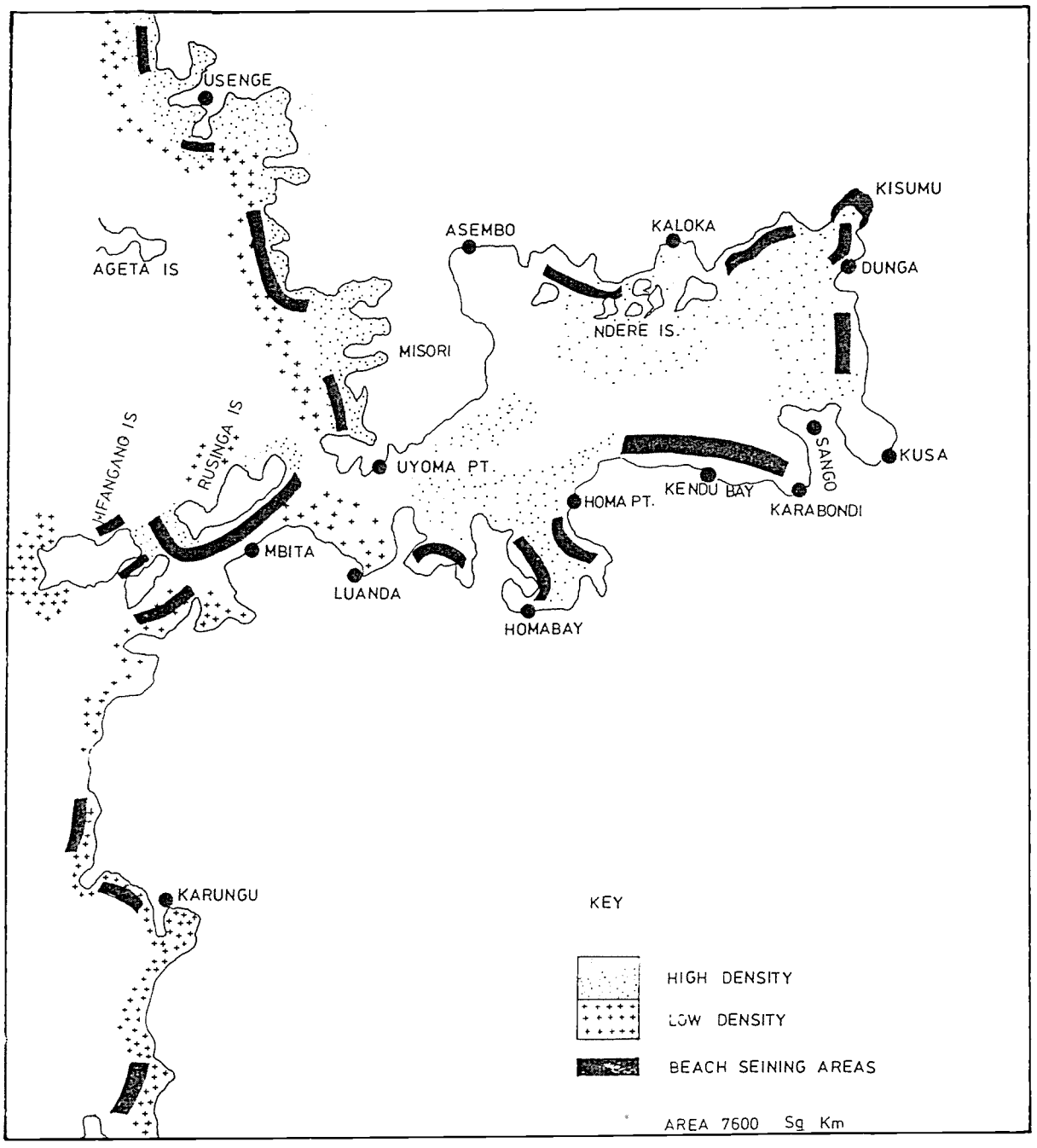


Figure 2 : Beach seining areas

- 1983 - now changed



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FISHERIES SOCIO-ECONOMIC SURVEYS FOR THE TANZANIA SIDE OF LAKE VICTORIA

by

M. S. Mkisi

ABSTRACT

This paper describes the socio-economic surveys which are planned and are currently being executed on Lake Victoria by the Fisheries Division of Tanzania. Mwanza Region was selected as the survey area as it covers 60 percent of both fishermen and canoe concentration of the whole lake.

Sets of questionnaires were designed to analyze information on: fishermen; fish processors; fish traders and fish consumers. Investigations center on living conditions, division of ownership, characteristics of fishing units, fishing operations, costs and earnings, and income generation.

A trial test of the questionnaires has been conducted and full scale interviews are to begin shortly. Some preliminary results of the trial test are discussed.

1. INTRODUCTION

This paper describes part of the overall surveys which have been planned and are being executed by the Fisheries Division. The overall socio-economic survey is being carried out as a technical assistance project by FAO to strengthen the statistical unit of the Fisheries Division.

Artisanal fisheries account for 90 percent of national fish landings. As there is very little information on the socio-economic conditions of the artisanal fishermen and the fishing communities in general there is a need for these socio-economic surveys if the fishery is to be managed efficiently.

The current socio-economic surveys being planned will attempt to collect baseline data on processing, distribution and marketing from the various target groups: fishermen, fish processors, fish traders, distributors, fish consumers and fish markets. Each target group has its own questionnaire and can be applied to any landing site or fishing village so that researchers or fisheries administrators can select the set of questionnaires that suits a specific area of study; be it fishermen and fishing operation for a fishery at a specific fishing village, or fish processing and marketing at a specific locality.

The purpose and range of each study will depend on the target area and the time and resources (in terms of manpower, materials and funds) available for the project.

2. DESIGN AND EXECUTION ON THE SURVEY

2.1 Methodology

2.1.1 Objectives

(i) to assess socio-economic conditions and incomes (costs/earnings) of the artisanal fishermen;

(ii) to assess post harvest activities of the operation connected with the fishermens communities.

2.1.2 Subjects

The target groups in the survey are: artisanal fishermen; fish traders, fish processors.

In order to design an appropriate questionnaire for the survey, inventory data on fishermen, gear, canoes, size of catch, distribution by landing site and fishing village was collected from the "village frame survey" and catch statistics of the Fisheries Division. The data was supplemented by socio-economic data elements previously collected through field trips to some of the landing sites and markets.

2.1.3 Survey Area

The choice of the survey area depends on the specific areas of operation of the target group. From the selected survey area eg. fishing village, a reasonable sample of the population from the target groups can be taken for

survey. A number of fish landing sites and associated fishing villages have been selected for the general survey. Among those selected in Mwanza Region is Kirumba, the largest landing site, where over 60 percent of both fishermen and canoes of Lake Victoria (Tanzania side) are situated.

This paper restricts itself to fishermen as the specific target group for the survey.

2.1.4 Design

The next stage is the selection of type of socio-economic data to be incorporated into the questionnaire and needs to be designed so that the responses provided by the respondents give the data necessary. The data required in the questionnaire for fishermen in charge of fishing units relate to:

a) Personal details: name, age, education, marital status, number of dependants, the type of fishing gear, boat, engine being operated;

b) Fishing unit: capital costs of equipment, source of purchases, ownership sharing pattern of earnings, crew size and loan or credit obtained if appropriate;

c) Fishing operation: period of fishing operations, number and duration of trips, average catch and species per trip, average prices per fish, estimated revenue per gear, other problems associated with the fishing activities.

Based on this questionnaire other questionnaires to investigate socio-economic data on fish traders, fish processors, and fish markets were produced.

3. TRIAL-TEST

A trial-test of the questionnaire (see Appendix A) was conducted in a few selected areas including Kirumba and Mwigobelo landing beaches in Mwanza. At each landing site, two enumerators and a supervisor assisted in the interviews with the respondents. The interviews took a long time because of language and interpretation problems. However the trial-test served as training for the field staff and also provided feedback responses to the questionnaires. A few modifications were made on the original questionnaires in the light of the feedbacks. Guidelines for the collection of field data has been prepared for distribution to enumerators and supervisors who will be taking part in the major exercise.

4. ORGANISATION

The revised questionnaire and other printed materials are being provided for the Project from the Fisheries Headquarters. Six landing sites, i.e. Kirumba and Igombe in Mwanza District, Mwigobero and Kinesi in Musoma District for Lake Victoria as well as Msasani and Banda-Beach, both marine stations off Dar es Salaam, area have been selected for the survey. (Three markets in each of the districts in Dar es Salaam will also be covered). It is planned to make use, at each of the selected landing sites, of the existing field enumerators

which have had previous training in statistical data collection organized by the project. A minimum of two enumerators and one supervisor will conduct the interviews for each selected landing site.

5. SURVEY

The actual field observations and interviews on the selected landing sites are planned to cover a period of two months i.e. April and May and the completed questionnaires are to be submitted to the statistics unit of the Fisheries Division Headquarters by June. Processing and analysis of the data will be carried out in July.

6. ANALYSIS AND RESULTS

Analysis and results will be undertaken after the survey. However for the purpose of this paper, attempt will be made at making preliminary assessment from the trial-test at Kirumba.

7. SUMMARY AND CONCLUSIONS ON PRELIMINARY ANALYSIS

(1) Responses on fisherman's age, marital status level of education and number of children per fisherman show that:

   (i) fishing activities employ young people who are educated and are fully committed to fishing activities (ie. full time fishermen);

   (ii) each fisherman is married, maintains a family of at least four children and owns a minimum of two houses;

(2) Responses on type of gear used, where purchased and source of capital show that;

   (i) gillnets of 7" and 8" and longlines are most commonly used;

   (ii) capital to purchase fishing inputs eg gear is obtained from their own sources or savings, and are mostly purchased from private shops;

(3) Responses on sharing systems show that;

   (i) the income from the first 3 trips go to the owner of the boat and the earnings from the 4th trip goes to the crew.

(4) Responses on peak/lean periods for gillnets and longline gear show that;

   (i) gillnetting is operated all year round with peaks between February - May and lean period between June -January.

   (ii) longlining is operated all year round except in June (because the water is more turbid and murky hence the gear is less effective). The peak periods are February-May.

(5) Responses on problems and their future plans for self advancement show that :

(i) there is wide spread theft of fishermens gear around the lake;

(ii) the fishing gear needed are hard to obtain and fishermen use gillnets made from other materials;

(iii) there is lack of cold storage facilities needed by most fishermen;

(iv) fishermen wanted to change from paddles to outboard motors if they become available.

Appendix

SOCIO-ECONOMIC SURVEY OF FISHING UNIT-TANZANIA

Region..... District.....

Fishing Village..... Landing beach.....

Enumerator.....

Name of the fisherman in charge.....

1. a) How old are you ?

   b) Years of experience in fishing

2. Are you full time or part time fisherman ?
   If fulltime are you the owner of boat ( ) gear ( ) engine ( )
   Or employed fishermen ( )

3. If part time what is your other occupation ?

4. Have you ever been to school? Yes ( ) No ( )

5. If yes what is the level attained. Elementary ( ) Secondary ( )

6. Are you married ? Yes ( ) No ( )

7. If yes how many children have you ?

8. How many of your children are attending school ?

9. How many of your children are fishing in your unit ?

10. How many dependents do you have ?

11. How many dependents are adult i.e. over 15 years ?

12. How many dependents are children i.e. below 15 years ?

13. How long have you stayed in this village ?

14. Was this your place of birth ? Yes ( ) No ( )

15. If not what was your original place of birth ?

16. What was your main occupation at your previous village ?
    Farmer, Fish trader, fisherman, boatbuilder, govt. employee,
    other ( )

17. What gear are you operating now ? Gillnet size, beach seine, longline, sharknet, seine net, hooks.
    Nr of units ( ) Expected life span if new. Years
    Age of the gear.

18. Do you operate a boat ? what type Length ( ) metre, How old. Life span when new

19. a) Do you operate outboard engine ? what brand Horse power ( ) How old. Lifespan when new.

    b) If yes how much fuel/trip ( ) litres cost shilling ( )

20. what are the costs of gear, ( ) boat. ( ) engine ( )
    Indicate year of purchase ( ) ( ) ( )

21. Do you pay for fishing licence ? Yes ( ) no ( )
    If yes how much shillings per year

22. From what source did you obtain
    a. Outboard motors: - government ( ) private shop ( ) middlemen ( )

    b. Gear:- government ( ) private shop ( ) middlemen ( )

    C. Boat:- Boat: Govt. boatyard ( ) private boatbuilder ( )

23. What is the sharing system (percentages)
    To boat owners, ( ) gear owner, ( ) engine owner ( )

24. a) What is the number of crew per boat.

    b) Do you provide food for crew Yes ( ) No ( )

    c) If yes how many shillings ( )

25. Did you obtain loan to purchase boat ? Yes ( ) No ( )
    If yes give source of loan.

Bank	Money Lender	Family	Friends
( )	( )	( )	( )

Date Received Year Amount of Loan

Outstanding loan Interest rate

26. Did you obtain loan to purchase gear ? Yes ( ) N° ( )

If yes ( ) which gear ( )
Give source of Loan

Bank	Money Lender	Family	Friends
( )	( )	( )	( )

Date Received Year Amount of Loan

Outstanding Loan Outstanding loan

Repayment Period Interest rate

27. Did you obtain loan to purchase engine yes ( ) No ( )

If yes, give source of Loan

Bank	Money Lender	Family	Friends
( )	( )	( )	( )

Date Receive Year Amount of Loan

Repayment Period Interest Rate

28. (a) How many months do operate in the Year ( )

(b) Indicate the Peak Period months ( ) Lean Period ( ) month ( )

(c) How many trips do you make in month during peak period, ( ) during Lean Period ( )

(d) What is the duration of trip No. of days ( ) hour ( )

(e) What is the average catch per trip in the peak period, ( ) kg/piece. During Lean period ( ) kg/piece.

(f) What are the main species caught ?

species:-	%	Average prices of each?/kg/piece
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(g) Indicate which months you don't operate and what are the reasons?

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29. How much fish do you take for home consumption after each trip? (- kg./piece)

30. (a) How many houses and lands do you own? No of Houses ( ) No of Lands ( ) Acreage per land ( )

(b) If none do you pay rent for the house. Yes ( ) No ( ) If yes, how much per month?

31. Any problems with your fishing operations ?

FEEDING HABITS OF TILAPIAS IN LAKE VICTORIA: BACKGROUND STUDIES FOR FISHERY RECOVERY DESIGNS

by

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and

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ABSTRACT

Lake Victoria is the second largest lake in the world and a major source of protein for over ten million people. The fisheries have undergone successive disruptions since the early 1920s. Major contributing factors have been the intensive non selective fisheries, extreme modification of the drainage area, invasion of the introduced species and the progressive change of physical and chemical factors in the aquatic environment. Anoxic waters have been observed at shallower depths than ever before suggesting a greatly increased oxygen demand in the seasonal hypolimnion.

The feeding ecology of the commercially important tilapias in Lake Victoria was studied. Out of 1698 specimens, Oreochromis esculentus was absent, Oreochromis varibilis was rare, while Oreochromis niloticus, Tilapia zillii and Oreochromis leucostictus were abundant.

It was found that Lake Victoria tilapias feed mostly on bottom organisms and are mostly found in shallow sheltered areas where there is a lot of bottom fauna. Experiments show that they feed on zooplankton and phytoplankton which is dominated by Cyanobacteria diatoms, green algae and dinoflagellates in descending order.

Their annual landing constitute less than 3%. Careful stocking programmes of tilapia species to restore the fish balance would be appropriate for Lake Victoria.

1. INTRODUCTION

Lake Victoria is a shallow lake between the eastern and western Rift Valley. It was formed as a result of tectonic activity that produced westward flowing rivers to form the lake basin. The lake is the second largest in the world and a major source of animal protein for over 10 million people in Kenya. Lake Victoria has undergone successive disruptions since the early 1920s. Major contributing factors have been the intensive non-selective fisheries, extreme modification of the drainage basin and vegetation, invasion of introduced species and the progressive change of physical and chemical factors in the aquatic environment. A second dramatic change in Lake Victoria, the development of a seasonal lake wide anaerobic hypolimnion, further threatens the integrity and biodiversity of this globally important ecosystem.

The near shore fisheries of Lake Victoria have experienced dramatic species alterations and reductions of fish stocks and may not be able to maintain economic and nutritional stability in the area. Before the intentional introduction of Nile perch (Lates niloticus), many tilapias and Haplochromine fishes served as the economic basis for the lake's fisheries as well as the dominant protein resource for the people. These non-predatory detritus and phyto-zooplankton feeding fish became major prey species for the Nile perch (Ogari and Dadzie, 1988). In 1976, only 0.5% of the commercial catch was Nile perch; by 1983 it had risen to 67.7%. Haplochromines fell from 34.1% in 1976 to 1.0% in 1983 (Ogutu-Ohwayo, 1984). Numbers of other endemic near-shore genera fell drastically as well (Okemwa, 1981).

Fisheries in Lake Victoria are now dominated by Nile perch, (Lates niloticus) 60%, dagaa (Rastrineobola argentea) 37%, Oreochromis niloticus 2.5%, and the rest of the species 0.5% (Rabuor, 1989). Yet little is known of the basic fish biology and the ecological food chain connections that support the fishery. Without such knowledge, current assessments of fish stocks, fish tagging efforts, and descriptive studies of fishing practices on fish yield can not provide sound management policies. Other problems in the lake include massive phytoplankton blooms, anoxic conditions and mass mortality of fish (Ochumba, 1987, Ochumba and Kibaara 1989). With the above information, we studied the feeding habits of the commercial tilapias in Lake Victoria and sought to provide information for the fishery management designs.

2. METHODS

Fish were collected by beach seining, trawling and gill netting in the Mwanza and Nyanza Gulfs of Lake Victoria. Plankton was collected by plankton nets (20 μ m and 100 μ m) and preserved in formalin 10% and Lugol's solution. The fish samples were measured, dissected, sexed and stomach contents preserved in formalin. The phytoplankton composition and abundance was studied using Utermohl's sedimentation method and a microscope. Limnological parameters (pH, temperature, dissolved oxygen, conductivity and depth) were measured with a Hydrolab surveyor II connected to a Sonde Unit S V R - S U. Feeding experiments on live fish were carried out in the laboratory using glass aquaria and plastic buckets. The fish were fed on freshly caught plankton from the lake.

3. RESULTS AND DISCUSSION

Phytoplankton composition and abundance in the lake environment was impractical to estimate due to the high abundance of Coenobial coccoid Cyanophytes. The Chlorophyta were scarce. The shallow bays are characterized by the dominance of coccoid Cynophytes (Aphanocapsa, Merismopodia, Coelasphaerium, Cyanodictyon and Microcystis) accompanied by the filamentous blue green Lyngbya Circumcreta. The diatoms were represented by Nitzschia acicularis and Melosira granulata. The dinoflagellates were represented by Ceratium spp., Peridiniopsis cunningtonii and Glenodinium Palvisculus. In open lake stations, there was a dominance of Lyngbya, Nitzchia and Cyclotella and a reduced number of species and organisms belonging to Chlorophyta. At 40m depth, no visible algae was recorded. According to Talling (1966) the offshore was stratified and was anoxic (Ochumba and Kibaara, 1989). It is worth noting that the available data on phytoplankton (Bachmann, 1933; Thomasson, 1955; Talling, 1966, and Melack, 1979) refers to netplankton and not nanoplankton which constitute an important food for herbivorous fish. The study therefore indicates that the assemblage of Lake Victoria phytoplankton has been altered.

Zooplankton identified in the water samples were Copepods -Thermocyclops spp, Mesocyclops sp. and Microcyclops minutus; Calanoids - (Thropodiaptomus neumanii); Cladocerans (Diaphanosoma excisum) Ceriodaphnia riquadi, Daphnia longispina, Moina Macroyus, Bosmina longirostris and Chydorus Sphaericus. The available zooplankton data is mostly taxonomic and biological and information on quantitative fluctuations is insufficient (Akiyama et al. 1977; Green 1971: Roska, 1957). The study indicated there were high densities of Cyclopods in the mid-Nyanza Gulf and in the open lake at depths between 6 - 40 m. Nauplii and Copepodites were found at 1 m depths. Cladocerans were found between 11 - 40 m depths. Moina and Bosmina were abundant at 1 m depths. High densities of Rotifers were found in shallow depths between 1 - 11 m. Calanoids were observed between 6 - 40 m.

In the feeding experiments, it was observed that most of the removed zooplanktons were small organisms collected by filter feeding mechanisms. Tilapia zillii, Oreochromis variabilis, O .niloticus and the Haplochromine fishes captured cyclopoid Copepodites and large Rotifers. The study suggests that tilapias feed more by utilising filter feeding mechanics than visual particulate attack under turbid conditions. In the experiments no other food source like bottom fauna, phytoplankton or macro invertebrates were used.

Results of the gut content analysis is presented in Table 1 for all classes of food items that comprised between 30-90% of the total content. In most cases more than one food item was found to be present in high quantities in one single specimen, therefore, total number of cases in Table 1 is higher than the number of analyzed fishes. Oreochromis niloticus was reported to be a filter feeder (Fish, 1955; Moriarty, 1973). Observations indicated that most of the food of this fish is collected on the bottom or close to the sediment surface. Some other components not typical of the bottom layers are also ingested in deep layers. The dominant food items for Oreochromis variabilis were found near the bottom sediments and plant debris. Low numbers of Haplochromine fish and Oreochromis leucostictus were analyzed indicating a dominance of bottom components.

Our study suggests that after the introduction of Nile perch (Lates niloticus), Oreochromis niloticus, O. leucosticta and Tilapia zillii, the foodweb structure was modified and water quality has slightly deteriorated

(Ochumba, 1987). As a result of Haplochromine predation by Nile perch (Ogari, 1985), grazing pressure was reduced from the phytoplankton leading to blooms that may inhibit zooplankton success. It is therefore concluded that fisheries technology and stocking activities in Lake Victoria were developed more rapidly than the scientific knowledge needed to device rational means of exploitation. As a consequence, stocking activities in Lake Victoria caused changes of the original population and regulation of fishery operations has not been optimal in recent years.

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Table 1. FOOD COMPOSITION OF T. NILOTICUS (TN), T. VARIBILIS (TV) AND T. ZILLII (TZ). NUMBERS ARE CASES OF DOMINANCE (30-90%).

	TN		TV		TZ	
	%	No.	%	No.	%	No.
Insect fragments	0.8	3	1.9	2	1.9	1
Trichoptera	8.0	31	22.1	23	20.8	11
Caridina	6.5	25	6.7	7	22.6	12
Sand grains	1.0	4	0.9	1	–	–
Mud	12.4	48	11.5	12	1.9	1
Chyronomids	5.7	22	3.8	4	1.9	1
Nematodes	–	–	5.8	6	1.9	1
Ostracods	5.4	21	0.9	1	–	–
Zooplankton fragments	2.1	8	–	–	–	–
Copepods	1.3	5	–	–	–	–
Bivalves	4.1	16	–	–	–	–
Moina	3.6	14	–	–	–	–
Chydorus	4.4	17	–	–	–	–
Fish scales	1.6	6	–	–	–	–
Spongilid spiculae	0.6	2	–	–	–	–
Simocephalus	–	–	–	–	–	–
Oligochaeta	0.6	2	–	–	–	–
Alona	0.3	1	–	–	–	–
Plant debris	10.6	41	20.2	21	35.8	19
Microsystis	4.9	19	3.89	4	3.8	2
Diatoms	7.4	28	3.89	4	3.8	2
Chlorophytes	3.6	14	2.9	3	1.9	1
Melosira	5.5	21	2.9	3	1.9	1
Detritus	3.2	12	4.9	5	1.9	1
Lyngbia	2.8	11	5.8	6	–	–
Anabaena	1.3	5	1.9	2	–	–
Ceratium	1.0	4	–	–	–	–
Filamentous chloroph.	1.3	5	–	–	–	–
TOTAL	00	386	100	104	100	53

FACTORS EFFECTING INPUT SUPPLY TO ARTISANAL FISHERIES OF LAKE VICTORIA (KENYA)

by

Ernest O. Yongo

ABSTRACT

Input needs of a fishery are: resource, labour, capital and entrepreneurship. This paper concerns itself with the labour and capital (including gear and infrastructure facilities) affecting fisheries of Lake Victoria.

Labour input is considered by looking at trends in boat registration from 1977 to February 1990. Assuming a crew consists of on average four people, it is estimated that there are 32,969 fishermen working 8,242 boats.

Capital is limited to the fishery industry due to migratory behaviour of the fishermen. With the high cost of equipping one boat rising well above Kshs. 45,000 the fishermen are bound to remain poor and fall prey to middlemen. The co-operatives through which the fishermen could obtain loans have failed and they remain a risk to loan supply sources.

Gear and instrument supply have changed with more fishermen aiming for Nile perch. Gill netting is still showing an upward trend despite the ban that has been imposed on the 4 inch mesh size nets. Mosquito seines and beach seines have a large and increasing demand.

Infrastructural facilities for the fish industry are poor. Only Homa Bay and Uhanya are connected to the natural markets by surface roads. Other facilities such as postal services, telephone and power are lacking, making it impossible to reach the urban markets efficiently.

1. INTRODUCTION

The fisheries of Lake Victoria have changed substantially in species caught, techniques used and manpower required. The changes include environmental variations, including these arising from the implantation of exotic species (Ssentongo and Welcomme, 1985), the evolution of stock densities and increased fishing intensity.

The introduction of Nile perch has caused a high demand for 7-8 inch mesh size nets, although other mesh sizes (4 inch") for Oreochromis fisheries are still supplied by the Kenya Fishnet Industry (Rabuor 1989; and Reynolds and Gréboval 1988).

Because of the greater demand in urban centres for Rastrineobola for human consumption and animal feed, the demand for mosquito seine nets is on the increase.

While the supply of labour remains unclear more and more boats (canoes) are being produced for fishing. A total of Kshs. 125 mollion was invested between 1977 to February 1990. The cost of a single fishing unit is Kshs. 15,000 (Ogutu 1988; Reynolds and Gréboval 1988).

Capital for investment is limited for fishermen; their migratory behaviour makes them a bad risk for loaners.

The necessary inputs required for the development of the industry are:

(a) The supply of gear and equipment;

(b) The supply of labour;

(c) Sources of investment capital;

(d) Basic infrastructure facilities especially landing points and beach ports.

Having identified these inputs, it is important to look at the policy implications regarding the development of the Gulf Fisheries and remedy the factors that need urgent attentions.

2. RESEARCH DESIGN

The objectives of this study were to investigate the major input supplies into the fisheries industry and evaluate their sources as they affect the operations of the fishermen.

The specific objectives were as follows :

(a) to identify what type of inputs the fishermen require in order to operate effectively;

(b) to determine the sources and flow of inputs into the fisheries industry;

(c) to evaluate the determinants of the supply of these inputs.

2.1 Information sources

Information about the industry was researched between December 1989 and March 1990.

The sources of information were mainly through interviews and questionnaires to the officials of such organizations as banks, co-operative officers, the management of Kenya Fishnet Industries and artisanal fishermen.

Stores that supply gear such as floats, hooks and manila twine were visited to obtain their pricing system. These interviews were not very effective and very little salient information was obtained; the majority of the suppliers were Asians who suspected the visit was for alternative motives.

The fisheries department was a useful source of information regarding boat registration which made it easy to assess the labour supply to the fisheries industry.

3. GEAR AND EQUIPMENT

3.1 Nets

Kenya Fishnet Industry is the sole producer of fishing gear to all Kenyan fisheries, both marine and inland.

Their major import is nylon twine imported from Japan. Various ply sizes are used ranging from 2 ply to 36 ply, depending on the different fishing method.

Their main output are the gill nets, beach seine nets, mosquito seine nets, shark nets and trawl nets mainly sold to the marine fisheries. Oreochromis fisheries require 2-3 ply for gill nets; 4-9 ply for beach seine nets. The Nile perch fisheries use gill nets of 12-15 ply (mesh size 7-8 inches). It follows therefore that fishermen use different gears depending on the type of fish they are after. (See Table 4 for details).

However, according to Reynolds and Gréboval (1988), exact figures on gear types and trends overtime are not known exactly. Rabuor (1989) gives gear composition by weight landed as follows: gill nets 33.63%; beach seine 18.1%; mosquito seine at 43.34%.

Mainga (1985) notes that gill netting was a predominant gear employed by the artisanal fisheries. He states further that gill netting accounted for 72% by weight of all landings, followed by mosquito seining 17%, beach seining at 7% and long lining 4%.

The fishnet management reckons that the demand for 7-8 inch mesh sizes had increased tremendously due to the changes brought about by the huge increase of Nile perch in the early eighties. The management also agrees that 4 inch meshes were also in demand though there was a general decline in the early 80s. This may confirm the claim that smaller meshes are on the increase (Reynolds and Gréboval 1988, Rabuor 1989).

The optimum capacity of the firm stands at 96 tons of fishing nets per annum, but presently the firm operates at below capacity of 48 to 60 tons per annum, mainly producing gill nets (of 7"and 8" mesh size), mosquito seines and

beach seines in that order. The low output levels are explained by the fact that some fishermen make their own nets from manila twine because of the increasing cost of fishing gear. Unlike the agricultural sector, the fisheries industry has not been exempted from import duty, increasing prices on such items as out board engines, nets etc.

From 1970 to 1984 the firm used to produce 72 to 84 tons of fishing nets per annum. The management attributes this high output to the then major Oreochromis fisheries which required gill nets with mesh size of 4". It is reckoned by the company that presently the 4 inch mesh production is again picking up. This again confirms fears that smaller mesh sizes are on the increase which could be disastrous for the fisheries. Table 5 reveals that most of the firms output were nets with mesh sizes of 6" and below with a reduction in 7"-8" nets. These nets are beginning to stock pile indicating that the fishermen are going for smaller mesh sizes.

3.2 Boats

On average a fishing boat used for harvesting perch (7"-8" mesh size net) costs approximately Kshs. 45,000. The wood for making the boat is mainly "Mvule" which is abundant in Alego and Ugenya. Table 1 shows that money invested in boat building has steadily increased with a record Kshs. 122,550,000 being invested in 1990, 1028 boat having been produced.

3.3 Supply of Labour

Generally there is unemployment in the country side. The excess labour is not absorbed into the fisheries industry because young men look down on fishing as a source of employment (Ogutu 1988, Reynolds and Gréboval 1988). The main labour in the fish industry are older men from traditional fishing families.

Assuming 4 people are members of a crew of a fishing unit, there are 32,969 actual fishermen with 8,242 boats. Ogutu (1988) puts the estimate at 24,676 fishermen with 7,207 fishing boat units. Ssentongo and Welcomme reported that there were about 25,000 fishing operators and some 3,800 fishing units. Hansen (1981); Coche and Balarin (1982) reported 31,000 fishermen operating more than 8,500 crafts. These findings are compared in Table 2.

All these estimations show that the labour supply and the number of boats is basically constant. It has been suggested that the rate at which boats drop out from active fishing is fairly constant with crew of drop out boats joining newly launched boats. Table 1 shows that there was a decline of boat registration from early 80s to 89 with a slight increase in 1987, going down again in 1988.

3.4 Supply of Investment Capital

A large amount of money is required to become a fisherman. Reynolds and Gréboval (1988) put total investment requirements by an artisanal fisheries at Kshs. 45,000. Ogutu (1988) states that lack of capital is a major set back for crew to become owners of fishing units. This could be one factor that stops the young labour force into not joining the fisheries industry.

One of the many interviews revealed that very little money is available as loans to fishermen. Normally the banks will only deal with them on a co-

operative basis and are not given hard cash but are loaned money to stock co-operative shops. In 1987/88, there was a general feeling that the fishermen should be assisted through credit favilities, but these discussions did not come to fruition, basically because fishermen generally have migratory habits; they are a bad risk as far as money lenders are concerned and tracking them down with respect to debts is very difficult .

Bank officials feel that, given the new government policies, which encourage increased food production and self employment, they would be more willing to give lend to fishermen. However, the geographical diversity of the beaches is a limiting factor. Lack of commitment by the co-operative officials and management inefficiencies are a further stumbling block.

Another limiting factor is working below capacity. Given the little knowledge that the fishermen have regarding the right gear and knowledge of the lake, they often operate below capacity. It is felt that fishing experts should provide local fishermen with the knowledge regarding stocks, the most efficient gear to use and during what period of the year it is best to concentrate fishing effort so as to increase production. This way, their incomes could be increased or made more stable during the year.

The general feeling is that co-operatives should be strong organisations with a strong service base. This would provide lower operational costs with the basic aim of profit maximization rather than commission collection of 10%. The co-operatives should diversify into processing and marketing. This will enable them to have assets that can be mortgaged for further development of the fisheries.

The amalgamation of all co-operatives into a giant body will be the only viable means of obtaining facilities such as freezers, cold stores and vehicles for transportation to market. The co-operative Bank is willing to help in export promotion if the fisheries co-operatives form themselves into a well organised body.

The Wichlum Fisheries Co-operative Society is taking this step by reorganising itself and is now proposing to purchase an insulated 3 ton van at present valuation of Kshs. 670,000 for transportation of fish from Wichlum to Kisumu. The loan has a good chance of going through. This is the right path that other fishermen co-operatives should copy.

Despite all the problems, the overall growth of the deposits for the co-operatives with their accounts at the Co-operative Bank was quite encouraging. In 1989, they had an overall growth rate of 60%. This growth rate was contributed to by five co-operatives; Misori, Dunga, Ogenya, Nyakach and Wichlum, with Wichlum having a growth rate of 200%.

3.5 Supply of Infrastructural Facilities

Services like surfaced roads can directly affect the incomes of the fishermen as this improves delivery to the major urban areas. However, most of the landing beaches are not well served by surfaced roads leading to delay hence spoilage of fish before they reach the markets (see Table 3 and Figure 1). In fact, the only beaches/fishing towns served by efficient roads are Homa Bay and Kendu Bay. Telephone/postal services are also missing with some beaches having neither postal nor telephone services. Other facilities such as power have not ever been considered.

Table 2 indicates the distance of beaches to surface roads. This is not hopeful to people who have invested or intend to invest in the fisheries industry. During the rainy seasons there are often delays as most of the roads are impassable.

4. CONCLUSION AND RECOMMENDATIONS

4.1 Gear and Equipment

While such inputs as nets, outboard engines and other gear are in constant supply, their costs remain a prohibiting factor in promoting fishing hence improving the lives of fishermen.

It is generally agreed that although farm inputs have been exempted from import duty, those inputs relating to fisheries have not been spared. It is thought that the fisheries sector should be treated the same as agriculture.

4.2 Labour Supply

Labour supply seems to be constant reflecting the attitude of the young generation with regard to fishing. Different observations made by scientists indicate that a thorough survey of the number of boats hence manpower should be determined if proper management regarding the exploitation of this valuable natural is to be achieved.

4.3 Investment Capital

Because of the nature of the fishing industry, there should be an evolution of strong co-operative societies through which loans could be channelled.

A pilot scheme based on a soundly managed co-operative should be established to act as a model for other fishermen co-operatives.

The co-operative should operate at the marketing level rather than being active at the beaches only. In this way they would manage their incomes rather than depend on the exploitative tendencies of middlemen.

4.4 Infrastructure Services

Provision of postal services, power, and good roads should be the prime objective of the authorities if the livelihood of the fishermen are to be improved.

Figure 1. MAP SHOWING THE KENYAN WATERS OF LAKE VICTORIA AND THE LOCATION OF THE PRIMARY SAMPLING UNITS (LANDING SITES)

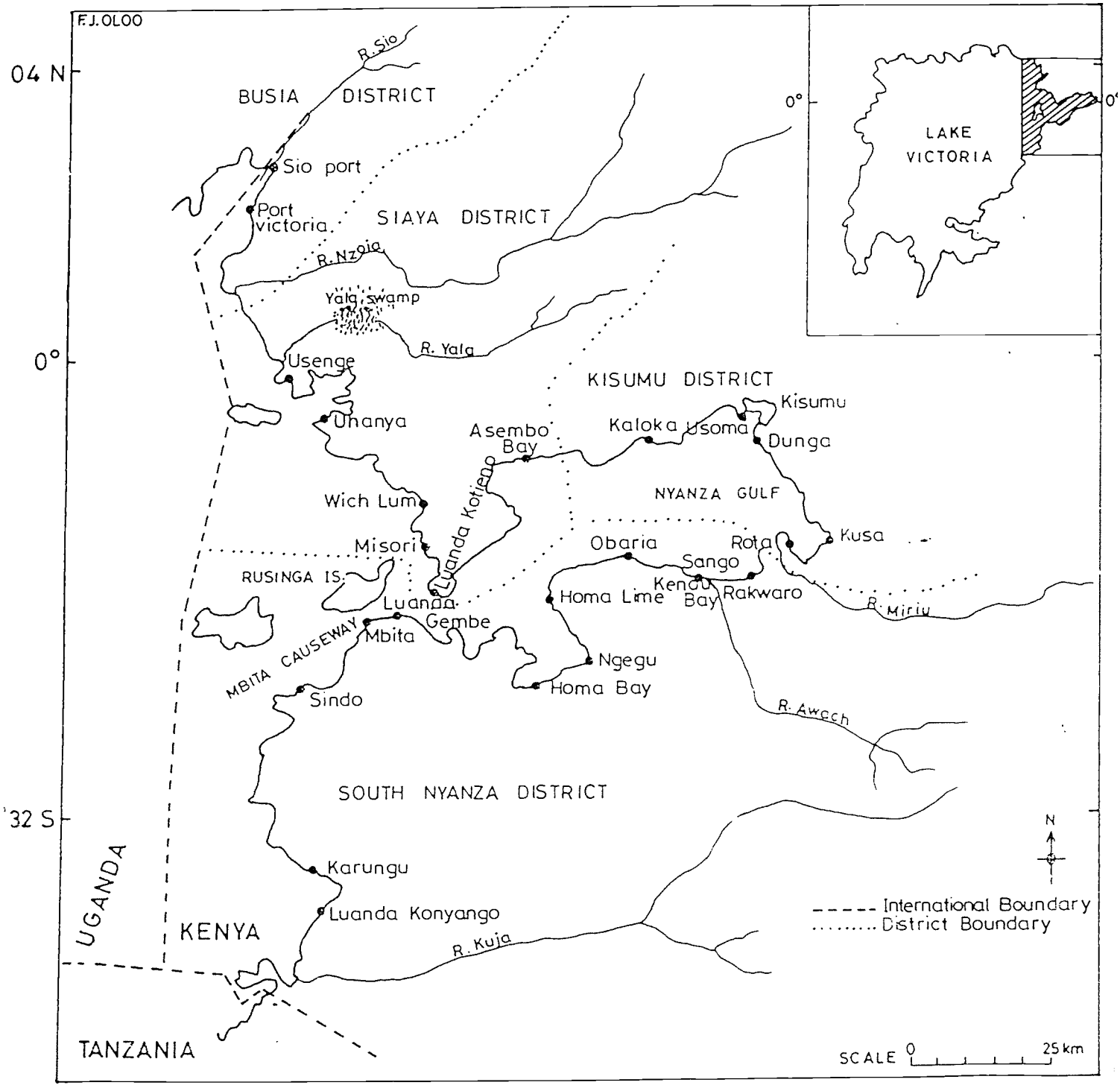

Table 1. TRENDS OF BOAT REGISTRATION FROM 1977 TO FEBRUARY, 1990

Year	Boats Registered	Number of Fishermen	Total Estimated costs of Boats (Kshs.'000)
1977	72	288	1 080
1978	180	720	2 700
1979	720	2 880	108 000
1980	756	3 024	11 340
1981	1 044	4 176	15 660
1982	684	2 736	10 260
1983	720	2 880	10 800
1984	360	1 440	5 400
1985	684	2 736	10 260
1986	540	2 160	8 100
1987	792	3 168	11 880
1988	302	1 208	4 530
1989	360	1 440	5 400
1990	1 028	4 112	15 420
TOTAL	8,242	32 968	122 550

Note : The total number of fishermen was computed using 4 people per boat

Table 2. A COMPARATIVE ANALYSIS OF BOATS AND FISHERMEN SINCE 1981

	Yongo 1990	Ogutu 1988	Ssentongo & Welcomme 1985	Coche & Balarin 1981
Boats	8 242	7 207	3 800	8 500
Estimated Fishermen	32 969	24 676	25 000	31 000
Crew/Boat	4	3	7	4

NB : These findings compares well with the findings of Ogutu 1988 and Coche & Balarin 1981, thus suggesting that labour supply remains fairly constant.

Table 3. THE NEAREST MARKETS/TOWNS WITH SURFACED ROADS AND BEACHES

BEACH	NEAREST MARKET (SR)	DISTANCE FROM BEACH (KM)
Sio Port	Burnala	22
Port Victoria	Siaya	32
Usenge	Usenge	0
Uhanya	Nyamonye	2
Wichlum	Bondo	20
Misori	Bondo	30
Lwanda	Bondo	34
Kotieno		
Kopiata	Bondo	45
Asembo Bay	Ndori	16
Kaloka	Holo	2
Kusa	Kusa	0
Kendu Bay	Kendu Bay	0
Mitimbili	Kendu Bay	26
Homaline	Kendu Bay	30
Homa Bay	Homa Bay	0
Sindo	Homa Bay	50
Sori	Migori	58
L. Konyango	Migori	60
Mbita	Homa Bay	48

NB : SR refers to surfaced roads. L. refers to Lwanda.

Table 4. TYPES OF BASIC FACILITIES FOUND IN EACH BEACH.

Beach	Post Office	Telephone	Petrol Station	Electricity
Port Victoria	X	X		
Usenge	X	X	X	
Wichlum				
Misori	X			
Lwanda Kotieno	X			
Kopiata				
Asembo Bay	X			
Kaloka				
Kendu Bay	X	X	X	
Mtimbili				
Homaline				
Homa Bay	X	X	X	X
Mbita	X	X		
Sindo	X	X		
Sori	X	X		
Lwanda Konyango	X			
Muhuru				
Uhanya				

Table 5 : OUTPUT COMPOSITION OF FISHING GEAR

Ply	Pieces	Total Length (mts)	Total Weight (kg)
3-4	6 527	878 829	4 589
6	846	64 236	829.3
9	1 181	46 713	1 408.2
12	1 305	210 175	2 771.6
15	1 170	110 880	2 376.1
36	94	158	27.4
TOTAL	11 123	1 310 991	12 001.6

Source : Kenya Fishnet Industries Ltd.

NB : - The Nile perch Ply starts from 12-15.

- Ply 36 is used in the trawl nets.

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