Socio-economics of the Lake Victoria Fisheries

THE MACROECONOMY OF THE EXPORT FISHING INDUSTRY IN LAKE VICTORIA (KENYA)

Crispin Bokea[1] and Moses Ikiara[2]

April 2000

[1] Research Manager

African Program

International Centre for Economic Growth

P.O. Box 55237 Nairobi. KENYA

[2] Lecturer

Moi University School of Environmental Studies

P.O. Box 3900, Eldoret KENYA

Lake Victoria is the second biggest freshwater lake in the world. with its 69,000 km^2, 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.

Newspaper Cutting: Excerpt of The East African, October 18 - 24, 1999

Design & Layout: IUCN EARO Communications Unit

Table of Contents

Acknowledgements

This report is prepared by Mr. Crispin Bokea (principal researcher) and Dr Moses Muriira Ikiara. Mr. Bokea, an economist, has for the last three years worked with the International Center for Economic Growth, Africa region office based in Nairobi as the Research Manager while Dr Ikiara is currently a lecturer at the School of Environmental Studies, Moi University, Eldoret, Kenya.

Preparation of this report was mainly based on review and synthesis of secondary data and information as well as visits to fishing beaches, markets and factories around Kisumu. The authors are grateful for the useful comments and general direction provided by Ms. Mine Pabari, Programme Officer with IUCN Eastern Africa Regional Office and Dr Eirik Jansen, Technical Advisor to the Socio-economics of the Nile Perch Fishery on Lake Victoria project. The authors also acknowledge the support and contributions provided by Mr. Booker Oduor, Director of Fisheries. Mrs Jane Kinya of the Fisheries Department assisted in reviewing literature from the Department.

1. Introduction

Kenya is a coastal state with a marine coastline of 640 kms and a marine fishing industry. In spite of this, Lake Victoria dominates Kenya's fishing industry. In 1995, for instance, the lake accounted for 94% of the 193,789 tonnes of fish produced while marine fishing accounted for only 3% of this output. This is notwithstanding the fact that Kenya claims only 6% of Lake Victoria's total surface area, with 45% being owned by Uganda and 49% by Tanzania. Kenya's portion is the most heavily fished, commercialized and productive of the three countries, producing an estimated 33% of the lake's entire fish output in 1990.

In terms of contribution to the gross domestic product (GDP), Kenya's fishing industry is small but growing. Thus, white the industry accounted for an average of 0.2% of the country's annual GDP between 1971 and 1981, the contribution rose to 2% and 4.4% of the non-monetary and monetary GDP, respectively, by 1990 (Ikiara, 1999)[3]. This increase is largely attributable to the Nile perch export business that emerged in the mid-1980s and expanded significantly in the subsequent years. This lucrative external trade in Nile perch has engendered a notable transformation of the hitherto artisanal fishery, ushering in an unprecedented inflow of national and international capital and completely new set of players. Within a few years of the emergence of this lucrative export business, the fish processing capacity grew from nil in the early 1980s to 15 registered factories by 1998 with a current processing capacity far in excess of production capacity.

In the 1990s, moreover, a fishmeal-based animal feeds industry developed with considerable consequences. In less than a decade, a total of eight animal feeds factories have prospered, six using large amounts of Rastrineobola argentea as an input while another two use the Nile perch skeletons to produce fishmeal.

The increasingly worrisome implications of the expanding Nile perch export industry and the use of fish and fish products in the animal feeds industry have provided the motivation for this paper. While foreign exchange earnings continue to be highly appreciated in a country that has a perpetual deficit in its current account, these have not come without cost. Specifically, food security for Kenyans has been increasingly compromised as more fish finds its way to external markets or animal feeds factories. In addition, jobs have been lost as the traditional small-scale processors and marketing agents have been pushed aside to pave the way for national and international capital. The biggest cost, moreover, has been the adverse impact on the ecosystem and threats to the sustainable exploitation of these crucial fisheries. The objective of this paper is therefore to assess the costs and benefits of the Nile perch export processing industry in order to determine whether the foreign exchange earnings in the country are large enough to offset the loss of food security, environment, employment and other factors? These are the macroeconomic trade-offs that constitute the subject of this paper.

The paper proceeds as follows. In the next section following this introduction, a brief historical overview of Kenya's Lake Victoria fisheries is presented. emphasizing particularly the rapid modernization that has occurred since the mid1980s. Section 3 describes the Nile perch export industry as the form of modernization that has had the most profound impact on the socio-economy of the Lake Victoria region and perhaps the entire Kenyan economy. The section also discusses the increasing use of fish in the manufacture of anima' feeds. This development is increasingly compromising the goals of sustainable fisheries management, food security, living standards of fishers and employment. Section 4 assesses the benefits that rapid modernization and commercialization have had and weighs these against the related costs. The main objective of this analysis is to find out whether this rapid commercialization has been justified and whether it should be encouraged or discouraged. Government policy for fisheries development is evaluated, in the light of the emerging picture of benefits and costs, as concluding remarks in Section 5.

[3] Kenya has limited capacity for regulation and data collection. For this reason, we believe that some of the contribution that the fishing industry makes, especially with regard to local incomes and subsistence, escapes recording and that the industry's contribution to GDP is much higher than reported.

2 Overview of Kenya's Lake Victoria

Economic Importance

Even though fishing constitutes only a small portion of Kenya's GDP, it is, nevertheless, an important source of livelihood for many Kenyans and has been so for many years. First and foremost, fish is an important source of animal protein, especially for most poor people living immediately around the lake. Panos (a London-based research institution) for example, estimates that fish provides about 19% of the total animal protein consumed by African people. In addition, sources cited in Myers (1997) estimate that seafood contributes 50% of all the animal protein consumed by human beings around the world, more than that supplied by beef and poultry combined. In Kenya, many ethnic communities. especially those in parts of Central and Eastern provinces, did not consume fish as recently as 198O, but fish has now become a an important source of cheap protein in almost all parts of the country. Thus, per capita annual fish consumption has increased from 3kgs in 1980 to 7.5kgs barely 10 years later (Kenya Fisheries Department. various years). In a later section of the paper, a more accurate picture of per capita fish consumption in the country will be presented.

Many Kenyans engaged in fishing earn income from the activity. This income has been increasing over the years, although distribution is becoming increasingly more inequitable, with the export-oriented fish processing sector taking the lion's share. In 1995, fishermen earned an estimated Kshs 5.9 billion from fishing, less than 30% of the value of the retail trade (Ikiara, 1999). The rest went to the people engaged in processing and marketing and the government in taxes. In the same year. fish exports earned Kenya Kshs 1.5 billion in foreign currency. These foreign exchange earnings are, in fact, an under-estimate as earnings from sport fishing are not included. In addition, there is speculation that fish processing firms frequently under-report their export quantities for tax evasion purposes.

Employment is the second avenue through which fishing provides a livelihood not only to Kenyans but many other people in developing countries. The Food and Agriculture Organization of the United Nations (FAO) has estimated that the livelihood of 100-200 million people, 95% of them living in developing countries, directly or indirectly depends on fisheries (Konstapel & Noort, 1995). In Kenya, the Fisheries Department recently estimated that a total of 798,000 people were directly or indirectly supported by the fishing industry compared to 720.000 in 1995. There were 34,000 fishermen, 238,000 dependants and 596,000 people engaged in the provision of support and ancillary services such as trade in fishing inputs, fish handling, processing and marketing[4]. A majority of these people live in the Lake Victoria region, an area in which alternative economic opportunities are limited largely due to low rainfall, poor soils and a shortage of paid jobs. In a country where the unemployment rate is estimated at between 25 and 30°/o and is in fact rising, fishing is clearly a very important economic preoccupation. In 1995, for instance, 560,000 people were estimated to have been employed in Kenya's fishing industry accounting for 25% of the country's total employment in the informal sector and 14.5% of the country's total employment.

Finally, the fishing sector supplies raw materials for other economic activities, notably manufacturing and agriculture. Thus, spoilt fish, by-products of fish processing and some fish species such as Rastrineobola argentea and Carodina nilotica are increasingly finding use in the manufacture of animal feeds, important inputs in poultry, dairy and beef production.

Historical Overview

The changes that have occurred in the fisheries of Lake Victoria have taken place in this century. Before the arrival of colonial rule, the fishery resource existed in harmony with the resource users (Geheb, 1995). The fishing community had traditional and territorial rules and regulations which ensured that the fishery

[4] The estimate for employment in support and ancillary activities suggests that for every job created in Kenya's fish harvesting sector, 15 others are created in support and ancillary activities. We find this hard to believe given international estimates. FAO estimates that every individual employed in developing country industrial fishing fleet creates 4 - 5 other jobs in support and ancillary activities while the ratio in artisanal fisheries is 1:1. Since Kenya's fishing industry is semi-industrial, we feel that a more realistic ratio is 1:3. This is the ratio we will use in this paper.

was exploited in a sustainable manner by limiting access to a specific group of people and to specified stock areas. The use of simple traditional technology such as traps and spears by artisanal fishermen, moreover, kept fishing intensity and pressure in check.

During the colonial period (1901-i962), the harmony existing between the resource users and the resource base started to crumble as a result of escalating fishing pressure (Geheb, 1995). This pressure was caused by factors such as the expansion h1 the market and demand for fish following the extension of the railway line from Nairobi to Kisumu in 1901. The introduction of taxes by the colonial government also forced Kenyans to join the cash economy. These factors, coupled with the introduction of more efficient technologies[5], the rapid growth of the fisher population. displacement of people to pave the way for cash-crop plantations in Western Kenya and lack of alternative employment (Geheb, 1995) contributed to the growth of the fishing industry.

The fishery started to decline following the escalation of fishing pressure. The catch per unit of effort (CPUE) and the average size of individual fish started to fall and the traditional regulatory mechanisms were subjected to increasing pressure, culminating in their total collapse by 1960. The colonial administration responded by introducing minimum mesl1 size and closed season regulations in the 1940s and of exotic fish species like Nile perch and Nile tilapia between 1950 and 1962 to enhance the lake fishery (Ikiara, 1999).

There have been various effects of escalating fishing pressure, collapse of traditional regulatory structures and remedial actions of the colonial administration. On the positive side, total fish catch from the lake has increased five-fold following the introduction of exotic species, particularly the Nile perch. For example, from 1960 to 1979, the annual catch from the three countries sharing Lake Victoria averaged 100,000 tonnes. The ownership of fishing equipment was highly decentralized so that fishing income was evenly distributed among fishermen. In 1989 the total catch from Lake Victoria reached about 500,000 tonnes. Total annual catch from the lake now fluctuates between 400,000 and 500,000 tonnes. While less than 1,000 tonnes of Nile perch were landed from the entire lake in 1981, this figure rose to about 363,000 tonnes in 1993 with Kenya accounting for about 29%. There have been many benefits associated with this increase in Nile perch landings (as will be discussed in section 4).

Pundits believe that the negative effects of increased fishing far exceed the positive ones. In less than a century, about half of the fish species that once existed in the lake have been lost. Out of an estimated 400 species thought to have existed at the beginning of this century, only about 177 remain (Kenya Fisheries Department, 1980; Witte and Van Densen, 1995). Barel (1986) estimates that as many as 300 species may be facing extinction. Moreover, the ecological make-up of the lake has experienced drastic changes. Ecological upheaval has been wrought by the introduction of alien fish species, overfishing and pollution, among a myriad of other factors. The once multi-species fishery is now a three-species fishery and is under increasing pressure to reduce further to a two-species fishery (Table 1). While the three species that now constitute the commercial fishery (Oreochromis niloticus, Rastrineobo1a argentea and Lates niloticus) accounted for only 5% of the total landings in 1970, this reached 95.5% twenty years later and remain at more or less that level today. This is shown in row 10 of Table 1. The exotic tilapia species (Oreochromis niloticus) shows signs of losing its importance in the commercial fishery. From its peak of 23.4% in 1990, tilapia dropped sharply to 6.5% in 1996 (Row 3 of Table 1). Consequently, the Nile perch and Rastrineobo1a argentea now dominate the fish catches of Lake Victoria.

Other adverse consequences of the new developments in the Kenyan Lake Victoria fishery in the course of this century include declining CPUE and the associated switch to destructive technologies. These in turn have reduced the number of fish processing and marketing jobs as well as the availability and affordability of fish to local consumers, leading

[5] The introduction of gillnets in 1905, in particular, was the key to the initial commercialisation of the lake fishery.

to basic food insecurity. Hence, the control of fishing technology and marketing has shifted from local fishers to large commercial entrants with access to capital, and one result has been the erosion of responsible fishing behaviour.

Table 1: Species Composition of Fish Landings in Lake Victoria (Kenya), (% of total weight landed)

	1968	**1970**	**1975**	**1980**	**1985**	**1990**	**1992**	**1994**	**1996**
1. Haplochomis	25.53	34.39	28.97	13.78	0.01	0.00	2.00	2.17	2.35
2. Protopterus	19.15	10.46	9.21	1.40	0.17	0.05	0.99	0.10	0.09
3. Oreochromis niloticus*	**0.00**	**0.00**	**1.27**	**4.49**	**8.78**	**23.37**	**11.09**	**6.10**	**6.47**
4. Other Tilapine	16.50	28.95	2.76	14.52	2.17	0.34	4.00	1.97	3.08
5. Rastrineobola argentae*	**4.99**	**3.36**	**28.52**	**35.80**	**30.00**	**28.52**	**23.42**	**35.70**	**29.84**
6. Lates niloticus*	**0.00**	**0.18**	**0.32**	**16.34**	**58.02**	**43.64**	**51.14**	**53.70**	**57.95**
7. All others	33.83	22.66	28.95	13.67	0.85	4.08	7.36	0.26	0.22
8. (5 + 6)	**4.99**	**3.54**	**28.84**	**52.14**	**88.02**	**72.16**	**74.56**	**89.40**	**87.79**
9. (3 + 5 + 6)*	**4.99**	**3.54**	**30.11**	**56.63**	**96.80**	**95.53**	**85.65**	**95.50**	**94.26**

* These three species currently dominate the fishery.

Source: Adapted from Ikiara (1999)

3 The Nile Perch Transformation of the Fishery

Desiring to enhance the fisheries of Lake Victoria the colonial government introduced several species of tilapia and Nile perch into the ecosystem between 1950 and 1962. These new species, especially the Nile perch, established themselves fully within only ten years. Two of these species, the Nile perch (Lates niloticus) and Nile tilapia (Oreochromis niloticus), now occupy a dominant position in the three-species commercial fishery that Lake Victoria has been transformed into. Without doubt, the non-indigenous species have served the fishery enhancement objective. Catches have expanded five-fold, and a lucrative export business based on Nile perch has taken root. Consequently, the price of Nile Perch increased in real terms, and the tilapia came to dominate the national fish market. Reynolds et al. (1992), report that the Lake Victoria fisheries produced a total value of US$ 280million between 1975 and 1989. Employment, too, increased from 158,000 employees in fishing and ancillary activities in the entire lake to 422 000 by 1992 when Nile perch fishery was at the peak (Wilson, 1993). Fishery expansion has not been costless unfortunately. It is now widely acknowledged that the introduction of alien species into an ecosystem causes biodiversity loss (Konstapel and Noort, 1995). Studies in Scandinavian lakes and North America show that such introductions lead to irreversible changes in food webs (Ochumba et al., 1991).

Catch Expansion and Export Development

Following their introduction into Lake Victoria, catches of tilapia and Nile perch started appearing in the mid-1970s (Table 1). Initially, there were more catches of the tilapia relative to Nile perch as consumers and fishermen were already familiar with other closely related species and therefore targeted the tilapia. On the other hand, fishers and consumers in Kenya regarded Nile perch as fatty, smelly and unpleasant as there was no prior experience with it.4 It was not until the late 1970s that significant amounts of the perch started to be landed in the Kenyan waters of Lake Victoria For example, 1,000 tonnes were landed in 1978. This increased to nearly 23,000 tonnes in 1981, 50,000 in 1985 and reached a peak of 123,000 tonnes in 1991 (Abila and Jansen, 1997). There has since been a declining trend.

Thus, the dislike of Nile perch among the Kenyan fishing community around Lake Victoria was short-lived. This development, coupled with the popularity of perch in Uganda and Tanzania saw the East African market absorbing thrice as much fish in the mid-1980s as in previous years without corresponding changes in prices (Abila and Jansen, 1997). During the initial years of the Nile perch boom, therefore, Kenyans and East Africans in general benefited enormously from increased availability of fish at affordable prices. In fact, Reynolds et al. (1992) observe that the dollar prices of Nile perch in Lake Victoria as a whole fell over the 1975 - 1985 period and then began to rise as export demand grew. This observation is supported by the data, plotted in Fig. 3.

The Nile perch strengthened the dominance of Lake Victoria as Kenya's leading source of fish. The lake's share of total catch rose from 50% in 1970 to about 94% in 1995 (row 8 of Table 2). This dominance continues. Row 10 of table 2 demonstrates the dominance of Lake Victoria fisheries in the country's fish output from all freshwater sources while row 11 shows the role of fish farming or aquaculture in the country's fishing industry. It is worrisome that the performance of aquaculture is deteriorating instead of improving. The worry arises from the fact that aquaculture ought to serve as an alternative source of fish. The last row of Table 2 shows the size of Kenya's marine fishery over time. The serious decline in marine catch since 1965, is, to some extent, a reflection of the fact that the potential officially thought to exist in this sub-sector is largely illusory. The value of fish produced from Lake Victoria has also recorded phenomenal growth, in real terms, since 1980 (Fig. 1), that is, from Kshs 0.2 billion to about 2.2 billion in 1995.

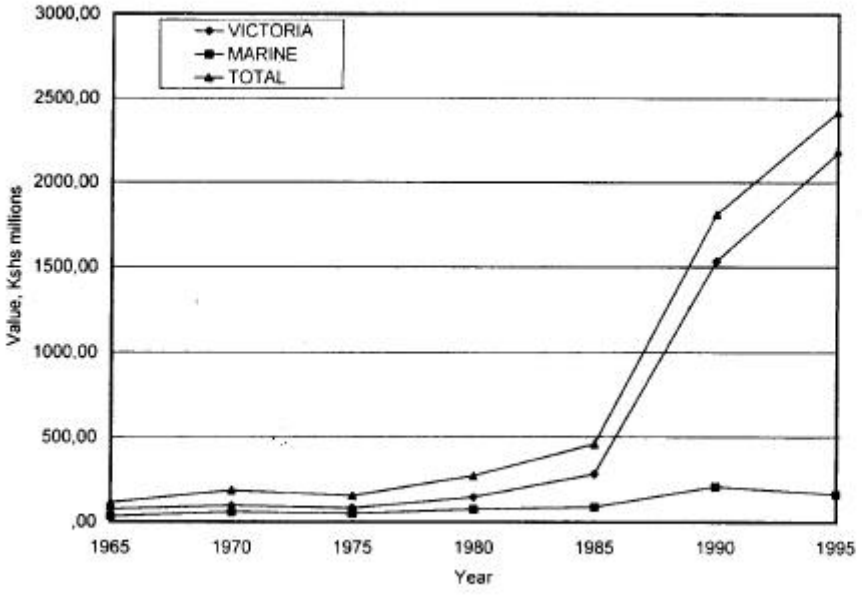
Table 2: Quantity of Fish (Tonnes) Landed in Kenya, 1965-1998

SOURCE	1965	1970	1975	1980	1985	1990	1995	1998
1. L. Victoria	13,000	16,988	16,581	26,914	88,589	185,101	181,888	158,876
2. L. Turkana	1,095	4,854	4,236	12,384	7,460	3,180	2,232	4,268
3. Others*	3,050	4,003	1,993	2,988	2,630	2,552	2,591	3,709
4. Fish Farming	130	-	-	596	1,085	975	1,083	217
5. All Fresh Water	17,275	25,845	22,810	42,882	99,764	191,808	187,794	167,070
6. Marine Fish	5,725	7,910	4,531	5,336	6,209	9,972	5,995	5,522
7. TOTAL CATCH	23,000	33,755	27,341	48,218	105,973	201,780	193,789	172,592
$^{1}/_{7}$ (%)	56.52	50.33	60.65	55.82	83.60	91.73	93.86	92.05
$^{1}/_{5}$ (%)	75.25	65.73	72.69	62.76	88.80	96.50	96.86	95.10
$^{4}/_{7}$ (%)	0.57	-	-	1.24	1.02	0.48	0.56	0.13
$^{6}/_{7}$ (%)	24.89	23.43	16.57	11.07	5.86	4.94	3.09	3.20

* This category includes other fresh water sources of fish such as lakes, rivers and dams.

Source: Ikiara (1999). Updated from Republic of Kenya. *Economic Survey 1999*.

Fig 1: Real Value of Fish Produced Annually in Kenya



Source: Ikiara, (1999)

The initial low demand for Nile perch in the domestic market and large supply stimulated the growth of an export business that now earns the country about Kshs 1.5 billion in foreign exchange annually. To meet the export market demand, fish processing factories were first established along the shores of Lake Victoria in the early and mid-1980s. In Tanzania. the first fish processing firms were opened between 1990 and 1995 (I VFRP/Techi99,'09, 1999). Even though the largest of the Kenyan fish processh1g firms, Samaki Industries, was established in Nairobi as early as 1965, it only established a commercial presence in Kisumu in 1986. The first firms established in Kisumu were Afro Meat Co. Ltd. and Prinsal in the early 1980s. These earned such high profits that, within a short period, many more factories were built. Currently, a total of I 5 fish processing factories are registered but only ten are operating. These include Samaki Industries, East African Sea Food, Prinsal, Peche Food Ltd., Tropical Food Products International (not currently operational), Modern Fishing Ltd., Afro Meat Co. Ltd., Kendag, Capital Fish, .E. Tilley (M) Ltd., Kenya Cold Storage (Foods) Ltd., Lake Victoria Fish (under receivership), Star Fisheries (not operational) and Eagle Fisheries (sold its factory to Samaki Industries). At the peak, in 1995, there were 15 registered fish processing firms in the country. Some of these have since either relocated to Uganda or Tanzania or closed due to raw material supply constraints. lack of access to markets or quality problems. Some companies close. relocate, sell or re-name once the 5-year tax holiday investment incentive ends. Consequently, six of the eight filleting firms surveyed by LVFRP/Tech/99/09 (1999) in Kenya were established in the 1990s. In fact, 88% of all the firms in the three countries sharing the lake were found to have been established since 1990.

Because of the efforts of these processing factories, Kenya changed from a net importer of fish in the 1970s and early 1980s to a net exporter in the mid-1980s (Table 3). The real value of fish exports from Kenya grew by an annual average rate of 268.5% between 1985 and 1995 compared with - 2.5% over the period 1975-1985. In 1998, LVFRP/Tech/99/02 (1999) estimates that the three East African countries earned a total of US$ 219.4million from the export of Nile perch, out of which Kenya accounted for US$ 34.8million5. Had most of this income reached the local fishers, their welfare would have appreciably improved.

In 1995, Kenya exported 12,052 tonnes of fish worth Kshs 1.5 billion (US$ 25million) in nominal terms or Kshs 0.7 billion in constant 1990 prices (Table 3). In that year, the country's fish trade account had a surplus of Kshs 1.43 billion (US$ 24million), a substantial sum for a country whose current account balance in one of its best fiscal years, 1996/97, stood at only US$ 90million (Ikiara, 1999). Viewed from this perspective, the Kenya government's encouragement of a vibrant fish export business, almost to the exclusion of the other development objectives of the fisheries policy, is hardly surprising.

Nile perch is the dominant fish species in Kenya's trade, accounting for about 91% and 92% of total fish export volume and value, respectively, in 1995 and all the fish imports coming into the country that year (Ikiara, 1999). Other fish and fish products exported from Kenya include octopus, beche-de-mer, marine shells and small quantities of fish bladders, prawns, lobsters, gray fish, live fish and dry shark fins. In 1995 Nile perch bladders (fish maws) earned the country Kshs 22.6million in nominal terms or Kshs 10.27million in constant 1990 prices, down from Kshs 23million (nominal value) in 1991. This Nile perch product is, therefore, very important too.

The EU and Israel have been and continue to be the principal export markets for Kenyan fish. In 1987, Israel alone accounted for about 55% of the country's total fish exports. This share dropped in subsequent years to stand at 32% in 1997. Meanwhile the share of the EU rose to reach 56% in 1995-96. Following three fish bans in the EU market since 1997, however, the share of the EU market dropped to only about 19% in 1998. Israel absorbed 48% of the fish exported from Kenya in 1998. A high and rising demand for Nile perch in these and other export markets has led to a tremendous increase in the price of Nile perch, especially the price in the export market, and therefore the value of the exports. While the volume of fish exports rose by 66% between 1989 and 1995, for instance,

Table 3: Kenya's External Trade in Fish and Fish Products, 1970-1997

YEAR	EXPORTS		IMPORTS	
	Volume. tonnes	Value. Kshs. millions*	Volume. tonnes	Value. Kshs. millions*
1970	1,369	-	5,274	-
1975	1,119	31.22	2,435	55.58
1980	784	18.32	3,757	49.75
1985	514	22.71	403	4.46
1987	4,677	183.16	155	1.20
1989	7,279	336.05	2,241	8.60
1992	11,762	506.86	409	1.56
1995	12,052	693.51	2,582	33.67
1996	14,412	963.62	1.2	0.06
1997	13,295	847.94	-	-

* Values are in constant 1990 prices. A GDP Deflator series (1990=100) for Kenya, obtained from IMF's *International Financial Statistics Yearbook*, is used to calculate real values.

Source: Adapted from Ikiara (1999).

the value increased by 386% in nominal terms and by 106% in real terms over the same period.

The Nile perch export business is facing increasing and challenging obstacles which cast doubt over its temporal sustainability. Thus, the country's fish export performance has started to decline. From the peak export of 14,412 tonnes in 1996 that earned the country Kshs 963.6million in real terms, performance has declined to 13,295 tonnes in 1997 and further to 10,861 in 1998. The value has also declined by 12.0% in 1997. The most daunting of these challenges are the dwindling supplies of fish, and serious quality problems.

The quantity of Nile perch available for processing has been declining since 1991. From a peak of 123,000 tonnes landed from the Kenyan side of Lake Victoria that year, the perch catch dropped gradually to only 96,500 tonnes in 1996. This decline occurred in spite of a substantial increase in fishing pressure. Between 1993 and 1995, for instance, the number of fishers and boats increased by 15% and 7% respectively (Ikiara 1999). In addition to these increases, previously existing fishermen and fishing units increased their fishing efforts substantially to compensate for declining CPUE. Diminishing availability of fish has meant that installed fish processing capacity is not fully utilized. In a recent survey involving the 12 fish processing firms in operation, Abila and Jansen (1997) estimated that only about 50% of the daily processing capacity of 380 tonnes was being realized. This is supported by a more recent survey which estimates fish processing capacity utilization of 49% in Kenya and 57% in the East African region (LVFRP/Tech/99/027 1999). This survey estimates that in the entire lake, 469 tonnes of Nile perch are processed daily out of an installed daily processing, capacity of 823 tonnes; twenty one out of the twenty three filleting firms surveyed by LVFRP/Tech/99/02 (1999) cited fish supply problems primarily attributed to low catches and high competition.

Factors responsible for this decline in catches include ecological consequences of overfishing, introduction of alien fish species, pollution and the water hyacinth infestation that has recently assumed alarming proportions. Overfishing. in turn, has been caused by excessive demand for fish in both local and external markets and improved fish prices. Other factors are excessive processing capacity, high rates of population growth, lack of alternative employment opportunities and open access to the fishery (Ikiara, 1999). Further discussion of these factors is beyond the scope of this paper.

Quality is the other major challenge to Kenya's fish export business. Even though most of the processing factories in Kenya generally meet

EU hygiene standards of design and construction, unscrupulous processing by unregistered and unhygienic factories occurs and the conditions at the landing beaches are generally poor (Goulding. 1997). Currently, Kenya's fish exports are going through a debilitating ban from the EU market, the largest market until last year. This comes only a short while after another ban, from the same market, of fresh fish imports from East Africa following a cholera outbreak which lasted from January to July 1998. Also, in March 1997, East African fish consignments to Spain and Italy were found to contain unacceptably high levels of bacterial contaminants, prompting stricter inspection procedures for subsequent consignments from the region (Ikiara, 1999).

These export bans have been accompanied by extremely heavy losses. The 1998 ban, for instance, led to a fall of 45-67% in the ex-vessel price of Nile perch in a period of only 3-4 months, reduction of the scale of operations by as much as 75% by some processing factories and laying off of workers (as many as 150 workers from only one factory), increased lack of confidence in East African fish even in markets outside the EU, and deteriorating confidence in other export commodities from the region. Others include the exit of some fishermen and their boats from the fishery, loss in tax income and incomes for people employed in the fishing industry and loss of business to airlines (as much as US$ 0.5million per week for one airline), among other losses (Ikiara, 1999).

Other Fishery Developments

In the last decade a fishmeal-based animal feeds industry has developed and generated unprecedented demand for the second most important commercial fish species in Lake Victoria, R. argentea (or omena in the local language), and for Nile perch skeletons. The development of this industry has, in effect, subjected omena, like Nile perch, to regional and international commercialization.

In a 1997 survey, Abila and Jansen (1997) found that six animal feed manufacturing companies in Kenya were using about 70% of all the omena that was produced every year to manufacture fishmeal while another two companies were using 60% of the Nile perch skeletons produced for the same purpose. It is noteworthy that up to the late 1980s, all the Nile perch skeletons (popularly known as mugongo wazi) were used for human consumption and that in the early 1990s all the omena was also consumed by humans. The demand for local fishmeal in the animal feeds industry is largely unmet, as it is rich in proteins and cheaper than imported fishmeal. It is obvious, therefore, that more and more of the skeletons and omena and perhaps other fish products are finding their way into animal feeds production. The implications of this development to food security, employment, living standards of the fishers and the sustainable exploitation of the resource system are discussed in section 4 below.

Besides catch and Nile perch export increases, there have been other developments in the Kenyan fisheries of Lake Victoria. The first significant change that accompanied the development of the Nile perch fishery was the introduction of new technology for both harvesting and processing. Until the mid-1970s, Lake Victoria fisheries were exploited by small-scale fishers with little technological inputs. The gillnet technology introduced in 1905, however, was an early technological improvement. This initiated commercialization of the lake fisheries. Even though 80% of artisanal fishers in the pre-Nile perch fishery derived their primary income from fishing, many also farmed, returning to fishing during agricultural off-peaks and in times of poor crop performance. In general, each fisher owned only a single canoe and a nominal number of fishing gears. This ensured that resource control and income were evenly distributed and that participation was widely distributed. Even at that time, however, increasingly larger numbers of people were entering the fishing enterprise as urban unemployment rates rose. In spite of the continued use of traditional technology, therefore, the increasing number of fishers caused a decline in individual earnings.

In the pre-Nile perch period, small-scale operators dominated the fish processh1g and trading sub-sectors too. These were mainly women from the communities living around the lake. They sold some fresh fish and processed the surplus, using such simple technology as smoking, salting and sun-drying. for later sale.

Table 4: Number of Fishermen and Fishing Vessels, Lake Victoria (Kenya)

Source of data	No. of fishers	No. of vessels
Graham, M. (1929)	5,000	2,000
Fisheries Dept. (1971)	11,000	-
FAO (1973)	10,000	4,100
Fisheries Dept. (1979)	18,000	4,600
Reynolds *et al* (1995)	21,500	5,500
Hoekstra, T.M. *et al* (1991)	24,000	6,229
Achieng, A.P. (1991)	30,000	7,000
Fisheries Dept. (1991)	25,000	7,279
Fisheries Dept. (1994)	25,000	7,425
Fisheries Dept. (1995)	30,000	8,000
Fisheries Dept. (1998)	40,000	15,000

Source: Ikiara (1999), some adjustments.

There were hardly any wholesalers. The fish processors and traders, moreover, exerted no pressure or control on fishers through credit relationships or any other mechanisms.

Since 1980, the situation has changed dramatically. The number of fishers grew by 200% between 1973 and 1995 to reach, 30,000 while that of vessels increased by about 95% over the same period to reach 8,000 (Ikiara, 1999; Table 4). This indicates that the number of fishers operating from the same boat increased from 2.5 to almost 4 during that period, ushering in an extremely intensive fishing regime. Current Fisheries Department statistics indicate that the number of fishers and boats has continued to increase, reaching 40.000 and 15,000 respectively, in 1998. This increase is, in fact, only a small proportion of the total increase in fishing effort, implying a declining catch per fishermen.

The industry is also witnessing increased investment in more efficient technologies such as gillnets, beach seining, mosquito seining, trawling, and lately tembea (drift net fishing technology) most of which are detrimental to the integrity of the lake ecosystem. Even though trawling has been banned for many years it is estimated that 15 trawlers, loosely related to the processing firms, are still operating, mainly from one beach (Jansen et al., 1999). The effects of trawling and tembea technologies, rapidly expanding as a result of the fish export business, will be discussed in a later section of this paper.

Furthermore, there is increasing evidence that fish processing firms are becoming involved in fish harvesting, either by extending credit to fishers or by purchasing their own equipment and hiring fishers. Tembea boats, for instance, are normally in fleets, and considering that the average investment in one tembea boat is approximately Kshs. 500,000, most of the fleets are owned and controlled by the processing factories. At the same time, one fish-processing factory owns Kenya Fishnet Industries, which produces and supplies 90% of fishing nets and beach seines in Kenya. As a result of increased vertical integration and control of the production, processing and even marketing functions within the sector, the export processing factories may soon have a monopoly of the industry and which in turn will marginalise the local fishers gradually and other fishery participants.

In a recent development (see the memorandum from a representative of the Kenya Fish Processors Association in Box I below), the fish processing factories are striving to achieve increased centralization of the Lake Victoria fisheries, a positive step towards improving the quality of handling fish and consistency with the export market (the EU in particular) standards and specifications. This objective, however, is in direct conflict with the interests of the local fishermen and fishing communities as its

implementation will deny the local fisherfolk access to the landing beaches. This is, no doubt, a very significant development which must be critically examined by the regulatory authorities, if the objectives of the Fisheries Department have to be achieved in a balanced fashion.

Moreover, resulting primarily from the ecological disruption associated with the introduction of alien species and also from overfishing and pollution, the ecosystem balance of the lake has changed substantially. The Nile perch is now known to be a predator of most of the fish species found in the lake including its own juveniles. As already mentioned many of the endemic fish species have now disappeared from the catches and the originally multi-species fishery has been reduced to a three-species commercial fishery.

The processing and marketing sub-sectors have also experienced transformation. New technologies for processing Nile perch were developed. Small-scale traders and processors were edged out by capitalized operations. The by-product of Nile perch filleting, the skeleton formed the basis of a new processing and trading business to which displaced women turned. An aggressive use of R. argentea and the skeletons for animal feeds manufacture also emerged. Artisanal traders and processors, 84% and 56% of whom are women in Kenya and the East African region, respectively, (LVFRP/Tech/99/02, 1999) now deal largely in small fish which are not accepted by the processing factories (Abila and Jansen, l997; Medard and Wilson, 1996).

BOX 1:

MEMORANDUM

Following our various discussions about fish export trade relations with the European Union, this letter is to give you a more in-depth understanding of the situation. The European Union is very concerned over the unhygienic environment of Lake Victoria's beaches. Their constant cry is in reference to inadequate landing sites and laboratories. These issues most definitely fall under the Government's umbrella and not the fish-processors, as is commonly implied.

To the European Union, more priority goes to landing beaches. Their recommendations is to enclose the landing sites and jetties restricting access to only the Department of Fisheries, Veterinary, Fish Cooperatives, Fish traders and Fish processors from the export industry. By restricting human traffic around the beaches, it will assist the government representatives to efficiently follow the required European Union Standards and Regulations. These officials are also expected to be in hygienic attire, such as white dust-coats, gum boots and gloves.

As far as laboratories are concerned, they require well-equipped labs to test for harmful chemicals (pesticides), as well as water-borne bacteria (E coli, Salmonella). The Government labs in existence are unfortunately ill-equipped and outdated according to European Union Standards.

In reference to the landing beaches, here are some suggestions that we feel may adhere to the EU requirements. First, four South Nyanza beaches and five Uyoma beaches should be upgraded to EU standards. This can be done by building 100-metre jetties into the water and making the landing sites restricted zones to the fishing industry and the relevant Government departments, in a bid to eradicate any sort of contamination. Also, by locating the landing sites away from the villages will assist in controlling human traffic (hawkers, vendors…). For your information, we have taken the initiative to upgrade the beach at Port Victoria by building a 100-metre jetty into the water This has costed us approximately Kshs. 2,000,000/- and as far as laboratory is concerned, we have collectively upgraded the Lab. in Kisumu. We have managed to repair all electrical fittings and add new refrigeration

In our estimation, to upgrade our Kenyan beaches to EU standards will cost in the tune of Kshs. 200-250million. If appropriate measures are taken, there is still hope for the fishing industry to survive.

We have information that the EU is planning to send officials around November this year. We hope we shall be prepared for them.

The most appropriate way to handle this situation is for the Fish Processors Association to take responsibility for the upgrading since they are the major stakeholders, as well as having a very good understanding of the EU rules and regulations. These measures may also influence Tanzania and Uganda to follow suit.

Summarily, we would like to appeal to you sincerely to give not only the fishing industry but also all other fish related industries a chance to survive and also benefit the country's economy.

Your cooperation and attention to our plea will be greatly appreciated.

Once again, thank you for your concern and cooperation.

Signed

For and on behalf of the Kenya Fish Processors Association.

October 2, 1999.

4 The Macroeconomy of the Fishery

In this section, we trace the socio-economic and environmental effects of fishery transformation that has occurred since the explosion of the Nile perch fishery and the development of an animal feeds industry using local fishmeal. We compare the costs and benefits of this transformation. Specifically, the section tries to answer the following questions: Have the benefits of the transformation been large enough to cover the costs? What has been the official policy position with regard to the transformation? In light of the assessment of the benefits and costs of the fishery transformation, has the official policy been well informed or does it need re-formulation?. Environmental effects are treated as part of the macroeconomic impact that fishery transformation has had since environmental effects ultimately affect the economy. It is, indeed, becoming increasingly critical that national accounts become "green" as a result of this realization so as to ensure sustainability.

Benefits of the Transformation

The commercialization of the Lake Victoria fishery that has been increasing since the late 1970s has, undoubtedly, yielded substantial benefits to the Kenyan economy. These benefits include foreign exchange earnings. income earnings to the owners of fish processing and animal feeds manufacturing factories, tax income to the government, a marginal increase in the real ex-vessel Nile perch price and therefore fisher incomes, creation of employment opportunities and commercial spin-off activities such as the processing and trade in Nile perch skeletons and the positive impact of higher quality animal feeds in the livestock industry.

Foreign Exchange (forex) Earnings

As noted earlier, Kenya changed from being a net importer of fish in the 1970s and early 1980s to being a net exporter ever since (Table 3). This is largely attributable to the development of a vibrant export business based on the Nile perch. The Nile perch now accounts for about 92% of the country's total fish export value. From Kshs 18.3million earned as foreign exchange from the export of fish in 1980, forex earnings grew to reach Kshs 963.6million, in real terms, in 1996 (Table 2). This translates into a substantial annual average growth rate of 303.5%. In 1998, Kenya exported fish worth Kshs 1.67 billion or US$ 27.8million. This constituted only about 1.4% of the country's total exports that year. While this is small, external trade in fish is very important for Kenya, as it is almost entirely a credit to the external account. One need only know that, in 1998, Kenya had a deficit in its overall current account of Kshs 24.5 billion to appreciate these forex earnings. The role of such forex earnings in the stabilization of Kenyan currency and generation of investible funds is highly significant. Thus, the fishery has no doubt increased foreign exchange receipts and potentially improved the foreign exchange position of the country.

It should be noted that forex earnings and total fish sales reported could be only a part of the actual figures. Pundits believe that fish processing firms and other medium- and large-scale dealers in fish under-report their sales and export figures for tax evasion reasons. Reliable sources have actually estimated that for every five kilograms reported in sales and export, two are not. If this is true, it implies that the value of the fish harvested annually is under-estimated by as much as 29%. This, from a simple calculation, seems not to be so far-fetched. A survey by the Lake Victoria Fisheries Research Project in 1998 (LVFRP/TECH/99/02, 1999), estimated that Kenya-based fish processing firms earned US$ 34.8million from the export of Nile perch. The officially reported figure of US$ 27.8 million is, thus, only 80% of the actual export revenue.

Forex receipts have thus been advanced as one of the largest benefits accruing from the fishery transformation. This position or argument, however, begs some questions. How much of these forex receipts are retained in the country considering that exchange controls have been removed? How sustainable, in temporal terms, is this benefit in light of the challenges currently facing Kenya's fish exports? Moreover, how significant is this forex benefit weighed against the economic cost of the fish export business and other benefits?

Even considering tax revenue, employment of Kenyans, sourcing of raw materials locally and the ownership structure of the fish processing firms, we believe that a high proportion of the officially reported forex receipts from fish exports is not retained in the country. Of the 12 processing firms operating in 1997, three were fully owned by Kenyan Africans, eight by Asians (some of whom were Kenyan nationals) either solely or in partnership with investors of other nationalities, and one by Israeli nationals (Abila and Jansen, 1997). Current information indicates that only ten fish processing companies are in operation, each of which has at least one Kenyan shareholder. Seemingly, as a rule, the fish processing firms employ influential Kenyan Africans as directors (Jansen, 1997). Since foreigners usually repatriate their forex, the ownership structure painted above suggests that most of the money earned from the export of fish may not be retained in the economy.

Even though the survey by Abila and Jansen (1997) indicated that some of the processing factories with foreign ownership have invested in other sectors of the Kenyan economy, including hotels, bakeries, bars, butcheries, meat processing plants and manufacture of fishing nets, there is no evidence to suggest that it is the revenue generated from the fish business that is re-invested in the country. Most likely, these businesses are set parallel to and independent from the fish processing business, hence they are avenues for making and repatriating profits - which makes sense from the perspective of good business practices. It is probable that most of the fish processing firms that relocated from the country or closed, since 1994, were foreign owned. It has been noted, in some quarters, that foreign fish processing establishments in the country benefit from the initial five years of tax exemption only to relocate, sell or close on the expiry of this period. Thus, even though Kenya had as many as ten fish processing firms in 1987 (Reynolds and Greboval, 1988), a survey carried out in 1998 indicated that six out of the eight firms surveyed in Kenya were established after 1990 (LVFRP/Tech/99/02, 1999).

On employment, the fact that the top managers of most of the processing factories are foreigners implies that a substantial amount of the total salaries paid leave the country. In 1998, for example, returns from three fish processing firms indicate that Kenyans took 55.8% of the salaries while the rest went to foreign employees. The same returns suggest, furthermore, that salaries took up 12.6% of total sales. It should not be forgotten, however, that Kenyans employed in these firms benefit from the transfer of technology and are in a position to open their own factories. Some proprietors of locally-owned factories are past employees of the foreign-owned factories.

As mentioned already, fish exports from Kenya have been banned from the EU market thrice in recent years. The latest ban is still in force. These bans have been due to inadequate quality. If the quality challenge is not dealt with exhaustively and urgently, there will soon be no fish export business. Encouragingly, there is external assistance to boost the quality of fish exports from East Africa. Earlier this year, for example, FAO gave over Kshs 20.6million for this purpose while the EU gave COMESA US$ 2.5million to enhance its Standards Quality Metrology and Testing (SQMT) project.

The declining productivity of the lake reflected in falling catches despite increasing fishing effort, falling CPUE and increasing proportion of juveniles in total landings is another serious challenge which casts doubt on the sustainability of the fish export business. The fall in the number of fish processing firms from 35 in 1995 to only ten in 1999 and the increasing use of small immature perch for processing are clear manifestations of the threat to the future performance of fish exports from Lake Victoria.

Another consideration in the forex benefit that Kenya enjoys from Lake Victoria fishery is exposure to international market fluctuations and risks. The recent fish export bans have dramatically illustrated this vulnerability. The bans do not only cause drastic fish price falls but also interfere with planning from the harvesting sector to the processing, marketing and transportation sectors and the general economy.

Additionally, with respect to the benefits of the foreign exchange earnings is the enormous economic and environmental cost associated with fish exports. These costs are discussed later in this section.

To summarize the discussion of the foreign exchange benefit of Kenya's fish export business we argue that the Kshs 1.5 - 2.3 billion earned annually should not be taken at face value. The actual value could be 20-29% more than these reported figures. It is doubtful that this unreported revenue ever gets into the country. Assuming that up to 50% of the reported revenue is retained in the country (a reasonable assumption), the Kenyan economy benefits from almost Kshs I billion every year in foreign currency. This would generate substantial growth benefits in the country's economy. This, however, has been accompanied by enormous economic and environmental costs. In addition, the future performance and sustainability of this benefit is cast into doubt on account of declining productivity and fish quality problems. Moreover, following the repeal of the Exchange Control Act, there is no statutory requirement obliging exporting firms to retain foreign exchange earnings in Kenya! The vulnerability of this trade to international market fluctuations casts further doubt on the real value of these foreign exchange earnings. We feel that the policy attention or priority given to this benefit over the other benefits cannot be justified, as will be demonstrated in section 5. In addition, other objectives like employment creation, food security and improved welfare of fishers are as important, if not more important, than the forex objective in the macroeconomic arena. These objectives are currently being sacrificed at the expense of the export market and foreign exchange earnings objective.

Income Earnings to Owners of Processing and Feeds Factories

Owners of fish processing firms and manufacturers of animal feeds are the main beneficiaries of Lake Victoria fishery. On the basis of their survey of 1997, Abila and Jansen (1997) estimated that. on average, each fish processing firm in Kenya incurred a total cost of US$ 2.00 for every kilogram of fillet exported and received an average income of US$ 3.50. This implies that the owner of the firm receives a profit of US$ 1.50 per kilogram of fillet exported. The owner of a factory that processes an average of 20 tonnes of Nile perch per day could obtain 7 tonnes of fillet (35% recovery rate) and earn an impressive US$ 262,500 (Kshs 18.4 million) in profits per month, assuming a 25working-day month and that all the processed fish is exported. This is very high compared with the Kshs 6,000 earned by the average fisher in a month of 30 days.

We could estimate the income accruing to fish processing firms by an alternative method. From Abila and Jansen's estimate, these investors receive about 42.9% of the export market price as their profit. Thus, in 1998 when Kenya's actual Nile perch exports stood at Kshs 2.1 billion (US$ 34.8), according to LVFRP/Tech/99/02 (1999 report), owners of fish processing firms received Kshs 0.9 billion from the export business alone. Since most of the firms also sell fish in the domestic market, they earn even more income. In 1996, Abila and Jansen (1997) estimated that 21,000 tonnes of Nile perch fillet were produced. In that year, statistics from the Fisheries Department indicate that 13,368 tonnes of Nile perch fillet were exported. Thus, about 36% of the fillet produced that year was sold in the local market. The fact that the demand in the external market is largely unmet and yet the processing firms sell some fillet in the Kenyan market suggests that the profit margins in the two markets are more or less the same. Since 10,861 tonnes of fillet were exported in 1998, 6,109 tonnes must have been consumed in the domestic market (assuming the 1996 market shares at about Kshs. 0.916 billion). The owners of the fish processing firms, therefore, must have received about Kshs.0.39 billion from the domestic market, bringing total earnings to Kshs 1.29 billion.

Owners of animal feeds manufacturing factories also obtain large profits by using omena and Nile perch skeleton as sources of fishmeal instead of using imported fishmeal as these are almost as rich in protein as the imported substitutes and yet cost almost half the price of imported fishmeal. It is not possible to estimate this, unfortunately, without a detailed primary survey of these animal feeds factories.

Tax Income

The Government of Kenya earns a substantial amount of revenue through the licensing of fish processing factories and animal feeds firms and through the taxation of export revenue. It is estimated, for example, that the government

receives 0.5% of the market price for every kilogram of fillet exported, as export levy. This levy is collected by the Fisheries Department. In 1995, the export of 12,470, tonnes of Nile perch fillet ought to have generated a total of Kshs l0.5million.

Government receipts from this export levy reached an all-time high of Kshs 13million in 1996. Between 1991 and 1997, the government received a total of 42.4million from this source. Between 1991 and 1995, an additional Kshs 0.44million was received as export levy on Nile perch bladders. These benefits can be entirely attributed to fishery transformation as fish was not previously exported. However, Kenya could be exporting more fish than is reported in the official statistics. We have estimated, in a previous section of this paper, that perhaps 20-29% of the actual fish exports are not reported. This suggests that the Government of Kenya is losing tax income amounting to Kshs 2million per year.

The government receives other income from the fishing industry. First, it is estimated that the Fisheries Department collects US5 30,000 (Kshs 1.8million) annually from the registration of boats, issuance of fish trader licenses, court fines for violators of fishing regulations and other similar sources (World Bank, 1996). Since this figure has remained unchanged for about the last nine years. it is incorrect to attribute this entire benefit to the fishery transformation. Nevertheless, in this paper we attribute this entire benefit to the fishery transformation as we lack data to indicate the proportion that should be attributed to the transformation. This assumption is reasonable given that the fishery transformation started more than nine years ago. Secondly, the Ministry of Health issues an export certificate at Kshs 500 for every container of fish. Since each container weighs 8,000 kilograms, it means that, in 1997, when 12,470 tonnes of Nile perch fillets were exported, the Ministry of Health received Kshs 0.78million through the issuance of export certificates. Thirdly, the Kenya Bureau of Standards (KBS) charges Kshs 200,000 for each annually renewable license. KBS is thus able to collect a total of Kshs 2.8million annually from the fish processing and animal feeds firms that are based on Lake Victoria fisheries. The Kenya Chamber of Commerce and Industry (KCCI) also receives some fee from these firms.

Finally, fishing co-operatives and local authorities receive a sizeable amount of revenue from fish trade. The co-operatives charge a commission of Kshs 0.2 for every kilogram of fish handled while the local authority of Busia district, for example, receives about Kshs 2 as levy for every kilogram of fish. It is estimated that all the local authorities and co-operatives in Kenya receive about US$ 2million (Kshs 120million) annually (World Bank, 1996). However, because of mismanagement and other institutional problems, our survey revealed that this money does not benefit the local fishers through improved services or infrastructure.

In total, we estimate that the government collects at least Kshs 131.6million (US$ 1.9million) annually from the Lake Victoria fisheries, most of which can be attributed to fishery transformation. This revenue is quite substantial (though there are opportunities to collect more!) and supports the argument that forex earnings do not comprise a significant benefit emerging from fishing.

Fisherman Income and Increase in Fish Prices

A look at the nominal fish prices indicates large increases across the species, particularly in the 1980s and 1990s when the Lake Victoria fishery became increasingly commercialized (Fig 2). The ex-vessel price of Nile perch, for instance, increased approximately nine times between 1988 and 1995. These high prices are, however, largely illusorv because of increasing inflation. After the prices are deflated, it is shown that only the ex-vessel price of Nile Perch has increased in real terms since the 1970s and 1980s (Fig 3). Even this increase, however, is marginal. Thus, the price a fisher received for a kilogram of Nile perch in 1995 was only 26% higher than what a counterpart received in 1975 (Ikiara 1999). Figures 2 and 3 indicate that the trends of prices for the three commercial fish species of Lake Victoria were more or less the same until 1991 when the real prices of Nile perch and tilapia followed a closely similar trend but the price of R. argentea followed the opposite trend. Thus while the real prices of Nile perch and Tilapia increased between 1991 and 1993 but dropped between 1993 and 1995, the price or R argentea dropped between 1991

and 1993, and increased between 1993 and 1995. If the data plotted are accurate, these trends suggest that prior to 1991, the markets of these three commercial species were largely independent but after 1991 the Nile perch and tilapia behaved as substitutes. As the price of one species increased, demand would be switched to the other, causing its price also to rise. The prices of the two substitutes would, thus, tend to follow the same trend. R argentea on the other hand continued to operate in an independent market.

Higher prices are one of the important macroeconomic benefits of the Lake Victoria fishery transformation. High prices have translated into higher incomes for the fishers. It is estimated that fishers earned Kshs 5.2 billion in 1995, representing 26.7% of the value of the fish retail trade. Had the fishery transformation not taken place, ex-vessel fish prices would not have reached present levels and the earnings to fishers would have certainly been less in absolute terms. Increasing fish prices have socio-economic and environmental costs however. These are discussed in a later section of this paper.

Largely because the transformation has not affected Tilapia and R. argentea as it has Nile perch, real prices for these two species in the 1990s have remained lower than their 1970 levels, although the declining trend that was evident in the 1970s and early 1980s was somewhat slowed down in the late 1980s and the 1990s. In fact, we predict that as the commercialization of omena intensifies in the coming years, the real earnings for fishers will surpass the 1970 level. As Figure 3 shows, prices have been on an upward trend since 1985 except for the decline experienced between 1991 and 1993 due to unprecedented high rates of inflation in Kenya. The same is true for Nile tilapia. As fish processing firms turn to the processing of tilapia in an effort to increase capacity utilization and as the domestic demand for this species increases, competition is likely to push the price upwards.

Employment and Livelihood

Due to superior infrastructural capacity, the large scale processing and trading companies soon pushed aside the small-scale operators in the Nile perch business, which was generating a substantial number of jobs. It has been estimated that a total of 180,000 new jobs were created in the harvesting, processing and distribution of sub-sectors of the Kenyan lake fisheries during the 1980s. During this time the lake community came to regard the Nile perch as 'the saviour" (Reynolds and Greboval, 1988; Greboval, 1989), and people who had been previously under-employed became fully employed as the fortunes associated with the Nile perch soared. Medard and Wilson (1996) suggest that for the whole lake the total employment in fishery (including that in ancillary activities), rose from 158,000 people before the Nile perch dominance to 422,000 people by 1992 when Nile perch fishing was at the peak. This suggests that the fishery transformation created 264,000 jobs.

The initial Lake Victoria fishery transformation contributed greatly to national food security and nutrition. Annual per capita fish consumption in Kenya increased from 2 kgs in 1963 to 8 kgs in 1992 (Kenya Fisheries Department). Even though the per capita consumption figures ignored the amounts of fish exported and used for animal feeds production, it is widely acknowledged that the initial years of the transformation wrought substantial food security and nutritional benefits. This initial beneficiary period of fishery was soon reversed, however. As large-scale capitalized processors and traders gradually took control of the harvesting, processing, distribution and marketing of Lake Victoria fish, jobs in the traditional sectors disappeared. These losses are described in detail in a later section, where it will be shown that the net employment effect of fishery transformation has been negative in the processing and trading sectors. Moreover, as fish prices increased, fish became increasingly inaccessible to the local fishing community and other poor Kenyans seriously threatened by food insecurity. This is also discussed in detail in later in this section.

In the harvesting sector, the transformation of Kenya's Lake Victoria fishery has had a positive impact on employment so far. As demand for fish at the ex-vessel market has expanded and prices risen, many people have been attracted to the fishery. This has been reinforced by credit relationships between the processing and harvesting sectors, whereas

previously there were capital constraints hindering the growth of harvesting. Of course the increase in the numbers of fishers and boats that has occurred following the growth of the Nile perch export business and the fishmeal-based animal feeds industry cannot be entirely attributed to these developments. Current levels of population growth and unemployment rates would have definitely caused some entry. Nevertheless, our opinion is that the fishery transformation has had a notable impact on employment in the harvesting sector.

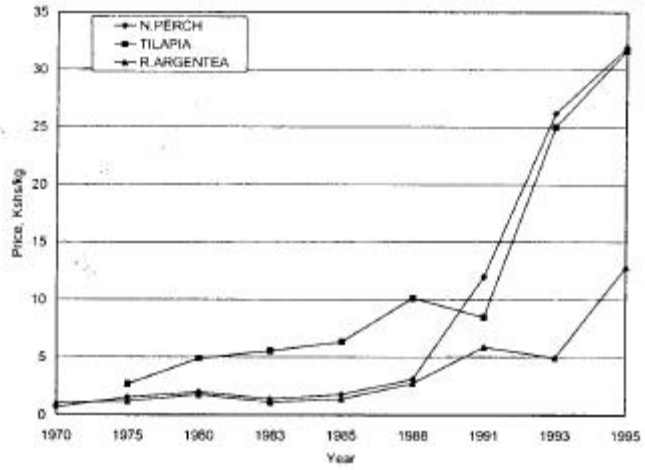
Between 1979 and 1985, the number of fishers in Lake Victoria grew by 19.4% compared with 9.1% over the 1989- 1992 period. 25% over the 1992-95 period and 33.3% over the 1995-1998 period. From this, we conclude that the rate of growth in the number of fishermen in the pre-Nile perch days was about 86% of the rate of growth in the era of fishery transformation. We believe that this acceleration in the entry of fishermen is largely driven by the rise in ex-vessel fish prices. This employment is a considerable benefit given that not only the fishermen but also their many dependants obtain a source of livelihood.

It is now estimated that there are about 40,000 registered fishers exploiting the Kenyan Lake Victoria fisheries (Fisheries Department). Given the high incidence of unregistered fishermen found during our random survey, we estimate that 80,000 Kenyans are employed as fishers in the lake. Our estimate is based on the fact that up to 20% of the boats were thought to be unregistered in 1991 (Hoekstra et al., 1991), yet these are easier to monitor and register than fishers. It is possible, therefore, that up to 50% of the fishers who operate in the lake are not officially known.

Total employment in the fishery can be estimated. Assuming that for every job created in the harvesting sector three others are created in support (boat building and repair, fishing gear manufacture and repair) and ancillary activities (processing, transport and marketing), we estimate that a total of 240,0000 people are employed in the Kenyan fisheries of Lake Victoria. Of course even if commercialization had not taken place, employment would have grown but at a lower rate; Lake Victoria fishery would have remained largely artisanal. Going by the FAO estimates that every job created in the harvesting sector of artisanal fisheries in developing countries creates one other job in support and ancillary activities, employment in Lake Victoria fishery (had the transformation not taken place) would have been 80,000. The transformation, thus, could be credited with creating an additional 160,000 jobs so far. This is an enormous benefit for a country which has unemployment in excess of 25%.

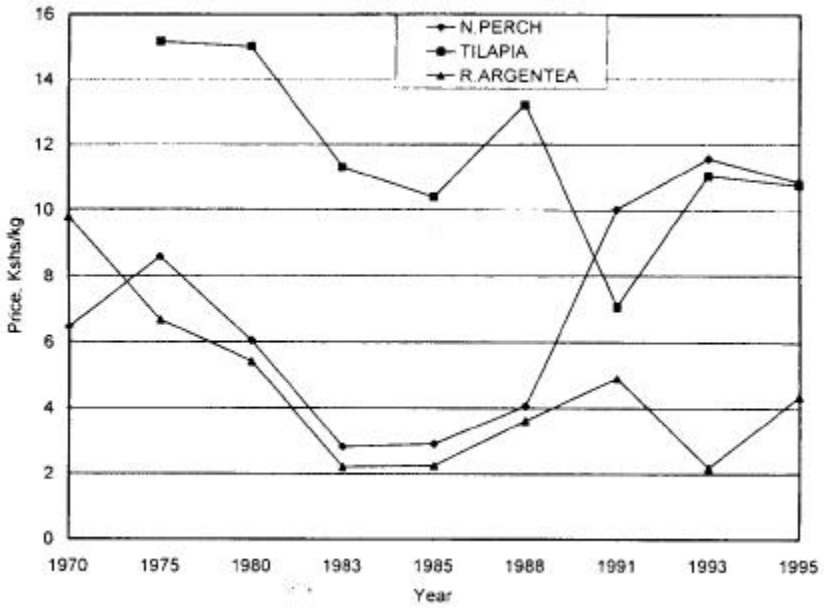
The value of these jobs in monetary terms can be estimated. In his study, Ikiara (1999) found the average monthly income for boat owners to be Kshs 6,000. Fishing crew-members earn Kshs 1,000-2,000 per month. We believe that people employed in the fish-processing sector earn slightly more than fishing crews. Since the

Fig 2: Trend in Lake Victoria Fish Prices, Nominal Terms



Source: Ikiara, 1999.

Fig 3: Trend in Lake Victoria Fish Prices, Constant 1990



Source: Ikiara, 1999

vessel owners are few in number, we assume an average monetary income of Kshs 3,000 per month for all categories of employment. This translates into a current annual amount of Kshs 5.8 billion.

Commercial Spin-off Activities

Processing and trade based on Nile perch skeletal by-products are the most important spin-off activities that have emerged from the modern processing industry. This by-product, which was a disposal nuisance for the processing factories in the early 1980s, has found a large market not only as food for human consumption but also as an input into the manufacture of animal feeds. There is, in fact, serious competition between the users of fish skeletons. An estimated 2000 workers, mostly women, were engaged in processing skeletons and sales in the early 1990s (Abila and Jansen, 1997). This commercial activity has served as a significant source of livelihood to these people and their dependants. This is a direct employment and income benefit of the fishery transformation. Assuming that the monetary value of each of these jobs is Kshs 3,000 per month, the annual income of this spin-off activity is Kshs 72million. This is, however, only part of the value estimated for employment in the entire fishery.

Commercialization of Lake Victoria fisheries has produced another important spin-off. The expansion of beaches along the lake-shore by more and more fish dealers setting up camp has attracted a significant amount of commercial and service activities. Most of the larger beaches are now dotted with cafes, bars and small hotels, among other business premises. Ikiara (1999) found that such business has been so good that more fishers are welcome now to join the beaches despite the negative externality bound to affect individual catch rates. To most, the benefits of this spin-off outweigh the negative externality. More research into this spin-off is needed in order to quantify the associated benefits.

The development of an animal feeds industry based on local fishmeal has yielded an additional benefit. Since fishmeal is rich in proteins, the quality of animal feeds which have some fishmeal is definitely high. This must have a positive effect on livestock production and, thus, the economy. Once again, we feel that research based on primary data is required to quantify the value of this spin-off.

Table 5: Annual benefits from Lake Victoria in Kenya

Benefit	Beneficiary	Annual amount, Kshs
Foreign exchange earnings	Kenyan economy	1 billion
Income to owners of fish processing and animal feeds factories	Investors, both Kenyan and foreign	1.12 billion + higher profits for owners and animal feeds factories
Tax Revenue: ♦ Export levy ♦ Registration of fishing operations ♦ Issuance of export certificate ♦ Kenya Bureau of Standards (KBS) charges ♦ Fisherman Co-operatives and local authorities	Government of Kenya Local Authorities Fishing Cooperatives	♦ 6.2 million 1.8 million ♦ 0.78 million ♦ 2.8 million ♦ 120 million
Income in fish sales and fishers income	Fishers	5.2 billion
Employment and livelihood	160,000 Kenyans employed since 1980	5.8 billion currently*
Spin-off commercial activities	2,000 Kenyans employed in commercial and service enterprises in the beaches in the last 10 or so years	7.2 million plus the unestimated but large value of enterprises
Total**		**At least 7.1 billion**

* This, of course includes income to fishers reported as Kshs 5.2 billion, and the value of spin-off commercial activities

****** Care is needed in totaling to avoid double counting

Summing up the Benefits

It is evident that the fishery transformation associated with the development of a lucrative fish export business and an animal feeds industry based on local fishmeal has wrought substantial benefits. These benefits are summarized in Table 5. One of the benefits that has received disproportionately large attention is foreign exchange earnings from the export of fish. It is easy to understand why. With a trade account surplus of up to Kshs 1.5 billion, fish trade is literally indispensable for Kenya which has a perpetual deficit in its current account. We feel, however, that the other benefits should receive as much, if not more, attention and therefore policy support. In particular, fishers' earnings is a benefit that ought to receive the largest attention with a view of finding how the export trade and other developments impact on it. So should employment generation, food security and resource sustainability as these are key macroeconomic concerns for Kenya. As Table 5 shows, employment and livelihood is a much larger benefit than foreign exchange earnings.

The annual value of fish trade in Kenya stands at about Kshs 20 billion, compared to Kshs 1.5-2.0 billion export value. This indicates that, as much as foreign exchange is seriously needed in the country, fish exports should not receive exclusive attention. All aspects of the fishing industry need to be considered because, over-emphasis on fish exports is diminishing the capacity of the fishing industry to fulfill its other objectives: sustainable resource management, food security and employment.

Costs of the Transformation

The transformation of Lake Victoria fishery that has been caused by the development of the fish export business and a local fishmeal-based animal feeds industry has had negative impacts too. These include an ecological upheaval, loss of control by the local community over most aspects of the fishing enterprise and displacement of people who were formerly employed in traditional fish processing and marketing sectors. In addition, there has been a skewed distribution of income and increasing food insecurity in the lake region and the entire country as fish has gradually become unaffordable and unavailable. These costs are briefly discussed in the remainder of this section.

Loss of Control of the Resource by Local Fishermen

The loss of control over the means of production as well as processing, pricing and marketing by local fishers to industrial investors has generated substantial costs. There is diminished access due to investments in such modern technologies as trawling and tembea. In the harvesting sector, newcomers have introduced trawlers and tembea boats, invested in many boats and a lot of fishing equipment and hired fishermen to do the fishing for them. The fishers in turn are controlled through credit relationships. The phenomenon of absentee fishers is now widespread. The local fishers have, thus, lost control of the means of production. Wilson et al. (undated), writing about the Tanzanian side of the lake, note that harvesting capacity is now concentrated in the hands of a smaller number of fishers and into a less diverse set of gears and techniques. In pricing, local fishers have no say because of lack of storage facilities, the perishability of fish and the pressure of credit relationships. In addition, each local fisher accounts for an insignificant portion of total fish supply and is therefore a price taker. In the processing and marketing sectors, large actors with a lot of capital have edged out traditional sellers and processors. Wilson et al. (undated) estimated that in the accessible, central landing beaches of Tanzania, 77% of all the Nile perch landed was sold to the processing factories, leaving little for other fishery participants. This has increased stratification within the industry and changed production relations. Gibbon (1997) estimated that in 1996, 50% of all Nile perch landed in Tanzania went to filleting factories. In Kenya for the same year, Abila and Jansen (1997) estimated that about 48% of all the Nile perch was taken by the filleting factories.

Some traders and agents now literally control the fish landings of entire beaches. Entry into and operations within the fishery have taken on a "free-for-all" atmosphere. Geheb (1995) noted that the transformation of the once controlled access to fishing with proper management by the indigenous community into a "free-for-all" situation is mostly attributable to the commercial fishing of Nile perch. This is, thus, another cost of fishery transformation. It is a cost because the local fishers have lost control and access to the fishery and thus, no longer have even the slightest incentive to adopt responsible fishing behavior, a factor that has accentuated the open access attitude (Owino, 1999). This may prove to be an enormous cost to the integrity of the fishery resource in the foreseeable future, particularly in the context of overfishing and biodiversity.

Loss of Employment and Livelihood

The employment situation changed substantially when large-scale processing and fishmeal industries and trading agents gradually edged out the women who traditionally dominated the processing and marketing sectors. On the basis of their survey of the 12 fish processing firms in operation at the time, Abila and Jansen (1997) estimated that these firms created about 2,400 jobs but displaced about 15,000 other workers in the traditional processing and marketing sectors. The net effect of these large firms as far as employment is concerned has been a loss of jobs. In fact, three quarters of the jobs created by the fish processing factories are casual, temporary, low-paying and have no long-term benefits (Abila and Jansen, 1997). Furthermore, these jobs are given to urbanites who live near the factories and not the local fishing community. The large proportion of omena going for animal feeds production represents loss of employment opportunities for the women who would have been involved in its processing and marketing.

Our estimate of the current level of employment in all sectors of fishery, suggests that 20,000

jobs have been lost since the 1980s when 180,000 jobs were estimated to have been created. The annual monetary value of this loss, using the assumptions made in the previous analysis, amounts to Kshs 0.72 billion.

The 2,000 jobs created in the processing and trade of Nile perch skeletons are also under threat as many of the skeletons are beginning to find their way into fishmeal production. Abila and Jansen (1997) estimate that 50-60% of these jobs have been lost and the remaining workers are underemployed. To take consideration of underemployment, we use the upper percentage to estimate that the cost of loss of jobs in the processing and trading of Nile perch skeletons is currently Kshs 43million.

Employment opportunities have, in addition, been lost as fish processing factories have invested in trawlers, other harvesting gear and motorized boats for fish transport from remote beaches to more accessible collection points. Trawlers and motorized transport consume less labour per kilogram of fish handled (Abila and Jansen, 1997), leading to loss of employment. There are currently about 15 trawlers operating on the Kenyan side of Lake Victoria, despite the existing ban on trawling. With motorized boats, a few traders or agents are able to control most of the fish produced, thus reducing the employment opportunities for other people. Some traders or agents have established relationships with the fish processing and animal feeds firms and have become very large. Mitullah (1999) reports that a single trader/agent in 1997 had eight motorized boats, had constructed a modern shed for handling fish more hygienically, had 50 employees and 40 part-time assistants. Tembea technology is catching on very rapidly, but it unfortunately involves a substantial loss of employment opportunity in the harvesting sector. Each tembea boat uses one more person than the ordinary gillnetting boats but catches 5-10 times more fish (Jansen et al., 1999). This coupled with the fact that one beach alone can have up to 40 tembea boats are seriously worrisome developments.

About 84% of the people engaged in fish trading and processing in the Kenyan side of Lake Victoria are women (LVFRP/Tech/99/02, 1999). Consequently the transformation of the lake fisheries engendered by the development of Nile perch export and fishmeal-based animal feeds industries, which has led to loss of jobs in the traditional trading and processing sectors, has created costs associated with gender disparities in income. Several factors have enabled Nile perch filleting factories and agents of animal feed manufacturers to push women and other artisanal traders and processors away from competition. These firms offer relatively higher prices for fish and often establish credit relationships with fishers; artisanal operators cannot match such terms. Another factor is the relatively high capital cost of processing the Nile perch. One of Kenya's important development objectives is to uplift the condition of women, the attainment of which has not been helped by the transformation of Lake Victoria fishery. In these fisheries, commercialization has pushed women out of employment. Scudder and Conelly (1985) note that in African fisheries, commercialization of fishing has worsened the status of women from part-time participation to exclusion. Our random survey of beaches along the Lake Victoria suggested that many women fishmongers and processors have been marginalised out of business.

The cost of these job losses is substantial. Not only are livelihoods taken away but social costs such as increase in crime rates and social tensions between the displaced people and factory owners are also worrisome. Furthermore, the displaced people have resorted to processing and trading in juvenile fish, a serious threat to the sustainable use of fisheries in the years to come. A detailed research based on primary data is required to estimate the cost of employment losses in the harvesting sector, the cost of increasing gender disparity in income and the costs associated with increasing crime rates, social tensions and the switch to dealing in juvenile fish.

Income Distribution

Following the development of the Nile perch export business and fishmeal based animal feeds manufacturing industry, fish prices have taken an upward trend. As discussed earlier, the price of Nile perch in particular has improved in real terms, a development that has benefited the local fishers. In spite of this, however, fishers are most probably worse off following these developments than they were before because of the fall in catch rates. It is doubtful whether the

increase in price has been large enough to compensate for the fall in catch rates. The situation with the other two commercial fish species has been worse as the fall in catch rates and real prices continues to be below 1970 levels.

The upshot of this is that income distribution is increasingly skewed in favor of the owners of fish processing and animal feeds factories and against the fishers, factory employees and fish consumers. The latter are forced to purchase fish at higher prices. The cost of skewed income distribution is that fishers feel exploited and ignored by the government. Besides the obvious political cost of such feelings, there is also an environmental cost since fishermen no longer have the incentive to uphold responsible fishing behavior which assists sustainability of the fishery and biodiversity of the lake.

Commercialization of Lake Victoria fisheries has also exacerbated the inequality between vessel and gear owners and their crew members. Wilson et al (undated) identify various ways in which crew members have been adversely affected by the internationalization of the Lake Victoria fisheries. For example, fishing boats operating from central beaches allocate a higher percentage of the catch to boat owners and less to the crew. Secondly, share systems assign "maintenance and depreciation" payments prior to sharing of the catch. Since fishing units selling in international markets have investments that are five times higher than ordinary units, internationalization of the fisheries has steepened crew members' career path so there has been social disruption and moral decay in communities along the beaches. In sum, the effect on fishing has been economic and cultural alienation from both their employers and communities. Most feel a sense of loss of ownership or long-term commitment towards the fishing (Wilson et al., undated).

Food Insecurity and Nutrition

After ecological upheaval, rising food insecurity is perhaps the largest cost of the establishment of fish export and fishmeal manufacturing enterprises on the fisheries of Lake Victoria. Fish has been an important source of animal protein for many Kenyans largely because of its relatively low price. From the national average of 2.2 kgs per capita in 1963, fish consumption in Kenya increased to 8 kg in 1992. A large part of this increase in fish consumption is attributed to improved catches of Nile perch. Consumption grew even in hitherto non-fish-eating areas of the country. For the fishing community around Lake Victoria, the availability of cheap animal protein was a godsend for this area of low agricultural potential and where people lacked purchasing power to acquire alternative sources of animal protein.

The initial years of Nile perch fishery, thus, improved food security as more fish was available at affordable prices. Greboval and Mannini (1992) argue that local diets around Lake Victoria improved between 1975 and 1989 as a result of an increase in the production of table fish from 44,000 to 405,000 tonnes and a 'lake-wide fall in the dollar prices of fish over the same period. This drop (Fig 3) benefited fish consumers in East Africa but adversely affected fisher incomes. However, as the domestic and external markets for Nile perch expanded in leaps and bounds, and as demand for tilapia and omena grew in the hotel and animal feeds industries, respectively, less and less fish remained for the local community, and whatever was available became unaffordable. This was exacerbated by declining production, particularly in the 1990s.

Two decades of these developments have now led to a serious food insecurity problem. Fish consumption in Kenya is now on a downward trend as most of the harvested fish either goes to the export markets or is used in the manufacture of animal feeds. The per capita fish consumption of 8 kgs reported by the Fisheries Department for 1992 neglects the fact that a substantial amount of the fish produced in the country is either exported or used for the production of animal feeds and is, therefore, unavailable for domestic consumption.

Abila and Jansen (1997) take these factors into consideration and offer a more realistic estimate of per capita fish consumption in the country. Their figures indicate that fish consumption in Kenya dropped from 4.5-5.0 kgs per person per year in 1990 to 3.1 -3.7 kgs in 1996, an indication of increasing food insecurity. This should be a source of concern given that fish is not only a source of animal protein but is also

cheaper than alternatives. It adds flavour to the staple diet; is rich h1 essential fatty acids, vitamins and minerals; is easier to process than other sources of animal protein and it offers food security at the household level by providing a safety net during harvest failures (Ikiara, 1999).

The growth of the Nile perch export business and the increased use of fishmeal in animal feeds production are largely responsible for worsening food security, especially in the fishing communities. In Tanzania, Wilson (1993) showed that even though there has been an increase in fish consumption by households with at least one fisher member, there has been a definite drop in fish consumption by many households within the lake region in general since 1989. The highest levels of malnutrition in Kenya are now found within fishing communities because fisher-folk consume very little of what they harvest and yet they have no access to supplementary sources of protein (Ikiara, 1999). Thus, Kwale and South Nyanza had some of the highest levels of stunting among children, at 43.4% and 30.9%, respectively, in 1987, which had increased from 1982 levels. Kisumu, the seat of the fishing industry, has the highest prevalence of urban food poverty as well as absolute poverty, at 44% and 47.75%, respectively (Republic of Kenya, 1997a). The same source reports survey results showing that people living around the lake, especially children, suffer from protein deficiency. Yet daily access to 10 grams of omena would adequately address the iron, zinc, and vitamin A deficiency among children (Mwaniki, 1998). Since the poor households are unable to access alternative sources of animal protein, the cost they suffer as a result of reduced access to fish cannot be estimated from replacement cost but from the cost related to declining productivity, malnutrition and other ailments.

The Lake Victoria fishery transformation has compromised food security in several ways. First, close to 50% of all the Nile perch produced is exported, leaving only half for domestic consumption. Moreover, most of what remains is consumed by rich urbanites, leaving only immature perch and poor quality rejects for consumption by the fishing community. The fish processing factories now process fish smaller than 1 kg in individual weight, leaving only juveniles and spoilt fish for the local market. In Tanzania, it has been estimated that about 30% of the Nile perch harvested is retained for local (that is lakeside) consumption (Wilson and Medard, 1999).

Secondly, Nile perch and tilapia became luxuries to the local fishing community a long time ago when demand for these fish species in the domestic and external markets pushed up prices to and made them unaffordable to Kenya's poor people. Even the fishers who harvested these fish could not afford to consume them as the opportunity cost was very high. Figure 2 shows the tremendous increase in ex-vessel fish prices, particularly since the mid-1980s. This increase in fish prices was not accompanied by rising purchasing power for the poor. When they could no longer afford Nile perch and tilapia, fishermen and other poor people consumed omena which is also rich in protein but much cheaper. However, the price of omena also increased substantially in the 1990s following greater demand for it in the animal feeds industry. Poor Kenyans, including the fisher-folk, are thus increasingly being displaced from the consumption of this species. Thirdly, the Nile perch skeleton left after filleting was in the 1980s a significant source of food and protein to the poor people in the lake region, but it is becoming increasingly inaccessible because it is used in the manufacture of animal feeds. Abila and Jansen (1997) estimated that in 1996 and 1997, 60% of all the skeletons were used for fishmeal production. Thus. not only are the skeletons unavailable for human consumption, but they are also becoming unaffordable. Another related threat to food security is that processing factories have improved their filleting efficiency so that up to 50% of the flesh is removed, leaving the skeleton rather "naked" (Abila and Jansen, 1997). Finally, the current use of about 70% of all omena harvested for the production of animal feeds has taken away what has been the main fish diet for the fishing community and other Kenyans. There are six animal feeds firms in Kenya using this fish. The fish remaining for human consumption is unaffordable. While the price of a kg of dried omena sold at only Kshs 20 in 199O, this tripled to Kshs 60 only five years later. There are indications, also, that an

export business based on this species might develop, with even more serious consequences.

One could argue that since fishmeal is used in livestock production (another source of animal protein), the use of omena and Nile perch skeletons for the manufacture of fishmeal does not constitute a real threat to food security. However, as Ikiara (1999) correctly observes, such use of fish other than for direct human consumption constitutes a "redistribution of nutrients or welfare from the have-nots' to the 'haves' since the livestock sources of protein are largely inaccessible to the poor."

Declining food security is a major macroeconomic cost of the increasing export of fish and use of fish and fish products for fishmeal manufacture, and this cannot be overemphasized. Abila and Jansen (1997) estimated that had Kenya not exported any fish and not used any for fishmeal production in 1996, the country's per capita annual fish consumption would have doubled to 6 kgs. This would have substantially improved health, productivity and economic growth. Medical outlays made to treat malnutrition would have, additionally, been saved and used elsewhere. A more detailed welfare survey in the direction suggested here would lead to useful estimates of the food security and nutrition cost associated with the fishery transformation. No data exist currently to aid in such estimation.

Ecological Upheaval

The ecosystem perturbation that has occurred in Lake Victoria over this century cannot be entirely attributed to pressure emanating from the fish export and fishmeal manufacturing industries as this process was initiated long before these industries were established. Certainly, however, these industries have accelerated the rate at which the lake ecosystem has been altered, particularly in the last three decades, through the effects of alien fish species, over-fishing and use of destructive fishing technology. The fish-processing sector has responded in various ways to their excess processing capacity, all detrimental to the quality of the environment. The most destructive of these has been the tendency to accept smaller and smaller fish sizes for processing as supplies dwindle and competition between the factories intensities. Thus, while factories previously could never accept fish that were smaller in individual size than 2-: kgs, they now routinely accept fish that are smaller than 1 kg or 44 cm in total length (Abila and Jansen, 1997: Wilson and Medard, 1999). Fish of this size are immature. In 1990, it was estimated that a sexually mature male Nile perch was 60 cm long or 2.6 kgs in weight while the corresponding figures for the female were 90 cm and 9 kgs (Ligtvoet and Mkumbo, 1990). Harvesting of immature fish poses a grave threat to the sustainability of this important fishery resource as fish are removed before they have had a chance to reproduce. It is estimated that catches of juveniles constitute 10 - 35% of the total Nile perch landings in some beaches (Abila and Jansen, 1997). The main factor responsible is the use of nets of small mesh size. A net with mesh size of 5 inches and below catches perch that are not sexually mature. From a survey of the Kenyan side of Lake Victoria in 1995, Ikiara (1999) found 29% of the boats engaged in Nile perch gillnet fishery using nets of below 5-inch mesh size; and 71% of those engaged in beach seine fishing were using nets of 3-inch mesh and below. The gravity of this situation cannot be overemphasized.

BOX 2.

WISHING-AWAY THE FOOD SECURITY CONCERN?

A Review of Findings of a European Union supported Marketing Study titled "Lake Victoria Fisheries Research Project Phase II" (LVFRP/Tech/99/02, 1999)

Not everyone shares the view taken regarding food security and the adverse consequences of recent developments in Lake Victoria fisheries. In a recent marketing survey carried out in the three countries sharing the lake, the Lake Victoria Fisheries Research Project (LVFRP/Tech/99/02, 1999), indicates that people living within a 35 km radius of the lake consume an average of 45 kgs of fish per person per year. In Kenya, this consumption is estimated at 42 kgs. This is unbelievable given the national per capita consumption figures mentioned in the previous paragraphs and notwithstanding the fact that average consumption levels for communities living around the Lake are likely to be higher than national averages. In fact, the authors conclude that the widespread belief that Nile perch is practically unavailable to local consumers since most of it goes to the processing factories and the export markets is not true. The report, in addition, finds no evidence to support the view that Nile perch available to local consumers is predominantly rejected and undersize. There is also no support for the view that the animal feeds industry has reduced omena availability to locals.

We fault the findings of LVFRP Tech/99/02 (1999) on the basis of a number of arguments.

- First, given that total landings from the lake have been declining in the 1990s (which the report acknowledges) while population and the amount of fish exported and/or used for the manufacture of animal feeds have been increasing, the amount of fish available to local consumers must have declined also. Moreover, in the LVFRP/Tech/99/02 (1999) survey, 45% of the local consumers cited low income as a constraint to the consumption of as much fish as would be desired. A further 25% of these consumers blamed poor catches and 19% blamed high prices. These percentages should indicate that food security is affected.

- Second, how could anyone return a verdict of no adverse effects without comparing consumption levels? National statistics show that malnutrition has been increasing among most communities around the lake i.e. Western and Nyanza region. In particular, children are suffering from protein deficiencies as described above. This suggests that per capita fish consumption has dropped over time.

- Thirdly, and perhaps more importantly, the methodology used in the survey, is scientifically untenable especially with regard to sampling procedures applied. The survey sample focussed on consumers in the beach-side markets, large inland markets and small inland markets. Households were not visited. This suggests a high probability for bias. Our thinking and suspicion is reinforced by the large differences in per capita fish consumption obtained by LVFRP/Tech/99/02 (1999) depending on the market in which the survey was done Thus, at the beach-side market annual per capita fish consumption was estimated at 66 kgs compared with 36 kgs at the inland markets. A more appropriate and empirically-sound methodology would have been one based on a random sampling of households located within a 35-km radius of the lake, supplemented with an observation of fishers to find out the proportion of their fish catch they retain for home consumption. In a survey applying the latter methodology, carried out by the authors on the Kenyan side of the lake, fishers were found to take home (for consumption) 1.5 kgs out of the average 18 kgs harvested per day. Assuming a 25-day fishing month and an average five-member fisher household, we estimate that in 1995, fisher households consumed 90 kgs per person per annum! This suggests that the figures obtained by LVFRP/Tech/99/02 (1999) may be close to the reality but also that in only four years, fish consumption in the fishing areas may have decreased substantially.

The criticism made above about the survey methodology adopted for consumers does not apply to the entire LVFRP study. Randomly selecting fish traders and processors in the three types of markets, in particular, facilitated the consideration of various community members. The only weakness is that islands were excluded from the survey.

Another way in which Nile perch processing firms have responded to declining fish numbers is adoption of strategies such as sourcing from their other factories in Uganda and Tanzania for enhanced procurement of raw fish. Some offer fishers credit in exchange for exclusive fish supplies. Others invest in modern harvesting technology including trawlers, tembea, large nets and motorized boats. Some processing factories have resorted to processing of tilapia as well as Nile perch to raise capacity utilization. The net effect of these coping strategies has been an unprecedented increase in fishing intensity which has adverse effects on the sustainable use and the very integrity of the resource system. The sourcing of fish supplies from the Ugandan and Tanzanian sides of the lake is also gradually shifting excess processing capacity, fueling fishing pressure there too.

By creating a strong demand for the second most important fish species, omena, the animal feeds industry has led to an unprecedented increase in the ex-vessel price of this species. This, in turn, has initiated an alarming increase in fishing pressure. The danger of this pressure on the ecosystem is expressed through two avenues. First, high fishing pressure will lead to harvest levels that exceed the optimum ones, seriously compromising sustainable exploitation objectives. Secondly, omena is now known to be an important component of the Nile perch's food web. The decimation of this species might, therefore, translate into a Nile perch decimation, effectively sounding the death knell for the lake fishery. Pollution from industrial, municipal and agricultural wastes, invasion of the lake ecosystem by the water hyacinth, destruction of the ecosystem through wetlands conversion and damming of rivers, and effects of fish pathogens are other factors that have contributed to the perturbation (Ikiara, 1999).

There are several manifestations of fishery decline that have occurred in Lake Victoria. The first of these is a serious erosion of diversity that has seen the number of fish species decline from an estimated 350-400 species in the early years of this century to about 177-200 currently. Witte et al. (1992), note that two-thirds of the Haplochromine cichlid species of Lake Victoria have either been lost or are threatened with extinction. The 1988 World Conservation Union Red Book lists hundreds of endemic fishes of Lake Victoria as endangered. In the pre-Nile perch period, Haplochromines constituted about 80% of the lake's total bio-mass while the group now accounts for less than 3% of the annual catch. It is now the Nile perch that forms 80% of the bio-mass. Although a general decline in the fish stocks was first noticed in the 1950s, the introduction of alien fish species between 1950 and 1962 triggered an enormous erosion of biological diversity, including non-fish species. This erosion has occurred mainly through predation and disruption of food webs. While primary and secondary consumers dominated the fish fauna before the dominance of the Nile perch, the situation has changed so that secondary and tertiary consumers now dominate. As the Nile perch population increased, that of haplochromines decreased, leading to the increase of phytoplankton, macrophytes, shrimps and benthic organisms. Nile perch is now known to be a predator of most endemic fish species, including, R. argentea and its own juveniles (Ikiara, 1999). Goldschmidt (1992) blames Nile perch for destroying about 65% of the endemic Haplochromines cichlids. As the favourite prey species are declining, the Nile perch is increasingly turning to R argentea, the only endemic fish species that has survived the perch onslaught to date. The pressure exerted on R. argentea fishery from the animal feeds industry and human consumption is. therefore, very alarming given that this fish species also constitutes a portion of the Nile perch's food chain.

It is impossible to start estimating the cost of this biological decline as human welfare is intimately related to species conservation and ecosystem integrity. Suffice it to say that the cost is monumental as the loss of biological diversity reduces ecosystem resilience, making it more vulnerable to more adverse perturbations and thus compromising the economic foundation. Moreover, some of the benefits of biological diversity are not yet known. The African Great Lakes, including Lake Victoria, are considered to be vulnerable to over-fishing, the introduction of alien species and pollution (Okeyo-Owuor, 1999).

The second manifestation of the fishery decline is falling productivity. Total fish landings from the Kenyan portion of Lake Victoria entered into a declining phase in the 1990s in spite of increasing fishing effort. This downward trend has continued as CPUE also continues to fall. For instance, daily boat catch rates have fallen from about 400-500 kgs in 1981 to 100-150 kgs in 1996 (O'Riordan, 1996). In addition, from an average catch of 25 tilapia per net from Nyanza gulf at the turn of the century, there was a dramatic decline to only seven fish per net by 1920 and to two per net by 1940 (Geheb, 1995).

The cost of declining productivity is large. Not only are foreign exchange receipts reduced but the welfare of fishers is threatened. There is an adverse effect associated with a general switch to nets of small mesh size and other destructive technology in response to falling catch rates. These technologies are a serious threat to the sustainability of the resource.

These adverse effects on the environment in general, and resource sustainability in particular, have been largely caused by excessive exploitation emanating from high demand for fish in the domestic and external markets (Ikiara, 1999). This demand has attracted excessive capacity into the harvesting and processing sectors. Fish processing firms have now invested in efficient but destructive harvesting technology, such as trawling and tembea, and assisted fishers to expand their harvesting capacity by switching to efficient but environmentally costly technologies such as beach seines and mosquito seine nets which catch smaller immature fish. The latter, coupled with the increasing tendency of people displaced from the R. argentea and Nile perch sectors to turn to juvenile fish for survival (Abila and Jansen, 1997; Wilson et al., undated), have effectively commercialized immature fish, again with devastating effects to the integrity of the fishery resource. This has led to high prices for immature fish, particularly "table" fish, initiating another strong force to accelerate the switch to inappropriate technology.

Table 6: Summary of the costs (annual) associated with the transformation of Lake Victoria (Kenyan Portion)

Cost	Who suffers	Annual amounts, Kshs
Loss of control of locals means of production, pricing, marketing and processing	- The local people - The lake ecosystem	Substantial
Loss of employment and livelihood	- Local people	763 million, plus
More inequitable income distribution	- Local people - Environment	Substantial
Food insecurity and nutrition	- The local people and poor Kenyans in general - The Kenyan economy due to reduced productivity and greater medical outlays	Substantial - enormous
Ecological upheaval	- The lake ecosystem and thus all people dependent on the lake and those with use and/or non-use value for it	Monumental, much more than the benefits combined

Desperate to increase processing capacity, some fish processing firms in Kenya have opened branches in Uganda and Tanzania to collect perch and carry out preliminary processing. In addition, many traders now have motorized boats which travel to the Ugandan and Tanzanian sides to collect fish for the Kenyan factories. The excess processing capacity existing on the Kenyan side is therefore gradually encompassing the entire lake.

Declining real prices, particularly for tilapia and R. argentea, have also increased exploitation pressure as fishermen struggle to increase their fishing effort in a bid to sustain or improve their real income levels (Ikiara, 1999). The high poverty levels that exist among the fishing community also contribute to high fishing pressure. Even with rising real prices, poor fishers strive to increase their fishing intake as much as possible.

In our estimation, the cost of ecological upheaval or threatened resource sustainability is the largest of all the costs associated with the fishery transformation. There are various reasons for this conclusion. Lake Victoria fishery is currently worth at least Kshs 20 billion to Kenya every year. We say "at least" because the fishery has non-market value besides the market value. In the case of most resources, the non-market value could be much higher than the market value. At the current rate of exploitation, the fishery cannot be sustained into the future. Within 20 years, under the current regime, the fishery could easily collapse. The country would have gained only about Kshs 300 billion (not discounted) within that period. However, suppose that the fishery is further transformed by way of rationalizing export levels and the use of fish for animal feeds production and by way of better management. Under such a regime, the annual market value could be reduced, say halved. The non-market value would, however, increase. Abstracting from the non-market value for clarity, the new market value, at the point where the fishery is being exploited optimally, would be received in perpetuity. It is obvious that the optimal management regime would yield much larger benefits to the country. To demonstrate this, consider a lifetime of 70 years only. Within that lifetime, total benefits from the fishery would amount to Kshs 525 billion. The cost of investment, in terms of rationalized harvest and processing rates, would be recouped in less than a lifetime. It is on the basis of such reasoning that we take the position that no amount of forex earnings, or indeed any other production targets, should justify pushing the fishery to collapse.

This paper has not been able to put actual quantities on most of the costs associated with the transformation of the Lake Victoria fisheries (Kenyan side) due to data unavailability. Research based on primary data is urgently required to facilitate the quantification of these costs. Even without quantification, however, we feel that the cost of fishery transformation has been monumental, especially the cost arising from ecological perturbation. This and other costs, as identified in this sub-section of the paper, are summarized in Table 6.

Do the benefits justify the costs?

The discussion in this section of the paper has shown that the costs associated with increasing exports of fish from Lake Victoria and the use of fish in the manufacture of animal feeds are monumental. They certainly surpass the benefits, in our opinion. In fact, the overall benefits are not large enough to cover the cost of ecological or environmental damage alone. This cost is enormous because uncontrolled fish exports and use of fish in the animal feeds industry could lead to the collapse of the resource system.

These costs, nevertheless, do not mean that no fish should be exported or that no fish should be used in the production of fishmeal. What it means is that the use of fish for these purposes vis-a-vis human consumption should be considered carefully with a view to rationalising the quantities of fish exported and those used in the production of animal feeds. Research should be undertaken to establish the optimal exploitation regime for these important fisheries. Such research would inform on the rational export quantities and the quantities of fish that can be safely used in the manufacture of animal feeds. Improved management of the fisheries, requiring perforce the input of all stakeholders and the government, is critical in raising the productivity of the fishery, thereby making more fish available to meet various needs.

What does the current fisheries management say about the issues raised in this paper? Specifically, what is the official policy regarding the export of fish, the use of fish in the animal feeds industry and human consumption of fish? What management strategies are currently being used to address these issues? Are there enough efforts or does something more need to be done? What alternatives exist to ensure that the fishery resource is sustainably exploited? These are some of the questions we attempt to answer in the concluding section of this paper.

FAO releases Sh20.6m to boost fish quality in EAC

By John Oyuke

FOOD and Agriculture Organisation (FAO) has given over Sh20.6 million to help East African countries address fish quality standards for export to the European market.

The Common Market for Eastern and Southern Africa (Comesa) Secretary-General, Erastus J. Mwencha, said the organisation had also received US$2.5 million from the European Union (EU) to enhance its Standards Quality Metrology and Testing (SQMT) project.

He said funds from FAO would be used by the organisation to upgrade quality and safety of fishery products in Kenya, Uganda and Tanzania in order to bring to an end persistent wrangles with the EU over quality of fish exports.

Mwencha made the remarks at the opening ceremony of the seventh meeting of the Intergovernmental committee at the Kenyatta International Conference Centre.

He, at the same, time appealed to Comesa members to meet the challenges of complying in full with the rules and provisions of the treaty which gave rise to the organisation.

"Over the last six months we have witnessed the taking of unilateral decisions to protect industries that face competition, or for revenue purposes, by raising duties, or not reducing them at all," Mwencha said.

He said that the standstill provisions in the treaty had provisions for the protection of infant industries, and included safeguard measures in the event of serious disturbances in the economy of a member state.

"Let us not, when we are so far down the road, with our destination in sight, be faint-hearted. Let us finish the task we have set ourselves and show the rest of the world that Africa is capable of helping in the globalisation of trade by fully following rules," he said. The organisation has set October 2000 as the date to achieve its aim of turning the region into a free trade area.

5 Concluding Remarks: Policy Implications

The Government of Kenya policy for the fisheries sector has the broad objective of managing fisheries sustainably in order to obtain the maximum yield while protecting the environment and securing benefits for future generations (Republic of Kenya, 1997b). In more recent policy statements, "maximum sustainable yield" has been replaced with the more realistic concept of "optimum sustainable yield" but without accompanying indications of an actual change of regime. The development objectives of fisheries management include:

- Increase in the per capita fish consumption through the production of low cost high protein fish;
- Generation of employment in fishing, fish processing and trade;
- Improvement of the living conditions of fishers and their dependants by the maximisation of economic benefits accruing to them through the provision of facilities for cold storage, fish handling and processing: and
- Maximisation of export and foreign exchange earnings capacity.

Other important elements of the fishery policy include focusing attention on value adding industries and strengthening mechanisms for the enforcement of rules and regulations, especially in Lake -Victoria.

Management of Fisheries in Kenya

The Fisheries Department is mandated to develop, manage and conserve fisheries in Kenya. The Kenya Marine and Fisheries Research Institute (KMFRI). the Lake Victoria Basin Development Authority (LBDA), the National Environment Secretariat (NES), various NGOs and other institutions are among the many institutions participating in the management of the Lake Victoria fisheries.

The management of Kenyan fisheries of Lake Victoria has relied on command-and-control (CAC) rather than economic or market-based instruments. CAC instruments involve a regulatory agency (the government) which determines the efficient level for a specified fishery and then enforces rules to ensure this level. In contrast, economic instruments rely on incentives rather than coercion to achieve efficient resource use outcomes. Economic instruments or incentives include Pigouvian taxes, well defined and secure property rights, tradable individual transferable quotas (ITQs) and subsidies for generators of positive externalities.

In 1940, the first rules for the management of Lake Victoria were promulgated, covering fishermen licensing, registration of boats, fish nets dimensions, fish size and catch size. Only tilapia, considered endangered at the time, was regulated. Currently, the policy of open access remains, with anyone able to raise the money required for annual licensing, boat labelling and registration allowed to join the fishery. The regulations that are enforced by the Fisheries Department at present include mesh size restrictions and closed seasons/areas.

Despite having had regulations for a long time and despite the large number of actors in the development and management of Lake Victoria fisheries, the fishery has experienced a serious decline. We have discussed in detail two of the causes of this decline: growth of Nile perch export business and increasing use of local fishmeal in animal feeds industry. Other significant causes of fishery declh1e are the poor management and lethargic enforcement of regulations.

Management of fisheries in Kenya has been and continues to be generally poor. This is hardly surprising given that management has been based on the command and control regime. CAC is verv costly and adherence to regulations poor on account of weak enforcement capacity particularly in developing countries. In Kenya, management has been characterised by weak political will; inadequate and outdated laws and regulations; a weak capacity for enforcing regulations; inconsistent and inadequate policies that have shifted continuously as the Fisheries Department has moved from one ministry to another; and a generally weak institutional set up (Ikiara, 1999, O'Riordan, 1996). Consequently, there is inadequate logistical infrastructure, inadequate staffing, inadequate information, corruption, conflicts of interest, regulations that are out of touch with the socio-

economic realities of the fishing communities, lack of incentives for compliance such as secure and well defined property rights, weak database and inconsistent fishery policy (Ikiara, 1999). In particular, fishery policies, statutes and institutional structures have failed to respond to developments such as ecosystem perturbation, structural adjustment programmes (SAPs) and the effects of trade liberalisation on the fishing industry. The law relating to fisheries in Kenya has retained colonial elements, despite a number of revisions, and has failed to respond to challenges associated with population increases and their effects and to develop an incentive structure that would facilitate self-regulation among fishery participants. Fishery policy and management have failed to respond or intervene as more and more fish gets diverted from domestic human consumption to export markets and the manufacture of animal feeds. The management and policy-making institutions appear to have been caught unprepared by the transformation in the fishery.

Economic incentives are powerful and cost effective means of achieving efficient fishing. For instance, the allocation of well-defined and secure property rights to the fishing community, has the potential to create requisite incentives for responsible fishing behaviour. Compared to CAC instruments, market-based instruments are less costly. easier to enforce, and generate revenues. In spite of their attractiveness and potential, economic instruments have not been used in the management of Kenva's Lake Victoria fisheries. Ikiara (1999) found that economic incentives could work in the management of these fisheries as fishers effort supply behaviour is responsive to economic variables. The most effective and efficient market-based instruments are landings taxes or ITQs. None of these is being used in the management of Lake Victoria fisheries and. despite their attractiveness and potential, we doubt that they could serve as an alternative management strategy under the present circumstances. In particular, the fact that the government is unable to effectively and efficiently collect the currently existing licensing fees suggests that these management tools would not stand a better chance of success. Besides this administrative weakness, poor database. difficulties inherent in the identification of genuine fishers, and lack of alternative employment for those contemplating leaving fishery. and other obstacles stand in the way of using economic instruments in the management of Lake Victoria fisheries.

Fishery Policy and Development Objectives

The development objectives for Kenya's fishery sector are clear and reflect the country's development needs. However, it is doubtful whether they were deliberated upon adequately before being adopted. This is because the forex objective continues to receive top priority over the other three development objectives yet these are also important macroeconomic concerns of the Kenyan government. Even after the FAO warned about the negative impacts of the fish export industry on food security and employment, the government has not acted in any way to address these concerns.

In general, the development objectives of fishing are production-oriented and largely motivated by the myopic desire to increase output. Conservation is not an explicit objective. The resource use patterns in Lake Victoria are driven more by markets than ecosystem considerations. The previous sections have shown that the export objective has been fulfilled, even to unexpected levels. This. however, has been at the cost of all the other objectives, including sustainable management. Either there were not enough deliberations before the policy was adopted, or the effects of fish export and animal feeds developments were not anticipated. It is also a reflection that the fish processing sector and other large-scale participants enjoy political sway over fishery artisans.

Where does fish feature in the country's food policy? In 1981, fish was regarded as being relatively unimportant in the overall national diet (Republic of Kenya, 1981). The food policy dealt mainly with staple foodstuffs. Fish was viewed as an important source of protein only in certain regions. By 1994, however, fish was recognised as one of the nine foods critical to the country's food policy (Ikiara, 1999). It is estimated that fish supply will have a shortfall of 5490 calories of energy and 1.05 grams of protein per person per day by the year 2000 if the supply situation is not improved. This underscores the critical role of successful management of the Lake Victoria fishery so as

to fulfil all the other objectives set for the fishing industry, including foreign exchange earnings, improved living standards for fisher-folk, employment generation and increased fish consumption.

Despite the recognition of domestic consumption shortfalls, nothing has been done to improve supply. The government erroneously believes that fish production can still be expanded from all the country's fish sources. Note, however, that fish production has been declining since the beginning of the 1990s in spite of increased fishing effort. Unlike food crops. no effort has been made to control the export of fish. This is a serious mistake given that fish, being rich in protein and relatively cheaper than alternative sources of protein, should be a key component in country's food policy. The policy with regard to fish appears to be to generate forex with which to import staple foodstuffs in periods of acute deficit (Ikiara, 1999). There is, thus, export encouragement for fish. The objective of the country's fish processing policy are to encourage fish imports from the neighbouring countries in order to ensure adequate supplies to Kenya's fish processing factories, encourage fish filleting for export through export and tariff incentives, rationalise tariffs on imported fish processing machinery and inputs, and support to fishers to increase their productivity. As we have noted in the previous sections, fish processing and export factories receive a five-year tax (VAT) holiday as an incentive. This policy is detrimental as it pursues the myopic objective of maximising forex without considering the effect on domestic availability of fish and the integrity of the resource base. Yet, there is no guarantee that these foreign exchange earnings are retained in the country. Thus, the failure of the government to rationalise the use of fish and fish products in the animal feeds industry and control of the quantities of fish exported are manifestations of a poorly focused and deliberated food policy. These failures are manifestations of a more serious weakness: lack of co-ordination and hamornisation of sectoral or micro-policies with macroeconomic policies. It is difficult to understand why food security, employment and living standards are not accorded priority in the fisheries policy when they are the main objectives of the country's overall macroeconomic policy.

Alternative Approaches

Intervention is imperative to rectify the increasingly worrisome situation with the Kenyan fisheries of Lake Victoria. Intervention is required at the level of management and policy formulation and implementation. Management institutions should be transformed to enhance their sensitivity to natural capital (lake ecosystem) and physical capital (fishing vessels and gears) (Ikiara, 1999). Fisheries management institutions must either mimic private property rights or regulate fishing behaviour in order to be effective while regulations require the willing participation of stakeholders for effectiveness (Wilson et al., undated).

Co-management offers the greatest scope in Lake Victoria (Ikiara, 1999; Wilson and Medard. 1999; Wilson et al. undated). This can increase the legitimacy of fishing regulations in the eyes of fishers (Jentoft, 1989). The government is central to any successful fisheries management strategy as it is the only agency viewed in Lake Victoria as having effective legitimacy for rule-making and rule-enforcing (Wilson et al., undated). In Kenya, 66.5°/o of the fishers surveyed by Ikiara (1999) in 1995 felt that the government was the best agency to manage the lake fisheries while another 22.4% felt that fishers themselves were most suited for that purpose. Even in the Tanzanian portion of the lake, the role of the government is undisputed (Wilson et al., undated). These facts suggest that co-management has enormous support in Lake Victoria. Even development agencies like the IDRC, UNDP, and the World Bank are encouraging stakeholder participation in the management of fisheries (IBRD, 1996). In co-management, fishers capacity and interest with regard to self-regulation is complemented by the government ability to provide enabling policies, legislation and institutions (Ikiara, 1999). A prerequisite for co-management to succeed is an assurance to the fishers that the resource belongs to them, an assurance that would reduce open accessibility and provide incentives for environmentally-friendly fishing behaviour. Thus, there should be a gradual transfer of fishery ownership to the fisher-folk, transfer of management authority to local levels, enhanced participation of fishers in decision-making and effective mechanisms to

ensure that the exclusive use rights of the fisher community are enforced, controlled and protected (Ikiara, 1999).

Whatever the management regime adopted, it should be noted that fishers in Lake Victoria are more supportive of restrictions on gears and destructive technologies than they are of restrictions on access. In Kenya, Ikiara (1999) found that 68% of fishermen support entry of new fishers while in Tanzania, Wilson et al. (undated) report that 72% of the fishermen do not support restriction of the number of people allowed to fish. This indicates that the management strategy adopted should not target immediate restriction of access if it is hinged upon fisher support.

Research is urgently needed, not only to facilitate the quantification of the costs associated with fishery transformation, but also to provide the data required for the successful institutionalisation of co-management. Co-management requires research into such areas or issues as local knowledge, socio-cultural contexts, resource management systems; and legal, administrative and institutional aspects (Konstapel and Noort. 1995).

To internalise cross-border externalities, a prerequisite for the effective management of Lake Victoria Fisheries, the efforts of the Lake Victoria Fisheries Organisation (LVFO), the umbrella regional organisation, and the efforts at unified management being made by LVEMP and donors are commendable.

With regard to fisheries policy, it is recommended that the amount of fish exported and the amount used in the animal feeds industry be controlled if the other objectives of the fisheries policy are to be achieved. This could be achieved through the introduction of an output tax on the fish processing firms and animal feeds firms using fishmeal, quantitative controls on the amount of fish exported and the fish used in animal feeds production similar to those existing in Uganda, and the shift of official view of fish as a source of foreign exchange to one in favour of fish as a source of nutritious food. It is, moreover, our opinion that food security, employment and living standards of the fisherfolk, after the objective of protecting the integrity of the resource system, receive priority over the other objectives given the malnutrition levels and poverty of the people living around the lake. The position taken by "Sessional Paper No 2 of 1994 on National Food Policy" of regarding fish as one of the nine foods crucial for the food policy is a step in the right direction. That step should be supported by the rationalisation of fish use for exports and for animal feeds production.

Finally, the country's record of policy implementation needs to be improved. It has been noted that, "Kenya's problem is not policy formulation; her policies in most sectors compare well with the best in the world. Kenya's problem is a very poor record of policy implementation" (Ikiara, 1999: 59).

References

Abila, R.O. and E. G. Jansen (1997) "From Local to Global Markets - The Fish Exporting and Fishmeal Industries of Lake Victoria: Structure, Strategies and Socio-economic Impacts in Kenya". Socio-economics of the Lake Victoria Fisheries (Report No. 2). IUCN Eastern Africa Programme. Nairobi.

Achieng. A. P. (1991) "Management Issues, Options and Strategies for Lake Victoria Fisheries". Appendix 3-4 In Ssentongo. G.W. and Dampha. N.J. (eds.), "Report of a .National .Seminar on the Management of the Kenyan Fisheries of Lake Victoria'' (UNDI'/FAO IFIP Project). Kisumu. Julv 22-24. 1995. pp 48-50.

Barel. G.D.N. (1986) "The Decline of Lake Victoria's Cichlid .Species Stock". University of Leiden, Zoologisch.

FAO (1973) "Lake Victoria Fisheries Research Regional, Kenya, Tanzania. Uganda Interim Report". FAO/UNDP, Rome. FI: DP/RAF/65/049:449.

Geheb. K. (1995) "Exploring people-environment relationships: the changing nature of the small-scale fishery in the Kenyan sector of Lake Victoria". In Binns. T. (ed.), People and Environment in Africa. New York: John Wiley & Sons, pp. 91-101.

Graham, M. (1929) "The Victoria Nyanza and Its Fisheries. A report on the fishery survey of Lake Victoria, 1927-1928". Crown Agents, London.

Gibbon. P. (1997) "Of .Saviours and Punks: the political economy of the Nile perch marketing drain in Tanzania"' Copenhagen: CDR, draft memo

Goldschmidt. T. (1992) "Reproductive strategies, subtrophic niche differentiation and the role of competition for food in Haplochromide cichlids (Pisces) from Lake Victoria. Tanzania". Annales-Musee Royal de l'Afrique Centrale, Sciences Zoologues (Belgium), No. 257. pp. 119-131.

Goulding. I. (1997) "Perch on a Precipice". Sea Food International, April 1997.

Greboval, D. (1989) "Managing the New Fisheries of Lake Victoria: Major socio-economic issues". FAO. Rome. IFIP Tech. Doc., UNDP/FAO Regional Project for Inland Fisheries Planning (IFIP). RAF/87/099-TD/04/89 (En).

Grevobal, D. and P. Mannini (1992) "The Fisheries of Lake Victoria: review of basic data". UNDP/FAO Regional Project for Inland Fisheries Planning (Development and Management in Eastern/Central/Southern Africa (IFIP), Bujumbura. FAO, Rome, Raf/87/099-WP/16/92.

Hoekstra, T M., A. Asila, C. Raburu and O. Rambiri (1991) "Report on a census of fishing boats and gear in the Kenyan waters of Lake Victoria". FAO, Rome. IFIP Tech. Doc., UNDP/FAO Regional Project for Inland Fisheries Planning (IFIP). RAF/87/099-TD/26/91.

Ikiara. M. (1999) "Sustainability, Livelihoods, Production and Effort Supply in a Declining Fishery: The case of Kenya's Lake Victoria fisheries". Thela Thesis: Amsterdam. 1999.

International Bank for Reconstruction and Development (IBRD) (1996) "Operational Strategy of the Global Environment Facility", Washington: The World Bank.

International Monetary Fund (IMF) (Various years) International Financial Statistics Yearbook.

.Jansen. E.G., R.O. Abila, and J.P. Owino (1999) "Constraints and Opportunities for Community Participation in the Management of Lake Victoria Fisheries". IUCN Eastern Africa Programme, Socio-economics of the Lake Victoria Fisheries (Report No. 6). Nairobi.

Jansen. E.G. (1997) "Rich Fisheries - Poor Fisherfolk: Some Preliminary Observations about the effects of Trade and Aid in the Lake Victoria Fisheries". IUCN Eastern Africa Programme, Socio-economics of the Lake Victoria Fisheries (Report No. 1), Nairobi.

.Jentoft. S. (1989) "Fisheries co-management". Marine Policy 13: 137-154

Kenya Fisheries Department (1980) "Review of the Fisheries Sector in Kenya" Nairobi, November 1980.

Kenya Fisheries Department (various years) "Fisheries Annual Statistical Bulletin", Nairobi.

Konstapel, K. and L. Noort, eds. (1995) "Fisheries in Developing countries: Towards sustainable use of living aquatic resources". Sectoral policy document of Development Co-operation. Ministry of Foreign Affairs. The Hague, Netherlands.

Lake Victoria Fisheries Research Project, Phase II: Marketing study by the socio economic data working group, LVFRP/TECH/99/02 (1999)

I.igtvoet, W. and O. C. Mkumbo. (1990) "Synopsis of. Ecological and Fishery Research on Nile Perch (Lates ,Niloticus) in Lake Victoria, conducted by HEST /TAFIRI". FAO Fish. Rep. no. 430, pp.35-74.

Medard, M and D.C. Wilson (1996) "Changing Economic Problems for Women in the Nile Perch Fishing Communities in Lake Victoria". Anthropologic .XXXVIII:149- 172

Mitullah. W. V. (1999) "Lake Victoria's Nile Perch Fish Cluster: Institutions, Politics and Joint Action" IDS I. Working Paper 87, Institute of Development Studies. University of Sussex, UK.

Mwaniki. D. (1998) Information provided in a video interview In "Big Fish, small frv" Socio-economics of the Lake Victoria Fisheries (video), IUCN-EARO, Nairobi.

Myers, N. (1997) "Marine fisheries: two macro-constraints". Environment and Development Economics 2(1997): 88-93.

Ochumba, P.B.O., M. Goshen and U. Pollinger (1991) "Ecological changes in Lake Victoria after the invasion of Nile perch (Lates niloticus): the catchment, waters quality and fisheries management", In Proceedings from the Aquaculture/Schistosomiasis Network Meeting in Manila, Philippines. Washington, DC

Okeyo-Owuor, J.B. (1999) "A Review of Biodiversity and Socio-Economics Research in relation to Fisheries in Lake Victoria", IUCN Eastern Africa Programme, Socio economics of the Lake Victoria Fisheries (Report No. 5), Nairobi.

O'Riordam, B. (1996) "An Assessment of the Current Status of Kenya's Lake Victoria Fisheries". A report for the Intermediate Technology Development Group. lT Kenya.

Owino. J.P. (1999) "Traditional and Central Management Systems of the Lake Victoria Fisheries in Kenya". IUCN Eastern Africa Programme, Socio-economics of the Lake Victoria Fisheries (report No. 4). Nairobi.

Republic of Kenya (1999) Economic Survey 1999. Government Printers. Nairobi.

Republic of Kenya (1997) Development Plan 1997-2001 Government Printers, Nairobi.

Republic of Kenya (1997a) Economic Survey 1997. Government Printers. Nairobi.

Republic of Kenya (1981) Sessional paper No. 4 of 1981 on National Food Policy Government Printers. Nairobi.

Republic of Kenya (1994) Sessional paper, No. 2 of 1994 on National Food Policy Government Printers, Nairobi.

Reynolds, J.E. and D.F. Greboval (1988) "Socio-economic Effects of the Evolution of Nile perch Fisheries in Lake Victoria: A Review'', Committee for the Inland Fisheries of Africa (CIFA) Technical Paper No.17, FAO. Rome

Reynolds, J., E.D. Greboval and P. Manning (1995) "Thirty years on: Observation on the Development of the Nile perch Fishery in Lake Victoria". In The impact of Species Changes in African Lakes. T. Pitcher and J.B. Hart (Eds). Chapmnan & Hall, London.

Scudder. T. and T. Conelly. (1985) "Management Systems or Riverine Fisheries". FAO Fisheries Technical Paper No. 263. Rome: FAO.

Wilson. D.C. (1993) "Fisheries Management on Lake Victoria. Tanzania". Paper presented at the Annual meeting of the African Studies Association. 4-7 December 1993.

Wilson, D.C. and M. Medard (1999) "The Implications for Fisheries Management of the changing Situation in Lake Victoria Fishing Communities: Preliminary Findings". Forthcoming in the Journal of African Rural and Urban Studies.

Wilson. D.C., M. Medard, C.K. Harris and D.S. Wiley (undated) "The Implication for Participatory Fisheries Management of Intensified Commercialisation on Lake Victoria". Rural Sociology 64 (4):554-572

Witte, F. and W.L.T. Van Densen, (1995). "Fish Stocks and Fisheries in Lake Victoria". Samara Publishing Ltd.: Cardigan, UK

Witte. F., T. Goldschmidt, P.C. Goudswaard, W.Ligtvoet, M.J.P. van Oijen and J.H. Wanik (1992) "Species Extinction and concomitant ecological changes in Lake Victoria" Neth.nds J. Zool 42: 214 - 232

World Bank (1996) Government of Republic of Kenya, Uganda and Tanzania. "Lake Victoria Environmental Management Programme Proposal: Final Report to the World Bank". January, 1996.