

REPORT ON A VISIT TO TANZANIA,  
KENYA AND UGANDA

THE LAKE VICTORIA FISHERY AND  
TANZANIA FISH KILN DEVELOPMENT

B F BLAKE AND A E GORDON

25 MARCH TO 14 APRIL 1991

## EXECUTIVE SUMMARY

- (i) NRI has been involved in post-harvest research on the Lake Victoria Nile Perch fishery since 1987. Most of the work to date has focused on the development of a fuel efficient smoking kiln in Tanzania. This visit to Tanzania, Kenya and Uganda sought to investigate trends in the lake fishery, providing a context for future inputs on the kiln or in other areas.
- (ii) The Nile perch fishery is still unstable, and few accurate statistical data are available. There is some indication that the Nile perch fishery has "peaked" in Kenya and possibly in the Mwanza area of Tanzania. This does not appear to be the case on the western shore, nor possibly in Uganda.
- (iii) Data from Kenya suggest that beach seining may put severe pressure on recruitment of Nile perch into the gill net fishery.
- (iv) The "dagaa" fishery (small sardine-like fish) is extremely important everywhere on the lake. It appears that this species has increased in absolute and relative importance, as the number of other fish competing for the same food has been reduced.
- (v) Post-harvest development of the fishery varies between countries. Generally though, Kenya has developed more high value products (notably frozen perch fillets for export), with traditional processing methods most prevalent in Tanzania. The Kenya industry draws fish from adjacent areas of the lake, "squeezing" traditional processors in Kenya and border areas. All three countries export large amounts of fish, with the regional market being most important for Uganda and Tanzania.
- (vi) Smoking of Nile perch remains important in areas distant from markets and cold chains, particularly where wet weather restricts sun drying. The western lake shore, and islands (all shores) are particularly important smoking areas. Most kilns are traditional models. On islands on the western lake, the shortage of fuel wood has led to the use of grass, resulting in a charred short shelf-life product.
- (vii) Market reforms in Tanzania have encouraged the development of export markets, notably for salted sun-dried Nile Perch in Zaire/Burundi/Rwanda. Where weather permits there appears to be a partial shift away from smoking towards sun drying.
- (viii) The Nyegezi kilns placed with operators are put to varying use. Financial viability seems to depend on cheap supply of fish ( eg at sites distant from markets and any means of chilled preservation), the need to purchase rather than simply collect wood, and adequate

operating capital. There seems little doubt that they use 50-70% less wood than traditional kilns, and that the depletion of fuel wood supplies is a serious problem in the area.

- (ix) Interest in the kilns has been expressed by relatively large-scale businessmen although only three of the eight built are currently in use (two project, one private). With the exception of the large private model at Bukoba all of the Nyegezi kilns have had some problems with fires. This is a result of poor control of furnace air inlets and lax operator care. However, the main reason given for not using the existing kilns was an inadequate supply of cheap fish.
- (x) Most traditional small-scale processors, who as a group smoke the greatest volume of fish, are deterred by the capital cost of the Nyegezi kiln. A large proportion of these processors gather rather than purchase fuel wood, and are therefore unlikely to recover the investment cost of the kiln. Labour has a low opportunity cost since there are few alternative sources of income. In areas closer to urban markets, fuel wood is more likely to be a purchased input, but in these areas traditional processing is most threatened by the higher value fresh, chilled or frozen market. Moreover, the Nyegezi kiln is not an option for processors on the remote western islands, where fish is abundant and smoking widespread since the scarcity of wood here has resulted in the predominant use of grass for fish smoking. Replanting programmes would seem an immediate requirement in these areas.
- (xi) There remains considerable justification for NRI involvement in the Lake Victoria fishery of Tanzania. However, given the level of existing and planned inputs from other agencies it is recommended that rather than act independently the Institute should :
  - a. investigate collaboration with the EEC regional project Phase 2 in pre-harvest issues.
  - b. contact executive agencies implementing projects with post-harvest components (particularly FAO) and investigate the possibility of NRI inputs.
- (xii) These opportunities in fisheries should be considered in the light of recent NRI exploratory work in West Africa, Thailand and Bangladesh. It is recommended that a meeting should be arranged at NRI to discuss common themes emerging and the indicated research strategies.

<b>CONTENTS</b>	<b>Page</b>
<b>SUMMARY</b>	<b>2</b>
<b>BACKGROUND</b>	<b>5</b>
<b>TERMS OF REFERENCE</b>	<b>7</b>
<b>STRATEGY</b>	<b>8</b>
<b>RESULTS</b>	
<b>PRE-HARVEST FISHERY</b>	
- TANZANIA	8
- KENYA	10
- UGANDA	10
<b>POST-HARVEST FISHERY</b>	
- TANZANIA	11
- KENYA	18
- UGANDA	19
- ECONOMIC SUMMARY FOR THE LAKE FISHERY	20
<b>THE NYEGEZI KILN PROJECT</b>	<b>20</b>
<b>PROPOSED AND EXISTING FISHERIES</b>	
<b>SUPPORT PROGRAMMES FOR LAKE VICTORIA</b>	<b>21</b>
<b>CONCLUSIONS AND RECOMMENDATIONS</b>	<b>22</b>
<b>APPENDICES</b>	<b>24-32</b>

## BACKGROUND

1. Prior to the late 1970s the fishery of Lake Victoria was multi-species, based mainly on indigenous cichlids (notably haplochromines), cyprinids and siluroids (ACHIENG, 1990). Following the introduction of Nile perch (Lates sp.) and exotic tilapias in the early 1960s the situation progressively changed until, within twenty years, the Nile perch totally dominated the fishery and was rivalled in importance only by the various tilapias and by the small pelagic sardine-like "dagaa" (Rastrineobola argentea).

2. These changes directly affected the fishing communities around the lake shore. Gear and fishing techniques changed with a new emphasis on large mesh gill net fleets, beach seines and ultimately commercial trawlers. In addition to these pre-harvest changes, the dominance of Nile perch had wide-reaching post-harvest implications for fish processors and marketers.

3. Traditional treatment of catches had formerly relied on sun drying of small cichlids and dagaa, or smoking in simple kilns. The new reliance on Nile perch resulted in processors, marketers and distributors having to adapt their operations in order to take full advantage of the new resource. To this day there is some reluctance by local populations to accept perch in place of their traditional cichlids.

4. Against this background, Cole (1984) visited Kenya on behalf of FAO to investigate the post-harvest implications of the new fishery, and to suggest acceptable ways of utilising the perch. One of the areas identified as meriting attention was smoking. It should be noted that at that time the perceived need was for ideas on how to use a fish which was locally unpopular.

5. Poulter (1986) visited Tanzania for a SADCC workshop on exploitation of fishery resources where the lack of information and the need for a study of the lake fishery was emphasised. As a result of this recommendation Rogers (1987 1988) of NRI visited Tanzania and concluded that there were significant post-harvest losses associated with the perch fishery (estimated to be at least 15%).

6. The 1987 and 1988 reports also identified smoking as the most significant method of preservation, particularly during the rainy season when Nile perch catches were reportedly highest. It was suggested that the losses in perch resulted from poor performance of traditional kilns during rains and the tendency of these kilns to catch fire as a result of the high fat content of the fish. In addition, it was noted that the kilns were extremely inefficient in fuelwood combustion, using 1-1.5kg of wood for every 1kg (fresh weight) of fish smoked.

7. As a result of these findings the Fisheries Section of NRI put forward a project proposal for R and D funding to

develop a smoking kiln better suited to the needs of Nile perch processors. The key objectives of the project were:

7.1 to prevent the fat from smoking perch dripping into the fire and causing the kiln to ignite;

7.2 to allow processing during the heaviest of rains, and to remove the constant danger of kilns being washed away;

7.3 to reduce by at least 50% the fuelwood requirement per unit weight of fish processed.

In addition to these key features, several other benefits were expected, notably an improvement in the quality and shelf-life of the product and an improvement in operating conditions for processors.

8. Although the overall objective of the project was effectively to generate increased incomes in fishing communities, the approach concentrated on the technical feasibility of producing the kiln, and no socio-economic study of the viability or implications of such a development was commissioned at this stage.

9. During 1989 two visits were made to Tanzania by NRI technical staff for the purpose of field testing and ultimately building pilot versions of a new kiln in collaboration with the Tanzanian Fisheries Research Institute, "TAFIRI" (Rogers, 1989; Rogers and Tariq, 1989). The resultant "Nyegezi" kiln was described as having the following beneficial features:

9.1 the fire box (furnace) was situated to one side of the smoking chamber, and there was little danger of the fish load catching fire if fat dripped;

9.2 the enclosed cement structure of the prototype allowed operation in all seasons;

9.3 the furnace and air flow system permitted almost total combustion, and fuel efficiency was more than double that of traditional kilns;

9.4 the smoked product was light in colour, attractive and, under Mwanza conditions, had a shelf-life almost double that of the traditional product (during the rains);

9.5 the kiln required less attention, and was less unpleasant for the operator to use than traditional kilns.

In addition, the pressure on forests from firewood requirements was already at a level where wood had to be transported many kilometres to smoking sites. It was considered that, in addition to the financial incentive to processors, reduction of fuelwood consumption had

considerable potential environmental advantage, providing the kiln could be taken up throughout the smoking sector.

10. With the last point in mind, a proposal was put forward for a project to extend the new kiln to the fishing communities. This was initially designed as a possible component of a multi-faceted ODA forestry project being considered for either Mwanza and/or Tabora regions.

11. At this point it became clear that a full assessment of technical achievement could not be made without reference to the projects' socio-economic context. A social-anthropologist was commissioned by NRI's Economics Social and Statistics Department (ESSD) to visit Tanzania and appraise the proposed extension programme in the light of the current field situation.

12. This mission (during the dry season) raised several important issues of which the key features were:

12.1 there appeared to be marked changes in processing and marketing practice--opportunities for export had opened up, icing/freezing had increased, and there was considerable emphasis on sun drying and salting to meet foreign demand;

12.2 little smoking was observed, and none of the prototype new ("Nyegezi") kilns had been used for some time; there were apparently both technical and financial reasons for this;

12.3 while there was clearly room for improvement over the traditional kiln design, the Nyegezi kiln was so expensive in relation to local versions that it was questionable whether even a favourable credit scheme would generate significant uptake; either a new, significantly cheaper kiln was needed, or the cost of the Nyegezi kiln must be reduced substantially to assure uptake amongst artisanal processors.

#### TERMS OF REFERENCE

13. Detailed TORs are given in Appendix 1. In essence, the present mission was charged with taking a broad-based, rather than kiln-specific, look at the Lake Victoria fishery, with particular reference to the questions raised by the earlier socio-economic report (Stickings, 1990). The outcome of the mission was to be a final report which would put the technical performance of the Nyegezi kiln into the broader context of the fishery, and the perceived problems of the communities prosecuting this fishery.

## STRATEGY

14. The consultants visited the three Tanzanian lake regions: Mwanza, Kagera and Mara and also made very brief stops in Kenya and Uganda. A map and detailed itinerary are included as Figure 1 and Appendix 2. In each region attempts were made to interview:

- Government Natural Resources & Fisheries Officers
- Fishermen
- Processors and fish vendors
- Other members of fishing communities
- Businessmen involved in the fishery

A list of people contacted is given in Appendix 3.

15. Visits were made to a variety of fishing communities in each area for the purpose of direct observation and information gathering. The consultants were normally accompanied by either a Fisheries Officer and/or a member of TAFIRI staff.

## RESULTS

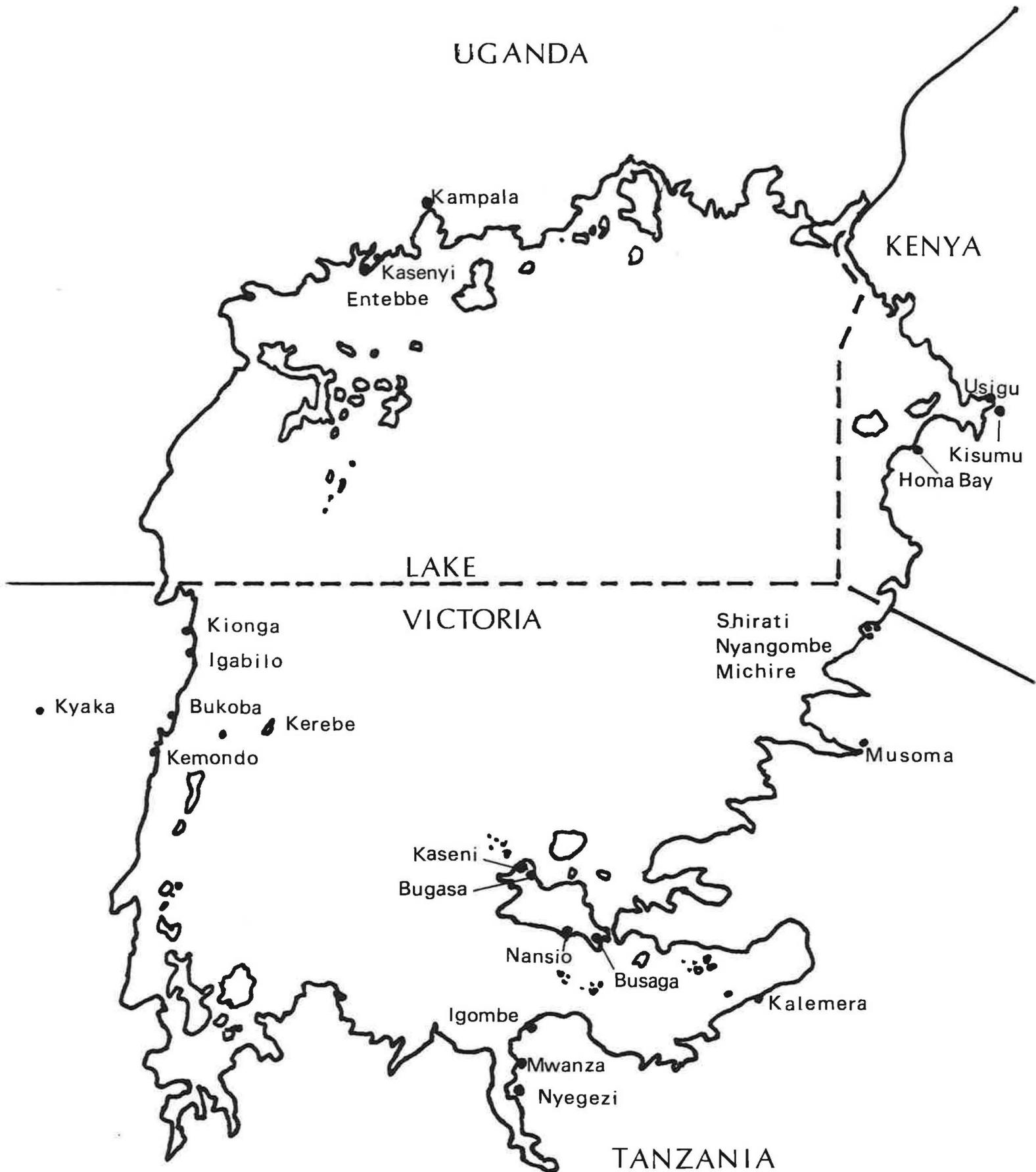
### THE PRE-HARVEST FISHERY--TANZANIA

16. It proved extremely difficult to obtain current catch statistics. Some landing data for 1989 and 1990 were obtained for Mwanza region (Table 1), but not for other areas. It was apparent that the collection, collation and production of fisheries statistics remains poorly developed in Tanzania. Official data are available only up to 1988 (Table 2).

17. In Mwanza region there was some suggestion from fishermen and processors of a decline in Nile perch catches, although there were few Catch Effort data to support this. Ligetvoet et al. (1990) recorded a slight decrease in mean total length of perch sampled with gill nets between 1987 and 1990 and related this to the reduced use of 8" gill nets in favour of 6" and 7" nets. However, total lake statistics for Tanzania (Table 2) do not suggest decreased production up to 1988. The supposed decline in the east lake relates mainly to 1989/90. Data for Mwanza region (Table 1a and 1c) in 1989 indicate a total production of 206,410 tonnes as opposed to a 1986 estimate of 159,789 and a 1988 estimate of 156,020. Again, there is no hard evidence of a decline.

18. The reported scarcity of fish in Mara appears to reflect the movement of fish catches from there into Kenya, rather than any reduction in catch levels. TAFIRI staff said there was some indication of a decline on the southern and eastern shores but there were no data to support this view. There was no suggestion of a decline in the Kagera fishery. Fisheries officials generally felt that 1988 had been the peak year for the Nile Perch fishery.

FIG 1. SITES VISITED



19. It was clearly stated that the trawler fishery had declined markedly (as much as 50%) and operational viability was now in question. It was extremely interesting that a supposed halving of the catches of 14 trawlers (as listed in 1988 statistics) should not be reflected in total catch figures for Mwanza, and that a similar level of decline should not be suggested for the gill net fishery. It may be that the trawler decline reflects both economic factors (fuel and maintenance costs), and bionomic factors which render the perch more susceptible to the flexibility of gill net setting strategies.

20. The fishery has remained very much a limited species activity; even beach seines catch almost entirely Lates sp. Bagrus, Protopterus and Clarias were seen regularly, but four mormyrids and two Labeo represented the only other non-cichlid species seen. Tilapias were noted commonly in Mwanza and Mara but not so often in Kagera. Species importance for 1989 is indicated by tables 1a and 1c.

21. The most striking feature of the fishery was the importance of the dagaa (Rastrineobola argentea) in all areas. It is likely that official records of dagaa catches (Tables 1c and 2) are significantly underestimated, and this fishery, in terms of importance to fishing communities, appears to exceed that of Nile Perch in some areas. While Table 2 indicates the importance of dagaa in the Kenyan fishery (up to 40% by weight) the figures for Tanzania appear extremely low (maximum 10% by weight). This is unrealistic when officials in both Kenya and Uganda stated that large quantities of dagaa are imported from Tanzania, and observations in Kagera made it clear that this fish is also exported to Rwanda, Burundi and Zaire, in addition to the substantial domestic trade. Moreover, at the large landing and distribution centre of Kirumba (Mwanza), four times more space is allocated to dagaa than perch. Despite this, the Mwanza regional data for 1989 show dagaa as only 1% by weight of total catches, and the municipal fisheries office did not even record this fish.

22. The principal gear for Nile Perch is the 6" or 7" gill net in Mwanza and Kagera regions and 7" or 8" in Mara; the beach seine and long-line appear more important in Kagera. There was no evidence of a reduction in mesh sizes below 6", as had been reported by some sources, although no meshes over 8" were seen anywhere. However, the mesh size of seine net cod ends is around 1/2", and the beach seine catches examined contained a very high proportion of small Nile Perch (less than 10 centimetres). It was strongly felt by some officials that this factor led to reduced recruitment which in turn contributed to a decline in catches. There is now talk of trying to ban this gear completely from the lake.

23. It was clear that the bionomics and dynamics of perch in Tanzanian Lake Victoria are poorly understood, and that in the east, catches may be declining. While a proposed second phase of the 3-nation EEC Lake Victoria project is to address these issues, it will face an up-hill task given that, despite the presence of qualified and experienced staff, the lakeshore

the routine collection, analysis and interpretation of accurate catch data. The reasons are a complex mixture of logistics, infrastructure and politics, complicated by unrecorded cross border trading.

#### PRE-HARVEST FISHERY--KENYA

24. The Kenya Marine and Fisheries Research Institute (KMFRI) in Kisumu provided some catch statistics for 1989 and 1990 (Tables 2 & 3; Figure 2). Informal discussion with staff suggested that, while overall production remains high, catches from Kenyan waters have declined as a result of over-fishing. The only direct evidence available was a decline in average catch per boat day from 179.7kg in 1989 to 152.1kg in 1990. The Kenyan industry for fresh Nile Perch and Tilapia includes significant contributions from both Uganda and Tanzania, although the precise quantity involved is unknown.

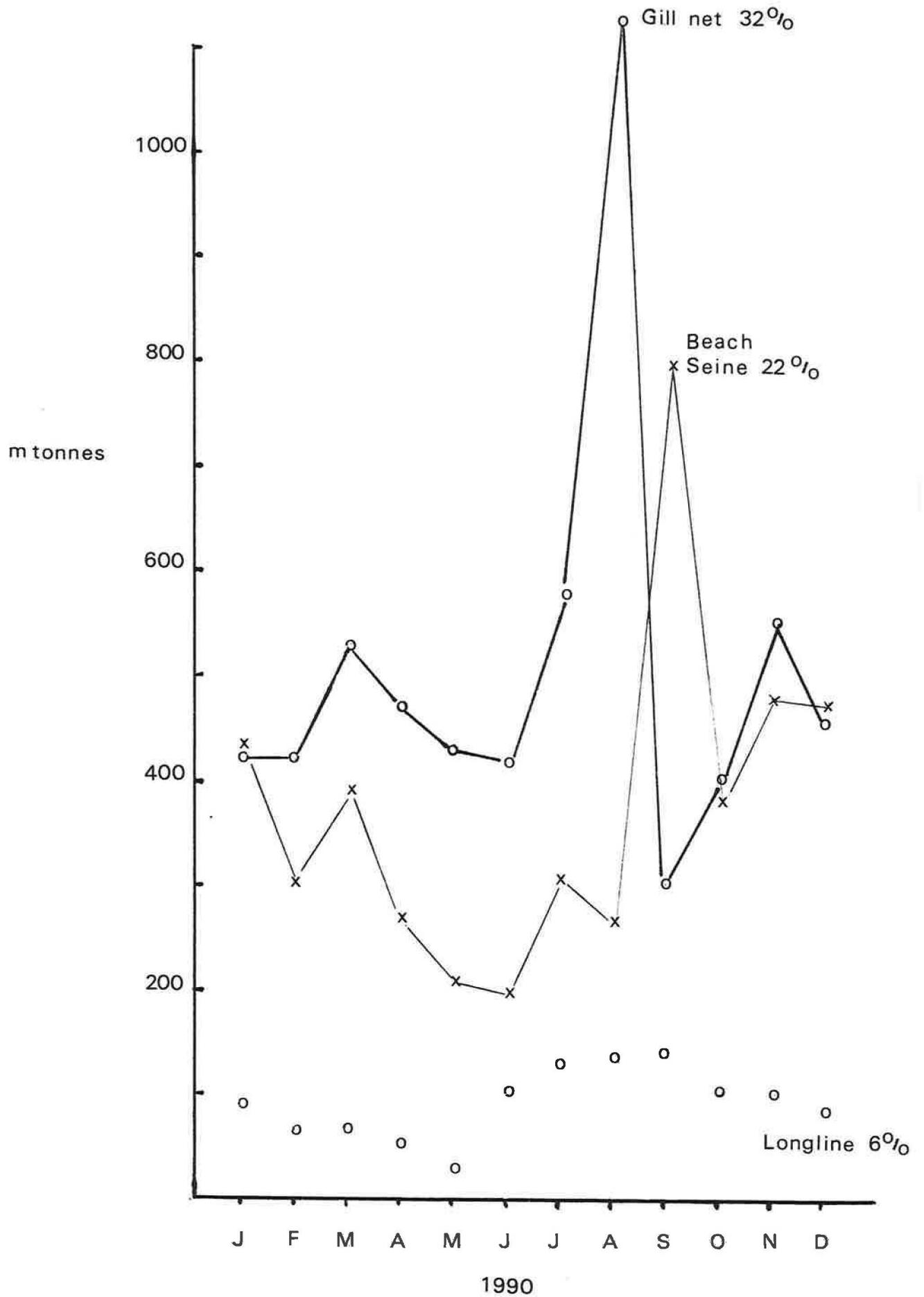
25. Some people hire boats and engines for the express purpose of collecting fresh fish from Ugandan fishermen. Both perch and Tilapia are bought into Kenya but the marketing tends to be separate.

26. Trawling has been banned, and gill nets, mosquito nets and beach seines are the main gears. Gill net mesh sizes range from 4" to 7". The beach seine has become popular, being less susceptible to theft than gill nets, and this is causing serious concern amongst fisheries staff. Beach seines are now officially banned on the Kenyan lake, though their use appears to remain widespread. The mosquito seine is used primarily for the dagaa fishery, but catch data indicate that these "catch all" nets also take significant numbers of juvenile perch and cichlids. The potential significance of the seine fishery is illustrated in Table 3c and Figure 2. The marked peaks of Lates catches occur in August for the gill net fishery and in September for the beach seines. It is tempting to relate this to the spawning patterns of the Nile Perch, and their reliance on inshore nursery areas, although no conclusions can be drawn from the data collected on this mission. What is clear from Table 3c, is that many thousands of tonnes of small juvenile perch are caught by beach seines (and possibly by mosquito seines) each year. The pressure on the fishery is exacerbated by the fact that fish of any size find a ready market in Kenya. In the absence of hard quantitative data this should be a serious cause for concern for the future of the perch fishery, both in Kenya and elsewhere.

#### PRE-HARVEST FISHERY--UGANDA

27. The consultants were informed that a formal request would be required from the British High Commission before catch data could be released. This was not possible due to the short time allocated to the Ugandan part of this study. However, some statistics were available in a paper by the Assistant Commissioner for Fisheries (Dhatemwa, 1989). Additionally, some statistical bulletins were available from Kampala bookshops (Table 4).

FIG 2. CONTRIBUTION BY GEAR TO SAMPLE BEACH CATCHES (KMFRI, 1990), ALL SPECIES



28. The Ugandan fishery appears to be booming, with high production of perch, Tilapia and dagaa. The offshore islands are the primary sources of fish, with the Buvina and Sesse groups dominating. The perch fishery is based on 7"-8" gill nets, although beach seines are also important. The latter gear is not yet banned, but it is discouraged as much as possible. Fishing regulation is seen as a sensitive issue, particularly in the islands.

29. It was suggested that any available catch data would not reflect the true production from Uganda waters since an unrecorded volume of fresh fish is exported to Kenya. This was estimated at 40 tonnes per day, split equally between Nile Perch and Tilapia.

#### THE POST-HARVEST FISHERY--TANZANIA

30. The Lake Victoria fishery in Tanzania is dominated by dagaa and Nile perch. Both species have increased in absolute and relative importance since the introduction of Nile perch. Observations at fish landings and markets suggest that the dagaa fishery may be at least as important, by volume, as the Nile perch fishery. Other species are present in relatively insignificant quantities, though slightly more in evidence in the eastern lake.

#### DAGAA

31. Dagaa is always marketed in dried form (dried on the beach, on the surrounding land, or laid out on cut grass), and tightly packed into gunny bags with dried grass across the top. It is transported by road or open boat, to important fish landings or trading centres, and thence to markets in Tanzania and neighbouring countries.

32. Dagaa is probably the most popular type of fish that can easily be marketed throughout the region. Since it can be sold in very small quantities it is accessible to all income groups. Demand for Tanzanian dagaa is further strengthened by an alleged decline in the Kenyan Lake Victoria dagaa fishery.

33. Kagera dagaa is said to sell at a discount of 20-30% relative to Mwanza dagaa. This reflects poor quality due to both poor drying conditions, and the presence of small pieces of grass which attach themselves to the fish during drying. Losses can also be high when large catches are landed during rainy periods. Additionally, dagaa may take up moisture after it has been dried, particularly when transported by lake during wet weather, or during distribution to/through areas of higher humidity.

## NILE PERCH

34. Nile perch, by contrast, is marketed in various forms: fresh, frozen, smoked, and salt dried.

### FRESH/FROZEN NILE PERCH

35. In densely populated areas, or in areas with good communications to urban centres, the majority of the catch is marketed fresh, mostly without the use of ice. This represents the highest value market, and where there is access to this market, other types of processing are precluded.

36. Most of the fresh fish is retailed locally. There is, however, a small but growing sector (predominantly in the area around Mwanza) engaged in freezing top quality Nile Perch for distribution to urban centres elsewhere in Tanzania and neighbouring countries.

37. In more isolated areas, including islands, Nile perch is preserved by smoking and, to a lesser extent, salted drying.

### SALT DRIED NILE PERCH

38. Salt dried perch is produced for export to Rwanda, Burundi and Zaire. The domestic market for this product is currently negligible. The export trade has been growing since 1987 when policy measures taken under the Economic Rehabilitation Programme made export activities easier and more attractive to businessmen.

39. In Mwanza region, particularly on Ukerewe Island, the authors observed a partial shift from smoking to salted drying of Nile Perch, even during the rainy season. Observations at Kirumba landing near Mwanza (outstandingly the most important fish landing and wholesale marketing centre in the three Tanzanian lake regions) suggested that this trade is probably at least as important as that for smoked Nile perch. This trend allegedly extends into southern Mara region, including some of the islands off Mara. In Kagera region, however, year round wet weather is an obstacle to participation in this activity.

40. Processors in the areas where there was both drying and smoking were divided in their opinion of the relative financial gain associated with each, though the gross revenue from salt dried perch is probably greater. On Ukerewe Island there was some suggestion that fish dryers were (indefinite) migrants from the mainland, with marketing contacts, and presumably less "loyalty" to traditional smoking of perch.

41. Availability of salt was not generally considered a problem by processors. At the time of the visit, salt used in this area was apparently imported from Aden.

42. Dried perch from the islands and isolated fishing communities is landed at Kirumba. Additionally, when prices are low, some traders purchase fresh (though often spoiling) Nile perch to dry on racks at the landing. During wet weather this product has high moisture levels and a very short shelf-life. Processors and traders insisted that this was not, however, a problem, since the product would be moved to markets quickly and more salt would be added if necessary. Where the fresh or dried fish is already spoiling, on being landed at Kirumba, the price paid by processors/traders takes this into account.

43. Dried perch is packed into trucks at Kirumba landing (Fig 3) for immediate transfer by road to export markets (estimated time to reach retail point 24-48 hours).

#### SMOKED NILE PERCH--TRADITIONAL TYPE KILNS

44. Smoking remains an important means of preservation where geographical isolation limits access to the fresh market, and where consistently wet weather, or the absence of linkages with the relatively new dried perch trade, precludes salt drying.

45. In order of importance, the main smoking areas are the western shore and islands (Kagera region), other islands (though around Mwanza there is a partial shift to drying), and the southern shore and islands of Mara region. In northern Mara, which was formerly an important smoking area, fresh fish is being moved into Kenya (an unregulated trade by sea and road), "squeezing" traditional processors. In Nyangombe for instance, the authors saw 28 kilns at one site, more than anywhere else in Tanzania, but only two were in use. In southern Mara there may be a partial shift to salt drying, though smoking continues. No information was available concerning the south-western lake, but it seems likely that this relatively isolated area is also involved in smoking.

46. Smoking appears to be subject to seasonal influences: catches are reportedly higher in the rainy season, so there is an increase in all fishing-related activities; additionally, although salted drying continues in the rainy season in Ukerewe, there is evidence of some "switching" to smoking during periods of prolonged wet weather.

47. The "average" number of days operation per annum is extremely difficult to estimate, partly because of the changes that the processing industry appears to be undergoing. On the western lake, fish supplies permitting, some kilns appear to be used throughout the year, though not necessarily continuously (which amounts to perhaps 100 "batches" of smoked fish per year). Elsewhere, seasonal falls in fish production, and competing demand for the fresh and dried trade, tend to limit smoking activities to the rainy season.



FIG 3

SALTED SUN-DRIED PERCH BEING LOADED  
AT KIRUMBA FOR ZAIRE



FIG 4. A TRADITIONAL MUD KILN  
AT IGOMBE

48. Virtually all of the kilns used are of a traditional type, and vary considerably in design:

- (i) mud walled kilns with multiple mesh racks (Figure 4)
- (ii) multiple mesh trays supported on "legs" driven into the ground, but no walls (Figure 5), and
- (iii) semi-pit kilns, with only one open side and multiple mesh racks laid across the pit

Kilns were mostly outside, but it was not unusual to see type (ii) inside a house. All of the outdoor kilns had corrugated iron sheets as covers, and some had plastic sheeting to protect them from heavy rains (the fire is presumably allowed to die back). All of the kilns seen used wood as fuel, except those on the wood-scarce islands off Bukoba, which used bundles of dried grass. In heavy rain traditional kilns may be damaged, but can generally be repaired at no material cost. The semi-pit kilns are susceptible to flooding during heavy rain.

49. Kiln cost varies considerably. Most kilns are built by the owner, so labour is not costed. Supporting wooden or steel legs and cross beams are usually taken from other equipment no longer used, as are the corrugated iron covers. Walls are made from mud bricks (at no cash cost). The costliest item appears to be the mesh racks (approximately 1,500/- each in March 1991), of which there are usually about seven. Most of the racks appear to be recycled from old kilns.

50. It is extremely difficult to estimate the number of traditional type kilns still used around the Tanzanian lake, partly because of the changes taking place in the processing sector, and partly because the fishing communities tend to be isolated. On the basis of the visits made, the consultants judge that there are likely to be at least 1,000 kilns in use at some point during the year, and there may be considerably more. In particular, it should be noted that no information on activities in the south western part of the lake was available to the consultants, but given its isolation, it seems likely that fish smoking is important there.

51. Discussions with processors indicate that the fatty Nile perch can on occasion catch fire, but that the risk of this is reduced as the operator learns to judge fuel use, and is generally careful with the fire. This appears to be less of a problem now than it was in the eighties when smoking of Nile Perch first became widespread.



FIG 5.  
SIMPLE GRASS OR  
WOOD BURNING  
KILN AT KEREBE

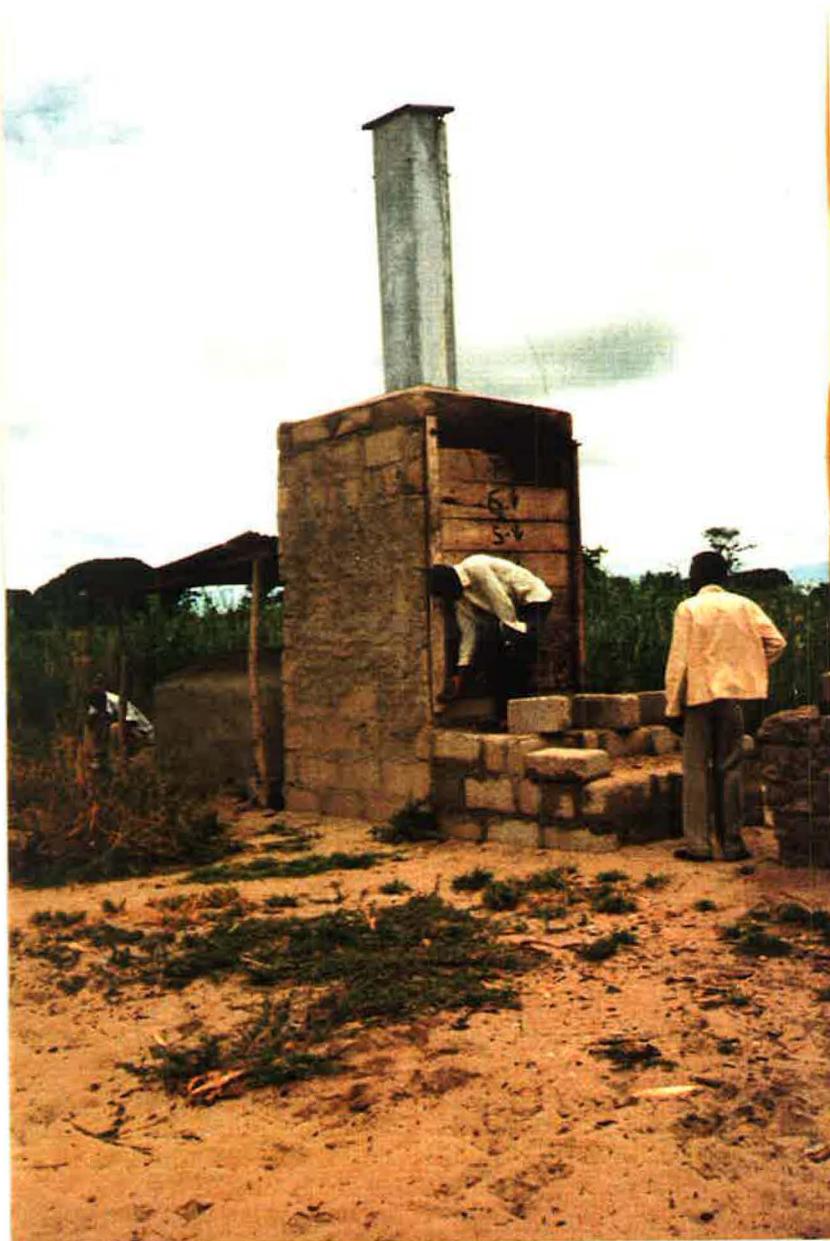


FIG 6.  
THE OPERATIONAL UKERWE "NYEGEZI"  
KILN (SHOWING SIGNS OF FIRE DAMAGE)

52. The quality of the end-product varies considerably. The grass-smoked perch is extremely charred and has a high moisture content. The wood-smoked perch is generally fairly dry and may be quite blackened, unless the operator is careful, when it can be a lighter more attractive product (in the eyes of the consultants). In some places it appears that the lighter product can be sold more easily, or at a premium. The semi-pit kilns seen in Kagera produced a dry, light-coloured product.

53. Similarly, fuel use varies considerably, and depends on the type of kiln and, again, operator care. The kilns seen in Kagera (mesh supported on wooden legs, but no mud walls) are particularly inefficient users of fuel energy.

54. In some areas (Kagera, parts of Ukerewe) wood is gathered, and although processors complain that they have to go further to find wood, it is not a purchased input. In other parts of Ukerewe and in more densely populated areas, wood is purchased, or a vehicle is hired to collect wood from an area where it is more abundant. On Kerebe island, off Bukoba, men and women cut grass for sale to kiln operators.

55. Various different tenure arrangements pertain to kiln operations:

- (i) owner operator responsible for purchase of fresh fish and sale of smoked product
- (ii) owner operator responsible for acquisition of fuel, but carrying out commissioned work for a merchant who supplies the fresh fish (kiln operator is paid piecemeal)
- (iii) either (i) or (ii) but with owner paying someone else to supervise the smoking for all or some of the time
- (iv) owner lets kiln to processors who provide fish and fuel, and pay per "mesh"; several processors may share the same kiln.

56. Wide variation in practice made any meaningful financial analysis extremely difficult. The kilns themselves vary considerably, and are largely constructed with little cash outlay. "Tenure" arrangements vary too. Firewood (or grass) may be purchased or gathered. Profitable operation depends principally on the price of fresh fish, *vis a vis* that of the finished product. This in turn largely reflects ease of access to markets for fresh fish in densely populated areas.

57. Traditional style kilns are clearly inefficient users of fuelwood. In urban areas where fuel wood prices are subject to the greatest upward pressure, the smoking industry appears to be "self-regulated", since traditional processors in these areas are "squeezed" by the fresh fish trade. In these areas, fish smoking consumes less fuel wood than, say, cooking.

58. The authors consider that the relative impact of fish smoking on fuel wood supplies is probably greatest in Kagera region, particularly on the islands. These islands, with their renowned good fish supplies, have drawn people from the mainland. These micro-economies revolve around the Nile perch and dagaa fisheries. The Nile perch share of this economy (40-60%?) is, however, worthless without some form of preservation prior to distribution to mainland markets. Wet weather precludes sun drying of perch, so smoking prevails. Wood was originally used, but with wood resources now severely limited on the islands, dried grass is used. Year round wet weather presumably compounds the damage caused by deforestation.

59. Smoked fish may be stored at processing sites for weeks or even months, whilst a sufficiently large shipment is amassed. Moulds are brushed off or the fish is re-smoked. Some women selling fish in markets re-smoke the fish at home if moulds appear. Fish moved to more humid areas, such as Dar es Salaam, is marketed quickly because of this problem.

60. Smoked perch is marketed predominantly within Tanzania, though there seem to be significant unofficial exports from Kagera region to Zaire/Burundi/Rwanda. Smoked fish is readily sold even in areas quite close to the lake, since ice is generally not available and road communications around the lake are frequently very poor (and time consuming).

61. Many smoked fish traders travel with their fish to the destination market where they depend on a single marketing contact. Smoked fish is mostly sent by rail from Mwanza to Dar es Salaam (and other points south), though road transport is more important for distribution of fish within Kagera region.

#### SMOKED NILE PERCH--THE NYEGEZI KILN

62. Eight Nyegezi style kilns are known to exist, and all were visited. The status of each can be summarised:

- (i) TAFIRI and Training Institute kilns -- non-operational
- (ii) Igombe kiln-- in working order, but not used for some time
- (iii) Nera kiln--privately built, in working order, but not in use
- (iv) Bukoba project kiln--operational
- (v) Bukoba private kiln--operational
- (vi) Ukerewe kiln--operational
- (vii) Nyangombe Kiln--a cracked door, but workable though not in use

63. Whilst people actually operating the kilns were in favour of the design, it was clear that there remain operational problems. With the exception of the large private kiln at Bukoba, all operational kilns had caught fire at some time. This appeared to be the result of careless use of firewood combined with an absence of control over the furnace air inlets. Only the Bukoba private kiln had adjustable doors on the inlets the other operational kilns were fully open-vented. Extensive damage to shelving supports and doors had resulted from fires (Fig 6). In addition, three of the four imported cast iron doors had cracked (Bukoba, Nyangombe and Mwanza Training Institute), and wooden fixtures were subject to termite damage.

64. Despite these problems, operators believed that the Nyegezi kiln used 50-70% less fuel than traditional type kilns, and felt that the smoked product was superior. However, it was clear that there are considerable problems even for entrepreneurial processors with access to capital. The Nera, Nyangombe and Igombe kilns had been out of use for some time and the Bukoba project kiln was rented out rather than run by the allocated operators. The reason given at Nera, Igombe and Bukoba was that the operators did not own nets or boats and found that if they bought fish to smoke, the product although very good, was too expensive to move quickly on the market (all three kilns are located in areas where fresh fish can be easily marketed). The most enthusiastic users were the private Bukoba (Fig 7) and project Ukerewe operators; the former owns a trawler, and the latter gill net fleets.

65. Profitable operation of the kiln therefore seems to depend on an adequate cheap supply of raw material (i.e., sited in an area of fish production which is distant from fresh fish markets); sufficient operating capital to keep the kiln operating at capacity (which is significantly more than that of traditional kilns); and fuel wood being a traded commodity (which therefore has a value other than the opportunity cost of the labour used to collect it). There is currently a tendency for traditional smoking to be concentrated in geographically isolated areas, with few other employment opportunities, where wood is less likely to be a traded good.

66. The relatively high capital cost of the Nyegezi kiln (70,000-100,000/- depending on the cost of a locally manufactured door, see para 82) puts it out of reach of most artisanal processors. Even renting space in such a kiln is unlikely to be straightforward. The owner would necessarily seek to recover his capital cost, and the logical saving is in fuel wood use. If the kiln is let, with the lessee providing the fuel wood, then the letting price would be higher than that of traditional kilns, requiring a certain transparency of operational coefficients if this arrangement is to be attractive to the processor.



FIG 7

THE LARGE BUKOBA PRIVATE KILN

KILN DOOR



## SMOKED NILE PERCH--OTHER "IMPROVED" KILNS

67. Altona kilns are in regular (rented) use at the Fisheries Office in Nansio, and were presumably felt to be better than the mud kiln, although there was no suggestion of much reduced fuel costs. Interestingly, one of the fisheries officers stopped renting Altona space and built his own mud kiln. Fish Products Supplies Limited has a fifteen kiln Altona house near Mwanza, but this is currently only in intermittent use. The owner has three trawlers which are producing extremely poor catches. These are the only two sets of conventional Altona kilns known to the authors on the Tanzanian lake, other than those at training institutes.

68. Modified Altona-type kilns (built using locally available materials) were in use in Mara region (perhaps 10-20). Those seen near Musoma had been adopted by businessmen or fisheries officers as a result of the local fisheries extension programme. They produced a dry, light product and apparently used less fuel than traditional kilns although it was not possible to quantify this. None of the three modified Altonas at Michire (Shirati) has been used since Autumn 1990, and the women's scheme reported by Stickings (1990) appears to have collapsed.

69. A project in Michire had also attempted to introduce Chorkor-type kilns (which are essentially very similar to the traditional mud-walled kilns) to women's groups, but at the time of the visit this scheme was no longer functioning.

## NILE PERCH FRYING

70. Another form of processing which is widespread throughout the areas visited is fish frying. This is exclusively a women's activity. Relatively small quantities of fish are purchased at the landing, and processed there, or at home, for retailing the same day.

71. As a general rule the direct involvement of women in the Tanzanian lake fishery is fairly limited. Women are involved in frying, and fish retailing. Additionally in Kagera region, women are involved in re-selling of fish at fish landings (small wholesale quantities), occasionally fish smoking, and grass cutting.

## POST-HARVEST FISHERY KENYA

72. Kenya has clearly developed into a producer of fresh and frozen fish for both internal consumption and export. Traditional smoking is diminishing in importance. As with the northern Mara situation, the fish has become too expensive for smokers to purchase. There are several commercial frozen fillet companies which purchase fish for export and the high value hotel/restaurant domestic market.

73. Two markets in Kisumu (one private, one municipal) specialise in fresh Tilapia brought from Uganda. The municipal market has a chill room and ice facilities. The Tilapia trade appears to be dominated by women, both as buyers, and as retailers and distributors. The fish is landed at Port Victoria, 1.5 hours by road to Kisumu, and taken on ice to markets in Kisumu (in pick-ups rented by women). In Kisumu the fish is sold to women fish vendors at the two markets, or packed on ice for road transport to Nairobi or Mombasa.

74. By far the most interesting post-harvest development in the Kenyan perch fishery has resulted as a spin-off from the frozen fillet business. The fish purchased for filleting are large and generate a substantial volume of carcasses with meat attached. A site of several hectares has developed at Obunga in Kisumu where women process the skeletons. The primary activity is cutting up and frying the frames, but there are several sub-specialities. Some women buy skins and scrape off the flesh to fry as perch chips. Others specialise in heads, cutting out the muscle, and then cooking the head and removing the skin. Another group specialise in drying the skins to sell as fuel, and yet others collect swim bladders.

75. This development illustrates how a change in fish processing (ie, smoked to fresh/frozen), which has displaced traditional processors, can lead to new opportunities for the artisanal sector.

76. The Kenya Marine and Fisheries Research Institute is producing high quality smoked perch fillets (AFOS kiln) and fish cakes which they hope to market in Nairobi and Mombasa. Interest was expressed in the Nyegezi kiln for this activity. No salting and sun drying of perch was reported in Kenya.

#### POST-HARVEST FISHERY UGANDA

77. Like Kenya, Uganda has a small industrial fish processing sector. Fillet freezer plants, traditional processing, and an important fresh fish trade for the domestic and Kenyan market co-exist. Unlike Kenya, smoking has retained an importance for the same reasons as persist in the Kagera region of Tanzania. Much of the fishing is from offshore islands, and fishermen are obliged to preserve fish by smoking.

78. Although most of the smoking allegedly occurs on the islands, a visit to Kasenyi, near Entebbe, revealed the largest collection of smoking kilns (30+) seen during the entire trip. These were a mud brick chorkor type, but were little different from traditional mud kilns, being single oven and lacking stackable trays. A few were in use whilst we were present, but a petrol shortage had limited the fish coming from the islands by motorised canoe. The smoked product landed on the beach from the island was extremely black and charred, even though the fuel used is wood (not grass). The product seen on the market in Kampala was similar in appearance.

79. Discussions with fisheries staff suggest that a wide range of kilns, from pits to completely enclosed types (ie, within houses), are used on the islands. Fuel wood is still readily available although supposedly expensive.

80. Two commercial smoking operations have been developed in Jinja. The first, with Italian aid, produces a cold smoked product, and the other, a large scale AFOS kiln (1-2 tonnes per day) is hot smoking. In both cases the European market is the target.

#### THE LAKE VICTORIA FISHERY: ECONOMIC SUMMARY

	TANZANIA	KENYA	UGANDA
<b>Country</b>			
Fish production 1988 ( '000 tonnes)	400	135	215
Kgs fish/capita/year	16	6	12
Fisheries contribution to GDP	-	0.3%	1%
Official exports 1989 (tonnes)	1,700	7,300	225
<b>Lake Victoria</b>			
Fish production ('000 tonnes)	220	125	130
Estimated Nile perch share	50-60%	50%	80%
Number of fishing boats	6,500	5,000	-
% of boats motorised	3%	-	-
Estimated people employed ( '000)			
--fishermen	23	-	47
--handling and distribution	-	-	93
--other related activities	-	-	93
% of production marketed fresh	55%	55%	60%

[ - "data not available"]

#### THE NYEGEZI KILN PROJECT

81. The Nyegezi kiln can be attractive to entrepreneurs with adequate investment and operating capital. The two main advantages perceived by users are fuel savings (of 50-70%) and a more attractive (higher value) product. Fuel savings can be translated into financial gain where fuel wood is a purchased input. Premium prices for improved quality can be realised for significant quantities of smoked perch where there is access to a higher income urban market.

82. Siting of the kiln is a crucial factor determining profitability of smoking (using any kiln) since this dictates the cost of the most important input (fresh fish). Neither the project kiln at Bukoba (which is occasionally rented out but not used by the intended operators) nor the private kiln

at Nera, Mwanza (which is no longer used) has access to a cheap supply of fresh fish. In Bukoba, fairly meagre landings of fresh fish can easily be sold at premium prices in local retail markets; in Mwanza, large landings of fresh fish are readily absorbed by this large urban market (and surrounding areas served by tarmac roads) and by traders distributing frozen fish to other areas. The increasing cost of fresh fish is a factor contributing to the non operation of mainland kilns at Igombe and Nyangombe. In both places the growing demand for fresh fish (urban demand and Kenyan demand) is starting to displace traditional processors who cannot compete with the higher prices. The other two kilns that are non-operational were built at government institutes for demonstration purposes.

83. The larger privately-built kiln at Bukoba processes fish caught by the owner's own trawlers (which operate on the western lake where catches are still high). He presumably finds it difficult to sell these relatively large quantities of fish locally at remunerative prices, and smoking is therefore an attractive option. Similarly, the project kiln in use on Ukerewe island is supplied by the operator's own gillnets and beach seines, and the traditional processing industry is also clearly strongest in places where fish is abundant, but markets distant.

84. The earlier socio-economic study (Stickings, 1990) raised the issue of the high cost of the Nyegezi kiln (ca. 136,000/-) as a factor which would limit uptake even under credit schemes. The Nyanza Foundry Company has examined the kiln door, and estimate that these could be produced for a maximum of 10,000/- (£28) with a reduction for bulk purchase. It is likely that similar reductions will be made on the grate and on other fixtures, suggesting that the overall cost of the kiln might be reduced to approximately 70,000/- to 100,000/- (compared to a cost of perhaps 10,000/- for a traditional kiln). A full written costing is awaited from the Foundry.

#### PROPOSED FISHERIES SUPPORT PROGRAMMES FOR LAKE VICTORIA

85. The FAO Investment Centre sent a team of consultants (including a post-harvest expert) to Tanzania in October/November 1990 (FAO, 1991) to prepare a project aimed at supporting artisanal fisheries development in Mara region and Ukerewe. The project is to be funded through an African Development Bank loan, and is due to start in 1991. The project covers pre-harvest issues, but also allows for provision of credit to build 30 smoke kilns of the Nyegezi type in the commercial sector. The report bases this recommendation on data apparently provided by TAFIRI from the NRI project. It is understood from FAO Rome that a revised version of this proposal may be in preparation, recommending a somewhat broader-based post-harvest approach.

86. UNDP is to provide support to fisheries development in Kagera region commencing in 1991 (UNDP,1990). The project will cover several areas including gear, engines and post-harvest problems. The project document mentions development of "back garden" kilns and insulated containers for bicycle transport of fresh Nile perch. A UNFPA project is also planned for the east lake shore fishing communities with special emphasis on women. There is likely to be some scope for a post-harvest fishery component in this project.

87. Phase I of an EEC regional project is under way, although behind schedule. The emphasis has been on up-grading of research vessels and gear. Phase II was discussed at a meeting in Jinja from 7-8/4/91, and is likely to concentrate on fisheries management.

#### CONCLUSIONS AND RECOMMENDATIONS

88. Although Nile perch processing has become more diverse in Tanzania, smoking remains important, particularly in isolated areas such as islands, and on the western shore. Elsewhere, some decline in smoking is due to increases in the fresh fish trade (urban demand and leakage to Kenya), salted dried perch (for export to neighbouring countries, with Mwanza representing the main collection point), and frozen perch (still a relatively small volume but increasing in the Mwanza and Musoma areas).

89. The relative impact of smoking on fuel wood reserves is probably greatest in Kagera region, and on islands entirely dependent on fishing activities. Additionally, year round wet weather in this region is likely to compound the damage caused by deforestation. On some of these islands, where fuel wood has become severely depleted, fish is now smoked using dried grass, resulting in a high moisture short shelf-life product.

90. The Nyegezi kiln offers advantages over traditional type kilns in terms of product shelf-life and fuel efficiency. These advantages have considerable appeal to a certain kind of commercial processor, a fact which is reflected in the enthusiasm of Regional Fisheries and TAFIRI staff for what is clearly perceived as desirable technological development in Tanzanian fisheries. It is difficult, however, to see the Nyegezi kiln as a solution to the smoking needs of the many remote and resource-poor fishing communities, where preservation is key to market access.

91. Many other problems were evident in the fishing communities visited. Some artisanal processing communities have been "squeezed" by high fish prices, as fresh fish traders spill out to areas of more abundant fish supplies. This will tend to have a redistributive effect within fishing communities, with fishermen and traders gaining, at the expense of traditional processors. The authors observed that the Lake Victoria dagaa fishery is extremely important, and subject to drying problems during wet weather (particularly in Kagera region). The authors also noted that fish spoilage in

gill nets appears to be a significant source of loss, and the gill nets themselves are subject to theft, causing a harmful shift to beach seines in some parts of the lake. On the Tanzanian shores, Kagera region seems to suffer the lowest per capita incomes, largely because of its relatively isolated location and poor infrastructure.

92. The complex interactive nature of these problems, and the need to find workable local solutions, suggests that they can only be effectively tackled through local organisations adopting an integrated and flexible approach to the constraints and opportunities faced by these communities.

93. In recognition of this, various integrated community development projects are planned to commence this year, with varying degrees of focus on fisheries. TAFIRI, whose field presence is limited by under-resourcing and few staff, has collaborated with the executing agencies in the planning of some of these projects. These projects would appear to represent the most appropriate avenue for assistance to the fishery and for further NRI involvement.

94. It is recommended that Fisheries Section, in collaboration with ESSD, appraise the FAO Representative in Dar es Salaam of the results of the current mission, and offer the services of NRI in defining the objectives and strategy of the post-harvest component of the proposed Mara/Ukerewe project. This would provide an opportunity to determine the most appropriate role for the Nyegezi kiln in the context of the emergent trends in Lake Victoria fish handling.

95. In the event of a positive response from FAO, Fisheries Section should consider the investment of further R & D funds for the development of solutions to post-harvest problems faced by the fishing communities of Kagera region. The use of grass for fish smoking on the West Lake islands is an area that merits further attention.

96. It was noted that the pre-harvest fishery posed many important unanswered questions. The apparent disproportionate decline in the trawl fishery, the seasonal and spatial movements of the perch, and the impact of the seine fishery on recruitment are obvious examples. It is recommended that NRI liaise with the EEC regional fisheries project to ascertain whether a role could be established for NRI in the development of Phase 2 pre-harvest activities.

97. On a broader level, it is recommended that NRI Fisheries and ESSD staff meet to consider the results of this mission, and recent research identification work undertaken in West Africa and south-east Asia, in order to pool ideas and themes.

## **APPENDIX 1**

### **TANZANIA FISH KILNS PROJECT - DRAFT TERMS OF REFERENCE FOR A VISIT BY B BLAKE AND A GORDON OF THE NATURAL RESOURCES INSTITUTE.**

The objective of the visit is to conclude the NRED-funded post-harvest research project on the Nile perch fishery of Lake Victoria (Tanzania), and to provide the basis for the final report and recommendations of this work.

The consultants will:

1. Review the current state of the fishery in both pre-and post-harvest terms. This will include trends in catch volume/composition and the economic importance of the fishery in local and national terms.
2. Assess any significant changes in the catching, landing, processing and marketing of Nile perch which have occurred since the NRED-funded project began in 1987.
3. Assess the current relative importance of smoking as a means of preservation in both economic and, as far as is possible, environmental terms.
4. Investigate the number, type and performance of "improved" and traditional kilns now in operation, including the Nyegezi model. This will include financial analysis of kiln operation and consideration of the environmental implications of fuelwood consumption.
5. Summarise any problems found to be constraining exploitation of the fishery and prepare a report which identifies the essential criteria for addressing these problems in technical, socio-economic and institutional terms.
6. Submit a Back to Office report to the project Manager within one week of visit completion, and a final report within one month.

### **TANZANIA KILNS PROJECT, CONCLUDING MISSION - TORS FOR BRIEF VISITS TO KENYA AND UGANDA.**

#### **BACKGROUND**

The proposed visits to Kenya and Uganda are for a maximum of two or three days each. The broad objective is to help put the final report of the Tanzania kilns project in the context of the overall Lake Victoria fishery for Nile Perch.

#### **TOR - KENYA**

1. To establish the routes, preservation methods, quantities and fate of Tanzanian Nile Perch exported through Kenya.

2. To look briefly at processing methods on the Kenyan lake shore in the context of current Tanzanian practices.

#### **TOR - UGANDA**

1. To establish the size and nature of the Ugandan Nile Perch fishery and the relative importance of different processing methods.

2. To establish the marketing strategy of the fishery and the fate of the Ugandan lake production.

3. To look briefly at processing methods on the Ugandan lake shore in the context of current Tanzanian and Kenyan practices.

#### **APPROACH**

Given the extremely short time in each country the TORs can only be realised with the cooperation of the local and national fisheries authorities. Most of the information will be derived from officials and any available statistics rather than by observation.

## APPENDIX 2

### ITINERARY

- 24/3 pm - A Gordon arrives Dar es Salaam  
25/3 am - To Bureau of Statistics  
- B Blake arrives Dar es Salaam  
pm - BHC--Mr S Crossman  
- To Dept. of Fisheries to make an appointment with Director.
- 26/3 am - To Kunduchi to see Prof Bwathondi, Director (TAFIRI). Also met Mr Nawani and Mr Mlay a processing specialist from TAFIRI, Kyela.  
pm - To Dept. of Fisheries, meeting with Mr Sichone (Director), also Mr Mngulwi & Mr Mbagwile.  
- Visited Kariakoo fish market.  
- Read Fisheries Dept. papers.
- 27/3 am - FAO Rep--Richard Fuller.  
pm - Flight to Mwanza  
- Flight diverted to Nairobi then on to Mwanza arrived 1600.  
- Travelled to Igombe by taxi, but prevented from reaching by flooded road.
- 28/3 am - Mr Mulegi, Regional Natural Resources Officer.  
- Mr Mairi, Asst. Municipal Fisheries Officer.  
- Mr Mtolela, Regional Fisheries Officer.  
pm - TAFIRI, Mr Katunzi, Mrs Mkumbo and Mr Zenge.  
- Fisheries Training Institute, Mr Mapunda  
- Kirumba fish landing
- 29/3  
am - PUBLIC HOLIDAY  
- Went to Nyanza Foundry, but closed.  
- Tried to contact Fish Products Supplies Ltd, but was closed.  
pm - Went to Kirumba fish market
- 30/3 am - Nyanza Foundry  
- Fish Products Supply Co.  
- Igombe fishing village
- 31/3  
1/4  
- EASTER SUNDAY - PUBLIC HOLIDAY  
- To Ukerewe  
- Visited Regional Fisheries Officer, Nansio  
- Went to Bugasa village  
- Continued to Kaseni village
- 2/4  
- Visited fisheries office and met DFO, Mr Barwan  
- Went to Bukimi and Busaga villages  
- Returned to Mwanza  
- Night boat to Bukoba
- 3/4  
- Arrived Bukoba  
- Visited Regional Natural Resources Officer, Mr Masongo and extension workers Mr J Majaliwa, Mr Mbena and Mr J Tiyahirwa  
- Visited Kemondo fish market  
- Visited the Regional Fisheries Officer, Mr K E Rushoke  
- Spoke to owners of the two Nyegezi style kilns in Bukoba  
- Visited Bukoba market

4/4 - Visited Bukoba market  
 5/4 am - Chartered boat to Kerebe Island (all day)  
 - To Igabilo & Kionga fishing villages  
 - To Kyaka, market town  
 6/4 - overnight travel back to Mwanza by boat  
 - Tried to see Regional Natural Resources Officer  
 and Regional Forestry Officer. Neither  
 available.  
 - Went to Nyanza Foundry  
 - Arranged car hire for remainder of trip  
 - Meeting with Yves Fermon, lake ecologist  
 - Afriline Cold Storage  
 - Departed for Kijereshi, en route to Musoma  
 - Kalemela fishing village  
 7/4 - Sunday at Kijereshi, report drafting  
 8/4 - Drove to Musoma  
 - Fisheries Training Institute  
 - Regional & District Fisheries Officers  
 - Visited kilns, landing site and market  
 - Drove to Shirati  
 - Visited TAFIRI sub-station  
 - To Michire village  
 - To Nyangombe village  
 9/4 - Drove to Kenya  
 - Stopped at Homa Bay landing site.  
 10/4 - KM & FRI  
 - Usigu Project  
 - Nyanmonge market  
 - KM & FRI  
 - Maseno South Diocese  
 - Obunga processing centre  
 - Municipal Fish Market  
 - Kondele tilapia market  
 11/4 - To Nairobi  
 - BDDEA, G Gilman  
 - BHC  
 - Fisheries Department  
 12/4 - To ENTEBBE, Uganda  
 - Dept of Fisheries - Assistant Commissioner  
 - Katwe market, Kampala  
 13/4 - Kampala  
 - Kasenyi landing and processing centre  
 14/4 - Return to UK

### **APPENDIX 3**

#### **LIST OF PEOPLE CONTACTED DURING VISIT**

Steve Crossman  
Aid Secretary  
British High Commission  
Dar es Salaam

W P Lupassa  
Brueau of Statistics  
Dar es Salaam

Professor Bwathondi  
Director  
Tanzania Fisheries Research Institute (TAFIRI)  
Kunduchi

MKL Mlay  
Centre Director  
TAFIRI, Kyela

L B Nhwani  
Principal Research Officer  
TAFIRI Headquarters  
Dar es Salaam

W A Sichone  
Director of Fisheries  
Fisheries Department  
Ministry of Lands,  
Natural Resources and Tourism  
Dar es Salaam

Baraka S M Mngulwi  
Fisheries Planning Officer  
Fisheries Department  
Dar es Salaam

A D Mbagwile  
Boat Builder  
Fisheries Department  
Dar es Salaam

Richard Fuller  
FAO Representative for Tanzania & The Seychelles  
Dar es Salaam

Mr Mulegi  
Senior Regional Natural Resources Officer  
Mwanza

Julius Mairi  
Assistant Fisheries Officer  
Municipal Fisheries Office  
Mwanza

J C L Mtolela  
Regional Fisheries Officer  
Mwanza  
Oliva C Mkumbo  
Researcher  
TAFIRI  
Nyegezi

C D Katunzi  
Head of Station  
TAFIRI  
Nyegezi

B Xavery Zenge  
Technician  
TAFIRI  
Nyegezi

Rafael R Mapunda  
Principal  
Freshwater Fisheries Institute  
Mwanza

N M Lukanya  
General Manager  
Nyanza Engineering and Foundry Co Ltd  
Mwanza

Y Mwakitosi  
Fish Products Supplies Ltd  
Mwanza

Mr Joaquim  
Fish Processor (Nyegezi kiln)  
Igombe

Cleophace Mihigo  
Nyegezi kiln operator  
Bugusa  
Ukerewe

Mr Barwan  
District Fisheries Officer  
Nansio  
Ukerewe

Kija Maduka  
Fish Processor  
Busaga  
Ukerewe

Joseph Masongo  
Regional Natural Resources Officer  
Bukoba

Mr Kagombola  
Fisheries Statistics Officer  
Kemondo  
Kagera Region

K E Rushoke  
Regional Fisheries Officer  
Bukoba

Severin Mbeni  
Fisheries Extension Officer  
Bukoba

Joseph Majaliwa  
Fisheries Statistics Officer  
Bukoba

Josephat Tiyahirwa  
Fisheries Legislation Officer  
Bukoba

Shija Makoye  
Private operator of Nyegezi kiln copy  
Bukoba

Mr Kasongi  
Forestry Officer  
Kagera Regional Office  
Bukoba

Mr Kagashe  
Regional Administrative Officer  
Bukoba

E Lovililo  
Nguvu Moja Wazazi  
(Firewood Co-operative)  
Kirumba  
Mwanza  
Yves Fermon  
Ecologist  
HEST (Fisheries Research Project)  
Mwanza

Hassan M Akrabi  
Director  
Afriline GT Ltd  
Mwanza

E S Kilosa  
Regional Fisheries Officer (Mara)  
Musoma

J J Munisi  
Regional Natural Resources Officer (Mara)  
Musoma

Meison Bwogi  
District Fisheries Officer  
Musoma  
I B Shaban )  
Simon Biseko )  
Herodias Matoke )  
Mwigabero Landing Fisheries Statistics Officers  
Musoma

Mr Lukuba  
Fish Processor  
Musoma

Jonathan Rwegasira  
Fish Processor  
Musoma

Bakari Mohammad  
Administrative Officer  
TAFIRI Sub-Station  
Shirati

Mr Chitamoyba  
Head of Station  
TAFIRI  
Shirati

Mr Ogunja  
Acting Deputy Director  
Kenya Marine and Fisheries Research Institute  
Kisumu

Joseph  
Food Technician  
Kenya Marine and Fisheries Research Institute  
Kisumu

Francis Wasonga  
Researcher  
University of Nairobi  
Usigu Fish Processing Project

Paul Okollu  
Development Co-ordinator  
Diocese of Maseno South  
Kisumu

P N Kamande  
Deputy Director  
Department of Fisheries  
Ministry of Regional Development  
Nairobi

Peter Kariuki  
Statistician  
Department of Fisheries  
Ministry of Regional Development  
Nairobi

Geoffrey Gilman  
Natural Resources Adviser  
British Development Division of East Africa  
Nairobi

Sally Bull  
Aid Secretary  
British High Commission  
Nairobi

C M Dhatemwa  
Assistant Commissioner of Fisheries  
PO Box 4  
Department of Fisheries  
Entebbe

TABLE 1

FISH CATCH DATA

1. TANZANIA

A. REGIONAL FISHERIES OFFICE, MWANZA - NILE PERCH LANDINGS AT SAMPLED BEACHES, 1989.

STATION	tonnes	
Kalemele	43,505	
Kayenze	14,941	
Nyakliro	4,234	
Ukerewe	22,929	
Nkome	684	
Busisi	2,317	
Chakula Barafu	64,074	(includes Kirumba)
Misungwe	634	

Total Perch Landing 153,318 mt (74% of catch) for Mwanza region.

B. MUNICIPAL FISHERIES OFFICE, MWANZA - PROCESSED PERCH LANDINGS AT KIRUMBA, MWANZA (tonnes).

	Smoked	Salted *
1990		
J	-	-
F	9.6	-
M	4.3	-
A	8.0	-
M	10.0	-
J	23.5	-
J	20.5	-
A	8.8	-
S	16.5	-
O	15.0	-
N	2.0	6
D	18.1	10
1991		
J	45.7	83.8
F	4.3	10.0

\* Recorded only after Oct 91)

C. REGIONAL FISHERIES OFFICE, MWANZA - LANDINGS OF NON PERCH SPECIES AT MWANZA REGION SAMPLE BEACHES, 1989.

Species	tonnes
Tilapia spp.	14,200
Clarias	11,000
Schilbeids	6,900
Synodontis spp.	6,000
Bagrus	5,300
Protopterus	3,400
Dagaa	3,000
Labeo	2,000
Haplochromis	900
	<hr/>
	52,700 (26% of Total Landings)

D. FISHERIES DIVISION NATIONAL STATISTICS, 1988 - LAKE VICTORIA CATCHES

REGION	WEIGHT OF FISH PER FISHERMAN t		TOTAL CATCH	TOTAL PERCH	
	1987	1988	1988	1988	%
MARA	4.0	4.6	29,162	22,555	76
MWANZA	9.9	15.0	156,020	111,268	71
BUKOBA	4.6	5.4	33,261	14,740	44
			<hr/>	<hr/>	<hr/>
			218,443	148,563	68
			<hr/>	<hr/>	<hr/>

**TABLE 2**

**TRENDS IN LAKE VICTORIA FISH CATCHES FROM KENYA AND TANZANIA**

		1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
TOTAL CATCH tonnes	1	Kenya 45,667	60,958	77,327	71,854	89,589	103,000	113,000	125,071	-	-
	2	TNZ 70,619	63,996	72,586	99,686	98,971	217,162	159,915	218,443	-	-
% contributed by weight of LATES	3	Kenya 60	54	68	58	57	55	60	49	53	57
	4	TNZ 0.4	3	23	53	38	57	61	68	74 (Mwanza)	-
% contributed by weight of Dagaa	5	Kenya 20	17	21	27	29	34	29	33	-	40
	6	TNZ 5	4	4	2	8	6	10	6	1 (Mwanza)	-

- Source of data
1. 1981 - 1988 Adapted from ACHIENG, 1990.
  2. FISHERIES DIVISION STATISTICS.
  3. 1981 - 1988 ACHIENG, 1990; 1989 - 1990 - KMFRI per comm.
  4. 1981 - 1988 FISHERIES DIVISION STATISTICS; 1989 RFO, pers comm.
  5. 1981 - 1988 ACHIENG, 1990; 1990 - KMFRI pers comm.
  6. 1981 - 1988 FISHERIES DIVISION STATISTICS; 1989 pers comm RFO.

"-" not available

TABLE 3

FISH CATCH DATA

2. KENYA

A. KMFRI SAMPLE BEACH DATA ( TONNES)

SPECIES	1989	%	1990	%
Lates	7,990	53	10,784	56.7
Dagaa			7,543	40.0
Oreochromis Niloticus			270	1.4
O. Leucostictus			19	0.1
O. Variabilis			97	0.5
T. Zilii			19	0.1
Haplochromis spp.	226	1.5	135	0.7

B. ESTIMATED TOTALS FOR LATES CALCULATED FROM KMFRI SAMPLING DATA AND ADJUSTED FOR THE KENYA LAKE FISHERY

AVERAGE WT Kg PER BOAT DAY	NO.OF DAYS FISHED	NO.OF BOATS	TOTAL CATCH	TOTAL PERCH
1989 179.7	250	5000	224,625	119,051
1990 152.1	250	5000	190,125	107,800

These estimates are far higher than the official figures for 1987/88, and should be regarded as "speculative".

C. ESTIMATES OF BEACH SEINE CATCHES

	TONNES
1. USENGE BEACH ONLY, FEB 1990	138
2. " " " 1989 TOTAL	1,322
3. " " " 1990 TOTAL	3,157

NUMBER OF BEACHES SEINED = 22 OF WHICH 10 ARE MAJOR.  
 TOTAL BEACH SEINE CATCHES 1990 THEREFORE ca 20,000t ?  
 LATES IS 75% OF CATCH, SO TOTAL SEINED PERCH 15,000t ?

TABLE 4

FISH CATCH DATA

3. UGANDA - (From Dhatemwa, 1989)

TOTAL UGANDAN WATERS CATCH 1988 214,302t

LAKE VICTORIA

SPECIES	TONNES	%
LATES	92,032	86
TILAPIAS	11,570	11
BAGRUS	206	0.2
BARBUS	30	0.03
CLARIAS	429	0.4
PROTOPTERUS	315	0.3
OTHERS	2,510	2 (DAGAA?)
TOTAL	<u>107,092</u>	

## LITERATURE CITED

Achieng,A.P.(1990). The impact of the introduction of Nile perch,*Lates niloticus* (L) on the fisheries of Lake Victoria. *Journal of Fish Biology* 37,17-23.

Cole,R.C. (1984). Improved utilisation of Nile perch. Report on a visit to Kenya on behalf of FAO.

Dhatemwa,C.M.(1989a). Fish Processing and Marketing in Uganda - Institutional aspects.Internal Report 5pp

Dhatemwa,C.M.(1989b). Fish handling,processing and storage in Uganda. A review of post-harvest losses, Internal report 13pp.

FAO Investment Centre (1991). Fisheries Development Project Preparation Mission. Report No:18 AF-URT 44.

Ligvoet,W., Mous, P.J., Budeba, Y.L., Mkumbo, O.C. & Klinge,M.(1989). Features of the developing artisanal Nile perch (*Lates niloticus*) and dagaa (*Rastrineobola argentea*) fisheries in southern Lake Victoria, 15pp.

Ministry of Lands,Natural Resources and Tourism,Tanzania (1988). Fisheries Division Annual Statistics Report.

Ministry of Planning and Economic Development,Uganda (1990). Background to the Budget,1990-1991.

Ministry of Planning and Economic Development,Uganda (1991). Key Economic Indicators - 4th issue :January 1991.

Poulter,R.G.(1986). SADCC workshop on management and exploitation of fisheries resources,Tanzania. NRI internal report.

Rogers,J.F. (1987). Report on a visit to Tanzania to examine the utilisation of Nile perch from Lake Victoria. NRI internal report.

Rogers,J.F. (1988). Report on a visit to Tanzania to examine the wet season utilisation of Nile perch from Lake Victoria. NRI internal report.

Rogers,J.F. & Tariq,A.S.(1989a). Report on a visit to Tanzania to construct and test an improved design of fish smoking kiln. NRI internal report.

Rogers,J.F.,& Tariq,A.S.(1989b). Report on a visit to construct a fuel efficient fish smoking kiln for field trial by artisanal fish processors in fishing villages,Lake Victoria,Tanzania. NRI internal report.

Stickings,J.(1990). Proposed Lake Victoria fish kilns project,Tanzania. NRI internal report.

#### OTHER LITERATURE CONSULTED

Bacle, J. & Cecil, R. (1989). Artisanal fisheries in Africa - surveys and field research towards development. Canadian International Development Agency document.

Greboval, D.F. & Reynolds, J.E. (1988). Socio-economic effects of the evolution of Nile perch fisheries in Lake Victoria. A review document, Tech. no. 17, FAO - CIFA 148pp.

Infofish (1986). Kenya - developing the Nile perch fishery of Lake Victoria. Infofish Marketing Digest No. 6.

Kent, G. (1988). Improved use of fisheries resources. Food Policy 13, No. 4, p 341- .

Maembe, T.W. (1990). A review of the main characteristics of long distance fish trade from Lake Victoria, Tanzania. IFIP Consultancy report, 32pp.

Ministry of Finance, Economic Affairs and Planning, Tanzania (1987). Selected Statistical Series 1951-1985. Bureau of Statistics, June 1987.

Ministry of Finance, Economic Affairs and Planning, Tanzania (1988). 1988 Population Census - Preliminary Report. Bureau of Statistics.

Ministry of Finance, Economic Affairs and Planning, Tanzania (1990). Agricultural Statistics 1988. Bureau of Statistics - Planning Commission.

Temu, A.B., Kaale, B.K. & Maghembe, J.A. (1984). Wood-based Energy for development. Proceedings of a national seminar held in dar Es Salaam, Tanzania 26 - 28/3/84.

Tettey, E.O. & Bon, J. (1989). Nile Perch - a new economic force. Infofish International No. 1.

UNDP (1990). Integrated Fisheries Development in rural fishing villages, Kagera Region. Project of the Government of the United Republic of Tanzania URT/90/005/A/01/12.