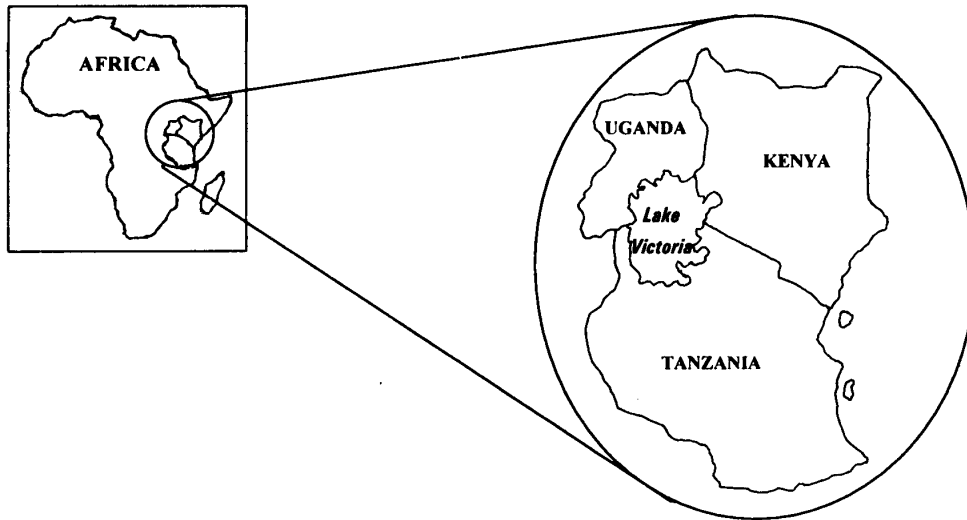


THE DEVELOPMENT OF THE LAKE VICTORIA FISHERY: A Boon or Bane for Food Security?

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June 2000

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Lake Victoria is the second biggest fresh water lake in the world. With its 69,000 km², the lake has the same size as Ireland. The lake is shared between three countries; Tanzania (which possesses 49%), Uganda (45%) and Kenya (6%) of the lake.

The findings, interpretations and conclusions in this publication are those of the authors and do not necessarily reflect those of IUCN or the partner organisations in this project.

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Design & Layout: IUCN EARO Communications Unit

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Executive Summary

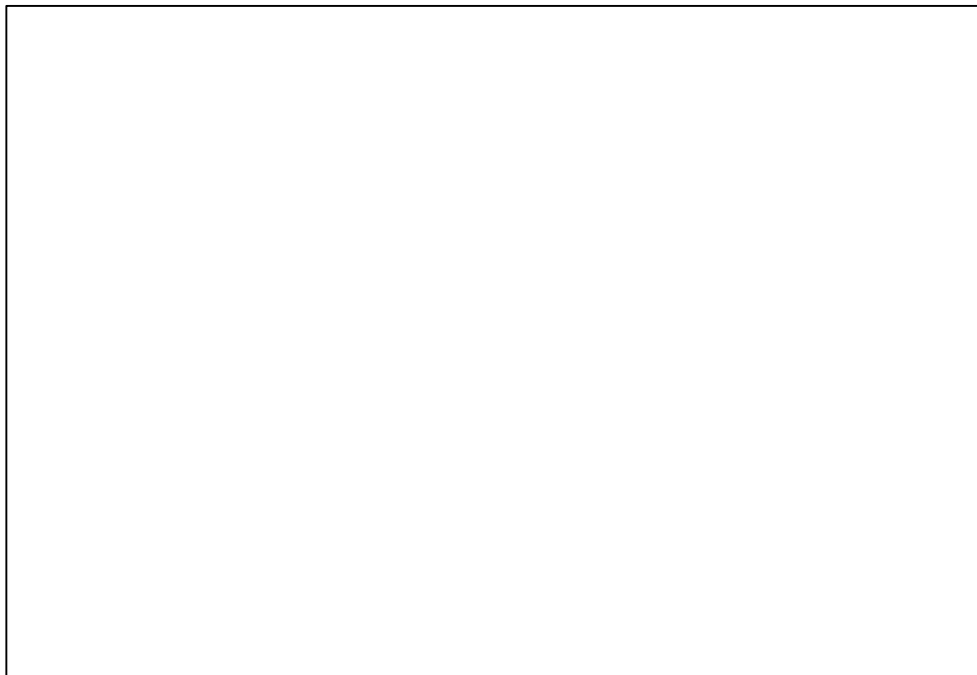
The Lake Victoria fishery has undergone tremendous development in the last two decades. From a socio-economic point of view, the greatest impact has been in the commercialization of the fishery and development of an export and fishmeal industry based on Nile perch and 'daga', which together constitute over 90% of fish of Lake Victoria. The benefits of industrialization of the fishery are foreign exchange earnings to the country; higher value of the fishery, hence, its contribution to GDP; increased employment in fish production and processing; better incomes to fish factories, their middlemen and some categories of fishermen, especially those owning boats, gear and outboard engines. The development of the fishery of Lake Victoria has, on the other hand, had an impact the food security situation for lakeside communities.

The problem of food insecurity in the Lake Victoria region is multi-dimensional, arising from a number of causes that put constraints to food availability, or limit local people's access to it. Fish is central to the food insecurity problem for lakeside communities. As a rich protein food, it is one of the most prominent solutions to the protein-deficiency conditions affecting children in the lake area. It is also a potential income source for those engaged in fish production, processing and marketing. Income earned from the fishery and in related activities may be used to purchase energy foods and other protein substitutes. Despite these advantages, fish is lowly regarded in the national food policies. The fisheries policy objectives recognize the role of fish in improving food security locally, but the need to maximize foreign exchange has superseded the interest for domestic food security.

This report argues that the importance of fish in national food security has been reduced in two ways: one, food has become *less available* especially to non-fishing communities in the lake region. Secondly, there is *limited and declining access* by lakeside communities to fish. Factors contributing to fish unavailability include the export of Nile perch, the usage of 'daga' and Nile perch frames for industrial purposes rather than direct human consumption, dwindling fish catch, among other issues. Limited access to fish, and other foods, for lakeside communities is caused by factors that reduce the purchasing power of households. They include, declining household incomes from fishery and non-fishery sources; loss of employment in fish harvesting, artisanal trading and processing sectors; unemployment in non-fishery sectors; fishery management problems; entrenched poverty and lack of alternative income sources; and socio-cultural constraints to consumption of fish and other foods. The industrial and domestic demand for fish has also increased pressure on the Lake, leading to unsustainable fishing and raising fears of long-term food insecurity.

This report analyses the food security issue in relation to the development of the Lake Victoria fishery. In particular, the report focuses on role that fish and the fish industry play in food security for lakeside communities and national food policy goals.

The report is based on primary and secondary data collected at various times, published and unpublished documents as well as the author's own observations over a number of years of working as researcher on socio-economic aspects of the Lake Victoria fishery. The paper concludes that, even though the development of the fishery has certain positive impacts on the lakeside communities and the national economy, the transformation has made fish, and other foods, less available and accessible. The current trends in the fish industry do not promote the important objectives set by the Government of Kenya for development of the fishery, in particular in relation to food security. Various recommendations are made to lessen the potential impacts the development of the fishery has on the food security situation of vulnerable communities in the Lake region. Recommendations are also made for non-conflicting fishery policy objectives, control on the expansion of industrial fish processing and exports and proper fishery management, including better surveillance, enforcement of the existing regulations and allocation of property rights to fisher communities.



Tilapia being loaded on to a passenger van at Asat Beach for Kisumu and Nairobi.

1. Introduction

Famine, malnutrition or in the short-term, hunger, remain some of the most intriguing challenges facing mankind at the close of the 20th century. Food insecurity is a global problem affecting much of the third world, and which demands concerted efforts by multiple institutions, including governments, development agencies, providers of relief services, international organisations as well as community groups. In the mid-1990s it was estimated that 33% of the population in Africa, comprising of some 138 million people, was food insecure (IFPRI, 1995; USAID, 1994). In particular, the three countries sharing Lake Victoria – Kenya, Tanzania and Uganda – are in a region especially prone to debilitating and widespread effects of hunger and famine. Attempts are often made to relieve periodic crises through food aid and other emergencies. These, however, are short-term measures that do not provide lasting solutions to the food problem.

Food insecurity in the Great Lakes region is a problem affecting a multiple of sectors, and which goes beyond different political or geographical boundaries. The Lake Victoria basin, in particular, is characterised by entrenched poverty and environmental degradation, arising from land degradation, soil erosion, desertification, biodiversity loss, among other factors. Such problems have partly compounded difficulties in producing sufficient agricultural food, trapping people in a vicious downward cycle of food insecurity. However, unlike other parts of East Africa, the lake region is famed for her rich fishery. Yet, despite this unique and vast natural food resource, many of the local communities who depend on the Lake Victoria fishery for their

livelihood are among the most food insecure in the region.

This report focuses on food security in relation to development in the Lake Victoria fishery, particularly in Kenya. It reviews concepts and perceptions of food security and examines how it is affected by economic, technological and socio-cultural transformation in the fisheries sector. Central to this is the role of fish both as a food resource and as a commodity that can earn income through exchange, and whose exploitation and trading is an important source of gainful employment. The overriding objective of the report is to evaluate the impacts of the development of the Lake Victoria fishery on food security, in terms of enhanced or decreased availability and access to fish and complementary foods by local communities.

The fishery is still undergoing tremendous changes. New actors are moving into the fishery, some of them introducing fish harvesting methods previously unknown in the area, and which should raise environmental concern. The fish marketing sub-sector is also undergoing significant development, with increasing fish processing and fishmeal production capacities and expansion in both domestic and export demand for fish.

Various recommendations are, therefore, made to lessen the potential impacts of the transformation of the fishery on the food security situation of vulnerable lakeside communities. Results and conclusions are based on primary and secondary data collected at various times, published and unpublished documents as well as observations made over a

number of years by the author. Many times in the text, reference is made to 'lakeside communities', 'Lake Victoria communities' or 'fishery-dependent communities', as the target group.

There is no clear demarcation of the geographical area occupied by these communities referred to in the text. The same terms have previously been used by other authors, sometimes in reference to fishing communities living right on lakeside villages, while others use it to describe selected communities in the whole Lake Victoria basin. In this study, perhaps the target group can best be described as those local communities who in one way or another depend on Lake Victoria or who live around the lake, even if they do not directly gain from it. These are the communities to whom development of the fishery has a lot of impact. They gain or lose from increased fish trade, industrialisation of the fishery, overfishing and any other changes in the fishery

The report proceeds under the following premises: First, that fish is potentially the single most important food resource for lakeside communities. The supremacy of fish as food over other protein sources is clearly explained in sections of the text ahead. Second, that the Lake Victoria fishery can be the greatest source of income and livelihood for those engaged in fish production, processing, marketing and related activities. Increased participation by local communities in fishery activities has the potential to improve their income base, hence, give them greater access to fish and other foods. The benefits of the fishery, if well harnessed, can trickle-down to a large number of other dependants who are not directly involved in fishery activities. Third, based on the above two premises, one way of tackling the food insecurity problem lies in improved management of the fishery to provide greater benefits to local people in terms of food and income.

1.1 Food Security: A Review of Concepts

Food security is a broad concept, whose meaning and scope has evolved over the years. The traditional concepts of food security included simple measures such as national food production, food grain storage, national food self-sufficiency and food aid. These were mainly macro indicators reflecting food supply, and which were used as a basis for developing conventional early warning systems against famine. In designing these systems, it was believed that such indicators could predict acute food insecurity and cause the relevant authorities to respond adequately through centralised distribution of national food reserves or food aid (Davies *et al*, 1991). However, famine has continued even in the face of conventional early warning systems. It has also not been possible to develop interventions that may prevent or reduce the extent of food insecurity situations in future (Buchanan-Smith *et al*. 1994).

According to Palfreman and Insull (1994), the global food production has outstripped population growth, thus, in the global arena, purchasing power should be the limiting factor to food security. This view, however, may not apply in many areas, particularly in the Lake Victoria region where food supply, distribution and affordability are all evidently major bottlenecks. In any case, it is now recognised that local food insecurity can exist amidst global food security, and that national and international development policies affect the food security situation at the household level.

This has prompted the need to redefine food security and to develop concepts that aim for longer-term, sustainable improvement in access to food. The new definition of food security should take cognisance of a number of facts. First, there is ample evidence that food supply and availability alone are not sufficient to relieve food insecurity. Borton and Shoham (1991) explain that food insecurity can occur in a situation where food is available but not accessible to sections of the community because their entitlements to food have been eroded. This argument counters the general assumption that deficits in food supply are the only important cause of food insecurity. Secondly, the level of food production is not necessarily correlated with differences in household consumption. This negates the assumption that food production is a sufficient indicator for food consumption, or that increased food supply will automatically result in improved nutrition (Frakenberger, 1992). Third, the generalisation that malnutrition is a conclusive indication of food insecurity is not necessarily correct. Malnutrition can result from other causes that are independent of food insecurity, for example, poor health or poor maternal and childcare. Thus, household food security is a necessary but not sufficient explanation for adequate nutrition. Similarly, a deterioration in child growth cannot be interpreted on its own as identifying a decline in food intake or a conclusive indicator of food insecurity (Frakenberger, 1992).

Based on above concepts, some authors argue that food security should be put into the broader context of livelihood security. They explain that food security is just one objective people seek to realise in the wider context of their livelihood survival. Some households may opt to forego food security in the short run in an effort to secure the sustainability of their livelihoods in the long run (Devereux, 1993; Shoham and Clay, 1989). According to O'Riordan (1997), food security means different things to different people at different times. To regular wage earners, it is about having sufficient income and a selection of affordable food supplies in the shops. To a rural subsistence farmer or fisherman, food security encompasses producing a harvest sufficient to meet

household subsistence needs and generating sufficient surpluses to exchange for cash so as to meet other livelihood and food needs. The World Bank (1986) defined food security as 'access by all people at all times to enough food for an active healthy life'. Its essential elements are the availability of food and the ability to acquire it. A more detailed definition used at the World Food Summit is 'all people at all times having physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life' (FAO, 1996). Simply put, food security means 'access to food for a healthy life by all people at all times' (Barraclough, 1996).

Most authorities, therefore, define food security in terms of access to food, sufficiency of food, ability of food to ensure an active and healthy life, and the consistency of access to food. Thus, the capacity to produce and store food is still critical, even though not sufficient, to ensure food security. Similarly, access to food - determined by the ability to buy or acquire food, control productive resources, or exchange other goods and services for food - is another important index of food security (Mwale, 1998). The food quantities accessed must be sufficient to meet national, regional or household needs, and should fulfil nutritional needs of adequate energy, protein and micro-nutrients.

A household's food security, thus, depends on its ability to secure adequate food, either through own food production or food purchases, for meeting the needs of all their members. Factors affecting a household's food security, therefore, include availability of food production resources such as land and labor, the household's income, availability of essential foods and their prices. When households are unable to produce or store sufficient food they become food insecure. Similarly, the loss of access, whether from a collapse of purchasing power, loss of rights to productive resources, inequitable distribution or inability to produce other goods and services in exchange for food, exposes households to food insecurity. Worsening food security prompts people to adopt coping strategies such as switching to inferior foods, resulting in a fall in nutritional status. If food insecurity is prolonged and it increases in severity, people will be forced to employ strategies that are increasingly threatening to their livelihoods.

In summary, therefore, a community or group will be food secure if there is sufficient food available; they have the necessary purchasing power or means of exchange to acquire it; and their social relationships allow them access to it both at the community and the household levels.

1.2 Fish, the Supreme Food

With very few exceptions, all foods provide a

mixture of two or more of the essential nutrients in varying proportions, namely; proteins, carbohydrates, fats and oil, vitamins, minerals and water. Proteins, in particular, are necessary for generating new body cells and replacing the ones worn out as a result of senescence, injury or disease. All adults and children need certain minimum amounts of proteins, and this requirement is higher for expectant mothers, growing children, breast-feeding mothers and the sick.

Proteins can come from both animal and plant sources. Soya beans, groundnuts, dry beans and peas are common plant protein foods. Three important aspects with regard to the protein source are the protein content of a given food, how much of that protein that the body can utilize and the type of amino acids it contains. Plant proteins are generally cheaper to grow or acquire, and they have high protein content but, compared to animal proteins, they are less utilized by the human body. When the two factors are taken into account, fish becomes one of the richest sources of protein. Table 1 clearly shows the high nutritive value of fish compared to other important protein foods such as meat, eggs and milk. Fish in the dried form has the highest protein content among common foods, and its protein is among the most readily utilized, making it a supreme natural protein food.

The difference shown in the table concerning the protein content of wet and dried fish is due to the differences in their water content. On average, wet fish contains about 77% moisture while the same fish, if properly dried, will only retain 18% of the water content (King *et al*, 1972). The human body can utilize 83% of either wet or dried fish proteins. In a way, therefore, processing of fish to lower its water content by drying or smoking it concentrates its protein composition, making it a food which is both nutritive and convenient to store.

Besides protein, the body also requires energy and vitamins. The energy requirement is dependent on age, body weight and the nature of an individual's daily activities. Energy requirement is often more critical than proteins in both adults and children. An average adult doing ordinary work would require 10 - 20 MJ of energy and about 40 grams of proteins daily (King *et al*, 1972; Kenya Government, 1997). Vitamins are also essential to the body, although they are required in very small quantities. Vitamin A is particularly vital for good vision and healthy skin. Dried fish, such as 'dagaa', is one of the richest sources of vitamin A. Mwaniki (1997) estimates that just 10g of 'dagaa' can provide sufficient levels of vitamin A needed by a growing child. Complementary vitamins B, C and D are found in a variety of other foods, such as fruits and some green vegetables (King *et al*, 1972).

In summary, fish has many advantages over other foods. It is an important source of protein to the poor as it is cheaper in comparison to meat, poultry and dairy products. Fish adds flavour to diet; is rich in essential fatty acids, vitamins and minerals and is easier to process and store (for example by sun-drying) compared to the alternative sources of animal protein.

1.3 Food Security; an Elusive Goal of Fisheries Policy

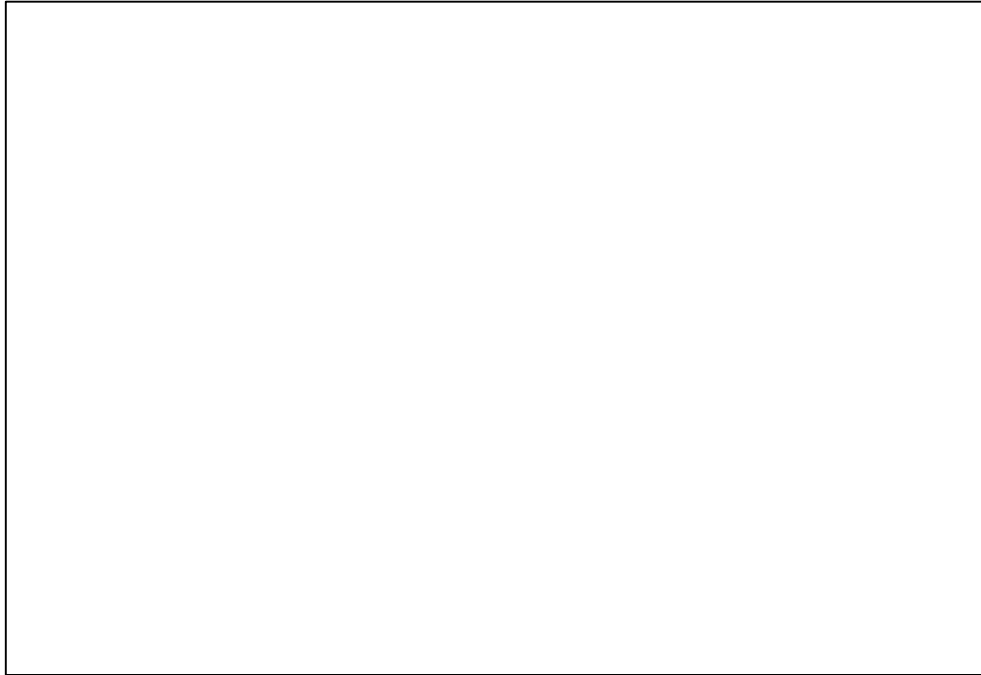
One of the stated policy goals of the Kenya Government is to improve the quality of life of its citizenry. It is government policy that nutrition objectives be considered in development projects, and that priority be given to collection and analysis of information on nutritional status of the population so that programs are designed to eliminate nutritional deficiencies. The Sessional Paper No.4 of 1981 on 'National Food Policy' stresses the role of government in attaining food security, by reducing problems relating to production, distribution and consumption (Kenya Government, 1994b). The central goal of Kenya's national food policy is to ensure that there is adequate supply of nutritionally balanced food in all parts of the country at all times. Specifically, the food policy aims at maintaining self-sufficiency and ensuring fair distribution of nutritive foodstuffs. Mogaka (1999) explains that this entails some or all of the following: increased food production, a food monitoring and reporting system, monitoring and forecasting weather in agricultural zones and growing drought-resistant crops in the dry lands.

The food policy puts much emphasis on staple foodstuffs, mainly grains, and has very little mention for protein foods such as fish. This is understandable since energy food requirement is often seen as very critical in many developing countries. However, protein deficiency is also commonly reported in many developing countries, Kenya included, particularly in the Lake region. Ikiara (1999) notes that fish has been regarded as a relatively unimportant food in the national scale. Fish is often seen as an important source of protein only in regions such as the Nyanza and Western provinces, where it is produced. Despite this, the government has clearly defined policy objectives for the fishery, where emphasis is put on attaining food security. These include goals to; i) achieve increased per capita fish consumption through the production of low cost protein food (fish); ii) generate employment opportunities and incomes in fishing, fish processing and trading; and iii) enhance the living conditions of the fishermen and their families by maximizing economic benefits to them (Kenya Government, 1995). A fourth, and somehow conflicting goal, is to maximize foreign exchange earnings from fish exports.

In summary, the Government of Kenya's policy goals for the fishery is increased fish production so as to enhance the supply of proteins, raise incomes and increase contribution to the GDP, in addition to contributing to employment creation and foreign exchange earnings. If these stated objectives of the government were achieved, the fishery would contribute greatly towards food security of lakeside communities. However, there is limited scope of expanding the resource base, which makes it difficult to achieve all of the stated policy objectives, some of which are contradictory in their aims. In practice, undue emphasis has been placed on the attainment of foreign exchange from exports over all other policy objectives for the fishery, especially those addressing the essential role of fisheries in the domestic food policy.

Table 1. Nutritive Value of Common Natural Foods

Food type	Protein content	Protein utilization rate	MJ of energy contained in 100g of food	Weight of food containing 40g of protein	Weight of food providing 40g of protein (adjusted for protein utilization rate)
Dried fish	63%	83%	1.3	63g	76g
Dried skim milk	36%	75%	1.5	120g	150g
Soya beans	34%	56%	1.69	120g	210g
Peas	22%	44%	1.45	180g	410
Beans	20%	47%	1.42	200g	430
Fresh fish fillet	18%	83%	.55	220g	270g
Meat	18%	70%	.92g	220g	320g
Chicken	12%	65%	.51	330g	510g
Eggs	12%	100%	.60	330g	330g
Wheat flour	10%	52%	1.52	400g	770g
Millet	10%	56	1.42	400g	710
Maize meal	8	55	1.5	500g	910g
Rice	7	57	1.5	570	1000g
Bread	7	52	1.09	570g	1100g
Cow's milk	3.5	75	.272	1100g	1500g
Green leaves	3	*	.092	1300g	*
Irish potato	2	71	.29	2kg	800g
Sweet potato	1	*	.41	4kg	*
Cassava flour	1	*	1.41	4kg	*
Cabbage	1	*	.07	4kg	*
Sugar	-	*	1.62	-	-



Nile Perch being dried out in the sun for sale in the local market.

2. Status of Consumption

2.1 Fish Consumption

Information on fish consumption is limited and very often inconsistent. Some nutritional studies have been conducted in the lake region, but they tend to be confined to specific districts, localities or to particular communities and rarely do they focus on fish. In spite of this, the contribution of fish to the economy and diets of lakeside communities is a subject that has attracted a lot of interest in recent years. For example, all major research projects currently being implemented on Lake Victoria fisheries have, as one of their objectives, to study some aspects of fish marketing and consumption. This has probably arisen because they have identified certain information gaps in relation to fish consumption.

One the most comprehensive studies on fish marketing and consumption around Lake Victoria was recently carried out by SEDAWOG [An acronym for Socio-economics Data Working Group], which is a unit of the Lake Victoria Fisheries Research Project. The report of SEDAWOG (1999a) shows that the largest proportion (constituting 46%) of fish consumers on the Kenyan side of the lake eat fish only 1-2 times a week. Generally most of the consumers, about 58%, do not change their fish eating patterns throughout the year. For 78% of the consumers, tilapia is the favorite fish to eat. However, the favorite fish species is not what is always available, and many of these consumers who prefer tilapia switch to other species, such as 'dagaa'

or one of the forms of Nile perch, whenever they cannot get tilapia.

Another fish consumption study, conducted for the Lake Victoria Environment Management Program (LVEMP) on 48 fishing and non-fishing households living on 3 villages next to Lake Victoria, revealed that, in fact, most households eat 'dagaa' and tilapia more frequently than Nile perch (Abila *et al*, 1998). However, households buy larger quantities and spend more money on tilapia each time they buy it than when they buy 'dagaa'. For example, most families buy about 1 Kg of tilapia and spend about Ksh 50 each time they go to buy it. In comparison, households buying 'dagaa' spend less than Ksh 20 each time they need it. This divisibility and affordability of 'dagaa' makes it more suited for low-income households.

Unlike the SEDAWOG (1999a) report, the LVEMP study found that most households do change their pattern of fish consumption within the month and during the year. There were more households consuming 'dagaa' during the dark moon phase, when much of it is landed and the price is lower. Similarly, a majority of households, 85%, indicated that they eat more fish during the rainy months of March, April and May. This is the time when more fish is landed and the roads to the beaches are very bad, hence more fish remains at the fishing village. Fish consumption is also high in the dry months of July and August, when there are few vegetables that can substitute it.

The IUCN Socio-economics of the Lake Victoria Fishery Project also funded, in a relatively small scale, a study on the consumption of fish in the lake region in 1997 (unpublished). This was a comparative survey conducted in three sites: Karungu, a small fishing village; Migori, a medium-size urban center; and Kisumu, the largest town in the lake region. A total of 258 households, fairly distributed in the three sites, were interviewed. As in the SEDAWOG results above, this study also found that most households, 61%, consume fish just two times in a week. It also established that Nile perch is eaten much less than tilapia and 'daga'. Nearly 47% of the households gave tilapia as the fish they consume most, 32% mentioned 'daga' while only 22% gave Nile perch. On average, families spent about Ksh 40 to buy fish every time they had it for a meal. This compares well with the findings of the other studies. Of the respondents, 63% indicated that their fish consumption pattern changes for some months in the year.

Naturally, fish consumption would be expected to be highest in areas adjacent to water bodies where fish is harvested, and in major urban areas. This view is consistent with the observations made in the mid-1980s by Nyagambi (1988). The great paradox, though, is that protein malnutrition reported as being greatest in the fishing districts. This, according to Ikiara (1999), is mainly because these communities eat very little of the fish they produce and, yet, they have no access to supplementary sources of proteins. There is still low acceptance of fish as food in parts of the country due to cultural and social norms, religion, food beliefs and personal factors. Possibly as a result of these factors, Ogotu (1988) estimated that in the period 1984 to 1986, only 3% of the fish landed from the Kenyan part of Lake Victoria was consumed by the fishermen and their families.

Where as there may be several differences in the results of the consumption studies cited above, the following generalizations could be made. First, fish consumption is lower than would be expected in the lake region, with a majority of households eating it just about two times in a week. Secondly, tilapia and 'daga' are the most consumed species. While tilapia is the favourite fish, 'daga' has the advantage of divisibility and affordability. Third, consumption patterns tend to change within the month and during the year; and this seems to be affected by the level of fish supply, price of fish, availability and price of substitutes.

2.2 Per Capita Fish Consumption

Per capita consumption is simply a measure of the quantity of a product that, on average, one person in a defined area utilizes in one year. It is a very useful measurement, since it can be used to compare

changes in consumption over a number of years. The most direct way to estimate per capita food consumption is by dividing, if data is available, the tonnage of food consumed in the subject area with its population. In the fishery of Lake Victoria, lack of reliable data is often a major shortcoming in deriving per capita fish consumption. There is hardly any accurate data on fish landing or on the quantity of fish entering and leaving one district or any defined area of study.

Some studies attempt to estimate per capita consumption through household surveys, by recording what each member of a household eats in a year. For a small locality composed of just a few households, this perhaps offers the most reliable results. However, as the study area enlarges, problems arise in relation to sampling, boundary definition and knowledge of numbers of households within the study area. Available estimates of per capita fish consumption must, therefore, be cautiously interpreted. Their accuracy depends on how they are derived, and what assumptions are made in calculating them. This may explain why the estimates made by different authors vary and are often quite inconsistent.

According to the SEDAWOG (1999a) report, fish-eating households on the Kenyan part of Lake Victoria consume, on average, 42 Kg of fish per person per year, a figure that appears quite high. As would be expected, the report shows that fish consumption progressively declines as one moves away from the immediate lake area. Fish consumers at the fish landing beaches eat an average of 62 Kg of fish per year, compared to 41 Kg in the intermediate small inland markets. Those in the big inland markets further inland eat, on average, 38 Kg of fish per annum.

The consumers targeted in the study lived within a radius of 30 km from the lake although, in a few cases, the survey extended up to 60 km inland. Data used to estimate the figures above were obtained only from the families who eat fish and left out the non-fish eating families. This possibly explains the high average consumption levels derived from the study results. SEDAWOG has proposed to conduct a more detailed household-based nutrition study. Possibly, this will produce more incisive information regarding per capita household fish consumption levels around Lake Victoria, and the factors explaining nutrition status.

According to various annual reports of the Fisheries Department, Kenya's per capita fish consumption at independence stood at 2.2 Kg per annum. This is estimated to have risen to 3 Kg in 1980 and then to 7.5 Kg per annum in 1999. However, Bokea and Ikiara (2000) explain that these figures may be inaccurate since they were calculated based only on the levels of fish supply, and completely ignored fish exports, imports and quantities used in fishmeal industry. These figures are inconsistent with estimates of Abila and Jansen (1997), who estimated the per capita fish consumption in Kenya at about 3.76 Kg and 3.13 Kg for 1995 and 1996 respectively. In their calculation, the authors took account of the levels of fish landings, exports and imports, quantity of fish used for fishmeal and changes in the population.

In spite of the inaccuracies, none of the figures above achieves the national per capita fish consumption of 9.3 Kg per annum which Okemwa and Getabu (1996) suggest as the desirable target for Kenya. The situation is worsened by Kenya's very high disparity in income distribution, which means that most of the fish is eaten by the high income groups while the poor may have none of it altogether. A point to note, though, is that per capita fish consumption in the country seems to be on the decline.

2.3 Other Food Consumption

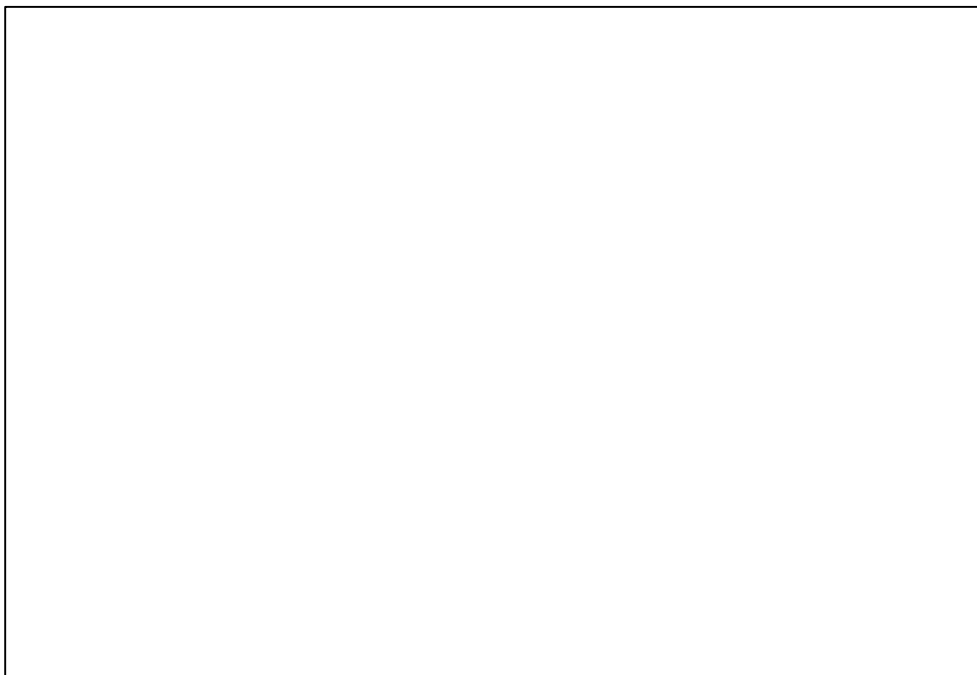
Table 2 gives the mean monthly values of selected foods consumed by sampled households in all eight provinces in Kenya. The Table indicates that Nyanza province, which is the base of the Lake Victoria fishery, consumes among the highest amount of cereals per household. However, the province has among the lowest levels of meat consumption. A logical suggestion is that fish compensates for the low meat intake. However, as fish becomes less available in the region, the communities are unlikely to increase their consumption of meat, owing largely to economic reason. Results of SEDAWOG (1999a) show that in the absence of fish, a majority of fish consumers would most often substitute it with beans or simply eat vegetables.

In their survey, Abila *et al* (1998) determined that most households living next to the lake eat a meal of vegetable (with 'ugali') about 15 times in a month. From a nutritional point of view, vegetables eaten in large quantity as the main meal are not particularly useful, as they contain some minerals, but are a very poor source of energy and have very little protein content and few of the essential vitamins (King *et al*, 1972).

Table 2. Mean Values (Ksh) of Monthly Household Consumption of Selected Foods by Province

Province	Cereal and Cereal Products	Meat and meat products	Oils	Vegetables	Root crops	Total Value of all Foods consumed by households
Nairobi	1707	1823	550	1325	280	5685
Central	1896	807	286	710	480	4179
Coast	2324	1028	269	719	192	4532
Eastern	1672	678	175	732	138	3395
North Eastern	1973	2172	434	347	55	4981
Nyanza	2285	870	238	392	123	3908
Rift Valley	2905	1162	203	533	171	4974
Western	1851	795	151	612	224	3633
Mean	2077	1167	288	671	208	4411

Source: Kenya Government, 1996



An open small truck waits for tilapia at a landing beach.

3. Causes of Food Insecurity

Food insecurity in the Lake Victoria is due to a number of factors. The severity of a particular cause varies from one community to another and for different households, depending on the nature of the

particular family's involvement in the fishery, their level of dependence on fish, the state of their income and savings, their ability to shift to other income sources, among other factors. Below are some of the most important factors that, in the view of the author, have had impact on the food security situation of Lake Victoria fishing communities. They include the transformation of the fishery from local, subsistence-based to a commercial venture serving largely industrial and export goals; unfavourable fish trade policies; entrenched poverty of fisher communities; and poor opportunities for agricultural production. In addition, fishery management failures, which have led to gear thefts, bad fishing methods (such as poisons and trawling) and detrimental effects of drift netting have also contributed to the food insecurity situation. These factors limit the continued participation of fisher communities in fish production activities. Food security is also constrained by certain bad cultures and beliefs. These factors act singly or

jointly to limit local communities' access to fish and other useful foods, by either causing or contributing to a decline in the supply of these foods, or lowering local people's ability to purchase them.

3.1 Transformation of the Lake Victoria Fishery and Impacts on Food Security

Lake Victoria has long been famous for its rich aquatic life and, in particular, as a high quality

fishery. In the first half of this century, the lake had a very diverse fauna, comprising of over 350 species. In the late 1950s, some species were introduced into the lake. Among them, Nile perch and Nile tilapia quickly established themselves, and were destined to instigate commercialization of the fishery three decades later (Achieng 1990; Anderson, 1961). Until the mid-1970s solely small-scale fishermen exploited the fishery of Lake Victoria (Butcher and Colaris, 1975), with varying degrees of involvement in the fishery. Some fished only on a part-time or seasonal basis while others were full-time fishermen. Nearly 80% of the fishermen derived their primary income from fishing (Francis and Hoddinott, 1993). Very few owners of canoes possessed more than one canoe or owned more gill nets than they were able to control themselves. The ownership pattern was thus very decentralized and the income from the lake evenly distributed among the fishermen.

During this period, the processing and trading sectors of the traditional fishery was almost totally dominated by small scale operators, most of them women, who were based in the local communities

around the lake. Fish which was not sold fresh was processed by being smoked or sun-dried on the beach and carried to local inland markets by the traders. There were few wholesalers in the fish trade, and the traders never acquired control over the fishermen as they have managed to do in so many other traditional fisheries through the establishment of credit relationships. Most of the animal protein eaten by the local population came from fish of the lake (Jansen, 1973; 1977).

The rapid proliferation of Nile perch started in the Kenyan part of Lake Victoria about 15-20 years after the fish was introduced. In 1978 about 1,000 tonnes of Nile perch were caught, in 1981 nearly 23,000 and in 1985 the production had increased to 50,000 tonnes. The Nile perch landing peaked at about 123,000 in 1991, and has since been on a declining trend (Abila and Jansen, 1997). It is estimated that only about 54,000 tonnes of Nile perch was landed in 1997 (Othina, 1999). In the Kenyan portion of the Lake, in 1995, about 91.5% of the catch consisted of a combination of Nile perch comosing 47.2% and *Dagaa* constituting 44.3% (Othina & Osewe-Odera, 1996). Thus, from a multi-species fishery in the 1960s, the lake is now basically a two-species fishery.

The reduction of most species probably occurred as a result of predation by Nile perch, competition for food and over-fishing (Witte and Densen, 1995). As the Nile perch catch expanded, the number of fishermen also progressively increased. There were about 11,000 fishermen on the Kenyan part of Lake Victoria in 1971, compared to 22,000 in 1989 and 24,000 in 1992. In 1995 there were about 30,000 fishermen. The number of canoes also increased in the same period. There were over 8,000 canoes of different types in this area in 1995. Besides, there was substantial investments in fishing nets, and especially the gill nets with larger mesh-sizes aimed at catching the bigger Nile Perch (Reynolds *et al*, 1992; Hoekstra *et al*, 1990).

The rapid production of Nile perch also caused a new dilemma. Initially the local market could not absorb all the Nile perch landed. In particular, it was difficult to sell the perch in the local markets in Kenya in the early 1980s. Many of the consumers living in the fishing communities near the lake resented the "oily and fatty" fish. However, it only took a few years before the perch became a popular table fish in Kenya, as new forms of fish processing developed (Yongo, 1994; Abila, 1995). During the mid-1980s, in a period of only 3-4 years of the Nile perch boom, the market in East Africa was able to absorb a supply of almost three times higher than any time previously, without much effect on prices. There is no doubt that many new fish consumers

gained tremendously from the changes which affected the rich Lake Victoria fishery during the 1980s, with huge amounts of fish having been made available at more affordable prices (Greboval and Mannini, 1992). People in the harvesting, processing and distribution sub-sectors of the fishery also benefited greatly from the new fishery regime. Many people who had been unemployed or underemployed were able to obtain incomes at levels they had never experienced before (Reynolds and Greboval, 1988). In the early and mid 1980s the fishery continued to be almost exclusively operated by small-scale rural fisher-folk, with little fundamental changes in technologies, techniques and practices. The period saw more women engaged in the processing and marketing of fish both on the Lake Victoria beaches and in markets in several towns in Kenya (Yongo, 1994; Abila, 1994).

In summary, the pre-1980 Lake Victoria fishery, by providing food, employment and income, greatly contributed to the food security needs of the local populations. The initial years of Nile perch fishery improved food security, as more fish was available at affordable prices. This has changed a lot with the advent of trade liberalization and the establishment of the fish processing and export industry.

3.1.1 Globalization of Fish Trade

About a quarter of world trade involves the import and export of primary products, among the most prominent being fish. The export of natural resources often involves environmental and social costs that are not reflected in national accounting. Over-exploitation of fish stocks in the developed world has increased dependence on fish stocks in the less developed countries. In the last two decades, the volume of fish exported by developing countries has represented close to 70% of world trade in fish stocks (Watkins, 1996)

To the classical economist, complete trade liberalization is often a desirable goal. This involves breaking any trade barriers, to enable an investor acquire and dispose of resources in such a way that maximizes his private profits. Free trade, it is argued, can make the economy efficient, as investors will concentrate their effort and productive resources in areas they have some comparative advantages in. The less efficient players in the trade will be out-competed and displaced by the cost-effective investors.

Watkins (1996) argues that free trade is no longer justifiable as an end in itself. Free trade hardly ever safeguards local people's social and environmental rights. Unacceptable levels of social exploitation and ecological damage often characterize unregulated trade, especially where it involves the exploitation of

natural resources. Issues of sustainable resource management and poverty reduction, among others, hardly ever feature in the free trade agenda. As a result, public welfare and sustainable development are subordinated in pursuit of self-interest and commercial profits. Unfortunately, governments of developed and developing countries remain bound by the principle that trade should be deregulated, and in fact encouraged.

The free trade philosophy has taken root in both the fish harvesting and marketing sub-sectors of the Lake Victoria fishery. The Kenya Fisheries Act places some restriction on certain fish harvesting techniques and mesh sizes. However, there is no limit on the number of fishing vessels or nets one may own. There is also sufficient leeway for one to switch from a less yielding fishing method to one which catches a lot of fish, even if this may have negative effects on sustainability of the fishery. In the marketing sub-sector too, there is hardly any form of control. One is free to buy any amount of fish at any of the recognized landing beaches at any price and sell it anywhere in the world at any price. It has been argued that the free trade policy is what has encouraged investments in the fish processing and exporting industry (Odongkara, 1999). The lack of price and other controls has ensured that the fish business remains lucrative, attracting new investors to establish new fish factories even when official statistics show that catches are on the decline.

Thus, the Kenya Government, international organizations and the fish processing industry itself have put a lot of effort to globalize fish trade, in line with international free trade principles. Abila and Jansen (1997) and Bokea and Ikiara (2000) describe some of these strategies in earlier publications. They include providing low-interest loans for constructing and equipping fish factories, low taxes or tax exemptions, duty exemption on essential factory equipment, funding projects aimed at improving fish quality, among others. Perhaps the most relevant recent example of such action is the Bunyala Fisheries Project described in Box 1 below.

To continue on the present course of unregulated trade in fishery products can impose huge costs on vulnerable communities, and threaten the interests of future generations. The difficulty, however, is to find alternative ways of balancing competing objectives of economic growth, employment creation, sustainable resource management and social equity. There is need for new trade rules which reconcile the demands of global commerce with people's social and environmental rights as well as food security needs.

BOX 1. BUNYALA FISHERIES PROJECT

The Bunyala Fisheries Project, to be initiated in early 2000, is to be located at Marenga, a remote fish-landing beach on Lake Victoria in Busia District. The overall project will cost Ksh 19 million, 90% of which will be financed by Community Development Trust Fund (CDTF) and the remaining 10% contribution by Bunyala Fishermen Co-operative Society. It will involve the construction of a fish landing jetty about 100m long, jutting into the lake; construction and equipping of a cold room and an ice making plant.

The objective of the project is to improve fish handling and enhance offshore preservation of fish. A consultant's report on the feasibility of the project was very positive that it would improve income to fishermen in the area, through the Bunyala Fishermen Co-operative Society (ETC, 1998). Not only will they be in a position to bargain for better fish prices, they will also sell ice and cold-storage services, hence generate additional revenue. The main fish targeted is Nile perch, but sellers of Tilapia and other species may also buy ice and be able to transport fish in better quality to major urban markets. The benefits of the project, according to the report, will trickle down to other sectors, such as sellers of cold drink and other businesses in the town. From the onset, therefore, it appears that there are sufficient economic benefits to justify investment on the Bunyala Fisheries Project.

However, the project seems to be the first in what currently is the policy in the fish processing industry, of building infrastructure on fish landing beaches to ensure quality fish exports. This policy is detailed in a communiqué from the association of fish processors in Kenya, which has been distributed, to fish factories, relevant government departments and potential financiers of the scheme. Bokea and Ikiara (2000) have presented a copy of that memorandum in their publication. It is true, and quite proper, that some quality improvement in fish should be attained through better infrastructure on fish landing beaches. What is at stake, however, is the lopsided nature of such a policy, and its potential effects on food security and the control of the beaches. In the first place, the policy aims only at improving quality of fish for exports and completely ignores quality aspects of domestically consumed fish. The policy also aims at increased quantities of better quality fish exports, without considering what this implies to the already precarious food security situation of local communities.

After building the infrastructure, the fish processors will fence off the developed fish-landing beach. Only personnel of Fisheries Department, Veterinary, Fishermen Co-operatives, Fish traders and fish processors from the export industry will gain access to the enclosed landing. This, according to the communiqué, is to prevent fish getting contaminated. If the plan is implemented, therefore, members of the local communities will not be allowed to enter the fish landing and freely buy Nile perch. This policy will make Nile perch officially a fish for export only. For the first time in the history of fishing on Lake Victoria, local people will be officially barred from buying fish in their own fishing village! This, no doubt, will aggravate the food insecurity situation of local

3.1.2 Nile Perch Processing

The development of the fish processing and marketing industry is closely linked to the rapid growth of the Nile perch fishery in the last decade. A huge demand for Nile perch developed quickly in the industrialized countries during that period. In order to satisfy this market, processing factories were established along the shoreline of Lake Victoria. The first Nile perch processing plants in Kenya were set up in the early and mid 1980s to process Nile perch and export its fillets to markets overseas (Reynolds and Greboval, 1988). They proved to be so profitable that more factories soon were set up in all the three countries. Today there are about 35 factories spread around the lake in the three countries.

A report by SEDAWOG (1999a) based on a survey of 25 factories in the three East African countries show that 88% of the factories were established after 1990. Many of the factories have been financed by international development banks and received support from government development aid agencies of the industrialized countries. Most of the factories have the technical capacity to process Nile perch that far exceeds the amount of fish they are able to obtain (Jansen, 1996; Abila and Jansen, 1997; SEDAWOG, 1999a)

The filleting factories around Lake Victoria are, therefore, competing to secure sufficient raw fish. Additionally, the factories compete for fish with the traditional fish processors, traders and consumers. This competition is not easily realized as, in many cases, the local traders have been completely displaced from the trade. At any fish-landing site, only factory trucks are seen buying Nile perch. The women traders are often seen standing far off, perhaps buying juvenile Nile perch or that rejected by factory trucks. However, whenever there are problems with the export trade, such as a ban on fish exports, or when a factory truck fails to arrive, the number of women buying Nile perch quickly increases. Traditional smoking kilns are quickly reconstructed and the women processors cum-traders are able to handle huge amounts of Nile perch at very short notice. Previously the factories only processed Nile perch of minimum weight 2-3 Kg. Due to increased competition for the dwindling supply of Nile perch, they now accept lower weights, at times even under 1 Kg. Approximately 90-95% of good quality Nile perch above 2 Kg goes to factories for processing. Nearly all Nile perch available in the local markets are the juveniles or that rejected by factories due to poor quality.

The fish factories vary widely in sizes, with processing capacity ranging between 10 to 75 tons of whole Nile perch per day. According to Abila and Jansen (1997), the fish factories in Kenya can process

up to 380 tons of whole fish per day. In 1996, the factories processed only about 208 tons per day, indicating that only 55% of this capacity was actually utilized. This finding is reflected by the results of a more recent survey presented by SEDAWOG (1999a), which estimates that only 49% of processing capacity by fish factories in Kenya is actually utilized. Abila and Jansen (1997) have explained why factories under-utilize their capacity. For most companies, the main constraint limiting maximum production is due to the difficulty in getting enough fish to process. Irrespective of all strategies put in place by various factories to procure fish supplies, many of them still cannot get sufficient quantities consistently. The second limitation is related to fish quality for the export market. Due to constraints in the availability of skilled labor and processing facilities, factories can only handle a limited volume of fish at a given time. Some factories also find difficulty in accessing particular markets overseas. This problem is common especially to new factories that have not established contacts with reliable fish wholesalers or retailers abroad.

In effect, fishing on Lake Victoria has been transformed from subsistence into a largely commercial activity. Rather than supplying local food needs, most of the catch is processed into high value export products or ingredients of animal feeds. This has deprived poor people of a ready access to their traditional source of proteins. Access to fish may be limited in three ways. First, the relatively high prices paid by processing factories makes it unaffordable to local consumers. Secondly, the export market takes nearly all good quality Nile perch. Local consumers can only get Nile perch that has been rejected by factories as undersize or poor quality. Third, concentration of fish harvesting resources in the hands of a few rich fishermen alienates the majority of potential fishermen from their entitlement to the fish resources.

3.1.3 Nile Perch Frames Processing

Nile perch processing, the remains of the filleted Nile perch, commonly known as the frame (or *Mgongo Wazi*), was considered a waste, and factories incurred expenses to dispose of it. In less than a decade, this product has become an important part of the diet of many people especially in Western Kenya. By the late 1980s, almost all Nile perch frames produced by factories was consumed by local people or discarded. The animal feeds manufacturing industry then depended either on imported fishmeal, fishmeal made from 'dagaa' or crushed animal bones and offal from the Kenya Meat Commission (KMC) slaughterhouses. However, the fishmeal industry soon started to use Nile perch frames in processing

fishmeal.

Their

demand for frames has increased so much that they now compete directly with the local market processing it for human food. In 1996 approximately 17,000 tons of Nile perch frames was processed to yield 4,000 tons of fishmeal, representing about 17% of fishmeal used in Kenya. It was then estimated that 55 tons per day, or 59%, of frames produced in Kenya went for fishmeal. The remaining 39 tons was left for local processing for direct human consumption (Abila and Jansen, 1997).

The fish processing factories have also adopted filleting techniques that remove more than half of flesh on the skeleton (frame). A common phrase by the artisanal frame processors is that these frames are "too naked". Consumers of such frames hardly get any edible flesh off the skeletons. It should be pointed out that even for a fairly filleted Nile perch, the edible flesh left on the skeleton is only 10-20% of the frame's weight. The rest is mainly bone, which are discarded by the eater. Increased filleting efficiency, therefore, further reduces this little edible flesh on the skeletons.

Despite these practices, the demand for frames by local consumers, who are usually the poorest in the community, has continued to rise. New artisanal "factories", at which frames are fried in deep oil, have emerged in Kisumu, Migori and Homa-bay, the same areas where processing factories are located. The fried frames have a ready market in several parts of Kenya, especially in the western region. Kakamega, Busia, Kitale, Bungoma, Oyugis, Kisii, Awendo, Rongo, Kisumu, Migori and Homa-bay are some of the prominent markets for the product. Other traders obtaining frames from Kisumu have been able to sell them to markets further inland such as Nakuru, Nairobi, Kiambu and even Taita-Taveta, which is more than 500 Km away.

As Nile perch catches decline, the quantity of frames available both for fishmeal processing and for local consumers has gone down. This would have been a sufficient disincentive to further investment in industrial processing of frames. In reality, though, the industry continues to expand. The most recent case is that of the fishmeal plant at Nyangoma in Bondo District, which is described in Box 2 below.

BOX 2: FISHMEAL PLANT AT NYANGOMA

This fishmeal processing factory was launched in November 1999 and, at the beginning of the third millennium, is the most recent fish-based industrial establishment in Kenya. The plant is located in Nyangoma, a remote village 4 Km away from Lake Victoria in Bondo District. It is owned by a local person who has worked in senior positions in the civil service, and also with local and international institutions, including providing consultancy services to the World Bank. Through these connections he has been able to get a huge loan of KSh. 30 million principally from a local commercial bank in Kenya to invest in the project. Almost all the machinery used to build the plant is itself not new. The factory owner bought second-hand machinery from the old Kenya Fishmeal plant in Athi River which, for some reasons, had ceased to operate, and transported them 400 Km to the new factory site. It would be difficult to establish the real market value of used machinery and, hence, verify whether the quoted cost of investment is exaggerated. At full operation, the company will employ a maximum of 70 people. In the short run, the produced fishmeal will be sold in other parts of the country, but there are possibilities to export it later.

The plant will mainly produce fishmeal from Nile perch fish frames. When the supply of fish frames become inadequate, the factory plans to use "dagaa". The plant has the capacity to process more than 40 tonnes of fish frames and "dagaa" per day into fishmeal, making it the largest producer of fishmeal in the country. An optional production target will be to combine fish frames and "dagaa" in a mix ratio of 5 tonnes of the former with 200 Kg of the latter. "Dagaa" has a high protein content but is more expensive than fish frame, which has less protein. The company has projected that it will be able to get fish frames from factories at KSh. 2 per Kg and "Dagaa" from the lake at KSh. 20 per Kg. In combining the two, therefore, the factory gets the price and protein-content advantages. Raw materials for the factory will come from fish processing factories and the lake itself. The plant has made arrangements to buy fish frames from Nile perch processing factories in Kisumu, Migori and Homa-bay. "Dagaa" will be directly sourced from nearby fish landing beaches. It will be possible to buy wet "dagaa" from the boats, load it into a waiting van while still wet to be dried during processing at the plant. The company intends to improve infrastructure on some of the nearby beaches and charge the fishermen and middlemen for using the services. In this way the factory will strengthen its position in the fish supply chain and be able to dictate fish prices.

The development of fishmeal factory of the magnitude described here has far reaching implications to the small-scale fish trader and processor. First, the plant will compete directly with artisanal processors for fish frames. Evidence has been adduced in parts of this report to show that there is no surplus of fish frames in Kenya. In reality, the demand for fish frames by local processors in Kisumu, Migori and Homa-bay far exceeds what they can get at any time of the year. The 40 tonnes to be processed by this one fishmeal plant daily, therefore, means less fish frames to be processed by locals. A number of artisanal traders and processors will become unemployed due to lack of fish frames. In addition to this, are numerous other people who provide support services such as fish cart operators, fish head-choppers, firewood suppliers and fish frame packers. A similar situation will arise in the case of "dagaa". By getting fish directly from fishing boats, the factory will cut off the women who have traditionally operated as processors-cum-middlemen for "dagaa". These women, in the past, obtained fish from the boats and dried it before taking it to the market or selling it to other traders on the beach. They will not be needed any more, for example, to dry "dagaa", since this can be easily done at the factory. Some of these women will now be under-employed or unemployed altogether. Considering its limited capacity to create jobs, the factory will result in a net loss of employment.

The fishmeal plant also has important consequences for food security. Those who will lose employment will have less or no income with which to purchase food, including fish. Furthermore, the factory will create higher demand for fish, and cause prices to escalate beyond the reach of many consumers. Finally, there will be less fish frames and "dagaa" available in the market for direct human consumption, increasing possibilities of food insecurity. To sum it all up, the beneficiaries of this fishmeal factory are its owners, who will get profits, the fishermen who may get better prices and its few employees. The country may also benefit from quality fishmeal or foreign exchange, in case the fishmeal is exported. The main loser is the lake itself, which now has to support an increased demand for fish at a time when its output is already dwindling. The local artisanal traders and processors of "dagaa" and fish frames will lose their jobs by levels that the factory can not compensate. Finally, consumers of "dagaa" and fish frames, who normally are the poorest in the community, will have to compete with the fishmeal producers for their basic food. It is certain that these groups will become more food insecure.

In summary, the recent changes in the processing and marketing of Nile perch frames, therefore, have three important negative implications to the local food security situation. First, increased use of frames in the fishmeal industry means that most of it is now not available for direct human consumption. Secondly, the factories remove much more flesh off available frames, thus greatly reducing its value as a food. Third, competition has caused a rise in ex-factory, and consequently retail, prices of frames. Initially considered a "poor man's food" which many people would not consider to eat, the frame has increased in price so much that poor consumers often cannot afford to purchase it (Jansen, 1996).

3.1.4 'Dagaa' in the fish meal Industry

According to KMFRI's catch records, 'dagaa' constituted about 77,000 tons, or 44% of the fish landed on the Kenyan part of Lake Victoria in 1995. In 1997 the catch had declined to about 68,000, although it now composed about half of the total fish landed in that year. In each of the past eight years it has composed between 37-50% of the catch (Othina and Osewe-Odera, 1996; Othina, 1999). Previously 'dagaa' has mainly been used for human consumption. It has been considered a "poor man's food" and has been a source of protein, especially to many low and medium income fish consumers in the country.

However, a significant proportion of this fish now goes into making fishmeal. The fishmeal industry in Kenya uses about 53,000 tons of wet 'dagaa' annually. This is equivalent to about 69% of all 'dagaa' landed in the country in 1995 (Abila & Jansen, 1997).

The animal feeds industry in Kenya started using 'dagaa' as the main source of crude protein in feeds in the early 1990s. In 1996 there were six major animal feeds manufacturing companies in Kenya that depended on 'dagaa'. The interest on *dagaa* has continued to rise, and at least two new factories using 'dagaa' have been established since 1997. The interest shown by the fishmeal industry for 'dagaa' has important implications for the food security situation in the country. With most of the Nile perch going for export, 'dagaa' has remained the "staple fish" to many households around Lake Victoria. For a long time, its price was low and many local people could afford to buy it. However, the price of dried 'dagaa' going for human consumption rose considerably from less than Ksh 20 in 1990 to about Ksh 60 per Kg in 1995. This has been attributed to increased pressure due to fishmeal factories buying this fish. The price has since fluctuated at Ksh 30-60 per Kg, depending on the season (Abila and Jansen, 1997).

The ready availability of 'dagaa' continues to attract investors into fishmeal processing. It is likely to be one of the raw materials in the fishmeal plant at Nyangoma described in the Box 2 above. The continued use of 'dagaa' for fishmeal will make it scarce and cause further price increases. Since most of its consumers are

vulnerable to any competition, however slight, with fishmeal factories. Despite the use of 'dagaa' in fishmeal industry leading to increases in its price, it has continued to have a strong demand in many communities around Lake Victoria. A fish consumption survey conducted for the IUCN 'Socio-economics of the Nile perch fishery on the Lake Victoria' project revealed that 89-95% of rural households are ready consumers of 'dagaa' (unpublished). However 79% of these households already find it more difficult now to get or afford 'dagaa' than five years previously. As more 'dagaa' goes for fishmeal, it has become scarce in many areas, and its price has progressively risen, preventing many consumers from getting sufficient access to it.

From the consumers' point of view, 'dagaa' has a distinct advantage. Being a sardine-like fish, people can buy small quantities of it without any difficulty. Many relatively poor consumers buy 'dagaa' for only Ksh 10-20 at a time, and still the fish contributes an important source of animal protein in their diet. Whereas the use of fish frames for fishmeal may, to some extent, be justified in that it is a by-product of fish processing which is consumed only as a last resort, the use of 'dagaa' for animal feeds cannot be sufficiently excused. Its high protein content and flesh composition is an advantage to the consumers, especially to children threatened with malnutrition. Yet, with increased industrialization of the fishery, these advantages of 'dagaa' will be lost to the local communities.

The next two sub-sections summarize and contrast the positive impacts of transformation of the Lake Victoria fishery against its negative effects.

3.1.5 Positive Impacts of the Transformation

Despite the food insecurity concerns, the development of the fishery of Lake Victoria has certain significant positive impacts. Citing various reports of the Department of Fisheries, Bokea and Ikiara (2000) estimate that about 798,000 people depend on the fishery directly or indirectly for their source of livelihood. Those directly employed in fish production increased four times from 10,000 in 1973 to 40,000 in 1998. Thus, the fishery transformation has been important in creating new employment opportunities especially in the fish harvesting sector.

Another important benefit of the transformation of the fishery is in foreign exchange earnings from fish exports, which increased by over 300% from Ksh. 18 million in 1980 to Ksh. 964 million, in real terms, in 1996 (Bokea and Ikiara, 2000). Related to this benefit is the tax income to the government accruing from fish exports. This is collected by the Fisheries Department as export levy, calculated at 0.5% of the f.o.b. price of fish exports. This levy rose to a peak of Ksh. 13 million in 1996, but has subsequently declined following the quality-related problems facing fish exports in the last three years.

local people with low incomes, they are likely to be

In addition, the government earns revenue through licensing fish processing and fishmeal firms, registration of boats, court fines, issuance of fish traders licenses and export certificates. The local councils and co-operative societies serving fish landing beaches also receive some amount levied on each Kg of fish sold to fish factories. Bokea and Ikiara (2000) estimate that in one year the Government earns Ksh. 132 million from the fishery, which can be directly attributed to transformation of the fishery. The Lake Victoria fishery also makes a small but important contribution to Kenya's GDP. The industry accounted for an average of 0.2% of the country's annual GDP between 1971 and 1981, which rose to 2% and 4.4% of the non-monetary and monetary GDP, respectively by 1990 (Ikiara, 1999). However, as is indicated in Table 3 below, stagnated at about 0.3% in much of the last decade.

The transformed fishery has also caused an increase in fish prices, which directly interprets as an improvement in earnings to fishermen. According to Bokea and Ikiara (2000), the ex-vessel price of Nile perch increased by about nine times between 1988 and 1995. However, much of this benefit has been cut down by the prevailing inflation. In fact, the change in the real prices (adjusted for inflation) of '*dagaa*' and tilapia were found to be downward during the same period. There are also spin-offs in trade on Nile perch skeletons and trade on Nile perch bladders. To fishmeal processors, there is a benefit in ready availability of fish skeletons and '*dagaa*', which come at a lower price than they would get from the alternative sources. Propounding on these benefits, Odongkara (1999) argues that the transformation of the fishery from a food production to a commercial activity, integrated into the national economic structures and into the international market is compatible, and in fact essential, for attaining food security.

Table 3. Contribution of Fisheries to GDP at Constant (1982) Prices (M K£)

	1992	1993	1994	1995	1996
Fisheries (Non-monetary)	1.27	1.21	1.26	1.31	1.42
Fishing (monetary)	12.24	12.60	13.11	13.65	14.20
Total fishing	13.51	13.81	14.37	14.96	15.62
Total GDP	4332.22	4342.79	4474.58	4690.13	4906.87
Fisheries % of GDP	0.31%	0.32%	0.32%	0.32%	0.32%

Source: Kenya Government, 1997

3.1.6 Negative Effects of Development of the Fishery

Taken at their face value, the benefits of transformation of the fishery of Lake Victoria would appear to be quite impressive. The negative impacts of development of the fishery, on the other hand, are even more compelling. In their assessment, Bokea and Ikiara (2000) explain that the costs of massive fish exports and the use of fish in the manufacture of animal feeds far outweigh their benefits. The costs associated with the transformation of the fishery are substantial, and some of them cannot be quantified. The greatest cost, no doubt, is the possibility of total collapse of the fishery if the current exploitation levels are maintained to satisfy the market demand. Uncontrolled fish exports and use of fish for fishmeal could cause the fishery to collapse, with ecological and environmental consequences that cannot easily be quantitatively predicted. The overall market and non-market value of the fishery is difficult to establish but, it suffices to say, its loss would be too massive to be offset by the current short-term benefits.

Another consequence of the development of the fishery is that local people have progressively been edged out of production, pricing, marketing and processing. Fish factories and their agents now tightly control these activities. As was discussed earlier, employment chances in traditional fish trading and processing sectors for Nile perch and its products, previously the preserve of poor women, are now largely integrated in the marketing chain for fish processing and fishmeal industries. Male actors now dominantly perform the roles which women played in the past. The decreased opportunities for local people, especially women, to participate in the fish industry means they have less access to fish. Arising from this, is also an inequitable distribution of income from the fishery, with local communities at a disadvantaged position, which effectively minimizes their ability to purchase other foods. These constitute a big loss to local communities arising from transformation of the fishery.

Last, but just as important, the unrestricted fish trade has contributed to food insecurity and reduced nutrition by taking out substantial quantities of fish to global markets, that would otherwise be available to local consumers. It is not possible to adequately compensate these people for the fish taken away. To most of these people, the lake is simply a source of food (fish), since they do not directly benefit from fish exports.

According to Ikiara (1999), the lack of a ceiling on the amount of fish exported per period denies Kenyans a cheap source of protein and increases pressure on the resource base. Similarly, the failure of government to rationalize the use of fish and fish products in the animal feeds industry also manifests a food policy that is focussed in the wrong direction. The proteins produced using animal feeds, such as poultry, beef and pork are not as readily accessible to poor people as fish would be, had they sufficient access to it.

3.2 Food Production Constraints in the Lake Region

Besides fishing, the main occupations of communities living around Lake Victoria are small-scale crop farming, livestock keeping, and trading of farm produce. The main crops grown are maize, sorghum, cassava, sugarcane, cotton, beans, millet and rice paddy (Kenya Government, 1996). The first three above are the common staple food crops in the area.

Cassava, a common crop in the drier parts of the lake region, is relatively very poor nutritionally in terms of energy and protein content. Communities that depend entirely on the crop are thus prone to nutrition problems, unless there is sufficient supplementation with carbohydrate and protein foods. In comparison, maize and millet both have higher energy output (Table 1). However, some parts of the lake region receive very little annual rainfall, which is insufficient to support growing of maize or millet. For example, in areas around Muhuru and Kadem in Migori District, maize can hardly grow, owing to the harsh weather. The ability of cassava to withstand prolonged drought makes it the dominant staple crop in these areas.

Agricultural production in all lakeshore districts declined in the early and mid-1990s, making the region a net importer of most farm produce. O'Riordan (1997) has cited the major causes of the decline in farm production as decreasing farm sizes, declining soil fertility, unreliable rainfall, increasing cost of farm inputs and emigration to urban areas or to the fisheries sector.

(Yongo, 1999) has given a more elaborate explanation of the conditions of the Lake Victoria region that seriously constrain its food production potentials. The poor climate of the lake hinterland is a major limitation to its agricultural potential. Much of the lake hinterland in Kenya is classified under the marginal agro-ecological zones, chiefly of the types marginal cotton zones and the midland livestock-millet zones (Yongo, 1999). The soils are mainly black cotton soils that are difficult to work during the

dry season and are waterlogged on the first rains, or sandy soils characterized by poor water retention capacity and underlying hard granite basement rocks. In most parts rainfall is bimodal but very unreliable, ranging from 900 mm to 1100 mm annually.

Trypanosomiasis (Sleeping sickness in man and *nagana* in animals), transmitted by tse-tse fly, has been a recurrent problem in parts of the lake region, particularly in and around the Lambwe Valley, which affects both human and livestock development. Quoting Achieng (1990), Yongo (1999) has traced the history and spread of sleeping sickness in the region. The first epidemic was experienced between 1901 and 1911, and covered a very wide portion of the lake region, including Mageta and Rusinga Islands, Kaksingri area in the south and Yimbo in the north, as well as into areas traversed by rivers such as Nyando, Kuja, Migori and Sio. The second epidemic was experienced between 1920 and 1930 and the third outbreak occurred between 1940 and 1950 in the northern zonal areas of Yimbo, Alego and Samia.

This was followed by a fourth epidemic between 1961 and 1965 in Yimbo, Alego and Lambwe and later the fifth outbreak of the disease in the 1980s, which was confined to the south Nyanza district, especially in Lambwe valley and which killed a number of cattle. The sleeping sickness problem remains unresolved, and there are frequent outbreaks, making most of these areas unsuitable for keeping cattle. Any farmer who continues to keep livestock must incur huge expenses in veterinary care. Despite this, a significant proportion of Kenyan fishers, 36%, still re-invest their money in buying livestock, a sector that as discussed above, is prone to livestock diseases (SEDAWOG, 1999b).

Droughts and floods, the two climatic extremes, are also persistent problems in parts of the region. Ojwang and Ogendo (1972) have noted that droughts or serious floods recur in the lake area after a period of 20–30 years. The best known floods are those of the *Uhuru* rains in 1963 and the most recent, the *El-Nino* rains. Another hazard has been the invasion of the lake region by the desert locusts, which often appear following periods of serious drought. The effect of the harsh climate and ecological factors is that crop production and livestock keeping in the immediate lake hinterland have not been successfully pursued. Fishing has remained as the main source of livelihood to many local people, exerting much pressure on fishery resources.

In the past, reports Geheb (1996), lower population levels and strong intra-clan relationships ensured that fishing combined with farming provided enough food for nutritional and exchange needs for all members of the fishing community. The situation has changed a lot because the present harvest is insufficient to meet food needs of a rapidly growing lakeside population. Declines in agricultural production do not seem to have been offset by earnings from other economic activities in the area. The decline in yields and income from agriculture around Lake Victoria has exposed local communities to increased levels of food insecurity.

Mogaka (1999) blames erratic weather, low incomes and poverty, poor infrastructure and lack of adequate storage facilities for failure to achieve food security at the household level in Kenya. Elsewhere in the Tanzanian shores of Lake Victoria, the main causes of food insecurity have been identified as inadequate food supply resulting from low and unreliable agricultural production, low consumer purchasing power, insufficient feeding frequency and increasing demand on women's workloads (TAFIRI, 1998). The latter is seen as a prominent problem since rural women must perform a number of chores, including planting and weeding, harvesting and marketing surplus food as well as household duties, which reduces the amount of time available to look after children.

In Uganda, Odongkara (1999) disapproves of the common view that food security among fishing communities is primarily a question of access to adequate supply of fish. He argues that fish may be a desirable food, but even with a minimum of it, there can still be food security for the communities. In his view, food security is mainly about community access to a balanced diet on a sustainable basis. Access to a balanced diet is determined by the supply of the relevant food items and the ability to acquire them. But in the same article, Odongkara (1999) admits that the fishing communities themselves are unable to produce the different food items due to a number of factors. Additionally, because of their low purchasing power, these communities are also often unable to access adequate nutritive food produced elsewhere. The studies above indicate that there is perceived food insecurity in the lake regions of all three riparian states of Lake Victoria.

3.3 Fishery Management Problems

There is little success in implementing most of the provisions of the Fisheries Act in Kenya that address the issues of sustainability of the fishery. In particular, the regulations pertaining to restricting the use of under-sized mesh nets, prohibiting fishing in breeding and spawning areas and those banning trawling are rarely enforced. According to Owino

(1999), these outlawed activities have continued unabated, putting the fishery at risk of over exploitation, and raising concerns of long-term food insecurity for dependent communities.

3.3.1 Gear theft and Fish Poisoning

The twin social evils of gear theft and fish poisoning depict a desperate situation where some members of the fishing community are using any means to earn an income, irrespective of the social, economic and environmental implications. Theft of fishing gear on Lake Victoria is an old problem (Jansen, 1973). Such cases, though, were isolated in the past and not in a scale that could have an impact on the overall fishing activities. In any case, the existing norms in the fishing community ensured that gear thieves received adequate sanction to deter them from repeating the crime.

The increased demand for Nile perch in the 1980s and early 90s provided enough incentives for fishers to invest in very expensive gillnets and longlines. Almost simultaneously, there was a rise in cases of gear theft. The situation reached uncontrollable levels in the second half of the 1990s. Gear theft is now recognised by the fishing community as one of the most serious management problems in the Lake Victoria fishery (SEDAWOG, 1999a; 1999b). In recent times, there have been even more serious cases of violent robberies on the lake, where outboard engines have been taken from fishermen at gunpoint. The Fisheries Department appears ill equipped to stop gear theft since they lack outboard engines and the capacity to confront armed robbers on the lake. At the same time there is no Police Unit specifically trained to combat theft or robbery on the lake.

The immediate consequence of gear theft is that many fishermen who have lost nets have become jobless. They cannot earn an income to support their families, making them food insecure. Some fishermen, though, have now turned to using beach seines and mosquito seines. These are active gears, since fishermen stay with them throughout the fishing operations, making their theft very difficult. Yongo (1999) has blamed the rapid increase of beach seines in Kenya on gear theft. Beach seine is a non-selective gear, with long-term disastrous effect on the sustainability of the fishery. In a way, therefore, gear theft has both short and long-term negative effects on food security of fishery-dependent households.

Catching fish using poisonous chemicals is even a more recent practice. The practice came to the limelight only in 1997-99, when the Government banned fishing to curb fish poisoning. Fish poisoning has not been confined to Kenya, as Uganda and

Tanzania also recognised it as a problem and took similar action to stop it. The origin of the poisoning problem is not well known. However, the Lake Victoria Fisheries Research Project conducted studies in 1998 and 1999 to determine the nature of the chemicals used, the origin of the poisoning problem and the factors facilitating its spread (unpublished). As in the case of gear theft, most fishermen lost a source of income when fishing was banned to stop fish poisoning. Local fish consumers also had no fish to eat during the time of the ban. Consequently, the combined lack of both income and food (fish) put the fishing community in a very food insecure position. Fish poisoning has since been largely curbed in almost all parts of Lake Victoria through a combination of government and community management strategies.

3.3.2 Overfishing; Trawling, *tembea* and other fishing methods

The Fisheries Act (Revised in 1991) of the Laws of Kenya bans trawling in the Nyanza Gulf and within 5 nautical miles from any point on the entire shoreline which, in reality, is the entire Kenyan portion of Lake Victoria. Since Uganda and Tanzania have already imposed a complete ban on trawling in their waters, the whole of Lake Victoria is legally free from trawling. In practice, however, trawling has continued. Mbuga *et al* (1998), Abila and Jansen (1997), Owino (1999) and Bokea and Ikiara (2000) all attest to the fact that trawling, which should be very easy to stop considering the size and visibility of the vessels involved, has never ceased. The practice seems so profitable that, irrespective of its illegality, the trawling ban has been ineffective. The misplaced contention by the trawler owners is that trawling benefits all the lakeside communities in many ways, including creating jobs directly and indirectly. In reality, though, trawling destroys other fishing gear on the lake, and displaces local artisanal fishermen, hence, it has a negative net effect on employment in the fishery. It is also largely non-selective, with long-term negative consequences on sustainability of the fishery.

Tembea, which is a form of drift net fishing, has caused havoc to a section of the traditional fishery. *Tembea* boats are normally in fleets, each outfit costing between Ksh. 300,000 and Ksh. 500,000. This puts the *tembea* technology out of reach of the common fisherman. According to Jansen *et al*, (1999), the *tembea* fishing technique constitutes a revolution in the Lake Victoria fishery, with important socio-economic impacts. The first most negative effect of 'tembea' is that it destroys gear of the traditional fishing boats, especially gillnets and long-lines, set out on the lake. Thus, the *tembea* fishery has caused a number of local fishers out of fish harvesting altogether. Secondly, *tembea* have

greatly increased fishing efforts to an extent that may not be sustainable. The initial *tembea* boats caught up to 1,200 Kg of fish daily (Jansen *et al*, 1999). This has gone down remarkably as a result of over-exploited fishing grounds, but a *tembea* boat may still get over five times the quantity of fish caught by a traditional boat of the same size. *Tembea* and trawling may be high yielding, but they can seriously impair the stability of the lake ecosystem and the sustainability of the fishery.

One of the greatest threats to long-term food security for fishery-dependent communities is overfishing. The demand for Nile perch in the export market has posed a big challenge to the conservation of the fishery of the lake in the last decade. In order to satisfy the export demand, trawling for Nile perch has continued, albeit illegally (Mbuga *et al* 1998). Besides harvesting by-catch and juvenile fish, trawlers destroy fish breeding habitats and interfere with stability of the water column. Beach seining, which is increasing in Lake Victoria, can also have similar, though localized, effects. Additionally, the fishmeal industry, particularly targeting '*dagaa*', now raises the possibility for even a greater threat to the conservation of biodiversity. Apart from being an important fishery itself, '*dagaa*' forms part of the food chain for Nile perch.

Overfishing may arise in two ways. First, small mesh nets and other techniques catch immature fish before they can grow, develop into adults and spawn. According to Abila and Jansen (1997), about one-third of Nile perch landed on different beaches of Lake Victoria is juvenile. Reflecting on this aspect, Owino (1999) found out that about 34% of fish landed in Dunga Beach in Kisumu District in March 1997 were juvenile. This makes fishing of juveniles an important problem in the Kenyan part of Lake Victoria, raising questions about sustainability of the fishery in the long-term. Furthermore, O'Riordan (1997) reports that the average mesh size used in the lake has also reduced from 12 inches in 1981 to 6 inches in 1996. Secondly, the use of certain non-selective fishing methods, such as trawling and beach seining, remove large quantities of fish or their food indiscriminately, thus interfering with food chain linkages. This disrupts the aquatic environment, making it less capable of supporting fish life.

A major consequence of overfishing in Lake Victoria is the declining trends in catch levels. Nile perch catches have been on general downward trend since 1991. Available statistics show that, in spite of increased fishing effort, only O'Riordan, (1997).54,000 tonnes of Nile perch was landed in 1997, a level only comparable with that of 1984-85. A second indication of overfishing is the reduction in average size of fish caught, from 50-100 Kg in 1981

to 5-10 Kg in 1996. In addition, boat catch rates have reduced from a daily average of 400-500 Kg in 1981 to about 100-150 Kg in 1996. This has gone down further to 80 Kg per boat per day in 1997. This means that both the income per boat and per fisherman have correspondingly dropped (O'Riordan, 1997; Othina and Osewe-Odera, 1996; Othina, 1999).

Despite the catch decline experienced in recent years, an official Kenya Government (1997) report still states that there is scope to increase fish production in the country fivefold. According to the report, the fisheries sector has a potential of 552,000 metric tonnes of fish annually but presently only 184,000 are being produced, representing only 33%. Whereas it may still be possible to increase output from Kenyan marine waters in the Indian Ocean and aquaculture, it is clear from available data that, with the current system of management, there is little chance of an upswing in Lake Victoria catches in the foreseeable future.

In order to ensure sustainable fishing, there is need to develop a more effective regulation and enforcement framework for the lake. The regulations should control sizes of fish targeted, mesh sizes used, fishing in breeding areas, the use of beach seining, trawling, pollution and aquatic weeds. Most of these regulations are already provided for in the Kenya Fisheries Act, however, the problem lies with lack of enforcement of the Act. Secondly, the government should enact administrative controls on the expansion of the fish processing factories, as well as that of fishmeal plants. In particular, the government should not license new factories since the fish processing industry is evidently already over-established. A related issue is for the governments to consider is the possibility of allocating export quotas to each factory. The quantity of 'daga' going for fishmeal should also be closely monitored and controlled. Factories can, on their own, contribute toward this effort by not processing immature Nile perch.

3.4 "Poverty Trap"

Official Government of Kenya reports use poverty benchmarks to distinguish the poor from non-poor. This is based on the minimum amount of food, and non-food expenditure needed to meet the basic

29% in rural and urban areas respectively (Kenya Government, 1997). The report uses the term "absolutely poor" or "hardcore poor", estimated at 7.5 million in 1997 in the country, to describe those who would not meet their minimum calorie requirement, even if they concentrated all their spending on food. Among the urban areas in Kenya, food poverty was highest in Kisumu in 1997, estimated at 44.1% of the households. Similarly Kisumu had the highest level of absolute poverty.

In a study conducted by SEDAWOG (1999a) most consumers gave low income as the reason why they cannot eat fish more frequently. Others blamed the rapid decline in catches and the high fish prices. However, Mogaka (1999) has explained that increased household income is a necessary but not sufficient condition for attaining household food security. Self-sufficiency at the national level often does not guarantee adequate nutrition at the household level. In Table 4 the mean monthly incomes are given for the eight provinces in Kenya in 1996. The Lake Victoria provinces of Nyanza and Western have the second and third lowest per capita income respectively, both which are below the national average. Ikiara (1999) explains that due to inequitable income distribution in the lake region, the level of malnutrition of both proteins and energy is much more severe among the lower income groups. The most vulnerable groups are the very poor, the near landless, children, pregnant and lactating mothers.

Poverty among the fishing households is closely related to the health and economic state of the fishery. The households most dependent on the fishery are prone to be poorest and most food insecure, when the lake is overfished. Over half of Kenyan fishermen surveyed had wives who were also engaged in a fishery-related activity. Almost all these, 96%, are engaged in fish processing and trading (SEDAWOG, 1999b). This seems to tally with the trends earlier recorded. In 1990, Hoekstra *et al* reported that 40% of 360 Kenyan boat owners' wives were involved in fish processing, mainly 'daga'. Geheb (1996) reported that 45% of Kenyan fishers were married to women fish traders between 1994 and 1995.

needs. In 1994, a household with a monthly total expenditure not exceeding Ksh. 978 in a rural area or Ksh. 1490 in an urban area was deemed to be below the poverty line. Based on these poverty lines, the overall prevalence of poverty in 1994 was 47% and

Thus, it appears that an increasing number of households are becoming dependent on the fishery as the basic source of family income, at a time when the fishery output is on the decline. The problem of poverty is further complicated by the high dependency ratio in the lake region. Reports of SEDAWOG (1999a; b) indicate that fishing and fish trading households and even the general fish-eating families in the lake region tend to have family sizes exceeding 6 members. This dependency situation has been aggravated by the AIDS pandemic, which has seriously affected family structure and stability in the Lake region.

Table 4. Mean Monthly Household Income by Province (Ksh), 1994

Province	Non-agricultural Income	Agricultural Incomes	Total Income
Nairobi	16351	438	16789
Central	6060	3206	9266
Coast	7659	2234	9893
Eastern	4184	2388	6572
North Eastern	5209	4722	9931
Nyanza	4377	2373	6750
Rift Valley	6125	6117	12242
Western	4760	2899	7659
Mean			9888

Source: Government of Kenya, 1996

3.5 Cultural Bottlenecks

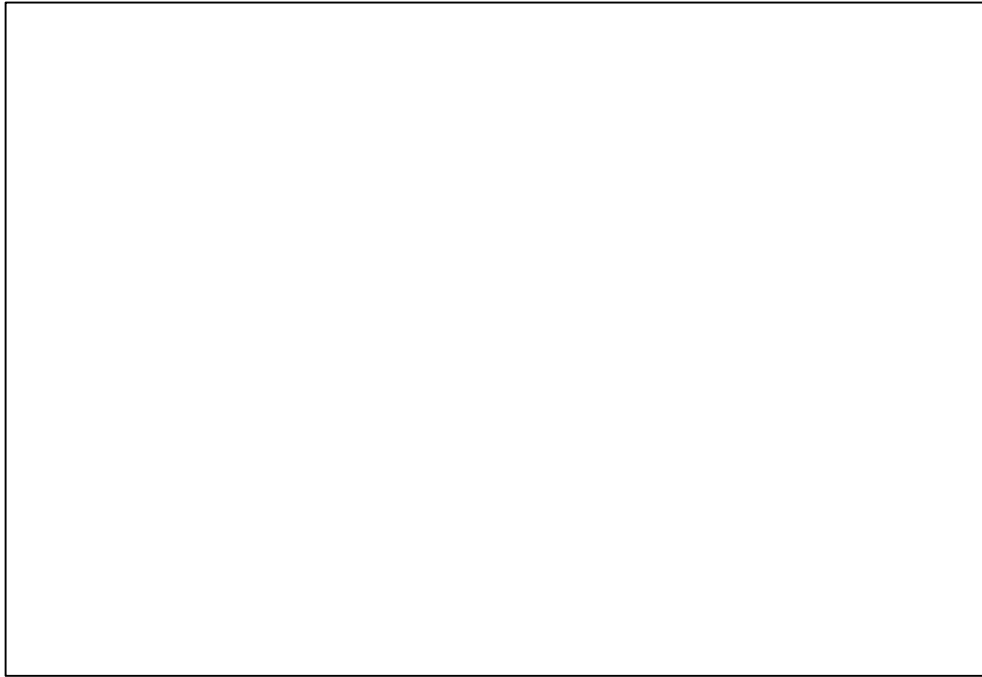
In Kenya many ethnic communities did not consume fish as recently as 1980, but fish has now become a delicacy in almost all parts of the country (Bokea and Ikiara, 2000). Certain socio-cultural factors of lakeside communities were found to be partly responsible for low fish consumption, especially in the case of Nile perch. Despite this, a recent survey revealed that the level of acceptance of Nile perch as food by lakeside communities has dramatically risen from 15% in early 1980s to 94% in the late 1990s (Abila, 1998). The few who still have not accepted Nile perch did not consume it for reasons listed in table 5 below. It is observed that some of the reasons given are merely as a result of consumer ignorance about the fish. There is, therefore, need to sensitize local communities about the nutritional benefits of eating Nile perch.

Odongkara (1999) also notes the role of culture as a constraining factor to achieving food security. Examples are the cultures that restrict purchasing power especially of women, through discrimination in income-generating employment and ownership of productive units, and eating practices that give priority to serving men over other family members.

Table 5. Reasons limiting the consumption of Nile perch

Rank	Reason for not eating Nile perch	% of times reason mentioned
1	Taboos, cultural factors, and bad beliefs about Nile perch	42
2	Medical reasons, e.g. allergy	29
3	Members of households just do not like taste or look of Nile perch	10
4	Nile perch often comes in bad state of quality	8
5	Nile perch gives a strong, repulsive odour	4
6	Household lacks skills to prepare or cook Nile perch	3
7	Nile perch is too expensive relative to other fish	3
8	Nile perch is not a prestigious fish to eat	1

Source: (Abila, 1998)



Women traders displaying "dagaa" in a local market.

4. Consequences of Food Insecurity

Food insecurity almost invariably results in some degree of malnutrition, especially in affected children. If a community is exposed to a critically inadequate supply of food for long period, a situation of famine may develop. Another angle to this issue is how food insecure people relate to their environment. The most prominent view is that, in an attempt to survive, communities that are food insecure will destroy their environment, thus aggravating their situation (Cleaver and Schreiber, 1999; Thrupp and Megateli, 1998).

4.1 Malnutrition

Malnutrition is the resulting condition when the intake of proteins and energy foods is critically inadequate for the needs, especially of a growing child. According to Young and Jaspers (1995), malnutrition results from an inadequate intake of energy and protein, as well as other nutrients. Perhaps the most important consequences of malnutrition are the diseases closely associated with deficiency in nutrient intake. Of these, *kwashiorkor* and *marasmus*, both of which mainly affect children in the first two years of life, are most common, hence, economically important. They represent the extreme forms of protein energy malnutrition. Kwashiorkor often results when children are not getting a particular nutrient, mainly proteins, in their diet, even though they may be eating enough food. On the other hand, marasmus arises when a child is not getting enough food of any kind, as in a situation of starvation. Under-nutrition refers to reduced food

intake in relation to recommended dietary levels. The nutritional status of young children is a sensitive indicator of health status and nourishment level of a population.

Malnutrition can be caused by a number of inter-related factors. The two immediate causes, which often occur together, are inadequate diet and infectious diseases. Young and Jaspers (1995) explain that the immediate causes stem from three groups of underlying causes. These are food security, basic health services and maternal and child-care. In practice, the three groups of underlying causes interact with one another. In the past, malnutrition was thought to be a protein deficiency problem that could be cured by intake of high protein foods. By the mid-seventies, the interaction between energy and protein was recognized, and energy intake became a focus in nutrition matters. This changed the dimensions of understanding nutrition, to include social and economic issues such as access to food, poverty and related conditions, which were seen as overriding causes. Thus, the main concern now is protein energy malnutrition which, in children, is commonly characterized by wasting or stunting. Wasting, or thinness, reflects recent rapid weight loss or failure to gain weight as a result of inadequate nutrition. Stunting, or shortness, reflects a height deficit that develops over a long period of time as a result of prolonged poor nutrition.

Child malnutrition is a problem in all districts around the lake region. Results of a survey carried out in 1994 show that, in most of the districts where fishing is a dominant economic activity such as Homa Bay, Migori, Kisumu, Siaya and Busia children are moderately or severely stunted, indicating a high prevalence of child malnutrition (Kenya Government, 1996). A study by Whyte and Kariuki (1991) showed that *marasmus* and *kwashiokor* were serious problems in Kisumu, Siaya and Busia districts. They attributed the causes of malnutrition to both problems of feeding and poor maternal care.

An earlier report by Chalken (1988) cited South Nyanza District as having the highest rate of child mortality in Kenya, as well as very high rates of malnutrition and malaria. The report stated that the main cause of malnutrition in the district was the consumption of low calorific value foods that provide insufficient protein, vitamins and minerals. Parents in the district fed children mainly on porridge made from cereal grains. Their incomes were often too low to afford a range of protein foods, including fish. The report recommended, among other things, that feeding children on the relatively cheap 'daga' porridge was one way of lessening child malnutrition.

Friis *et al* (1997) also reported on vitamin A deficiency in children in Siaya District, which they attributed to inadequate dietary intake of the vitamin and low absorption and utilization of Vitamin A due to infectious diseases. In the 1994-96 National Development Plan for Kenya it is estimated that at least one-third of Kenyan children are anaemic, mainly because of low dietary availability of iron and folic acid. The solution to Kenya's chronic food insecurity, according to this document, lies in increased economic growth, improved income distribution and growth in agricultural and other sectors (Kenya Government, 1994a).

Another survey conducted in Kisumu District in 1982 found that the prevalence of stunting was below the national average. Five years later the prevalence of chronic and acute under-nutrition had declined nationally but increased in Kisumu District. . In 1987, about 23% of children in Kisumu District were stunted, compared to 20% nationally (Mogaka, 1999). Kisumu town, the largest urban area in Kisumu District and on the Kenyan part of Lake Victoria, has been repeatedly rated as having the highest prevalence of food and absolute poverty among urban centers in Kenya, with 44% and 48% of the population falling in the two categories respectively in 1997 (Kenya Government, 1997). From the above studies it is apparent that malnutrition of children around Lake Victoria is the

result of a number of factors, including poor maternal care and food insecurity.

A study conducted around the same time to determine differences in levels of malnutrition between fish farmers and non-fish farmers showed that there is no significant differences (Mogaka, 1999). This result would, erroneously, suggest that fish has little or no role in nutrition. An alternative explanation is that even fish farmers do not consume enough quantities of the fish they produce, or buy sufficient protein substitutes.

TAFIRI (1998) conducted a study on nutritional aspects, in which they employed a variety of data collection tools, including anthropometric measurements, observation methods and interview techniques such as questionnaires and focus group discussions. The comparative experimental study conducted in three districts of Mwanza region in Tanzania established that there exists protein energy malnutrition around the Lake region. From a sample of 207 children, malnutrition was manifested mainly in forms of stunting (30.5%), underweight (15.8%) and wasting (2.5%). The report identified the main cause of malnutrition in the region to be inadequate dietary intake, both in quantitative and qualitative terms. The major underlying cause, the report concluded, was the low purchasing power of poor rural families, which limited their access to most foods. Other causes were poor sanitary facilities; inappropriate feeding habits and health related reasons. The report treated malnutrition as a multi-dimensional problem, and did not directly relate it to the levels of fish consumption. However, it recommended that future nutritional studies in the region should make use of longitudinal surveys to examine the contribution of fish to nutritional status in the region.

King *et al* (1972) explain that a young child requires to eat about 250g of most common food combinations such as maize, cassava, millet and oils daily to meet the minimum energy requirement. There can, therefore, be two explanations for child malnutrition around the lake. One, that most households around Lake Victoria are not able to provide their children with 250g of food daily to meet the energy requirement. Malnutrition, hence, would be partly or fully an energy-deficiency problem. Secondly, that most families are able to meet the energy requirement, such that malnutrition is mainly a protein-deficiency problem. Carbohydrate foods are generally cheap and, in fact, most families in the lake region eat a carbohydrate food in nearly all meals, be it porridge, 'ugali', bread or food cooked with oil. In comparison, protein foods are much more expensive, hence, less

accessible to many households. On this basis, the protein-deficiency explanation for malnutrition would appear to hold more weight. There is need of further research in this direction to establish the cause of the malnutrition problem in the area.

4.2 Famine

Famine is the resulting situation when there is prolonged critical inadequate supply of food to a section of the population. Sen (1981) showed that famine and starvation are not solely related to overall food supplies, but are the result of a decline in people's access to food, or as he termed it, a decrease in their 'exchange entitlements'. The exchange entitlements are attained mainly through trade, own production, own labor or asset transfer. Employment opportunities, wage rates, market prices and cost of essential purchases, food included, all have an effect on exchange entitlements. When these exchange entitlements fail to meet the minimum food needs then famine or starvation results. A reduction in exchange entitlements may be equated to food insecurity.

4.3 Environmental Consequences

Cleaver and Schreiber (1994) explain that a critical link exists between food security and the environment, which may be destabilised by slow growth in agricultural and food production, rapid population growth and increasing environmental degradation. According to Thrupp and Megateli (1998) there is an intricate linkage between food security, environmental security (natural resource management and pollution prevention) and social security (political-economic security, social justice and conflict resolution). These three parameters are equally vital for livelihood and sustainable socio-economic development. Environmental degradation, food insecurity and socio-economic decline are, thus, interrelated in a vicious cycle. Reardon and Shaikh (1995) explain that overexploitation, pollution and depletion of resources undermine productive capacities, leading to declining yields in agriculture and fisheries, and to high socio-economic costs. Such

reverse, food insecurity often causes poor people to overexploit and degrade resources in an attempt to survive.

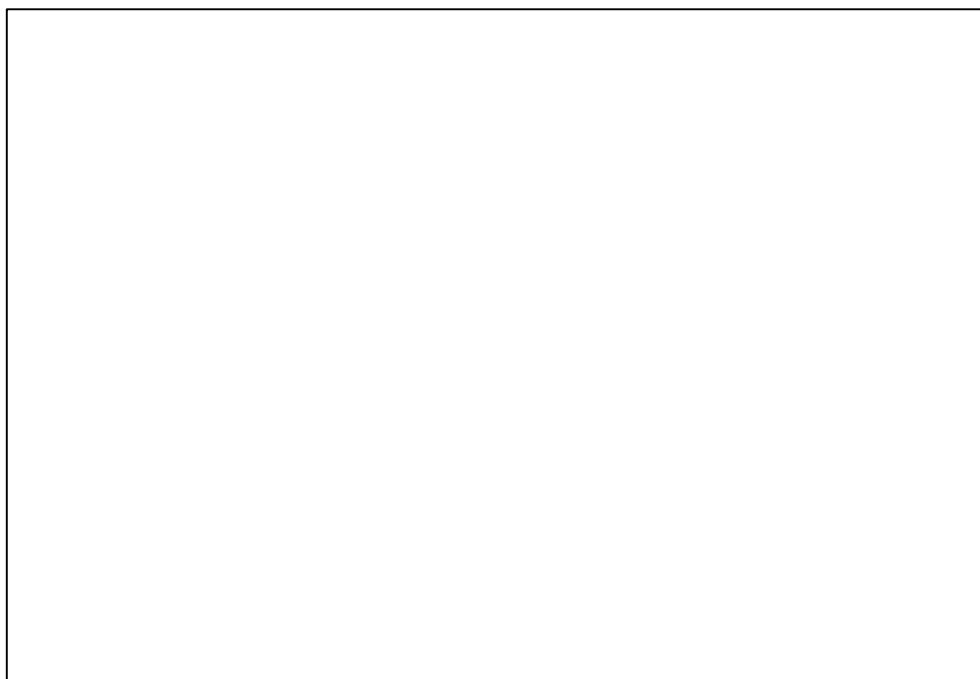
The stress from a rapidly growing population on the available land and natural resource base has been tremendous in many areas around Lake Victoria. In the past, traditional cropping and livestock production methods and cultural practices were well suited to the needs of a slowly growing lakeside population living off a fragile environmental resource base. However, the situation has changed rapidly in line with a declining per capita arable land. Farmers and rural inhabitants are increasingly being forced to adopt practices that are ecologically disastrous, such as cultivating in forested areas or on erosion-prone slopes.

As expected, fishermen of Lake Victoria have responded to a declining fishery by changing their gears. The change has mainly been induced by the high theft of passive gears when left overnight in the lake, causing fishermen to shift to active gears, which they are able to monitor all the time. Beach seines have intensified fishing, particularly around river mouths. Yongo (1999) reports on the intensity of beach seining at the Nzoia river delta and in parts of Suba District, where it is actively carried out in a continuous basis throughout the day and night. Most of the beach seines have a codend measuring far below the Fisheries Department mesh size requirement of 2.5 inches. The beach seines, therefore, harvest a lot of juvenile Nile perch and tilapia.

Many of the traditional fishing grounds are already over-exploited, and expansion of fish production has very limited scope. Yet, according to SEDAWOG (1999b), a sizeable number of fishermen still re-invest their money and capital in the fishery. Many households are also becoming more dependent on the fishery as their only source of income. Thus, a serious decline in the fishery will, in the long run, have important consequences on the food security

conditions, in turn, contribute to food insecurity. In

situation for the fishery-dependent communities.



Juvenile Nile perch in a fish trader's container.

5. Summary, Conclusion and Recommendations

5.1 Summary

- By definition, a community or group will be food insecure if there is insufficient food available over a period of time; they lack the necessary purchasing power or means of exchange to acquire it; and their social relationships do not allow them access to it within the household.
- Fish is central to the food insecurity issue in the lake region. As a food fish has many advantages. It is a relatively cheap source of protein; it adds flavor to diet; is rich in essential fatty acids, vitamins and minerals and is easier to process and store, for example by sun-drying, compared to the alternative sources of animal protein.
- The national food policy puts much emphasis on staple foodstuffs, mainly grains, and has very little mention for protein foods such as fish. Fish has been regarded as a relatively unimportant food in the national scale, only seen as an important source of proteins in regions such as Nyanza and Western provinces, where it is produced.
- Despite this, the government has clearly spelt out policy objectives for the fishery, which place emphasis on attaining food security. However, in practice the goal to maximize foreign exchange from fish exports seems to supersede all other objectives for the fishery aimed at attaining domestic food security.
- The pre-1980 Lake Victoria fishery, by providing food, employment and income, greatly contributed to the food security needs of the local populations. The initial years of Nile perch fishery improved food security, as more fish was available at affordable prices.
- Fishing on Lake Victoria has now been transformed from subsistence into a largely commercial activity. Rather than supplying local food needs, most of the catch is processed into high value export products or ingredients of animal feeds. This has deprived poor people of a ready access to their traditional source of proteins.

- Access to fish is limited in three ways;
 - i. The relatively high prices paid by processing factories makes it unaffordable to local consumers;
 - ii. The export market takes nearly all good-quality Nile perch. Local consumers can only get Nile perch that has been rejected by factories as undersize or poor quality; and
 - iii. Concentration of fish harvesting resources in the hands of a few rich fishermen alienates the majority of potential fishermen from their entitlement to the fish resources.
- The recent changes in the processing and marketing of Nile perch frames have three important negative implications to the local food security situation. First, increased use of frames in the fishmeal industry means that most of it is now not available for direct human consumption. Secondly, the factories remove much more flesh off available frames. Its value as food is thus greatly reduced. Thirdly, competition has caused a rise in ex-factory, and consequently, retail prices of frames, to the detriment of local consumers.
- The demand for ‘*dagaa*’ among local people is high and largely unmet. There is much potential in selling it in many new markets directly for human consumption. Its use in the fishmeal industry therefore threatens local food security.
- Increased industrial utilization of fishery resources has negative impacts on conservation efforts of the resources for long-term food security.
- Whereas there may be several differences in the available results of fish consumption studies, the following generalizations could be made. First, fish consumption is lower than would be expected in the lake region, with a majority of households eating it just about two times in a week. Secondly, tilapia and ‘*dagad*’ are the most consumed species, with very little Nile perch available for local households. Third, consumption patterns tend to change within the month and during the year; and this seems to be affected by the level of fish supply, price of fish, availability and price of substitutes. Per capita fish consumption in the Kenya, too, seems to be on the decline.
- The development of the Lake Victoria fishery clearly has contributed to the food insecurity problem. The current trends in the fish industry do not promote the important objectives set by the Government of Kenya for development of the fishery, in particular in relation to food security.
- Despite the declining fishery, fishing communities themselves are unable to produce the different food items to substitute or supplement fish. Food production in the Lake region is constrained by a number of factors. They include the extremes of weather: Low and unreliable rainfall, prolonged droughts and seasonal floods; poor and declining soil fertility; decreasing farm sizes; rural-urban migration of labor and poor farming skills. Additionally, the tse-tse fly that result in periodic epidemics of disease, which incapacitates livestock development.
- Other identified causes of food insecurity in the lake area are the entrenched poverty of fisher communities; fishery management failures, which have led to gear thefts, bad fishing practices, consequently, overfishing; and certain cultural constraints to fish consumption.
- The most serious consequence of food insecurity is malnutrition, indicated by wasting, stunting, *kwashiorkor* and *marasmus* conditions. There is sufficient evidence that children in the lake region are among the most malnourished in Kenya.

5.2 Conclusion

In conclusion, food insecurity is indeed a problem for lakeside communities. This is manifested in the critical state of child malnutrition in the lake area. The problem of food insecurity is multi-dimensional, arising from a number of causes that put constraints to food availability or limits local people's access to it. Fish is central to the food insecurity problem for lakeside communities. As a rich protein food, it offers a solution to the protein-deficiency conditions affecting children in the lake area. It is also a potential income source for those engaged in fish production, processing and marketing. Despite these advantages, fish is lowly regarded in the national food policies. The fisheries policy objectives see the role of fish in improving food security locally, but the need to earn foreign exchange has superseded the interest for domestic food security. Factors constraining food security are related to transformation of the fishery into an industrial and commercial venture, fishery management problems, low agricultural productivity and socio-cultural impediments. Thus, the development of the Lake Victoria fishery clearly has contributed to the food insecurity problem. The current trends in the fish industry do not promote the important objectives set by the Government of Kenya for development of the fishery, in particular in relation to food security.

5.3 Recommendations

1. The fisheries policies should be re-focussed to put greater emphasis on food security. It should avoid conflicting objectives such as goals to both maximize foreign exchange and ensure food security, since there is a limited supply of fish in the country.
2. There is need to set priority in terms of use of fishery products in fishmeal production, when there is high demand for them for direct human consumption. It would be socially and economically important to control the use of fish frames and 'daga' in fishmeal. The human market must take priority over fishmeal whenever there is direct conflict. In addition, the frames for human consumption could generate new opportunities for employment in the traditional sector.
3. There is clearly a need for controlling the expansion of the fish processing and exporting industry. This is important for food security as well as sustainable exploitation of the fisheries. Such controls may involve limiting the licensing or establishment of new factories. The Government may also institute a policy of allocating export quotas to existing factories. A good point to start may be to consider the export quota already instituted in Uganda, ostensibly to address the local food insecurity interests. The Ugandan Government has allocated quotas on the quantity of fish to be processed by fish processing plants. This policy intervention by the Ugandan Government ensures that there is a clear balance between fish going for export and that for the domestic market.
4. Fourth, there is a need to address the critical fishery management problems. This, as suggested by Mak'ochieng (1999), may include limiting access to the resources by instituting and allocating long-term exclusive use rights to fishery. A second management strategy is to improve enforcement capabilities through greater surveillance. To support this, the penalties for default should be increased such that the costs of breaching a regulation exceed the potential gains from the wrong act. Fishery activities should also be diversified, particularly to include the development of aquaculture.
5. A major limitation to this study is that it is based on broad macro-data, and uses very little of primary household-based data, especially on nutritional status. Such household nutrition data is largely unavailable. There is need for further studies at household level to generate such data, examine the problems of food acquisition within the household and constraints to food consumption in the family unit, and identify factors that cause nutritional constraints at that level.

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