

# The Nile perch processing industry in Tanzania: trends, issues and development

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## ABSTRACT

Under modern conditions of product competition, it is increasingly risky not to innovate and, at the same time, it is extremely expensive to do. Consumers always want a stream of new and improved products. Competition amongst producers is a factor, which will contribute to the complexities involved in meeting these demands. As with all such initiatives, there are obstacles to new developments in Tanzania's Nile perch export industry. It is from this perspectives that this paper examines the emergence of the Nile perch filleting industry in Tanzania, its main product types and trade routes, the obstacles to new product development and, finally, the benefits that factories perceive that they deliver to the nation.

**Key words:** Fish processing industry, obstacles and development.

## INTRODUCTION

The fisheries of Lake Victoria in Tanzania contribute significantly to the foreign exchange earnings of the country, and earning it an estimated at US\$ 14 million in 1994 (Maembe, 1997). The Nile perch, the largest of the lake's fish, generated most of this value. Recently, the total fishery exports of fish and fishery products from Lake Victoria Tanzania, for the last five years (1997-2001) is estimated to be 172,359.7 metric tonnes valued at US \$ 343,428,141.5 (F.O.B) of which the Fisheries Division received a total of T.Shs. 14.61 billion as royalty (Hoza *et. al.*, 2002).

Stocks of the species, however, are limited and there is an indication of declining catches (Mkumbo and Cowx, 1999), (Medard, 2002). Such findings suggest that it is unlikely that additional value will be derived from augmenting landings of the fish any further. An alternative route to improving the value of the fish is through its transformation into various formats. Presently, the extent of such transformation is restricted, and virtually all the Nile perch leaving Tanzania is either chilled or frozen fillet.

Around 1988 most of the Nile perch fishing took place between Kenyan waters and just west of Mwanza Gulf (Reynolds and Greboval, 1989), (Gibbon, 1997). The Tanzanian Nile perch export business was started in May, 1991 by Mwanza-based companies. Principal buyers of the fish were Kenyan importers, whose equipment - such as insulated collection trucks, ice, weighing scales and selectors at landing beaches - all came from Kenya. At this early stage, ten small companies were involved: the Bright Communication Co., the Nyakutonya Co., the Rweyemamu Import and Export Co., Mtindi Fish Supplies and six other small fish export companies owned by Tanzanian nationals. All of these exported whole Nile perch to Kenya for further processing and onward export to external markets, primarily Israel.

Between 1992 and 1993 a Nile perch boom and banning of whole and semi-processed fish exports by Tanzanian government forced Kenyan investors to establish sister processing factories in Tanzania and hence stimulated the growth of the activity in the Tanzanian side of the lake (Gibbon, 1997).

However, before having the sister factories the prices on Tanzanian landing beaches ranged from US\$ 0.08 to 0.16 per kilo and sold to Kenyan buyers for between US\$ 0.24 – 0.28 a kilo. Twice a week, trucks with a capacity for seven tonnes of fish crossed the border in to Kenya, representing a weekly export of 14 tonnes of fish, or an export from Tanzania to its northern neighbour of around 700 tonnes of Nile perch a year (Batenga, Director, Bright Communication Co. pers. comm.). In Kenya, Nile perch buyers negotiated their prices with landing site co-operatives. In Tanzania, however, there were no co-operatives. Thus, Kenyan fish buyers and collectors found it difficult to deal with individual Tanzanian fishers. They thought it would have been much easier to negotiate prices with co-operative leaders rather than dealing with individual fishers. Tanzanian fishers were, however, only too aware of their poor local market, and had no realistic alternative but to accept the prices offered by the buyers.

It was from these early Kenyan buyers and collectors<sup>1</sup> that pioneer Tanzanian buyers learned their trade, and from whom they adopted the techniques used. These techniques involved informal credit schemes and incentive systems established with prominent fishers permanently resident on supply beaches. Buyers would make regular visits to potential beaches where they identified fishers with whom to establish supply arrangements and sometimes the collection and transportation of Nile perch is under the direct control of fish processors. They

own fleets of collection vehicles and boats, which go around fish landing sites. These mobilisation strategies are still used today by industrial filleting factories. It was in this way that beaches such as Mwaloni Kirumba, Kayenze, Igombe and Nyashimo came to be known as reliable Nile perch supply points. It was also in this way that dependent relationships were forged between fishers and buyers. Under these arrangements, even slight arrival delays by collection trucks represented large losses to fishers. Conversely, because competition was, at this point, very limited, buyers were able to offer extremely low prices.

These early purchasing companies represent the forerunners of the Nile perch filleting industry in Tanzania. Low levels of expertise and poor knowledge about the international market for fish ensured that development within the sector was slow. Nevertheless, the establishment of factories did occur and by 1992, there were five Nile perch filleting factories operating in Tanzania: Vic Fish, Tanzanian Fish Processors, Tan-perch, Fish Pak and Nile perch. Several of these had been established with Kenyan capital raised by sister companies located north of the border. At this time, managers within the industry came from a wide diversity of occupations and backgrounds, including cargo and transportation, hotel and manufacturing, a marine fish business, a journalist, a publisher, a large bakery, a poultry farmer and a shop owner. Additional expertise was obtained from Kenyan sister factories. The early nineties, therefore, represented a transitory period for the nascent Tanzanian factories in which they consolidated, trained and established their presence on the local and international Nile perch markets.

Difficulties were also, at this time, being encountered by the institution in charge of regulating this process, the Tanzania Fisheries Department. Most of the problems that they encountered concerned the failure, by the processing factories, to declare correctly the value of fish exports (under-declaration of exports), failure to pay royalties and the unauthorised export of tilapia. Relations between the Fisheries Department and the fish processing factories were, in the early 1990's, poor. One respondent for this study explained that the reasons for this were that the Fisheries Department had very limited resources, and were unable to field extension workers to monitor factory activities at landing sites. As a result, fish were loaded without first being inspected. These difficulties were compounded by the Fisheries Department's limited knowledge of the growing Nile perch business, and the profit maximisation motives driving industrial owners resulting in the neglect of required procedures and formalities.

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<sup>1</sup> People who use both trucks and boats to collect fish in landing beaches and islands.

In mid-1994 the export of whole fish and semi-processed fish from Tanzania was officially banned as part of a government policy for the nation's food security (Mahatane, pers. com.). The government decided to take measures to ensure that maximum earnings to the nation were gained through various taxes and royalties imposed on value-added products, such as processed Nile perch. In addition, the export of tilapia by processing factories was prohibited, so as to protect local consumers. The latter were unable to compete with Nile perch fishers and their connections to fish processing factories, and who had substantially greater access to all species of fish. These measures were also enacted to ensure that tilapia supplies to local markets were not threatened.

Pressure to establish the ban of whole Nile perch exports was brought to bear, in part, by Nile perch processors unable to withstand the competition with their counterparts in Kenya. Kenyan processing factories enjoyed several advantages over their Tanzanian counterparts, not least being physically closer to harbour facilities at Mombasa, as well as the comparatively better Kenyan road infrastructure.

The export of semi-processed fish was allowed until August 1994 so that Tanzanian factories could complete the installation of processing facilities, as well as bringing in refrigeration and food processing experts to guide the process (Lupondije, pers. com).

This paper explores the development of Tanzania's Nile perch filleting industry, examines perceived obstacles to its operation, and considers the development of product lines within the industry. The findings from this paper are additional output to a regional marketing study, which was conducted by Lake Victoria Fisheries Research Project (Phase II) in 1999 in the riparian states (Kenya, Uganda and Tanzania) with the aim to examine the marketing characteristics of fishing activities and their effect to fish product forms and quality, prices and distribution networks from the consumer to the producer.

## **MATERIALS AND METHODS**

Questionnaire administration to the factories Directors, Focus Group Discussions (FGD), in-depth interviews and secondary data have been applied in this study. In some area where it was somehow sensitive a triangulation of more than one technique has been applied.

## RESULTS AND DISCUSSION

### Nile perch fillet export routes in Tanzania

During the course of events described above, the principal export routes were road based. There was also some lake-based smuggling of fish from Tanzania in to Kenya, particularly in the Mara/Shirati area, close to the Kenyan border (Wilson, 1996). Presently, export routes within Tanzania depend on three main factors:

- The product format: whether the fillet is chilled or frozen.
- The availability and status of transport facilities (road, air, railway and water).
- The costs associated with the export route (chilled fillet, for example, is more expensive to export than frozen fillet).

As such, distribution channels from Tanzania's Nile perch filleting factories can be categorised along the lines of product type:

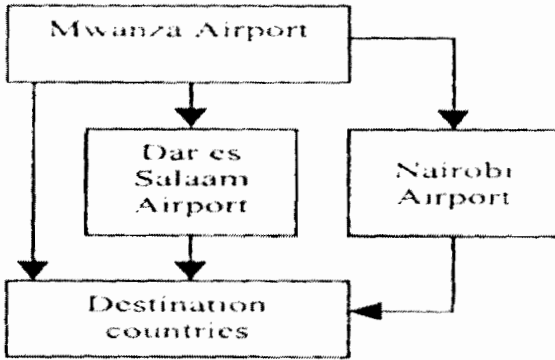
#### **The chilled fillet route**

Chilled fillets need to be moved from the factory to final destination as quickly as possible. This distribution channel is therefore characterised mainly by air transport. The country's fish processors have three main routings down which they send their products (Fig. 1). Firstly, the processors may independently or jointly (depending on the cargo volume involved) charter flights directly from Mwanza Airport to the destined foreign market. Secondly, processors may send their fish from Mwanza to Dar es Salaam on scheduled flights, where they can meet scheduled international flights for onward delivery. Four factories interviewed during this survey indicated that this was their principal export route. Thirdly, processors may fly or drive their cargo to Jomo Kenyatta International Airport in Nairobi.

#### **The frozen fillet route**

Because of the durability of frozen fish and the development of refrigerated containers, Nile perch processors have several options for sending their frozen Nile perch abroad including by air, road, sea or rail.

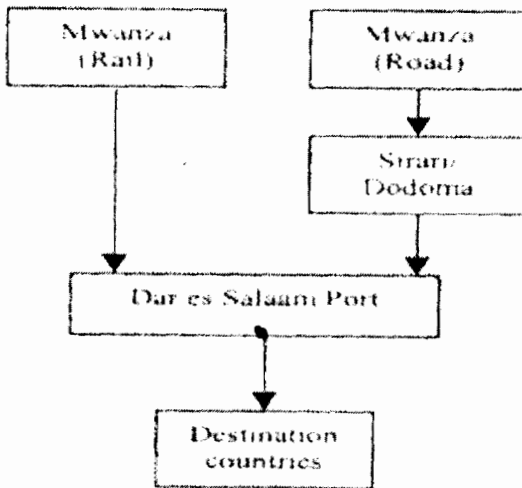
Figure 1: The chilled Nile perch fillet export route from Mwanza by 1999



Source: Author field study, 1999

Three factories in Mwanza have been ferrying their fish to the port at Dar es Salaam using the Mwanza – Dar es Salaam rail link. Alternatively, processors can also get their fish to the harbour by road, either via Kenya and then through Arusha, or through central Tanzania, via Dodoma.

Figure 2: The frozen Nile perch fillet route from Mwanza by 1999



Source: Author field study, 1999

Both rail and road networks can, however, be affected by severe weather. During the 1997-98 *El-Nino* rains, for example, parts of both the road and the railway to Dar es Salaam were washed away, obliging some processors to ferry their frozen fillets to Dodoma by rail, where it would be transferred to trucks for onward delivery to the port. Needless to say, the costs of off-loading and on loading increased considerably as a result.

### **Nile perch export markets and challenges in Tanzania.**

The main export markets for Tanzanian processed Nile perch is Europe, in particular Holland, Italy and Germany. Other markets lie in the Far East, Middle East, Australia and the United States. Products to these markets include frozen and chilled fish and, more recently, head-on gutted fish. Additional Nile perch products, such as belly flaps, maws and off-cuts may also be exported. Maws have a ready market in the Far East, while belly flaps, off-cuts and Nile perch oil are exported to Kenya.

### **Obstacles within the pipeline**

*Transportation problems:* Many of the problems faced by the fish exporting companies are common to all commercial sectors in Tanzania, along with those problems associated with the deterioration of the product. A poor road infrastructure is a major problem faced by fish filleting factories. During the rainy seasons many of the access roads around the Tanzanian part of Lake Victoria become impassable, resulting in delayed deliveries. As a result, rejection rates at the factory increase, a cost, which is transferred back to the fisher. The poor quality of roads results in high vehicle maintenance costs.

Air transport and associated facilities are still inadequate in terms of quality and the efficiency of services required for export of fish fillets. The main problems encountered by Tanzanian Nile perch filleting factories are detailed in Table I.

*Water quality:* There are three major sources of water for processing fish: lake water bore holes, and municipal water. Lake and municipal water are very expensive to purify. Tanzanian fish processing factories treat their water by passing it through settling tanks, sand filtering, active carbon filtering and chlorination.

Table I: Tanzanian fish processing factories' major problems

| Problem                     | Frequency of factories |
|-----------------------------|------------------------|
| Poor infrastructure         | 5                      |
| Taxes are too high          | 6                      |
| No government assistance    | 1                      |
| Poor handling at landings   | 1                      |
| Fish supply fluctuations    | 1                      |
| Lack of qualified personnel | 3                      |
| Other                       | 5                      |

(Source: SEDAWOG<sup>2</sup> Tanzania marketing study, 1999)

Three factories in Mwanza have dug boreholes to the depth of 60-80m to tap underground reservoirs. This water, the factories claim, is easier and less expensive to purify. The regional Water Department carries out bi-weekly inspections to ensure that all water used meets various health and safety standards.

*Electricity:* The factories buy electricity from the Tanzania Electricity Supply Company (TANESCO), the only national power generation company in the country. Electricity supplies to the factories are erratic because of the imbalance between the population growth and industrial growth. Over the past two years, however, supplies have tended to be more reliable. Nevertheless, all factories have stand-by generators in case the electricity supply should falter.

*Export market information:* Tanzanian Nile perch exporters gauge the status of their markets from information obtained over the Internet, at international trade fairs, industry literature of the Ministry of Trade, the embassies of the exporting countries, the Fisheries Department and exhibitions. Additional information is also obtained from the buyers to whom the factories sell. Most factory owners claim that the fish market is “buyers market”, whereby buyers dictate the standard of quality, the product format, fillet size, packaging requirements and so on. Two factories visited during this survey had experienced visits from their regular foreign buyers to demonstrate how to cut and pack the fish for specific products.

<sup>2</sup> SEDAWOG stands for Socio-economic Data Working Group of the riparian states.



*Skills:* Factories have experienced considerable problems obtaining suitably qualified personnel for laboratory posts and fish quality control procedures. Five factories visited had their own laboratories. In three cases, the technicians employed came from Kenya, India and Greece. The remaining factories employed Tanzanians. Filleters are expected have a basic secondary school education, and to have undergone 'on the job' training. Training programs for fish filleters are available from a local fisheries training institute. Some 2,400 filleters have been trained by the institute in fish handling, processing and marketing (Lupondije, former, Zonal Inspector in charge, Fisheries Division, national fish laboratory; and Kiteri, Head of training depart.; Nyegezi Freshwater Fisheries Institute pers. comm.). Factory owners will send their employees to the institute for training, or may ask the institute to train them at the factories.

*Export procedures and formalities:* In order to export Nile perch products, processing factories have to fulfil a number of basic requirements, the main ones being:

- An export license issued by Ministry of Trade: a licensing procedure established to ensure that there are no restrictions on the product to be exported.
- Customs Entry Forms issued by the Tanzania Revenue Authority (TRA): these documents provide detailed information about the shipment (the export), including the name of the consignor, consignee, the importing country and the type of the cargo.
- Permit for export of fish issued by Fisheries Division: following the payment of export royalties, the Fisheries Division issues an export permit.
- Health certificates issued by the Fisheries Division: these are issued provided the Division is satisfied with the quality of the fish (determined through regular visits to the factories and microbiological analysis of products) and the implementation of Hazard Analysis and Critical Control Point (HACCP) (Lupondije, pers. com.).
- Exchequer Receipt Voucher issued by the Ministry of Natural Resources: a receipt issued to indicate payment of all necessary export royalties.

The diversity of regulation and the multitude of different government organs to whom the processing factories must apply is problematical. Two of the factories visited suggested the need for a centralised office dedicated to processing fish export formalities. Nonetheless, the factories appear to have adapted to the system, and do not generally have difficulties obtaining the necessary clearances and documentations for fish exports.

*Royalty fees:* Royalty fees are taxes paid to the state by the processing factories, and which comprise a percentage of the declared f.o.b. price of various fish products. The international prices for Nile perch will vary over time, and hence the government and the factories agree upon a stable price against which the royalties are paid. Thus, it is agreed that, at present, the price for Nile perch fillets is US\$ 2.50 per kilo, against which the factories pay 6% of the value of every kilo exported. Such predetermined prices are set against other products such as dried fish maws (US\$ 6 per kilo), fish oil (US\$ 0.30 a kilo), belly flaps (US\$ 0.25), and other products such as fish meal (US\$ 0.20) and fish frames (US\$ 0.15). The agreed upon price of the product is reviewed and altered as deemed necessary.

Fish processing factories complain that the royalty fees are too high, particularly when they must also pay other municipal taxes and industrial cess fees. Kenyan and Ugandan factories do not pay high taxes. The Tanzanian operators therefore complain that they are forced into a disadvantageous position *vis a vis* other Eastern African competitors.

### **New product development**

As mentioned earlier, the dominant products to emerge from the Tanzanian Nile perch processing industry are chilled and frozen Nile perch fillets. Manufacturers in this industry claim that theirs is a 'buyers market' in which case customers determine the product form. To date, foreign customers have preferred chilled or frozen fillets. Respondents for this study provided several reasons for why product development within the industry in Tanzania had focussed almost solely on fillets as opposed to other products, such as fish fingers. The reasons were:

- Technology and investment needs on other products are completely different.
- Markets were readily available for fish fillets.

- Other products need more market survey and research.
- Buyers gave advice on this product.
- It is too expensive to develop the associated communication and infrastructural requirements associated with new product lines.
- Because of connections with Kenyan-based sister companies, the marketing of fillets was easier.
- Too risky to develop alternative product lines, particularly given insecure foreign markets.
- Fillets allow more room for the importing companies to handle consumers' needs and preferences.

There have, however, been some developments in the production of alternative product lines. In 1997 the Industrial Fish Processors Association sought permission from the Tanzanian Government to export headed and gutted fish to various markets. Permission was granted by the state provided exports of gutted and headed fish never exceeded 15 per cent of the total export by each factory. This initiative was, in part, motivated by the hope that some degree of product diversification would reduce some of the risks of trading upon a volatile global market. At the same time, however, the costs associated with product development are a deterrent to the processing factories, particularly when their production is so frequently subject to quality-related closure by EU markets. Other factories are worried about loss of market share if they developed new products too quickly.

The processors realised that it would be difficult to completely remove the risk associated with product development. Because of the continuing threat of subsequent fish export bans, it is becoming increasingly risky to innovate. Market failure in the actual estimation of market share was also mentioned as a worry, lest competitors were quick enough to enter into same product line. A number of factors such as the cost involved in strengthening the production, marketing strategies, size of investment, company size and interests in new scientific development were other concerns raised by respondents.

The frequently imposed export bans of fish to EU markets – such as the most recent ban imposed in April 1999 – have shaken producers' confidence in these markets, with the result that the market is perceived as persistently risky. This perception in turn affects the factories' willingness to develop new product lines.

There are additional factors affecting factories' willingness to develop new product lines. The high fat content of the Nile perch, leads to development of fillets with 'stale oily' smell and flavour after a few days of storage in ice (Howgate, 1996:5). This makes fillets to be more prone to spoilage, and therefore need for storage and temperature control was mentioned as a disincentive that makes it difficult to move away from the traditional fillet formats. The factories have not sought to develop tilapia-based product lines because of the Tanzanian ban on the export of this fish.

Biological information on growth rates, spawning time and fish abundance particularly the Nile perch is highly demanded by the fish processors. In the absence of such ecosystem information as well as management and competition, many factories are unsure as to whether the present investment is long-term, or not to embark on new product development. 'We need time to venture into new fish fillets product because of uncertainties and therefore we are primary producers' a fish quality official confirmed this (Lukanga, pers. com).

Despite these constraints, however, two factories visited during the study had received queries concerning the development of consumer packed products such as breaded fillets or battered fish. While agreeing that it seemed a good idea, factory owners were worried about the costs associated with such innovation. An important consideration in the development of new product lines lies in persuading a sufficient number of buyers that the product's quality has indeed improved to the extent necessary to motivate its purchase. This is necessary if the costs of the product's development are to be recouped.

Alternatively, improvements can be made to the product's features in terms of real or fancied user benefits, such as designing it in such a way that it offers more convenience, safety and/or efficiency to its consumers. While the styling and improvement of features for food products is difficult, these may be ameliorated to some extent by effective packaging design.

Although product development necessarily involves risks, it is generally accepted that the higher the risk the greater the possible benefits or profits. There are also additional incentives to product development such as the future survival of the firms involved. Tanzania's fish firms may, therefore, consider a gradual modification of products rather than an abrupt one, so as to minimise the associated risk. Alternatively, risks might also be reduced by continuing

traditional product lines alongside new ones, while also making adequate investments in marketing research.

### **Benefits to the nation**

The importance of Nile perch fish processing industry cannot be over emphasized. The Nile perch industry has been the major stimulation of several economic activities for the people residing along the lakeshore and its hinterland communities.

Small fishing beaches turned into urban centres. Thatched huts have turned to modern and well-built homes. In area where it was not accessible by road or water means of transport it has turned to be much more accessible through the provision of trucks, cars and boats to perform various socio-economic activities. Economically and socially the situation has changed the status of the fishing households through the involvement of people in various fisheries related activities. The benefits of the existence of these industries go beyond the direct link of fishery industry and other economic activities.

Nile Perch fish processors, feel that their activities are of considerable importance to Tanzania. By driving fish prices up, they argue, incomes to fishers and their communities have improved. Before full processing commenced in Tanzania, Nile perch could be bought at fish landings for as little as Tshs. 80.00 a kilo (ca. US\$ 0.11 at 1999 rates). After processing commenced, prices rose to Tshs. 200 a kilo (ca. US\$ 0.30 at 1999 rates). Recently there has been a drop in prices due to the EU ban on fish exports from T.Shs. 450.00 to T.Shs. 80.00 (462.5% drop) while at the same time in towns such as Dar-Es-Salaam a kilo of whole Nile perch (head-off) was sold at T.Shs. 800 to 1200.00 (that is \$ 1.0 to 1.4).

The growth of the industry and the provision of both direct employment (within the factories) and indirect employment (in the fisheries as a result of increasing demand) is also viewed as a benefit to the nation by the factories.

Three-quarters of those employed by the factories are male, while an almost equal proportion of women (69%) dominated the Nile perch bye-products market in all areas except swim bladders, which are the exclusive domain of men (Medard *et. al.*, 2000b).

In 1997, the ban on Nile perch exports arising from fears of contamination resulted in the loss of 500,000 jobs, from Tanzania. (THE BUSINESS TIMES, 1997). This is equivalent to the total number of people employed directly and indirectly in Tanzania's Lake Victoria fishery (Maembe, 1997; Bwathondi, 1998). Significant increases have occurred in Nile perch by-product sectors, such as the collection and drying of fish maws, in fishmeal industries, extraction of Nile perch oil and the processing of fish frames.

The factories' inputs to the fishery in the form of collection and fishing boats, money, ice, storage facilities, road construction to the beaches and collection trucks were also viewed as benefits to the fishery, and are viewed against a backdrop of general developmental benefits accruing to the fishery along with achievements in product handling and improvement. Respondents from the factories argued that, advances in these ways have served to reduce the amount of post-harvest loss from the fishery, particularly those losses associated with the Nile perch fishery. The ways in which factories feel that they have benefited the nation are summarised in Table II:

Table II: Ways in which factories feel that they have contributed to national development

| Developmental contribution           | Frequency mentioned |
|--------------------------------------|---------------------|
| Contributions to fishers' incomes    | 6                   |
| Employment generation                | 4                   |
| Provision of gear and other inputs   | 3                   |
| By-products sold on to local markets | 1                   |
| Other                                | 3                   |

(Source: SEDAWOG Tanzania marketing study 1999)

Despite those achievements, cheating through weighing scales in the beaches by agent and industrial processors, under declaration of the export prices as stated previously (F.O.B prices of US\$ 2.50/ kgs of both fresh and frozen fillet for exports), unsustainable management influence to the use of fishing gear which leads to harvesting of juvenile Nile perch (Medard *et al.*, 2000, 2001; Medard, 2000b) and insecurity and piracy in the lake waters which deprive artisanal fishers particularly the women from fishing (Medard, 2000a; 2002) have contributed to the poverty condition in fishing communities.

## **CONCLUSION AND RECOMMENDATIONS**

There are many factors that still challenge the Nile perch processing industry in Tanzania. Stock dynamics within Lake Victoria and linked ecological changes still ensure that the lake remains in ecological flux. There exists no firm understanding of how the lake's ecology will appear once it stabilises. This information is needed. Currently, the international market for Nile perch has served to increase the relative value of the fishery and encouraged considerable economic in-migration to it. This has direct implications for over-fishing, and there is still no real information concerning the status of the lake's fish stocks, not least on Nile perch reserves.

Other concerns also exist. An estimated 80 per cent of the Nile perch landed from Lake Victoria is destined for the Nile perch processing factories (Gibbon, 1997). The combined whole fish intake of the eight factories visited for this study is an estimated 72,800 tonnes of Nile perch a year against 121,940 tonnes of regional annual fish intake (SEDAWOG, 1999). Together with the rise in the market for Nile perch carcasses, this demand has led some observers to speculate about the possible nutritional impacts of this export both within Tanzania (Wilson, 1993) and in Kenya (Abila and Jansen, 1997).

The Nile perch processing industry has created an air of dependency – when the markets close as a result of quality control concerns, local impacts are widespread and worrying as incomes decline, the price of fish crashes and a significant part of the national economy effectively collapses. There is, clearly, a need to develop markets outside of the European Union, as well as to consider ways of alleviating this dependence on a single source of income for the many thousands of individuals involved in the industry.

The contribution of the industry to the national economy is considerable. Some 500,000 jobs have been created as a result of the industry, and the value of the combined output of the eight factories visited for this study is estimated to be US\$ 81.9 million annually (SEDAWOG, 1999). From this accrues the royalties paid to the state, along with the many indirect benefits expressed as employment or incomes to lakeside communities and infrastructural benefits through investment in fish collection networks and the improvement of fish landing sites.

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