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EDITORIAL

SAMAKI, The Aquatic Resource Magazine is published quarterly. Its aim is to keep the world wide research community informed about the activities of Small Scale Fish Systems Project and to highlight issues relating to Environmental Research as well as Aquatic Resource Development and Utilization that have become topical in our country and time.

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Editor

Editor

Gilbert E.M. Ogutu

Small Scale Fish Systems Project

The Objective of the Small-Scale Fish System Project is to improve the earnings of rural women fish traders, through their reintroduction into the mainstream of the emergent Nile perch producing, handling, marketing and processing system, and through Omena processing methods. It is also aimed at helping the fisherfolk adopt new technologies or improve on traditional practices to boost their income, improve their standard of living and sustain the resource.

The initiator and director of the project, Dr. Gilbert E.M. Ogutu was educated at Makerere, Nairobi and Oxford Universities. He has done extensive research in the Socioeconomic aspect of fish production and marketing. He has provided a lot of consultancy services to researchers in the fisheries sector in Kenya and other countries. Currently he teaches at the University of Nairobi, Nairobi, Kenya and is a member of Programme and Strategy Review Committee (PSRC) of IDRC Fisheries Programme for Africa and the Middle East.

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The Cover

1. Dr Ogutu assisted by a fisherman lifts a 45 kilo Nile Perch.
2. Deep frying Nile Perch at Luanda Gembe.
3. Fish Technologists from Kenya Marine and Fisheries Research Laboratory at Uwaria Field Station.
4. Omena drying racks at Uwaria Field Station.
5. Nile Perch smoking at Uwaria Field Station.

The views expressed in the articles are those of the authors and do not necessarily reflect those of the partners in Small Scale Fish Systems Project.

Netting Gains for Small Fisheries

by Craig Harris

Loaded with ice, the truck rushes along the narrow dirt road, honking noisily and stirring up an impatient cloud of dust. Its destination is Uhanya beach, a small fishing community on the Kenya shores of Lake Victoria.

Once the truck reaches the village, workers get out and, like a well-drilled army corps, load freshly caught Nile perch into frozen storage holds. They will transport the fish to plants in the nearby city of Kisumu for processing and eventual export.

For the small-scale fish processors and traders of the Lake Victoria basin, this truck and the rapidly expanding fish export industry it represents is the competition. And competition these days is tough.

"The entire fishing industry in the Lake Victoria area has changed dramatically over the past 10 to 15 years", says Dr. Gilbert Ogutu, the leader of an IDRC-funded project looking into the viability of traditional artisanal fisheries. "People who before relied on fishing for survival and modest income are now forced to either compete with larger fisheries or face complete marginalization".

The most significant change has been the sharp increase in fishing's contribution to Kenya's foreign exchange. Dr Ogutu, a lecturer at the University of Nairobi, estimates that as much as half of all fish caught in Lake Victoria are filleted, frozen, and exported to countries in the Middle East and Europe. For a region that produces over 90% of the fish in the country, this is a substantial figure. Traders and processors here view daily for Nile perch and other fish at the more than 70 major landing beaches along the lake's shoreline.



There have been advantages and disadvantages to the fish exporting boom. Some fishermen have benefited from higher prices for their catch and export-oriented processing plants have provided some jobs. But, like many other resources used for export, much of the revenue from fish is reserved for the relatively large and the relatively few.

Big Business Benefits:

Commercial firms have carved out an inordinately large slice of the market. They were quick to take advantage of the changes in Lake Victoria's fish population, which experienced an increase in Nile perch. The firms developed overseas markets for frozen perch fillets and bought up an expanding proportion of the fish caught. They have been able to secure "client-Patron" relationships with many of the fishermen, renting them motors for their boats and giving them higher prices in return for exclusive rights to their daily catch. Smaller traders have often found themselves boxed out of these deals.

Local fish processors have also suffered. Their traditional technology is not well adapted to processing Nile perch, which is very oily. The technology neither cost-effective nor efficient enough to compete with the equipment of the commercial processors.

Increased competition means sharply reduced incomes for the small-scale fish traders and processors, 75% of whom are women. Many of these rural women face bankruptcy and unemployment in an area where there are not many alternatives for making a living. Fishing is one of the few natural resources in the region, much of the land around Lake Victoria is non-arable.

The export industry also means that the supply of fish for local consumers had dropped while prices have been driven up. Poor people who live within 50 Km of Lake Victoria's shoreline can no longer afford what used to be a low-cost source of protein. There are no programs to develop an alternate source of cheap protein and researchers fear that the scarce supply of local fish could have a severe nutritional impact in a few years.

Another result of changes in the fishing industry has been the increase in temporary communities on the shores of Lake Victoria. Uhanya beach,

Dr Paul Vitta, former Deputy -Regional Director IDRC, when he visited the Small Scale Fish project.



set up ostensibly to meet the demands of larger fisheries, is just one of the many communities that have sprung up along the lake's shores.

To work here, processors and traders walk as far as 80 Km and stay away from their families for weeks, sometimes longer. They live in small wooden or metal shacks with roofs of corrugated steel. Children, whom mother frequently bring with them, play around in the hot afternoon sun, avoiding the accumulation of waste that is inevitable where there are few sanitation facilities. "Such makeshift communities are not positive developments for the Kenyan people", days Dr. Ogutu. "We have found that they draw people from miles away with the lure of quick money". The problem is that the fish processors and traders, mostly women, are often away from their husbands for extended periods of time. Researchers with the project have noticed an increase in marriage separations and a general decline in family cohesion.

Eliminate Exploitation:

For Dr. Ogutu, who grew up right near the lake, this situation must change. His main objective in the project is to give the people of the region a chance to make a living from the land and water they inhabit. "When the giant export firms get involved in the deals, it almost invariably becomes an exploitative situation for the people who live near Lake Victoria", he says. "We are trying to change that".

To break this cycle of exploitation and the low standard of living, Dr. Ogutu and fellow researchers realized that the small-scale processors and traders must be taught skills and given new tools to compete effectively with larger, export-oriented fisheries. The ultimate goal of the project is to identify ways and means of improving the earnings of rural women fish traders. Specifically, this has involved several initiatives, from teaching the traders and processors basic accounting skills to introducing improved varieties of kilns for drying fish.

"We had to start with the basics," says Dr. Ogutu, "Many of the small-scale traders and processors had no real business skills". Some, for example, did not take into account overhead costs in their estimation of income and found later that they were losing money.

To combat this problem, the project sent 26 women to workshops on accounting and general business skills. Dr. Ogutu says he has noticed significant changes. "Many of these women became immediately more knowledgeable about their businesses and more interested in the daily process of transactions, costs, and profits.

The project also encouraged the small-scale fish traders and processors to form co-operative, the largest

being known as Kinda. The Kinda Co-operative which in the local Luo language means "perseverance", allows these women to share resources and streamline ways of preparing fish and bringing it to market. Banks are also more willing to lend much-needed money to a co-operative than to individual traders and processors.

Better Technology:

Another intervention designed to help the local people has been the refinement of the technology involved in drying, processing, and marketing fish. The technology needed to be made more efficient so that small-scale traders and processors could compete with commercial firms and still sell fish to local people at reasonable prices. In particular, smoking kilns used to dry Nile perch were in want of improvement. Traditional kilns frequently rotted or eroded from exposure to the weather and they needed a large amount of fuelwood to smoke the fish a scarce resource in the region.

Researchers developed four types of kilns. Some were closer in style to the traditional kiln, because, as Dr. Ogutu points out, "People are often afraid of rapid changes, so they need to be allowed to change at their own pace." Although the refined, efficient kilns are more expensive to make, they smoke the fish in as much as half the time and use half the amount of fuelwood as the traditional kilns. Because they are made of brick and can be covered, these kilns are more weather-resistant. Dr. Ogutu says the small-scale processors and traders can recoup their investments on the newer kilns in as little as a year.

Another refinement has been the introduction of drying racks for the popular omena fish. This fish has commonly been dried by simply being laid out on the ground in the sun. In addition to a long drying period, this process resulted in high fish loss due to dirt and bacteria. Dr. Ogutu and fellow researchers were instrumental in designing an omena drying rack made of mesh and metal that would dry the fish quicker and, because of its raised platform, protect the fish from bacteria on the ground.

These interventions, from both a skill-development and technological perspectives, have been successful in helping many small-scale fish traders and processors of the Lake Victoria region, Dr. Ogutu says. And that continues to be the goal of the project. "We are trying to create, or should I say re-create, a sustainable environment for the people who live closest to the resources those people who ought to be benefiting from the fish".

Craig Harris is a freelance writer from Ottawa, Canada.

SMALL SCALE FISH PRODUCTION TO CONSUMPTION SYSTEM

Research Agenda for Lake Victoria

by Gilbert E.M. Ogutu

Introduction:

Considering recent development plans (78-83 83-88, 88-93) and legislation on the Fisheries resource's development (Fisheries Act 1990), it needs no emphasis that Kenya government is very concerned about fisheries performance. With this in mind, and to ensure viability of our project, factors like:-

- **Sustainable resource use:** Sustainance of a balanced aquatic biodiversity of the common property resource.
- **Productive employment:** Informal sector and the attendant human impact, including resource utilization pressure in response to acute unemployment.
- **Education and Social Policy:** Appropriate, time tested, and policy oriented innovation in harvesting and processing technology and distribution infrastructure.
- **Nutrition and Health:** Equitable accessibility, distribution and/or marketing of the fish products.

were found to be impelling in our attempt to take viable research decisions geared to the realization and availability of affordable animal (fish) protein in a sustained (planned and regulated resource use) manner.

We noted for review, that the tenure of the Lake Victoria aquatic space called for international cooperation, given that the lake is shared by three East African countries of Kenya, Tanzania and Uganda. It became apparent that for the industry to provide productive employment there were inevitable barriers to entry which needed to be spelt out through commodity chain analysis. Finally, sustainable development of the resource, prompted the evaluation of the viability of the community level resource exploitation control mechanisms in response to market forces.

Development of Small Scale Fish Production to Consumption System Approach:

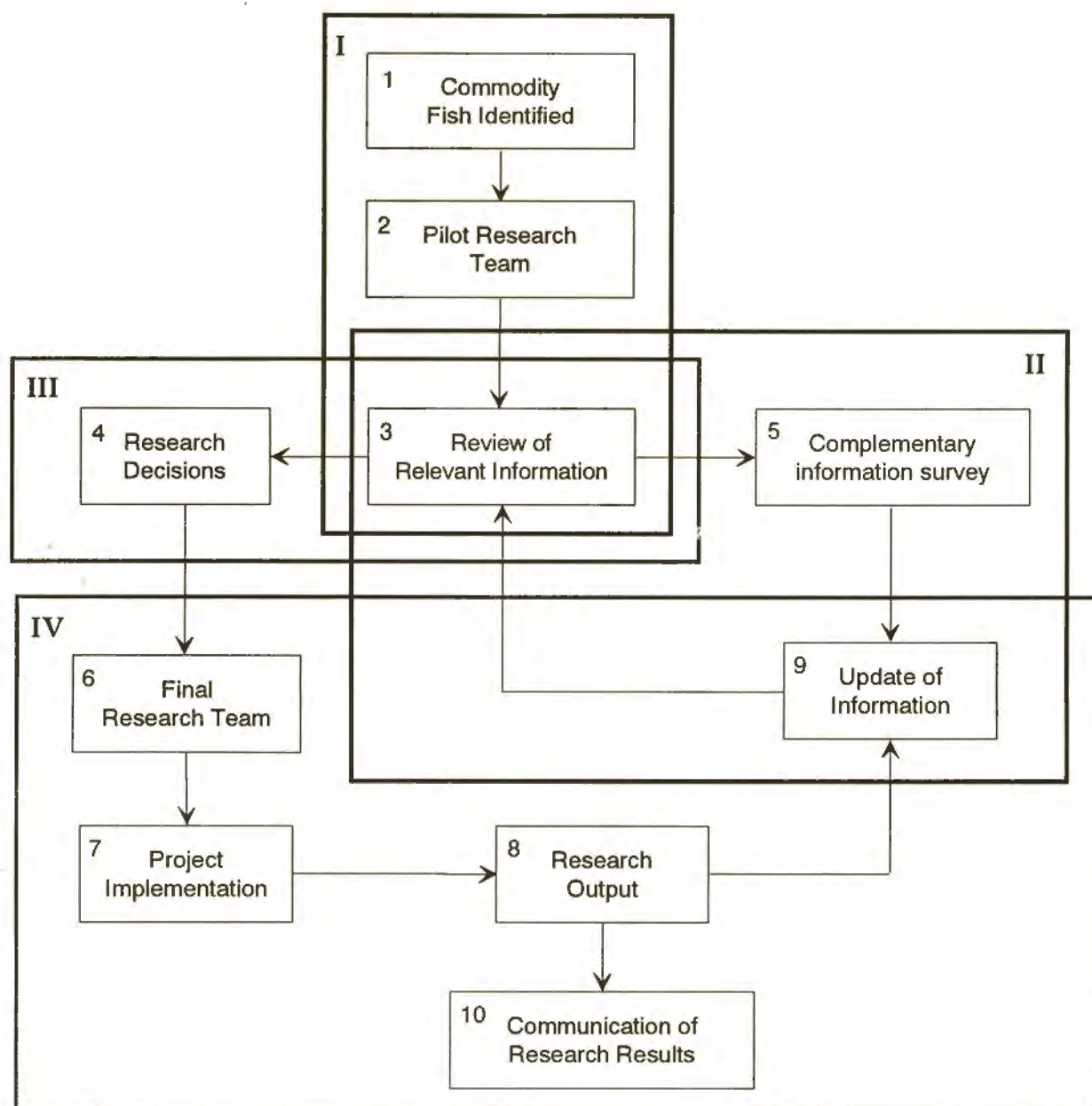
Following the foregoing considerations, it was possible for us to develop our project in ten steps looking at (1) the target commodity, (2) pilot research team, (3) review of relevant data, the insufficiency of which led us to, (5) undertaking complementary information survey and (9) to updating of information. Satisfied with the information, we (4) took the key research decisions, (6) agreed on composition of final research team, (7) implemented the project and (8) came up with outputs at various stages of the project. Some of the results have already been (10) communicated to beneficiary/users of the results. The ten steps were accomplished in four stages as follows:-

Stage	Steps
I	1, 2, 3
II	3, 5, 9
III	3, 4
IV	6, 7, 8, 9, 10

See Flow-chart next page



Dr. Gilbert Ogutu (centre) explains the smoking process to Ozzie Schmidt and Edward Weber of IDRC at Uwaria Field Station



Relevant Information Review:

The nature and dynamics of change (quantitative and qualitative changes) brought about by least agricultural production and leading to the depletion of forestry resource in Lake Victoria ecosystem made us look for information that related small scale fish system to other sectors of the local economy and other resources, particularly agriculture and forestry. We had, therefore, to gather information on:- fisheries resource and its habitat, harvesting, processing, marketing and consumption. As regards the local economy we looked at the emergent industrial fishery, local agricultural practices, sustainable forest resource required, and the emergent commercial enterprises including the marketing of fish. All these had to be seen in the light of the

priorities of the participating institutions and government policy on the resource. The commodity system information chain inevitably led us to making reference to biology and stock assessment, understanding the social and economic aspects of production and marketing, as well as occupational and geographical mobility of the fisher-folk. The quest for this kind of information, naturally led us to investigating legislation relating to fisheries resource management, including fishing methods, target species, fleet types and sizes.

Continuous Information Update

From past experience, we were aware that the kind of information we needed in order to adequately



undertake our project became insufficient when and where written and sales records were not sufficiently consulted, census and/or sample survey were not taken or where there was lack of interface with the past and/or on-going researches. For us, therefore, the role of key informants and/or seasoned researchers remained pertinent. Thus, our information update brought in maximum sustainable yield estimation requirements, identification of innovation and training needs, economic and business management needs and, finally, information on the general social structure of the fishing industry as an occupation. Here our focus was on the labourer fisherman, the vessel and gear owners, the processors and traders; and consumers who seek inexpensive protein. In other words, we were, particularly interested in the composition, structure and behaviour of the target groups with regard to leadership, organisation and the nature of their enterprises whether one-man or joint.

Research Decisions and Theoretical Framework:

On being convinced that we had enough take-off information, the next step was to determine a theoretical frame of reference given our target commodity dimensions namely quantity, quality, timing, placing and pricing. We had also to bear in mind the requirements and preferences of end users of our findings i.e fellow scientists and decision makers. Aware that our research was to generate policy matters that would affect the fisherfolk, we had to highlight issues relating to end user (resource endowment, knowledge, abilities, motivation) and to speculate on regulations and possible institutional support.

Critical decision points regarding these included, among others, the problems of overfishing, pollutants, changes in species spectrum given the emergent carnivorous propensity. This took our minds to a review of available information on processes of ecosystem changes including those on such basic issues as nutrient dynamics and productivity, chemical and physical processes, fish pathogens and diseases, and the inevitable link to global atmosphere and climate.

With our stated objective of ensuring the realization of the availability of affordable animal protein in a sustainable manner, our theoretical framework was pivoted on change and continuity, the daynamics of which we continue to analyse socioeconomically. The approach we adopted has helped us to create an awareness through reading and consultation with physical scientists. As other scientists have stressed, "social scientists must, alongside rigorous means of analysis, better inform themselves about fisheries science".

Basic Research Questions:

Assuming that the foregoing were viable parameters for our project, we then raised the cardinal research questions, namely, what to research (research subject), what for (objective), how (methodology) and why (location and rationale). Such questions, and our experience from the previous researches threw our searching minds to possible technological and institutional interventions that could enhance our quest for optimal survey and investigation of the commodity chains data, with beneficiary and/or end user expectations and their immediate contribution in mind. This was not to forget that the primary objective of our project was to increase the earnings of the fisher-folk in order to improve on their standards of living. This should explain our focus on income generation in relation to the identified commodity dimensions, namely quantity, quality, timing, placing and pricing.

Our guiding hypothesis remained that with requisite technological and institutional interventions, the small scale fisherfolk can, on the one hand, survive the threat caused by the commercial sector, and, on the other hand, improve the living conditions of the participants, absorb more labour force, and favourably compete the emergent export oriented sector.

Composition of Research Team:

The diversity of our project components made it necessary that we make up a multidisciplinary research team which include social and technical experts, business development advisers, as well as guided data assemblers and analysts. The nature of our research design naturally led us to considering what was feasible, given the location of our field work, methods of investigation, and the needed materials and equipment as these were dictated by the researched commodity dimensions. It was such considerations that made us apply production to consumption analytical techniques to our investigation of ways and means of improving the earnings of rural women fish processors and traders.

Research Design:

The objective of the Small-Scale Fish System Project as has been stated above was to improve the earnings of the rural women fish-traders, through their re-introduction into the mainstream of the emergent Nile perch producing, handling, marketing and processing system, and through Omena processing methods.

The project aimed at determining the most efficient means by which women, in groups, could participate in the Nile perch processing and marketing system; develop and introduce improved techniques



for fish handling, smoking, drying and marketing to benefit women processors; train project staff and processor participants in subjects relevant to development in fishing communities; and develop a plan for the dissemination and replication of the research results in other fishing communities along the Lake Victoria shoreline.

Given the objective, the research design included a deliberate consideration of the location (northern shores of Winam Gulf), methodology (sampling, instrumentation and response), materials and equipment and, finally, a clear understanding of the Nile perch (Mbuta) and Sardine (Omena) Systems. From this point we were then able to proceed to implement the project.

Project Implementation:

As already stated, our research efforts concentrated on Lates niloticus or Nile perch (locally known as Mbuta) and *Rastrineobola argenteus* or sardine (locally known as Omena). We investigated patterns of production, distribution, processing, marketing and consumption of the two fish species. We looked into requisite quality control intervention on the commodity products at post harvest and post processing/preservation stages. The relationship between the product types and processing methods remained critical in our investigations particularly where this touched on commodity chain analysis, with reference to commodity dimensions and market requirements. Beyond this we made an overview of consumer preferences and buying habits in the local, urban and export markets.

Thus, while focussing on group activity, we first, looked at the technological patterns: harvesting, handling, processing and/or preservation, as well as packaging, hauling and storage. Secondly, we continue to look at the emergent patterns of market economy as these related to costs and returns to the producer (harvester), the distributor, the processors, the trader and the impact the returns had on the local economy and the standards of living of the participants.

It has become clear to us that the technological and economic patterns had direct bearing on the identified commodity dimensions. From the foregoing our concerns, in this project, must be seen in the light of allocation of resources and distribution of income, and that these are dictated to by the prevailing pricing system.

Envisaged Research Output:

The parameters for use of research results must worry any serious researcher. This underscores our concern for quantity and quality of research output, knowledge and abilities of users, rules, regulations and motivation as well as financial and political support

likely to be realized. Thus the nature of Small Scale Fish Production to Consumption System which was meant to culminate in policy formulation entailed hinterland exploration, beach assessment surveys, commercial activation activities, and technological intervention.

In our investigation, we have been all along mindful of whom our research affected, when and how, and what its potential direct and indirect effects are likely to be. The task here has been that of justifying immediate and longterm priorities, and making decisions relevant to somebody, somewhere, somehow, given that we are researching on a globally important food commodity. Our apparently limited approach has been beefed up by our constant reference to accumulated information on the geographical and ecological diversity and the nature of Lake Victoria fisheries undertaken by other researchers and agencies in time perspective. Such time series data should enable us to estimate the contribution of the industry to rural income levels, Gross Domestic Product, nutritional needs and alleviation of rural unemployment.

Uwaria Field Station:

In order to enhance fisherfolk participation, we made our research activities and/or experiments beach and project site specific. We stationed ourselves at Uwaria beach, on the northern shores of Winam Gulf, some 80 Kilometres from Kisumu town. Here we have rented a compound and premises owned by Palwa Research Services Limited. We initiated a research body known as the Centre for Environmental Research and Aquatic Resource Development and Utilization (CERARDU) and named the compound where we stationed ourselves as Uwaria Field Station.

Among other things, our activities at CERARDU concern the harvest (Fishermen) where we look at the impact of gear and vessel technology as well as the timing, placing and pricing of the raw commodity (fresh fish). Our data also relate to quality control mechanisms. The processing practices are our primary occupation. Here we look at the kiln, pan for deep-frying, the drying racks as well as the requisite supply of water and fuel-wood. The trader is our next concern. We see him very concerned about product types, improved shelf-life, packaging techniques to reduce post-harvest losses, and finally, review the requisite understanding of market structure, behaviour and performance. The target, in all these, is to satisfy the consumer with product types, improved shelf-life, high quality products, and considerate placing and pricing in order to meet the local and international trader requirements as well as the expectations of the local and international consumers.



Dissemination of Research Results:

The final goal of any viable research project is to generate information that could be disseminated to as wide a group of beneficiaries and users as possible. Such a project should at the same time, provide the research team with knowledge of new concepts and analytical approaches. It should also help the wider scientific community to be able to define interdisciplinary research agenda. For a common property renewable resource like fish, the support agencies, policy makers and resource allocators will, naturally, be interested in the possible sustainability of the resource. The information we finally disseminate must address such questions.

Whereas we were agreed that the fisherfolk must be and remain the immediate beneficiaries to our research findings, we were often tempted to find out the composition of our audience. We identified two inevitable users of results as the dissemination target groups as follows:- (i) the project team and the wider research community, and (ii) policy makers and resource allocators. These groups of people must be reached by means of Discussions Papers, Digests; Executive summaries; Audio visuals, detailed descriptive and book-length publications, Journals; and finally, workshops, seminars as well as field-day demonstrations. Our feeling is that there is a serious need for wider sharing of information, particularly in the East African region.

I wish to emphasize that the foregoing highlights of our approach have been, to us, provocative and/or indicative rather than definitive, insightful rather than exhaustive. Our agenda remains to discuss and reinforce the economic significance of preserving the fisheries resource and improving on the living standards of the marginalized women fisherfolk.

In order to conceptualize what we have covered or are yet to cover, the following summaries are useful:-

1. Highlight of Objectives

The project objectives were, among others, to create a functioning group with sustainable integration structure; encourage efficient and hygienic fish handling practices; introduce viable smoking kilns for Mbuta and improved omena drying technology; work out an equitable fish distribution and marketing system; assess economic benefits to processors and traders; test for improved standards of living for participants; assess level of reduction in post-harvest fish losses; improve on artisanal preservation techniques: storage facilities; and at the end of the field work, predict and map out technological and economic patterns to ensure viability and sustainability of the recommended interventions;

2. Hinterland Survey

Knowledge of immediate hinterland was found to be crucial in our work plan. This explains the hinterland exploration which was to help us identify the catchment area in order to spell out the geography and agricultural activities in the immediate hinterland; determine land tenure system and agricultural activities; assess the general socio-economic status of households; evaluate requisite infrastructure for landing site modernization; assess education and health facilities; and determine migratory trends especially rural-urban migrations and the resultant repatriation of income, some of which financed the fishing activities.

3. Beach Survey

Our field activities were beach and market specific. We therefore set out to study activities at some selected beaches in order to determine location and to give physical description regarding development and accessibility, assess characteristics of beach population, fishing activities: including boat and gear ownership, Social differences between beach and hinterland dwellers, household and beach settlement heads and individuals per household, migratory trends of beach dwellers and their ties with the local communities.

4. Commercial Activation

In order for the women participants to reintroduce themselves into Mbuta system and Omena marketing process, they had to be activated commercially. To do this we had to identify target groups; determine the ages, marital status, number of children, level of education, level of literacy (reading, writing and simple calculation) among the members of the target group; determine earnings, division of effort, occupation, specialization, cost of living, ownership of houses and means of production, economic feasibility of their businesses; identify factors of marginalization by pinpointing available alternative enterprises besides marketing of fish, fuel wood cost, lack of accounts and records; create organized target groups where these did not exist and take note of possible pull factors, like labour, finances, marketing, touching on such issues as processing knowhow, ownership, and representation within the group; identify possible push factors like roles and relations, immediate turnover, access to other alternative activities; generate mutual group relations in the area of decision making, choice of leaders, corruption free joint enterprises; instil group organization and to facilitate sustainable activation, including revolving fund administration; and finally to assess level of group and individual earnings from time to time.



5. Staff Induction

The project was, by design and execution, meant to be, partly, a learning process to both staff and participants. For the staff we undertook to test expertise and experience with dried and smoked tropical fish products; made on the spot acquisition of experience with functioning fish-trade associations and fishermen's cooperatives particularly those in the catchment area, train them in project management techniques with private consultancy groups; give development education and rural communication skills for technical and professional staff; and arranged for workshops for project participants at the project site.

6. Technological Intervention

All our aims, objectives and field activities evolved around initiating technological intervention. To realize this objective we set out to focus on Mbuta and Omena resource system: production, processing and marketing; determine if the group activity created by us, was essential and substantial in processing and marketing; find out if appropriate development education and training could help; determine whether the smoking kilns were efficient, appropriate, acceptable: measured by fire control, product quality, fuel-wood saving, reduced labor requirements, and accessibility to processors; show whether Omena drying racks were efficient, appropriate, acceptable; measured by product quality, reduced labour requirements, and accessibility to processors; introduce staff and participants to rural fish trade organization, associations, cooperatives at the site and other areas along Lake Victoria shoreline; in-

itiate participatory development principles and practices and finally establish an assembly of information.

7. Policy Formulation

The project was designed to bring together diverse areas of socioeconomic life and activity. It sought to, among others, generate policy into the sustainable utilization of fisheries resources by suggesting applied and adaptive techniques on the transformation and marketing of fisheries resource products; mapping out environmental impact of fish feeding habits that would enhance balanced aquatic vegetation and, also, encourage forest rehabilitation; indicate possibilities of macroeconomic adjustments and institutional intervention aimed at the financing of fish trade and technology improvement; identify policy issues relating to conditions, planning, implementation, management and outcome of fish food system process as strategies for human development; identify health risks in the living and working environment of the fisherfolk built on the local knowledge, circumstances and behaviour on health; and finally, pinpoint issues relating to flow and use of scientific, technical and other information generated by these research activities.

Gilbert Ogutu is the Project Leader, Small Scale Fish Project, University of Nairobi, Nairobi, Kenya.



Lady Smokers at Uwaria Field Station

Appropriate Technology and Quality Assessment tests for Raw and Processed Fish

by J.C. Ogunja and G.E.M. Ogutu

Our quest for appropriate technology in this sector covers inboat transportation and post harvest processing. The aim was to identify a cheap and efficient technology that would enhance quality and increase shelf-life of the smoked or sun-dried products.

We started our experiment with boxes which the fishermen took with them into the lake and into which they put the catch covered with sacks to keep fish cool. This was not well received and we had even to suspended the experiment. We tried the experiment again between September 1991 and February 1991. The result was encouraging as organoleptic tests revealed that the level of spoilage dropped by about 15% per 100 kilogrammes of fish on average. Boats not using the boxes experienced 20-30% losses while our experiment recorded 5-15 losses for the same amount of fish. The use of boxes has been emulated by some other fishermen and we hope more of the fishermen will adopt the simple technology in order to keep their catch fresh.

Meanwhile we are still haunted by the reasons that made the experiments unacceptable initially. The fishing units we used for experiments claimed that arranging fish in the boxes was cumbersome and also that the boxes took a lot of space given the sizes of the canoes and crew members. They also argued that once the fish landed the buyers did not care how the fish was handled in the boat. These were futile claims. What needs to be emphasized are organoleptic tests on all the fish landed followed by grading of the same. If this was done, the fishermen would realize the need to guard against exposure of fish to direct heat before landing.

The response also depends on educational background of the fishermen. As more affluent group get into the fishing industry, and as they insist on high quality fish, the technology is likely to be widely accepted. At the moment we much contend with our experimental findings.

Quality Assessment Tests:

The most crucial technological intervention carried out by the Small Scale Fish Project has been at the post-harvest level, involving the construction of smoking ovens for smoking Nile Perch and raised platforms for sun-drying *Rastrineobola* (omena). The experiments, were started in July 1990 and went on till September 1991. Samples were, periodically, taken from sun-dried *Rastrineobola* and smoked Nile perch on several occasions. These were taken to Kenya Marine and Fisheries Research Institute Laboratory for analysis. The following were some of the results:

(a) Organoleptic tests for Fresh Nile perch

Skin	-Brilliant, few dull patches
Scales	-firm
Gill colour	-reddish patches, little slime
Eyes	-reddish yellow, sheen convex
Texture	-firm and elastic



Dr. Gilbert Ogutu explains the fish cleaning process to the Nyanza Provincial Commissioner Mr. Peter Kiilu at the Uwarua Field Station

**(b) Proximate Composition of Raw Nile perch**

Protein	- 21.3%
Fat	- 68.8%
Moisture	- 7.5%

(c) Proximate Composition of Smoked Nile Perch

Moisture % by wt	- 15%
Protein (N.x6.25) % by wt	- 65%
Oil (solvent extract) % by wt	- 17%
Ash % by wt	- 1.6%
Calcium as Cal % by wt	- 0.9%
Phosphorus as P % by wt	- 0.05%

(d) Approximate Composition of Raw Rastrineobola

Protein	- 19.6%
Fat	- 0.2%
Moisture	- 28.4%

(e) Proximate Composition of Sun-dried Rastrineobola(Omena)

Moisture % by wt	- 7.05%
Protein (N.x6.25)% by wt	- 64.06%
Oil (Solvent extract) % by wt	- 12.04%
Ash % by wt	- 13.91%
Calcium as Ca % by wt	- 4.30%
Phosphorus as P % by wt	- 0.12%

Total bacterial count was also done on samples of Nile perch and the following were the results:-

Total Germs	-10 per gram
Staphilococci	-Negative
Enterococci	-Negative
Clostridia	-Negative
Salmonellae	-Negative
Entero bacteria	- 60/Gra

It came to our awareness that the drying and smoking experiments required continuous recording by both the participants and the research personnel. This was our major pre-occupation during the field work. The results, some of which have been cited above,

were very encouraging. The shelf-life of smoked Nile perch was greatly improved by these experiments. Some of the samples were kept at ambient temperature and remained fresh for upto 36 days and the traders as well as consumers had no problems with them. This was a great improvement on the traditional methods of smoking where shelf - life, at the very best, was only 3 - 5 days. ITDG oven was found to be very efficient in terms of the way the trays changed positions and also firewood consumption. Compared to the traditional smoking kilns, for the same amount of fish, chorkor and ITDG

ovens needed only 50% of the fuel wood. This made them very attractive to the fish traders. The only handicap was the cost of constructing one. Although the chorkor is many times more durable, the financial base of most of the fish traders makes it appear beyond their reach.

All in all, the results of these technological interventions have been very encouraging. Raised Rastrineobola drying platform was a complete departure from the traditional methods and success story in the eyes of the participants and the people who have visited the experimental site. Quality of the sundried fish was high, while the drying time was reduced drastically. Small scale Fish System still continuing with the experiments as well as collecting statistical data which should reveal more as regards the economics of these two areas of technological intervention. The findings should bring out important policy issues, particularly at the processing level. This we consider crucial because reduction in fuel wood consumption would check on the disturbing deforestation along the lakeshore; while high quality products will increase shelf-life and expand the market for artisanal fish processors and traders.

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Visit to Uwaria Beach Fish Processing Project, Lake Victoria, Kenya.

by Eva M. Rathgeber

This project, jointly supported by Post Production Systems, Fisheries and GAD, is under the supervision of Dr. Gilbert Ogutu of the Department of Religious Studies at the University of Nairobi. Dr. Ogutu had undertaken two earlier projects and thus has in-depth knowledge of the fishing and fish marketing conditions in Lake Victoria region.

A major aim of the project has been to organize local semi-literate women into fish-smoking and marketing associations and to teach them the most efficient ways of smoking fish as well as basic accounts keeping. The women are divided into two groups - the processors and the traders. There is no attempt to teach any of them all aspects of the business since the lines between processors and traders have been definitely drawn in the past. At Uwaria Beach, I was shown several different fish smokers that have been tested by the project. The most efficient had proved to be the one designed by the Intermediate Technology Development Group. It was more durable and more fuel efficient than any of the traditional or other improved ovens, but it had the disadvantage of being rather expensive to construct (requiring bricks and cement). However, through careful record keeping, Dr. Ogutu and his research assistants have been able to prove that the higher cost of the ITDG oven will be offset within six months as a result of savings in stable suppliers can no longer be found in the open. Although fish smoking has a long history in the region, the tradition ovens have tended to consume a lot of fuelwood, have not offered protection from rain and have smoked out very quickly.

Currently, 16 women and two men are engaged in the fish processing part of the project. The women, who have been formed into a society, pool their own money to buy fish - mostly Nile perch but also omena and tilapia - from local fishermen. They process the fish in the smokers and then sell them to the traders. Initially a revolving fund of Kshs. 50,000 was established from which association members could borrow to purchase fish. In every case, these loans were paid back in full. According to Dr. Ogutu, this is a clear indication both of the trustworthiness of the individual members but also of their commitment to remaining in the project and the association. Certainly this seemed to be the case when I spoke with a group of eight members. They expressed their strong desire to continue to work together even after the project ends.

One of the problems faced recently was been the great variations in the price of fish. Nile perch has sold from 16 to 22 shillings a kilo and it has been difficult for the women to budget accordingly. Periodic shortages of fish have also been a problem (this of course, has led to higher prices).

In the near future, the project will begin to offer training to other groups of women. The current association members will act as trainers while they continue to smoke fish for their own business purposes. It is anticipated that no more than six outside women at a time will be brought in for training. In general, the project is trying to encourage women to work in groups - to pool their resources to buy smoking ovens.



A Section of Fish Processing Team at Uwaria Field Station with a Social worker attached to the Project Mrs. Millicent Ayuyo at extreme right. This is the group Eva Rathgeber met at the site.



We also visited Uhanya Beach, in the same part of Lake Victoria. While Uwaria Beach is a small landing beach with only a few huts, Uhanya Beach is a prosperous settlement of more than 2,000. Although there is a lot of money associated with the village, I was appalled at the poor hygienic and lack of health or education facilities.

This is an interesting project in that each step has built upon the knowledge and experience obtained in the earlier research. I believe that there is potential for this to be carried even further. Dr. Ogutu and I discussed the possibility for the women to diversify from simple fish smoking to the preparation of simple fish foods and ready to eat fish meals. This would provide yet another source of rural employment for women in the region.

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Impact of Fuelwood Changes in Fish Smoking

by D.M. Kamweti

Projection of wood supply and demand over the next 5, 10 and 15 years indicates that wood resources is fast declining. If no corrective intervention is made, a far reaching repercussion is likely to take place on the fish smoking communities. Casual observation of the natural vegetation particularly along the lake shore confirms the supply and demand data which shows serious wood deficit.

Shortage of fuelwood will lead to higher prices of fuelwood and by implication higher cost of fish smoking. This in itself will lead either to higher prices of smoked fish or cessation of fish smoking activity by a large section of fish smokers. A discussion with a local fish monger in Mbita revealed that a mark of KShs. 30.00 for fresh fish is only KShs. 50.00 after smoking, this is a days work without considering fuelwood used.

A research by Dr. Gilbert Ogutu on employment in Lake region found out that the majority of people particularly the youth are self-employed in fish industry. DANIDA study found that 80% of the respondents in Lakeshore in Nyanza practise fish smoking. Abandonment of fish smoking by some people due to lack of fuelwood or due to exorbitant prices will exacerbate the unemployment situation in otherwise marginal area where alternative sources of income is very limited.

Currently fish merchants with refrigerated trucks are competing with local fish smokers and any serious

shortage of fuelwood (or higher prices) will drive fish smokers out of competition paving the way for larger number of fish merchants from distant urban areas such as Nairobi and Mombasa. Effectively nutritional standards of the local people will adversely be affected by this scenario.

Urban market does not like very large fish which are too fatty. Similarly the existing and future fish filleting processing factories will have by-products which need to be preserved. It means that some of the fishermen output might go to waste again triggering a bad multiplier effect not only on the fish smokers but also on the fishermen and their assistants

There are also those low income households who are involved in marketing smoked fish. The chain is long as women selling smoked fish are to be found in all markets in the district and also in other urban areas outside the district such as Kakamega, Kericho, Nakuru, and Nairobi. The communities involved in fishing, smoking and marketing of preserved fish will be affected adversely by continued fuelwood shortage which is also likely to affect the domestic energy sector. It must be borne in mind that smoked fish from Lake Victoria is widely consumed in the whole of Kenya. The low income groups faced with unemployment are likely to migrate to urban areas in search of jobs and hence frustrating the Government policy of retaining people in the rural areas as a way of curbing rural-urban migration.

Before giving up, the fish smokers will attempt hopeless job of using agricultural residue for fish smoking. It will mean higher utilization of agricultural residue which should ideally be recycled back to the



soil for sustainability of soil productivity. As agricultural residue burn very fast and are also seasonal, this alternative is not likely to be an effective substitute for fuelwood.

Animal residue is also likely to be used for fish smoking. During the study, a woman in Rusinga Island was found using cow dung for fish smoking

It was mentioned by the lady that one bag of dry dung costs her Kshs. 15.00 and that it can smoke about 50 Kg. of fish. Simple calculation shows that about 60 kg. of manure is needed to preserve 50 Kg. of fish. On that assumption, one ton of fish requires 1.2 tons of manure.

Fertilizer is hardly used in Lake region due to its high cost in relation to people's income. Manure is the only hope as a source of fertilizer and if it is going to be used for fish smoking on a higher scale, food crop production is going to be adversely affected. Apparently there are many more people who use cow dung to smoke fish due to fuelwood shortage.

The opposite effect of increased fuelwood (most unlikely in the near future) would be lower prices of fuelwood and hence more fish smoking activities will mean sustainability of the local community in terms of employment, nutrition and income generation.

There will be efforts to improve efficiency of fish smoking kilns in an effort to economise the large quantity of fuelwood needed to smoke fish currently. Significant savings resulting from higher efficiency are not foreseen in five years time. In 10 and 15 years, a saving of 5% and 10% respectively will be realized on fuelwood demand for both domestic and cottage industry.

David M. Kamweti, is a Forestry researcher with Kamfor Company, Nairobi, Kenya.



Firewood ferried from one of the islands seen at Luanda Kotieno Smoking site.

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