

Socio-economics of the Lake Victoria Fisheries

TRAWLING IN LAKE VICTORIA:

Its History, Status and Effects

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

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

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PREFACE

Many methods are being used to catch fish from the rich fishing grounds of Lake Victoria. The use of large trawl nets, pulled by motorized boats, is one of these methods. Trawling for fish in Lake Victoria has a long history. We believe that this paper is the first of its kind tracing the origins of research and commercial trawling in Lake Victoria, relating the trawling operations to the fish export industry and discussing some of the socio-economic impacts of the trawling operations for the fishing communities around the lake as well as its biological effects.

Because of its negative effects on the ecological habitat of the lake and the damage it inflicts on the fishing gears of the artisanal fishermen, trawling has been banned for several years in the three countries sharing Lake Victoria. However, trawling still continues. In Kenya new trawlers are now being built in a shipyard in Kisumu. There is no doubt that the fish export factories prefer the fresh fish obtained from the trawlers in order to comply with the strict standards of the export markets on other continents. From several quarters, arguments are once again being forwarded to legalize trawling operations. Because of the fluidity in the situation of trawling operations, we want in this paper to focus on certain aspects of the history, status and effects of trawling in Lake Victoria.

From many perspectives, this paper is not complete. It does not deal with the past and present trawling operations in the Ugandan part of the lake, nor does it give a detailed account of the history of trawling in the Tanzanian part of the lake. No doubt, many aspects of the trawling operations are not dealt with in this paper. However, in view of the recent attempts made to increase trawling of Lake Victoria, we have, nevertheless, decided to publish this paper.

In order to present information about the trawling activities on the lake, we have asked some of the most knowledgeable people in the field to write about their experiences of trawling activities. From the various sections of this paper, it will become clear that the authors, with their diverse backgrounds, have different viewpoints about the role and effects of trawling in the lake.

The main section of this paper is written by James Siwo Mbuga. Educated and trained in fisheries gear technology in Japan, Norway and the Netherlands, Mr. Mbuga has worked for the Kenya Fisheries Department for 32 years. Mr. Mbuga has constructed most of the trawl nets which are used in the Kenyan part of Lake Victoria. He has participated in experimental and commercial trawling in Lake Victoria since 1967 and knows all the trawlers and their owners in the Kenyan part of the Lake. From a practical point of view, nobody knows the recent history of trawling in the Kenyan part of Lake Victoria better than James Siwo Mbuga.

Mr. Albert Getabu and Mr. Andrew Asila of the Kenya Marine and Fisheries Research Institute (KMFRI) are biologists who for many years have been engaged in experimental trawling in the Kenyan part of the lake. In their contributions, they present their viewpoints about the ecological impacts of trawling. Ms. Modesta Medard of the Tanzania Fisheries Research Institute and Mr. Richard Abila of KMFRI are experienced socio-economists who have in-depth knowledge about the fishing communities around the lake. In their separate papers they explore the impact trawling operations have for the traditional fisheries and fishing communities.

Our aim with this publication is to present new information about the trawling activities in Lake Victoria, and to stimulate a debate on the future role of trawling in the lake. In this way we hope to contribute to improved coherence between the riparian governments' policy on trawling and the practice.

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Socio-economics of the Nile Perch Fishery on Lake Victoria

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SUMMARY

Trawling is carried out on Lake Victoria both for research and commercial purposes. Commercial trawling on the Kenyan side of the lake began in the 1960s, mainly to harvest haplochromines, but in the last two decades Nile perch has been the main species targeted. The trawlers are in business primarily to supply fish to the processing factories for export. They have cold storage facilities on board, thus ensuring high quality of fish. For this reason, there is strong linkage between trawling and the fish processing industry. Some factories own trawlers while others finance the operations of privately owned trawl boats, which supply them with fish. In Kenya 5-10% of the fish processed by factories is caught by trawlers. Of the fish landed by trawlers, it is mainly reject and undersize fish that is made available to the artisanal fish processors and traders.

A trawler with engine capacity of about 300 HP and fitted with suitable gear can catch over 1 ton of fish in a day, earning the owner good profits. Such a trawler can employ about 10 crew. In comparison, about 8 artisanal boats employing over 30 crew can catch the same amount of fish. On a limited resource base such as Lake Victoria, therefore, one trawler can potentially displace many artisanal boats, resulting in a net loss of employment. At times though, trawlers assist in rescuing capsized boats or tow small vessels loaded with fish back to land.

Trawling is regarded as the appropriate fishing method in deep parts of the lake where there are strong undercurrents. However, in practice, trawlers rarely restrict their activities to the open waters, preferring to operate in the shallower but richer fishing grounds traditionally occupied by artisanal fishermen. They destroy the set gillnets and long lines, leading to conflicts between the two groups.

Trawlers can also have adverse biological implications. Bottom trawling disturbs the substrate, the water column and interferes with the breeding ground and the spawning process, especially for tilapines. It can also destroy larvae and eggs of fish, macro and micro-invertebrates at different strata of the lake. Thus, trawling using non-selective mesh nets, may cause overfishing by taking away both the adult and juvenile fish, reducing their potential yield.

Trawlers and beach seines are officially banned in all parts of the lake. However, there is a big gap between fisheries policy statements and actual practice in all three countries. In Tanzania, for example, the enforcement of fisheries regulations is hindered by many factors. These include the lack of logistical support and inadequate remuneration to field staff, poor interpretation of the law by enforcement officers and mismatch between the fisheries policy goals and the interests of local communities. Although the ban on trawling in Tanzania when it was implemented, negatively affected business activities and employment, it also subsequently caused an increase in average catch to artisanal fishers. Before the ban, trawlers landed about 15 tons of fish daily in Tanzania.

Trawlers do not in any way complement the activities in the artisanal fishery. Rather, increased trawling activities can have negative consequences on local employment, food security and resource sustainability. In conclusion, the negative socio-economic and biological effects of trawling on Lake Victoria clearly outweigh its advantages.

TRAWLING IN THE KENYAN PART OF LAKE VICTORIA

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Introduction

Lake Victoria, with an area of 69,000 square kilometres, is the home of a variety of tropical fishes, including the world famous cichlids such as tilapines (oreochromines) and haplochromines. The giant Nile perch (*Lates niloticus*) was introduced to the lake from Lakes Albert and Turkana in the late 1950s, and revolutionized the fishery of Lake Victoria from a mere subsistence to a highly commercialized and export oriented one. In 1989, the total catch, landed by some 80,000 fishermen using 20,000 fishing crafts, was estimated to be over 500,000 metric tons, of which 325,000 tons was Nile perch. Gill netting and beach seining have been the most prominent fishing methods for the last century. Other methods such as long lines, mid-water seines (or surrounding nets) using attraction lamps, impound nets and traps are also used.

Both research and commercial trawling have been conducted on the lake, beginning in the early and mid years of the 20th century respectively.

Among the notable initial operators of a research trawler was a Japanese vessel captain, working as a volunteer with the Overseas Technical Co-operation Agency (OTCA) of Japan. He started trawling at Kisumu Fisheries Research Station in 1967 on board MV Pelican, a Fisheries Department patrol-cum-research boat. Research trawling programmes gained momentum from the late 1960s through a regional research organization known as the East African Freshwater Fisheries Research Organization (EAFFRO). When the East African Community, the political and economic body unifying the three states sharing Lake Victoria - collapsed in 1977, each of the countries formed a national fisheries research body. Kenya formed the Kenya Marine and Fisheries Research Institute (KMFRI), Uganda instituted the Fisheries Research Institute (FIRI) while Tanzania started the Tanzania Fisheries Research Institute (TAFIRI).

As early as 1968, commercial trawling was carried out by an 18ft vessel, MV Orada, at Port Victoria, on the northern part of the Lake in Kenya, to harvest tilapines for a fish processing plant in Kisumu. The boat belonged to a Cabinet Minister in the Kenyan Government, who lived around Port Victoria. The late seventies to date have seen the emergence of a steadily growing number of trawlers in Kenya, which at one time reached 50 throughout the lake. In spite of explicit fisheries regulations prohibiting commercial trawling, in addition to strong objections by the artisanal fishermen, the practice became prevalent, initially in certain areas and later extending to cover all parts of the lake. The trawlers have been financed through private savings, by loans from local financial institutions and international donor agencies.

Of the fishing methods employed by artisanal fishermen, seining along the shoreline extending to five nautical miles offshore is regarded as the most destructive harvesting method in the lake. The five nautical miles strip is the main spawning ground for many species, hence, when fine meshed beach seines are used, they not only destroy the ecosystem but also harvest fish eggs, juveniles and brooders.

Trawlers, if selectively used in the deep waters of the lake, are the most effective gears targeting the harvestable fish stocks. However, when small meshed codend is used on a trawl net and is operated in designated breeding grounds, then it becomes very destructive. Some trawl boats, however, operate in the shallow parts of the lake, where a large number of artisanal fishermen's nets are set. They destroy the nets, depriving the fishermen of their livelihood, and causing conflicts.

Research Trawling after 1960

Since the advent of trawling in Lake Victoria for research purposes, fish catch composition has greatly varied. The most affected groups are the tilapines, haplochromines, Clarias, Schilbe,

Labeo and Bagrus species. High catch levels of haplochromines in the 1960s and 1970s caused EAFFRO to institute a stock assessment survey. The study concluded that commercial trawling of haplochromines, and their eventual industrial processing was viable. The by-catch of other fish species could be marketed fresh or in traditionally processed forms. Some international private companies showed an interest in undertaking the haplochromines processing. However, the project never took off since the catch composition of the cichlids started to diminish. The East African Community was also disbanded, making such a project uneconomical for individual states.

In Kenya, KMFRI engaged in effective research trawling as from 1980, initially using three trawlers. A 48ft steel boat, MV Utafiti, with an engine capacity of 150HP, was added to the KMFRI fleet in 1984. This enabled the institute to conduct effective stock assessment surveys. When the first Nile perch filleting plant was established at the Kisumu Yard of the Kenya Industrial Estates in the early 1980s, the research vessels supplied them with fish caught during the surveys.

Concurrently the Kenya Fisheries Department also engaged in trawling operations for research and experimental surveys. The department used its patrol vessels for trawling when it became necessary. These included MV Pelican, a 48ft steel hull vessel and MV Fulu, a 24ft steel board vessel. There were also wooden boats, such as MV Ningu and MV Gogo, in the Fisheries Department trawling fleet.

Commercial Trawling in the Kenyan part of Lake Victoria

As mentioned earlier, serious commercial trawling was first conducted on the Kenyan part of the lake in the late 1960s. Tilapia and haplochromines were then abundant and the trawlers had good business. In 1979, commercial trawling for Nile perch was done by the Mbita Multipurpose Co-operative Society, using a 22ft stern trawler named MV Rebecca, with a 44 HP engine and fiberglass hull. The vessel was financed by an NGO, the Kenya Freedom from Hunger. MV Rebecca was later bought from the Mbita Multi-purpose Co-operative Society by the then Assistant

Director of the Fisheries, for private use, when the co-operative failed to run the vessel. The new owner used it effectively for commercial trawling. Based at Lwanda Naya point, where the most thriving trawling grounds exist to date, MV Rebecca made good returns, landing an average of 500kg daily. In the early 1980s, MV Gogo, a wooden vessel previously owned by the Fisheries Department, was acquired by a businessman in Kisumu and renovated into a successful trawler. The owner proceeded to acquire MV Ningu, another boat formerly owned by the Fisheries Department, and two more boats, and developed the first large scale trawling company on the Kenyan part of the Lake, with a fleet of four trawlers. The late 1980s experienced a consistent build-up in the number of trawlers. By 1992, a fleet of 18 trawlers was in operation around the Nyanza Gulf.

As the number of processing plants increased, more trawlers were acquired or constructed. One fish processing factory based in Kisumu acquired three fibreglass composite steel trawlers from a company based in Ungwana Bay on the Kenyan Coast, which previously did shrimp farming but later collapsed. These similar boats measured 42ft, with 12U HP engines each, and were named MV Liwatoni I, II and III. The boats had originally been imported from India. Another fish processing factory made a futile attempt to introduce a fleet of five steel trawlers named MV Pluto I, II, III, IV and V, each of which was equipped with an insulated container for transporting fish under ice preservation. Introduction of the MV Plutos met protests from the fishing communities, who were worried about the swelling number of trawlers in the lake. As a result of these protests, the Minister in charge of Fisheries banned trawling within 5 nautical miles of the nearest shoreline. This ban was later extended to cover the entire lake. Some trawlers, though, have continued to operate openly in spite of the ban.

The majority of the trawlers were converted from vessels previously owned by government departments such as Fisheries, Police, Health and Customs. Kenya Railways Corporation also sold a number of its old vessels. Such vessels were originally designed for patrolling the lake,

transportation and general services, but were later suitably modified for trawling. Local expertise was available to assist in designing and making deck machinery, equipment and arrangements for the trawlers. Local experts have to a large extent, helped in providing the required manpower for making and maintaining trawling equipment.

The Kenya Railways Marine Yard has provided all the maritime services for the construction, modification and maintenance of trawlers. The informal sector, commonly termed Jua Kali in Kenya, has played a major role in making and servicing equipment such as trawl doors (otter boards), shafts and engines. In many cases, second hand motor vehicle engines have been installed for the propulsion of trawlers. A Greek boat builder-cum-naval architect based in Kisumu has constructed several steel trawlers such as MV Baraka, later re-named MV Salama (now abandoned on a beach in Lake Turkana), MV Cecilia, MV Tom, MV Ratego, (later re-named MV Nyar-majengo) and MV Niko. The same naval architect has also introduced the technology of converting motor vehicle air-cooled engines into marine water-cooled ones, with modified gearboxes to fit.

Relations Between Trawler Operators and the Artisanal Fishing Community

In the earlier years of research trawling, both EAFFRO and the Kenya Fisheries Department developed a good relationship with the fishermen, except when a trawler damaged their fishing gear. The researchers informed fishermen in advance not to set nets and lines on routes where trawling would be carried out at a given time. Trawling programmes were well coordinated by the researchers, Fisheries Department and the Government administration. Trawling period in a given zone was short, lasting a few days to one week, therefore, damages to fishing gear of local fishermen were rare and minimal.

In order to promote fish consumption in the country, the Fisheries Department started the "Eat more fish" campaign. This involved supplying free fish to the agricultural shows and fish exhibitions throughout the country. To have enough fish for that purpose, both the Fisheries Department trawl boats and those owned by

KMFRI caught fish almost throughout the year. Trawling for shows and other fish exhibitions thus became an officially permitted exercise. The relationship between these type of trawlers and the artisanal fishermen remained good since the fishermen were informed of the trawl operations in advance.

Commercial trawlers soon joined the research ones, initially growing slowly in the 1970s, but shooting up in the late 1980s. The increased trawlers invaded the limited fishing ground used by the artisanal fishermen, especially in the gulf as shown on the map. The commercial trawlers chose suitable and strategic landing points which were accessible by road. Luanda Naya point remained the most popular trawler landing base, owing to its proximity to the rich fishing grounds and its accessibility by road. Other trawler landing bases have been Asat (Uhuru) Beach, Asembo (Kokach) Bay and the Kenya Railways landing piers at Mbita point, Kendu Bay and Homa Bay. Trawlers also docked at Bala Rawi (Kobiero), Madundu and Kopiata beaches. The Kenya Railways piers, which had been handling little business previously, became active with trawler crew and traders selling fish and other goods.

Trawlers 'damage' fishing equipment

By JOHN OBIRO

Eight trawlers, whose presence at the Karungu Beach on the shores of Lake Victoria sparked a battle between fishermen and the police on Saturday, have reportedly damaged fishing net and other implements worth more than Sh500,000.

The Nyanza District Commissioner, Mr. Zephaniah Owigo Odingo, claimed that the destruction of the nets has sparked tension in the area and asked the Government to have the trawlers removed. He said trawlers, allegedly owned by two businessmen based in Kisumu and Kisumu respectively, should be made to pay for the destruction of local fishermen's property.

Mr. Odingo said the continued presence of the trawlers in Lake Victoria was a security risk as fishermen may resort to acts of lawlessness. "I am appealing to the Government to avert a looming disaster by ordering the removal of these destructive trawlers," Mr. Odingo told a press conference in Homa Bay town yesterday.

On Saturday, more than 100 fishermen from Karungu Beach battled with the police who tried to restrain them from burning some of the trawlers. The police had to shoot in the air to scare off the protesting fishermen.

By yesterday, the trawlers were still being used for fishing between Son and Mutur beaches as armed police kept guard at the shores.

Efforts to get comments from the Nyanza District Commissioner, Mr. Hassan Haji, and the local Fisheries officer failed.

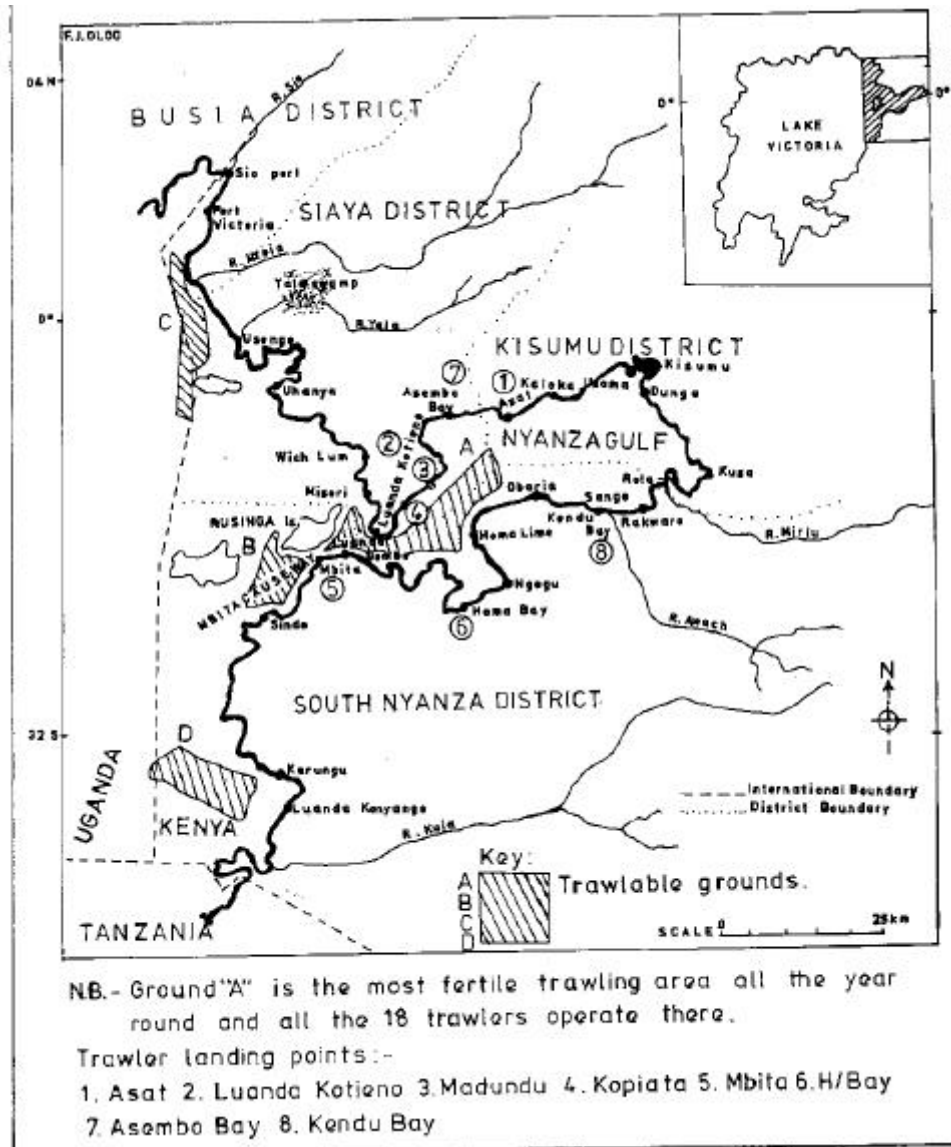
(Daily Nation, 5 October 1993)

As the trawling fleet swelled in the gulf, the limited space could not allow them to operate without coming across a long line or a gill net. In most cases, a trawler's crew would not divert the boat in time to prevent partial, or in some cases, total damage to the fishing gear. Some of the damage occurred in the presence of the traditional fisherfolk who, therefore, went after the trawler for compensation. Trawler owners compensated the fishermen without protracted disputes. Some bad trawler owners, though, became arrogant and confrontational to fishermen. Such cases were reported to the Chiefs, District Officers or even the Provincial Commissioner for arbitration. A few cases ended up in the Law courts, where the guilty parties were fined or jailed, depending on the extent of the damage.

In one incidence on the northern part of the gulf bordering Ugandan waters, trawlers met resistance from fishermen in Mageta Island/ and those from Yimbo, Samia and Bunyala locations. The climax of such conflicts, however, occurred when fishermen at Sori-Karungu adamantly refused to allow trawling around their bay or the landing of trawlers at Sori-Karungu Beach. Fishermen in Sori-Karungu, Kadem, Muhuru and Gwasi locations were enraged to see a large fleet, consisting of 8 trawlers, invade a common fishing ground known as Karungu-Kadem sediment flat. This is a very popular fishing ground, constituted by floods of Migori and Oyani rivers delta - an area always concentrated with fishing nets and lines. A lot of damage was done to the gear, inevitably leading to conflict between the artisanal fishers and trawler operators. Beyond this popular fishing area lies a narrow margin of permitted trawling ground, which is 5 nautical miles offshore. However, trawler operators hardly restricted their activities to the permitted zone, and often attempted to infringe on the richer inshore fishing grounds where many fishermen set their nets. Some trawler owners sought the support of the Police and Government Administration whenever conflicts with fishermen arose. In the above cases, the then Nyanza Provincial Commissioner intervened and re-enforced the ban on trawling in Lake Victoria.

What is most surprising is that a large number of trawler owners have developed good relations with fishermen they interact with inside some parts of the Nyanza gulf. Fishermen in the gulf have fought a long battle with trawlers until they have apparently learnt to live amicably with them. Perhaps the main underlying factor is that trawler owners are themselves related to the fishermen. Occasionally, trawlers are involved in rescue operations. When sudden rough weather develops, some fishermen may find themselves unable to sail with their catch back to the beach. Some canoes may capsize while others cannot anchor until the waters calm down. All these cases get free assistance from trawlers. Some trawlers will tow back boats carrying huge loads of fish that the fishermen cannot easily transport, especially when the fishing ground is a long distance from the landing bases. Without trawlers nearby, some of the above fishermen would incur huge post harvest losses. A unique relationship has thus evolved between the fishermen and the trawlers. When accidents occur in the lake involving fishermen or passengers on board a transport or cargo vessel, trawlers are called upon to voluntarily engage in the rescue operations. Their presence in an area therefore gives some sense of security to the artisanal fishermen.

Trawlers also employ local fishing crew. Where trawlers land their catches, conspicuous fish marketing and processing activities have developed. This has influenced the attitude of local communities, who now appreciate the positive economic impacts created by the trawlers. Trawlers are popular with industrial fish processors, who get high quality fish, as well as with some fishmongers and traditional fish processors, who utilize the by-catch, juvenile fish and damaged or bad quality fish rejected by industrial processors. At each of the landing beaches for trawlers, there is thriving business during high catch times. The best examples are at Lwanda Naya and Asat beaches. The misplaced contention among trawler owners is that the positive effects of trawling benefit all lakeside communities. According to them, at prominent trawler landing bases, the local community stands to benefit in many ways. The crew of fish buying trucks usually spend part of their money freely



at the beaches, buying good food and drinks and booking into the best hotels and lodges. When a trawler lands, several casual jobs are created, including for those to operate canoes offloading fish, deck cleaners and those to carry fish from the boat to the banda or to an improvised shade. Trawler crews are also picked from the local communities. Once employed, they are exposed to rare navigational and technical skills in handling deck equipment such as compasses, echo sounders, fish finders, radar, net haulers and the winches. They learn how to repair, make and operate trawl components and this

increases their job opportunities in the region and even in foreign countries. Some people who started their careers as trawler crew on Lake Victoria are now employed in more senior posts in marine vessels on the Kenyan coast. Some of the local people employed are also trained in lofting and actual design and building of the steel boats. The Greek naval architect previously mentioned currently employs and trains a number of Jua Kali artisans in boat building, including metal works and engineering.

Relations between Trawler Owners and Industrial Fish Processors

Because of the high quality fish landed by trawlers, processing plants have made some form of contractual agreement with the trawler owners and operators. Some factories, apart from paying for fish at the prevailing market prices, also provide trawlers with some amount of fuel for free. For instance, 40-60 litres of diesel may be given to a trawler daily as an inducement to ensure that all fish landed by the trawler is purchased by the agent for the factory concerned.

In another aspect, when a trawler breaks down or is due for a major overhaul, a factory would accept to pay the repair bill that would be later offset by several deliveries of fish caught by the trawler. Soft loans, disguised as advance payment for fish to be delivered, are often given to trawler owners or to their fishing crew. Some factories have not only built trawlers of their own but also financed the building and equipping of several trawlers. This is done on the basis that the assisted trawlers will deliver all their catches to the particular factory.

In earlier years, some factories owned by non-local people attempted to put their own trawlers on the lake, but these were rejected by artisanal fishermen. The argument advanced here was that if outsiders were allowed to venture into fishing, they would not only do it indiscriminately, but also render the local fisherfolk unemployed. The second reason was that fish processors should not be allowed to carry out fishing since that would create vertical integration into the fishing industry. The relationship has, therefore, remained that industrial fish processors sponsor local people to carry out trawling, on agreement that the particular factory is supplied with all or much of fish caught by the trawler.

Income from Trawling

During peak catch seasons, trawlers can land large quantities of fish. A trawler with an engine capacity of 300 HP can land over one metric ton of fish daily. Figures 1 - 4 are graphical presentations of records of income and expenditure of two trawlers of different sizes, MV Cathelene and MV Salama, in 1991 and 1995. Each trawler employed at least ten people who were paid regular wages. The

employees also received a bonus whenever they brought in bumper catches.

A lot of money is spent on establishing trawling operations, including the cost of purchasing and equipping the trawlers as well as the operational costs. However, trawling is a "quick return" investment, and is very lucrative, especially when fish prices are high. On the other hand when fish prices drop, trawlers earn very little. If the daily catch value cannot meet the overall operational costs, trawling operations have to be subsidized by the accumulated savings, or compensated for by the projected anticipated earnings. In the latter case, the industrial fish processors usually offer soft loans to trawler owners to sustain their operations. During such low catch seasons, the trawler crews receive low wages and are not given a bonus.

As previously mentioned, trawler operators and crew spend a significant proportion of their earnings on food and drinks at the landing points. This has promoted the growth of landing beaches and turned them into sprawling trading centres with hotels, bars, lodges and goods stores. A lot of other merchandise is sold there in stalls, kiosks and open-air markets. Senior trawler operators, such as the skipper and his engineer, like to rent independent houses or spacious hotel rooms. A number of crew live with their families at the beaches and, in such cases, the wives engage in fish processing and trade. A trawling crew can therefore afford to take care of himself and his family satisfactorily and still have some savings for school fees, housing and other basic requirements.

Trawler owners are in most cases relatively rich persons. During high catch seasons, and if fish prices are good, they make big profits. A medium size trawler can earn a net income of between Ksh 100,000 and Ksh 150,000 during a good fishing expedition lasting one month. This competes well with the earnings from most medium size business ventures in Kenya.

Out of fifteen trawler owners interviewed, ten re-invested their earnings in enlarging their trawler fleet, some of them from between one to four boats. This indicates that trawler owners are very optimistic about trawling opportunities in the future. Some of the trawler owners also have interests in industrial fish processing.

Other trawler owners are successful businessmen and women who have well-established chains of business. One thing which is clear though, is that none of the huge profits earned from trawling is re-invested in improving the fishery. If trawling should continue, then ways of channeling some of the earnings back to fund fisheries research and management must be established.

Trawling and the Aquatic Environment

Globally, one of the most sensitive environmental issues is the indiscriminate destruction of biodiversity in various unique habitats. This is most important in the developing world, where conservation awareness has not been taken seriously. Lake Victoria, as stated earlier, has been the home of a large variety of fish species and other organisms that have attracted a lot of attention from the scientific community worldwide. Due to indiscriminate fishing methods, such as seining with fine meshed mosquito nets and small meshed gillnets, as well as trawling in spawning ground using under meshed codend, coupled with predation by Nile Perch, a number of fish species have disappeared or are near extinction. Trawling in the lake can end up harvesting a lot of the primitive bottom aquatic biomass. It's wide use in all fishing grounds could, therefore, spoil important niches and break down essential food webs. Heavy indiscriminate trawling not only destroys the bottom stratum but also interferes with the breeding patterns and may have been one of the causes of the sudden fall in tilapines and haplochromines which had been abundant in the lake in the 1960s and 1970s.

Future Prospects for Trawling

Water hyacinth - the fast multiplying floating water plant - has hindered fishing in many fishing grounds and hindered the use of ordinary fishing methods, including beach seining. Only trawling can persist at all times since trawlers move from place to place, thus evading hyacinth-infested areas. The water hyacinth continues to invade most prime fishing areas and restricts fishing. Trawl gear stands the best chance of coping with the situation and should therefore be regarded as a good alternative fishing method.

Certain parts of the lake experience very strong undercurrents that deter artisanal fishermen from setting their gear there. Artisanal fishermen often lose their nets to currents, or their long lines may be damaged. Such areas experience upwelling as warm water mixes with cold one. Rich fishing grounds are formed in such areas, which can only be fished by trawlers. Therefore, trawlers will still be required to fish in the deep parts of the lake where the other boats cannot reach.

So far, trawling provides the best quality fish and would be the method to recommend for "export quality" fishing. The landing beaches lack basic sanitary facilities such as piped water, proper toilet facilities and other general requirements. Hence, they are the most likely source of bacteriological contamination. Trawlers carry fish in containers under ice, which is directly transferred into insulated or refrigerated trucks and then transported to the processing plants.

In contrast, most artisanal fishing crafts are wooden canoes that are usually prone to leakage. They are not properly cleaned or maintained and therefore, when the fish gets in contact with leaking water, it gets spoilt very fast. Fish brought on these boats also pass through several stages of handling. These include removal from the gear, transfer from vessel to the ground or into containers, weighing and sorting at the beaches and loading into the trucks before it is transported to the factory. This exposes the fish to many potential sources of contamination.

The landing of high quality fish is becoming an important issue on Lake Victoria. This is because some of the markets, for example the European Union, has in the past banned the import of the fish from the lake, for quality related reasons. It would therefore be easier to establish the required hygienic standards by using trawlers since the majority of them are steel-hulled and can have sterilized fish holds or containers. Their crew can be equipped with proper working uniforms and tools since the trawler owners can afford to provide such kits. Most trawler operators are also properly trained in maritime hygienic requirements

Trawling in Lake Victoria for research or commercial interest cannot, at the moment, be regarded as intensive. It is scattered, sporadic and seasonal. The number of trawlers in a given fishing ground is still quite small. The damage that trawlers have inflicted on the aquatic environment of Lake Victoria is thus, not extensive, but increased trawling should be

closely monitored by ecologists and conservationists. The number and size of trawlers operating in Kenyan waters should be a matter of concern. If possible, scientists and administrators may determine limits of trawl operation, by area and season, so as to balance rational exploitation and fisheries management goals.

Fig 1: GROSS INCOME vs EXPENDITURES, MV SALAMA (52ft, 162HP)

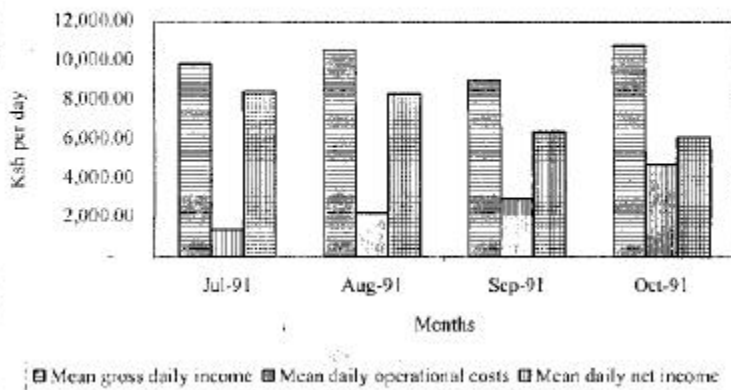


Fig 2: INCOME vs OPERATIONAL COSTS, MV CATHELENE (18ft, 44HP)

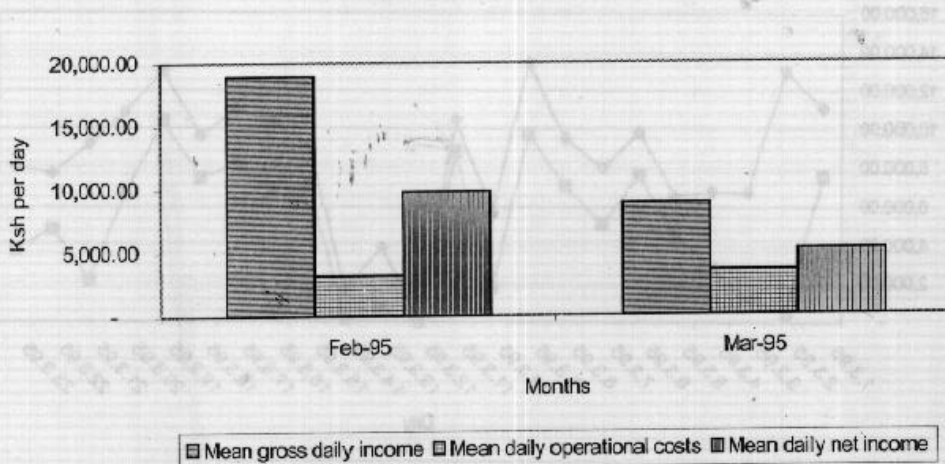


Fig 3: DAILY VARIATION IN GROSS AND NET INCOMES, MV SALAMA (52ft, 162 HP)

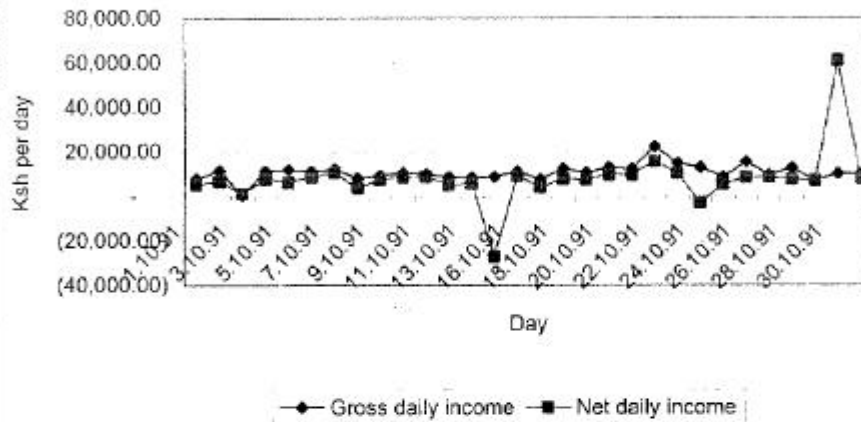
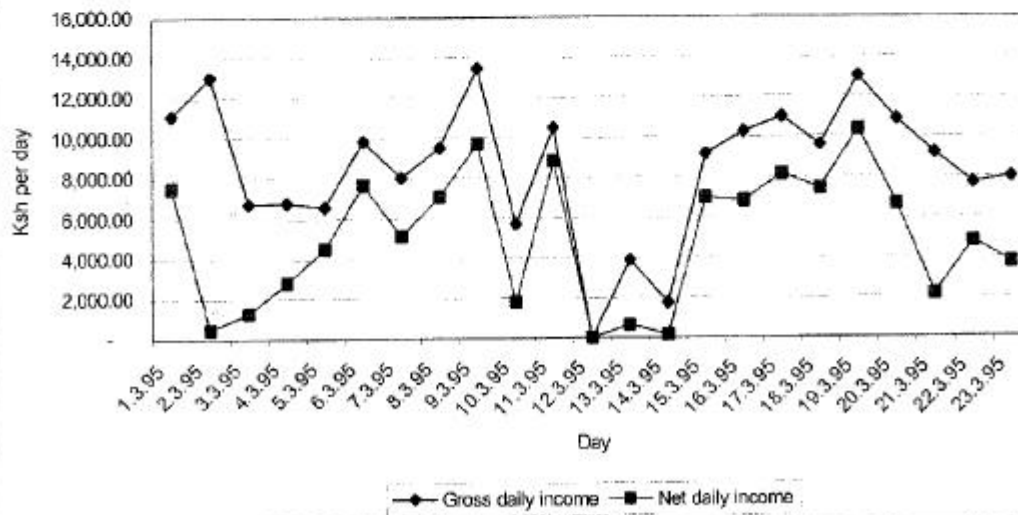


Fig 4: DAILY VARIATION IN GROSS AND NET INCOMES MV CATHELENE (18ft 44HP)



THE DEVELOPMENT AND PROSPECTS OF EXPERIMENTAL AND COMMERCIAL TRAWLING IN LAKE VICTORIA

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History of Experimental Trawling

The first recorded evidence of trawl fishing on Lake Victoria was made by Graham in 1928 using a small beam trawl (Graham, 1929). The main objective was to evaluate trawl catch characteristics. Fair catch rates for Protopterus species and large catches of Haplochromis species were obtained. However, because trawl nets are less selective for the size of fish caught, Graham recommended that commercial trawl fishing should not be permitted on the lake. On the other hand, because of the potential large catches of Haplochromis species, it was proposed that a fleet of 200 trawlers be established to catch them to be used for manure in colonial Kenya's agriculture.

Further trawling experiments in 1948 by the Lake Victoria Fisheries Service (LVFS) also indicated heavy catches of Haplochromis species (E.A.H.C., 1948). The study also revealed potential new commercial fisheries for Mormyrus and Haplochromis species (E.A.H.C., 1951). Later experimental trawling again indicated large quantities of Haplochromis species which could be harvested commercially (EAFFRO 1951, 1952; Gee and Gilbert, 1966).

All the experimental trawl surveys so far discussed were localized and not lake-wide. In order to confirm the findings made and for management or development considerations, lake-wide coverage of trawl operations became necessary. Thus, during the period January 1969 through May 1971, the United Nations Development Program (UNDP) and the Lake Victoria Fisheries Research Project (LVFRP) embarked on an exploratory trawl survey covering the entire lake (Cordone and Kudhonga 1972). The major factors which necessitated this included the lack of background information needed for successful application of quantitative stock assessment, and the fact that Lake Victoria is large with complex

habitats and has a multi-species fishery which requires efficient utilization and conservation. The conclusions and recommendations drawn from this survey largely concerned the then abundant Haplochromis species. Before these could be effected, the haplochromine stocks diminished due to progressive prominence of the introduced Nile perch (*Lates niloticus*).

Significant observations made during the lake-wide exploratory trawling of 1969 - 1971 indicated that pelagic catches were small at only 12 kg/hr, mainly consisting of Haplochromis species and that demersal (bottom) trawling was more economic than pelagic trawling due to the fact that fish in Lake Victoria are more demersal than pelagic (Cordone and Kudhonga, 1972). The total catch rates and species diversity varied inversely with the mean depth, a factor which has an important bearing on making the decision to legalize commercial trawling in the lake. The results obtained indicated that an ichthyomas of 700,000 metric tons, of which 80% was made up of the haplochromine species assemblage, could be trawled (Kudhonga, 1973).

Commercial trawling is a labour and energy intensive undertaking. It is important to know when and where in the water column a trawl can be deployed profitably so as to obtain moderate to maximum catches, as well as the number of hauls to be made at economic return rates. It is also important to know which type of trawling (bottom, surface or mid-water) should be made in order to obtain optimum catches. Observations made during the lake-wide trawl surveys indicated that demersal and pelagic catches are complementary, with some species moving off while others move to the bottom during the day but reverse direction during the night. For example, catch rates of Haplochromis species, *Oreochromis esculentus*, *Bagrus docmac* and *Labeo victorianus* were

higher in bottom trawls made during the day, but were higher in mid-water trawls made during the night. *Oreochromis nilotica* and *Protopterus aethiopicus* were caught in higher quantities with bottom trawls during the night but, together with *Rastrineobola argentea* (Dagaa), were caught in higher quantities during the day with mid-water trawls. Mormyrid catches were only obtained from bottom trawls during the night while catches of *Schilbe*, *Mystus*, *Xenoclaris* and *Synodontis* species occurred only in mid-water trawls during the night. These vertically opposite temporal and spatial migrations serve to protect the fish species involved against direct competitive interactions for resources in the water column. They may also serve to increase the range of food items available to the fish species involved (Cordone and Kudhongania, 1972).

Observations by Gee and Gilbert (1966) show that large shoals of *Rastrineobola argentea* occur in surface waters of the open lake down to a depth of 20-35m particularly at dawn and dusk. Several recommendations were made on harvesting this resource. Gee and Gilbert (ibid) recommended that the fish can be commercially harvested using a much larger trawl than the one they used, or using a 300-500m purse seine of 1/4" mesh size, which is about 30m deep. Other results included the spatial and temporal distribution of fish species, with *Haplochromis*, *Bagrus*, *Clarias* and *Synodontis* being eurybathic (have a wider distribution in the water column). The current situation shows that these fishes were only found in inshore waters except the haplochromines. *Tilapia* and *Protopterus* species were also in inshore waters. These species are oligobathic (with a narrow distribution in the water column) and were found to have the same distribution patterns as at present. There were also observations made on the habitat preferences by certain fish species: *Bagrus*, *Protopterus* and *Barbus* species were found on both sand and mud bottoms. *Tilapia zilli* and *Tilapia variabilis* were common over sandy bottoms while *Tilapia esculenta*, *Synodontis*, *Clarias* and *Xenodarias* species were common over mud bottoms (Kudhongania et al., 1971).

The results of the UNDP/LVFRP lake-wide survey enabled the construction of a preliminary picture of the distribution and relative abundance of the demersal stocks and the estimation of fish biomass in different areas, and at different taxa, and their variation in relation to variables such as codend mesh size, depth, and time of the day. They provided the guidelines for sensible commercial development and technological improvement of the fishery (Kudhongania et al., 1971)

Since the UNDP/LVFRP lake-wide survey, experimental fishing has been conducted by the Fisheries Departments and research institutes namely: Kenya Marine and Fisheries Research Institute (KMFRI), the Fisheries Research Institute (FIRI) of Uganda and the Tanzania Fisheries Research Institute (TAFIRI). These research institutes came into being after the collapse of the East African Freshwater Fisheries Research Organization (EAFFRO) in 1977. The trawl surveys by these institutions have been restricted to their respective national waters. They have been undertaken in irregular frequency, and have been carried out for various individual needs of the institutions.

In the Kenyan waters, experimental trawling was first conducted in 1967 at Kisumu using a Fisheries Department boat, MV Pelican. This was extended to Port Victoria in 1968 using a 6m plastic boat, MV Orada. Further experimental trawling has been conducted by KMFRI. Currently, the three East African fisheries research institutes, with the technical assistance of a consortium of European universities, are undertaking a lake-wide experimental trawling. The funding for this activity is provided by the Lake Victoria Fisheries Research Project sponsored by the European Union.

History of Commercial Trawling

Commercial trawling in the Kenyan waters of Lake Victoria was introduced in 1968 to harvest tilapines for a fish processing plant at Kisumu. It was carried out at Port Victoria, Kisumu and Mbita. In 1979, the Mbita Multipurpose Co-operative Society was involved in extensive trawling for Nile perch using the stern trawler MV Rebecca. As the Nile perch fishing became increasingly prominent, and as the market

opened up locally and internationally, the number of trawlers increased to 50 in the three countries sharing the lake. The number of fish processing plants also increased together with the number of trawlers, as well as the level of fish production. At one stage, the number of trawlers operating in Kenyan waters was so high that it caused violent protests from the artisanal fishermen. Thus in 1989, a total ban on commercial trawling was announced by the Kenya Government. Later, fisheries regulations prohibiting trawling in certain areas were enacted. This was due to the fact that trawlers invaded the limited fishing grounds particularly in the Nyanza Gulf, causing damage to artisanal fishermen's gears - mainly gill nets, beach seines and long lines. Therefore the Kenya Fish Industry Act of 1991 was promulgated to prohibit trawling within 5 nautical miles from the shoreline. This automatically excluded the Nyanza Gulf from commercial trawling. Despite this, trawling still continued in the Nyanza Gulf.

In view of conflicts between trawlers and the artisanal fishermen, in the southern and northern coast waters of Lake Victoria, it seems that the ban on trawling as contained in the Kenya Fishing Regulation Cap 378-380 has been inconsequential. The operation of trawlers by non-indigenous people invoked a great deal of protest from the local fishermen to the extent that in some cases fishing ventures were disbanded. Earlier, prospects for commercial trawling had diminished with the disappearance of the once abundant *Haplochromis* species and due to the fact that Nile perch was not, at that time, a target species in the fishery. As the importance of Nile perch came to the fore, commercial trawling again took off rapidly and spread.

The trawler concerns have been financed by individuals, companies and, in the past by the Mbita Multipurpose Co-operative Society. Experimental trawling by research institutions and the Fisheries Departments has been funded by the riparian governments and donor projects.

Impacts of Trawling on the Ecosystem

Trawling, if done judiciously, does not have adverse effects on the fishery, but excess fishing efforts can be destructive. Bottom trawling, in

particular, damages the bottom structure and fauna thus destroying the brooding and nursery grounds. Trawlers, being less selective, catch different fish sizes and especially juvenile fish. On the long term this reduces the total catch and the production potential of the stocks, contrary to the situation when gillnets are used. This is due to the fact that trawlers capture fish before they attain sexual maturity as well as recruitment size. The fishing pressure on the lake's stocks particularly in the Kenyan waters is very high. Trawling will further worsen the situation on the already unsteady Nile perch catches and the overfished inshore stocks. Further, the artisanal fishermen operating in inshore waters need protection.

It is known that species diversity decreases with increasing mean depth in the lake, particularly in the central 40% of the lake region (Cordone and Kudhongania, 1972). Further trawling in deeper water with illegal mesh can reduce the already stressed biodiversity of the haplochromines. The major species which are expected, as indicated from trawling experiments by LVFS, EAFFRO and UNDP/LVFRP, such as *Synodontis*, *Bagrus*, and *Clarias* are already absent from deeper waters. Trawling in inshore waters can even have further negative consequences on the reduced biodiversity, comprising of *Oreochromis* species, especially *Tilapia zilli*, and *Protopterus* species, as well as a reasonable range of riverine and anadromous fisheries, including the small *Mormyridae*, *Bagrus docmac* and *Labeo victorianus*. The inshore shallow waters (in the depth range 0-20m) constitutes 18% of the lake area but was found to contain 30% of the fish biomass, and is the principal region exploited by the artisanal fishermen (Kudhongania et al., 1971). Trawling in this region will particularly destroy the tilapine breeding and nursery grounds and reduce their potential yield.

There is lack of sufficient knowledge on the temporal and spatial distribution and abundance of fish, particularly the Nile perch. Past research indicates that its prey *Rastrineobola argentea* and *Caridina nilotica* occur in reasonable quantities in the open lake waters, suggesting there may be significant quantities of Nile perch there. However, there is competition

for resources such as breeding and feeding grounds as well as predator-prey relations amongst various fish species. These, together with increased fishing mortality and changes in the selective properties of the trawls, can have a negative impact on the biotic potential of the lake. Trawling in deeper waters increases the operational costs since a longer distance has to be covered in order to reach the trawling grounds. This could encourage the trawlers to fish inshore, where the fish catch is also higher and thus cause the range of problems discussed above.

Prospects for Future Commercial Trawling in Lake Victoria

Certain fish species, namely *Oreochromis esculenta*, *Oreochromis variabilis*, *Labeo victorianus*, *Monnyrus kannume*, *Bagrus docmac* and *Schilbe mystus*, which could form the basis of the trawl fishery in deeper waters, have been overfished from the traditional fishing grounds. Furthermore, earlier yield estimates from the lake suggested that, due to excessive fishing pressure or selective fishing on certain stocks, many fish species were not being harvested proportionately (Kudhongania, 1973).

The only possibility which exists is the deeper water trawling for Nile perch. In this case, exploitation is not as much as in inshore waters since the distance involved is greater and there are limitations to fishing due to greater depth and dangerous water currents. Additionally, existing artisanal fishermen are incapable of exploiting fish resources in deeper water due to limitations in fishing technology. The development of an offshore trawl fishery could therefore supplement the declining catches from inshore waters and hence reduce fishing pressure inshore. The major commitments will involve the appropriate gears to be used as well as the most suitable crafts to be operated. This will also make it easier to impose fishing regulations as there would be alternative fishing and more catches for consumption.

The development of a trawling industry will depend on the characteristics of the fish resource. This should focus on *Rastrineobola argentea* and *Lates niloticus* in the open lake waters. The yield potential of these two species is not known. In addition, the spatial and temporal variability in the catch rates of the two species arising, for example, from seasonal migrations is not well documented. Besides this, most species in the lake, except Nile perch and Dagaa, are below the peak of their bio-economic optimum (Kudhongania et al., 1971).

Several research disciplines, especially bio-economic studies, are needed to assess the viability of a commercial trawl fishery in the open deeper waters. The parameters which should be considered in developing the trawl fishery include the biological yield potential of commercial stocks, basic economic considerations such as costs of managing and operating the fleet of trawlers, demand and prices of fish and their products, the necessary shoreline infrastructure to handle increased landings and the availability of skilled labour, besides profit potentials. It is therefore necessary for the riparian states to coordinate the activities of commercial trawlers in their respective waters. Data on biometrics, for example on fish sizes and weights, effects of gear on different fish species and their temporal and spatial distributions should be compiled from the trawlers in order to estimate their fishing effort.

Fish production using trawlers minimizes labour and its introduction will require serious considerations. Socially, it will be undesirable as it will force thousands of artisanal fishermen out of their livelihood, hence the need to limit it to the deeper, less exploited waters. Unfortunately for Kenya, the area of deeper water is limited as most of the Nyanza Gulf is shallow and trawling is officially banned.

TRAWLING ON THE NYANZA GULF IN THE KENYAN PART OF LAKE VICTORIA - BIOLOGICAL-IMPLICATIONS

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Introduction

Nyanza Gulf has a multi-species fishery with over 300 species and is exploited by many small-scale fishermen. Exploitation of fisheries resources is done using different selective harvesting methods. The choice of gear depends on the target species and investment capacity of the individual fishermen. The increase in the number of fishing boats in the lake has been a direct result of scarcity of agricultural land along the lakeshore, lack of alternative employment opportunities, specialization of the lake community on fishing activities and demand for more fish from the rest of the population who traditionally did not eat fish. Along with the increase in the number fishing boats is the adoption of different gear, particularly the small-meshed nets in order to conform to the reducing sizes of fish. Both commercial and research trawling have also been practiced in the lake. In order to understand the biological implications of trawling there is need to understand the following.

Depth Stratification of Nyanza Gulf

The mean depth of Nyanza Gulf is less than 10m and the deepest part of the Gulf is 50m along Rusinga channel. About sixty per cent of the Gulf is less than 5 m in depth. Much of the Gulf is soft mud substrate with isolated areas having sandy substrate. A greater part of the Gulf environmental conditions is influenced by rivers, especially Nyando and Sondu-Miriu, which drain agricultural land. The mouths of these two rivers have a dense growth of macrophytes. Siltation from the drainage basin might adversely affect the nature of the substrate of Lake Victoria, particularly the Nyanza Gulf.

Fish Stocks and Fisheries

Three main species have formed the backbone of the fishery in the Gulf in the last ten years, namely; Nile tilapia (*Oreochromis niloticus*), Nile perch (*Lates niloticus*) and Daga (*Rastrineobola argentea*). They account for over 95% of the total landed catches, which has also increased threefold during this period (Kenya Government, 1996).

Distribution of fish stocks is dependent on habitat and food. Nile perch is both demersal and pelagic, but high catch is observed mainly in the mid-gulf. Nile tilapia is found in shallow bays up to 10 m. *Rastrineobola argentea* is pelagic and highest densities are observed at the entrance to the gulf, where fishermen get all-year round high catches. Between mid-gulf and the entrance to the Gulf there is high concentration of gillnet fishery, mainly for Nile perch and Nile tilapia. At the entrance to the Gulf, in addition to the gillnet fishery, there is a high concentration of mosquito seine nets used in the *Rastrineobola argentea* fishery. Sheltered bays normally have a number of beach seines operating. Such a scenario is also common in the other parts of the lake.

Sexual maturation in Nile perch and Nile tilapia occurs at varying sizes. First maturation in Nile tilapia occurs at 28cm total length, for females, while in Nile perch it occurs at about 60cm total length.

Trawlers continue fishing — report

By NATION Correspondent

Trawling has persisted in Lake Victoria despite protests from small-scale fishermen, according to the latest issue of an environmental newsletter, *The Lake Victoria Bulletin*.

The newsletter, published monthly by Osiwala, an environmental NGO, says hundreds of tonnes of immature fish have been harvested, in total disregard of fishing regulations.

"Despite strong protests by some 300 fishermen last year, it appears little is being done to control trawling in Kenya's side of Lake Victoria," the bulletin says.

It adds that between seven and nine trawlers currently operate on the lake, each supplying an average of 1,000 tonnes of the Nile perch (*mbuia*) to local fish processing firms daily.

The report claims that some of the trawlers are owned by senior civil servants and influential politicians.

Quoting sources from beach-based fish co-operative societies, the report says that between July 28 and September 20, 1994, five trawling vessels stationed at Asar Beach in the Winam Gulf caught a total of 5,280 kilogrammes of *mbuia* and 2,528 kilogrammes of assorted immature fish.

"Trawling, a highly mechanised and indiscriminate fishing method carried out by well equipped vessels fitted with strong nets and powerful engines, is only authorised for research but greedy individuals have turned the boats into elements of destruction," the report says.

The vessels are also said to have destroyed hundreds of kilogrammes of fishing gear belonging to local fishermen as they cruise along the beaches.

Late last year, a fight between small-scale fishermen and trawler crew in Rachuonyo District left eight people seriously injured and several boats destroyed.

(Daily Nation, 28 February 1997)

spawning process. When a substrate is disturbed it also interferes with the detritus formation and hence cuts off the continuum of the energy flow. The drag it causes at the bottom may also interfere with the larvae and the eggs of some fish stocks, inclusive of fishes that have pelagic eggs. The movement of the trawl at the bottom will also disturb benthos and other bottom dwelling invertebrates, hence disturbing the energy flow in the aquatic ecosystem.

Even though a trawl net can be made selective by the control of the codend mesh size, after initially taking the correct sizes which blocks the codend, it saturates and begins to trap also smaller fish, which would otherwise pass through the codend mesh.

Ordinarily it would lead to recruitment overfishing by intensively taking away the spawners which are the targeted population. As it eliminates spawners, their number decreases in the population and that might lead to weak year classes. If the mesh sizes are not carefully selected then it would fish out a number of juveniles from the fishery. This leads to growth overfishing since most of the juveniles will have been taken before their maturity. Trawling will also interfere with nests for macro-invertebrates. Most of the trawl nets in use have a codend mesh of about 60mm. This has its own unique selectivity characteristics, with a selection factor of about 3. There is the tendency that as the fish become scarce, it would be lowered to catch the smaller fish in the population as has been witnessed in the gillnet fishery.

Impact of Trawling

Bottom trawl fishery in the gulf has been deploying codend mesh sizes between 50mm and 70mm which have a high selectivity, with fifty per cent lying between 15cm and 20cm for Nile tilapia and Nile perch respectively. Compared to the size at first maturity, trawling, if allowed, would have irreparable consequences to Nile tilapia and Nile perch recruitment.

Bottom trawling disturbs the substrate and hence interferes with a number of factors, it is known that Nile tilapia prepares nests for spawning at the substrate. When a trawl net passes through these nests, it interferes with the

REPORT OF THE SOCIAL-ECONOMIC IMPACTS OF THE BAN ON TRAWLERS AND BEACH SEINES IN SPEKE AND MWANZA GULFS IN TANZANIA

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Introduction

The total landings of fish in the Tanzanian waters of Lake Victoria increased from 1987 to 1990, in line with the increasing abundance of Nile perch. However, a trend of decline in the catches of Nile perch, and consequently in total landings, has been observed since 1991. The decrease in catches influenced fishermen to reduce mesh sizes of gillnets used. Beach seines also became more common, while the number of commercial trawlers targeting Nile perch increased. As a result, the modal length of Nile perch caught in the artisanal fishery in the Tanzanian part of the lake, which had been 60-80cm in 1988 decreased to 50-60cm in 1992 and further down to 45-51cm in 1994. Some of the other species, especially the haplochromines, had also declined in abundance or completely disappeared as a result of predation by Nile perch and increased fishing pressure to meet demand for human consumption and fishmeal. The changes in the Nile perch stocks and in the species composition of the lake necessitated the formulation of new management measures to ensure sustainable utilization of the fishery.

To achieve this, the Government of Tanzania imposed a ban on the use of commercial trawlers, beach seines and gill nets of less than 5-inch mesh, towards the end of 1994. At that time there were about 15 trawlers which operated within the area around Mwanza, namely: MV Nyanza, MV Malkia, 3 from Tanzania Fishing Company (TAFICO), 3 from LABECO company, 2 from Tanzania Fisheries Research Institute and 5 other unidentified trawlers. These could catch, on average, a total of 15 tons of fish daily.

Since January 1996, the Tanzania Fisheries Research Institute (TAFIRI) has been conducting research in three lakeshore villages

around the Speke and Mwanza Gulfs of Lake Victoria in Tanzania, to monitor and evaluate the socio-economic and biological effects of the ban on beach seines and trawlers. The objectives of the study are to establish fish species composition and distribution, determine biomass, length of fish at first maturity and food of demersal species and also evaluate the socio-economic effects of the ban. This report discusses the preliminary results, obtained after one year of fieldwork, of the socio-economic aspects of the research. Data was obtained by interviewing artisanal fishers, small-scale fish traders and processors, village leaders and elders, as well as Fisheries Officers, by using semi-structured and detailed questionnaires. Focused group discussions and field observations backed this up.

Problems in Law Enforcement

Despite the existence of the regulations restricting certain gears and mesh sizes, these are not fully enforced. Fishermen still openly and widely use some of the banned gears and meshes. In particular, the study showed that beach seines were still used in many places, both at night and during the day. An interview with Fisheries Officers and local fishing communities revealed a number of difficulties in enforcing the laws and regulations. The following are some of the issues, which they thought are the main hindrance towards achieving full enforcement of the law.

First, staff of the Fisheries Department working out in the field felt that, as much they tried to enforce the ban, lack of their personal security prevented them from achieving their aim. On some beaches, the Fisheries Attendants - the low ranked personnel of the Fisheries Department responsible for enforcing the fisheries rules and regulations in the fishing beaches and villages, worked together with the

traditional guards, locally known as sungusungu, and this enabled them to perform their duties without fear. On other beaches, fishers gave them outboard engines on which to carry out patrols, but without security, and it was very difficult to do the work. In this case, the cost of fuel and payment to engine operators, was the responsibility of the Fisheries Attendant concerned. Most of them thought that the exercise was risky and too expensive for them.

Secondly, the Fisheries Department personnel in the field experienced some difficulties in interpreting the law. For example, it is not clear to them who should be arrested for violating the law - whether it is those who just make and sell the prohibited gear, or those who own and use them. The Fisheries Attendants thought that the law intended to ban the ownership of wrong gears, and suggested that it should clearly give a specific boundary along the lakeshore, where such gears cannot be owned. This would make it easier for them to enforce the regulations.

A third reason, according to some Fisheries Attendants, is that the Government made regulations without considering the measures and strategies of implementing them. "It is not simply paper work, though the Government treats it like that", one of them remarked. The Law enforcers disclosed that they were left to act alone for a long time with no financial or material support from the government. "We are just like orphans", one personnel of the Fisheries Department commented.

It was also learnt that the laws and regulations could easily cause conflicts if strictly administered. This was especially true in the shallow parts of the lake, where fishermen prefer under-mesh sized gill nets, because of the size of fish available. "When we tell them to stop using banned meshes, they tell us that we are depriving them of their livelihood", one Fisheries Attendant commented.

Related to this, some politicians think their voters are being oppressed by the law and that the Government wants to reduce the economic capability of those who depend on the lake for their livelihood. Some of the fishers and traders also expressed their worries over regulations that are unacceptable to the fishing community. This was mainly in reference to the ban of

beach seines and the use of nets with less than 10.0mm and 127.0mm mesh size for Dagaa and other fish, respectively. They explained that there are various fish species in the lake, which are of different mature sizes, and some of them can only be caught by the disallowed gears.

Fifth, there is no motivation especially to those who perform this exercise well. In some of the districts, the Fisheries Attendants have been enforcing the ban seriously and managed to confiscate a number of nets. However, according to them, there is no difference in remuneration between them and others who have decided not to enforce the regulations.

Financial constraints by the local councils also make it difficult to implement unplanned expenditures. In such a situation, the local government authority charges levies on banned gears, especially the beach seines. The Local Council Levy authorities have tended to promote the acceptance of beach seines by demanding financial contributions from the owners of such illegal gears. The implication of this is that the owners of banned gears continue with operations, as they feel that the government is recognizing their role in revenue contribution.

There is also a serious shortage of manpower in local governments, both in terms of quality and quantity, for designing and implementing strategies to be adopted in different programs in the fisheries sector, including those banning the use of non-selective gears. The Department of Fisheries has very few personnel, and the majority of them have no formal education, which makes it difficult to achieve high level of efficiency in their operations.

Bribery is also a common problem affecting law enforcement, and it involves village leaders, Fisheries Officers, institutions of justice and the community as a whole. It was reported that, because leaders in the community accept bribes, the implementation of certain laws, such as the ban of beach seines and the use of small mesh size nets are not easy to achieve. About 3.8% of the people interviewed confirmed that they had seen personnel of the Fisheries Department receiving bribes from beach seine operators. "Corruption has been accepted as part of our life style", one old fisher emphasized. Another villager remarked, "Corruption is a two-way

traffic: One gives, the other receives. We are the losers but we blame the Fisheries Officers, and the Government for not stopping it".

Why Traders Prefer Buying Fish From Illegal Gears

A driving force towards the use of non-selective gears is that they provide fish that has a ready market among small-scale traders or household consumers. The perishable nature of the product and lack of storage facilities makes the seine operators to sell at cheaper prices. In contrast, factories buy the large sized fish from fishermen with selective gears, at higher prices. Small-scale fish traders and most of the household consumers cannot compete with factories and afford the high prices of fish from the selective nets.

Thus, most of the small-scale fish traders prefer the informal pricing system that is used by illegal gear operators. It was also learned that the small-scale traders and processors in turn sell per piece or heap of fish, and hence make more profits. Therefore, illegal gear owners continue to land juvenile Nile perch and sell it in the local market while selective gill-nets land big fish, which are sold at high prices to industrial processors. This is one of the reasons which makes the small-scale fishers and illegal gear operators to remain in business despite the ban. The reasons why beach seines and trawlers remain popular among small-scale traders, processors and household consumers are summarized in the table below.

Negative Effects of the Ban on Trawling

Before the trawl ban, the fishing villages under study were reported to have three main income generating activities; fishing, farming and informal (petty) trading. The villagers stated that there were time variations in undertaking the three activities, and explained how their incomes changed from one to another. During the rainy season, which normally extended from October to May, fishing and farming were the main activities. June to September was harvesting time, and cash and food crops were plenty in the markets. During that period, informal trade was also at the peak. Traders, fishers and other business people took advantage of the good prices then available.

Economic activities such as petty trading of firewood, selling food in stalls and fish processing were common on the landing beaches. Some traders also operated mobile shops where they sold things like second-hand clothes, soft drinks, sweets and nuts, and household items. Shop owners enjoyed the mobile shop system because the products moved fast. "The economy is hidden here in the lake. If fishers and fish traders have no money we are the people to suffer most", one shop owner in Nyamikoma Village commented. The villagers spoke of the fishery as a "mining camp", because the population was high and the fishery accelerated business of different kinds.

Summary of Reasons why Respondents Buy Fish from Banned Fishing Units

Beach seine and under mesh nets	Trawlers
<ul style="list-style-type: none"> ◆ Price is relatively low ◆ Convenient source of supply to local traders and consumers ◆ The buyers get both big and small fish and can choose to re-sell to either industrial collectors or household consumers ◆ The deal does not take a lot of time - no wastage of time in bargaining because the sellers are afraid of being caught by law enforcers ◆ They don't have fixed prices, hence buyers sometimes gain ◆ Catch various species, including Dagaa and haplochromines and therefore widens the choice to local consumers 	<ul style="list-style-type: none"> ◆ The buying area is often close to the consumers' homes ◆ Lands enough fish within short period. In comparison, small boats only supply very little fish ◆ It is available at right time (the trawlers land in evening hours). Hence smoking fish is started when the weather is cool ◆ The buyers don't need to wake up at night to wait for fish ◆ Sells juvenile fish cheaply since it is not their priority ◆ Satisfies small-scale traders, household consumers as well as the industrial buyers

Source: Field study 1996

The respondents who previously worked in trawlers explained how they got economic setbacks after the ban. Casual employees from private boat owners became redundant. These included casual crew members, net repairers and menders, boat cleaners, loaders, porters, cooks in trawl boats, guards, fish gutters and scale removers, as well as agents who supplied food items in different boats. These employees were often sure of getting income on daily or weekly basis, and were therefore adversely affected by the ban. An interview with them revealed that some had managed to build two houses while others bought assets like radio, bicycle, and house furniture before the ban. They could not seek employment in smaller boats after the ban since the salary for employees in these boats was pegged on their production levels, which would be much less than what they were paid while working in trawlers.

One of the respondents stated that he had a shop, which closed down immediately the ban was effected. The village leaders and elders also indicated that about 15 small shops or groceries, 10 tea hotels and 4 bars closed down in one of the market centres, following the ban.

Positive Impacts of the Ban on Trawlers

Before the ban, there was a conflict between artisanal fishers, who appeared to suffer increasingly from incursion of commercial trawlers into inshore waters reserved for artisanal fishing. In addition, the artisanal fishers complained that they caught less fish during commercial trawl operations. Collection of fish catch data in the course of this study proved to be quite difficult, as the fishers did not keep records of their catch. However, I managed to get monthly catch data from four fishers in a period of two months, for the purpose of knowing the changes in their catch to verify the claim that during commercial trawl operations the fishers caught less fish. From the results, the mean catch during the commercial trawling period was consistently and significantly lower than when the ban was implemented. In the survey, the fish caught before the ban was 5 - 22% more than what the fishers harvested with the ban in place. Therefore, it is apparently true that fishermen

caught more fish when trawling was banned than when it was allowed.

A discussion I had with elders in Nyamikoma Village using the Focus Group approach reported the behavior of people in the villages when trawling was permitted and the changes that took place when the ban was imposed. For example, the influx of immigrants into the fishing villages and the increase in economic activities led to an increase in sexual promiscuity, including commercial sex in the fishing villages. "I had to restrict my children, and I had a certain amount of tension with my wife", one old and retired fisher remarked.

A medical doctor in Nyamikoma also revealed that some of the people in the villages generally felt they were at risk of contracting sexually transmitted diseases (STDs) from the so-called "loose people", who were there in the villages as immigrants. Married women especially felt that they were more at risk since they believed that their husbands had partners among the immigrant women.

"These immigrants should be questioned about what they are really doing here and where they came from, but nothing is being done because they often bribe the village leaders to accept them in the village, despite their immoral behavior", explained one young married teacher.

In order to justify the perceived connection between immigration of people during commercial trawling and STDs, I looked at hospital data for periods when there was commercial trawling and when it was banned. Results from two different health units reveal that, in both health centers, STD incidences were higher during trawling time. The villagers' observation was that when the trawl ban was imposed, the number of immigrants, quickly went down. These included temporary traders, hawkers, adventurers, smugglers, fortune seekers, as well as providers of all kinds of services - from catering to traditional medicine. As a consequence, cases of STDs greatly decreased.

Most fishers also stated that, with the growth of industrial fish processing, they had opted to use nets that catch fish preferred by the fish filleting factories. There is therefore no need for trawlers since, according to them, the latter can easily cause over fishing. They in fact blamed the Government for having taken too long to decide on banning trawling, which they feared could cause the depletion of fish stocks in their waters, as had happened in the neighbouring countries, particularly Kenya.

Some of the illegal fishing was done by school children. Such children were mainly involved in pulling beach seines, processing and trading juvenile fish from both the beach seines and trawlers. An interview I had with the headmaster of Nyamikoma Primary School revealed that poverty and hunger within the households forced some of the parents to involve their children in beach seining, and selling fish. About 28 pupils were seriously involved in pulling beach seines, and moved from one beach settlement to another. The trend of involving children in fishing activities was said to have increased tremendously before the ban. However, with the ban in place, many of them had no fish to sell and so went back to school.

Conclusions and Recommendations

The survey has established that the ban on trawling has been largely effective where as that on beach seines has not. There were still many beach seines operating illegally in the lake despite the ban. For some of the fishers using these gears, fishing is the only source of livelihood. This poses serious challenges to fisheries management. One way of handling the situation is by using participatory approaches, involving the local communities, in the

formulation and enforcement of fisheries regulations.

In spite of the adverse ecological effects trawlers could cause on the fishery, they only contributed about 15 tons of fish per day before the ban. The bulk of the fish processed within the country still came from other fishing methods. As such, the trawl ban did not affect a large proportion of the lakeshore communities.

It was also established that other gears also catch juvenile fish. More investment should therefore be placed on improving the other fishing techniques, such as hooks and gillnets, to make them more selective.

The ban on trawlers has also eliminated the conflict between trawl and gillnets operators, giving advantage to artisanal fishers in terms of increased catches, and incomes.

The prevalence of STDs in the fishing villages has dropped, since the trawl ban became effective. A large number of potential STD carriers, who had been attracted to the fishing camps by trawling and business activities, moved away after the ban. In this respect the ban should continue so as to protect the health of the communities.

A mechanism should be put in place to enable fishers and the Fisheries Department to collaborate in the supervision and control of fishing activities. The Community Fishery Management concept, which uses an integrated approach to management, should be practiced for the development of the artisanal fishery. More effort should also be put in educating the fisherfolk about the laws and regulations governing the fishery.

Police battle fishermen over trawlers

BY JOHN OYWA and BUDO JAMAK
Police in Migot had a busy day on Saturday trying to control riotous traders in one incident and fighting off irate fishermen in another.

The traders were descending to be met their salaries at the Barbers Bank branch while the fishermen stormed policemen claiming they were protecting illegal fishing trawlers in the lake.

The fishermen became angry at Karungu Bay and attacked three administration policemen with clubs, axes and other missiles. The policemen drove the fishermen to drive off the angry fishermen.

No serious injuries were reported, however.

Police in Migot and Macabier confirmed the incident which occurred at around 4 pm and said

they had launched investigations. Sources at the scene said the fishermen attacked the three policemen because they were fishing in a fish trap which was set up at the Karungu beach.

The sources said the fishermen had threatened to burn any trawler seen in the lake.

The fishermen's mobility over 100 trawlers, the policemen and vowed to kill them unless al

trawlers were removed from Lake Victoria," a police spokesman said.

Fishing sources from Karungu township said the fishermen threatened to turn East Karungu Location into "another Molo" unless the Government stopped trawler fishing in Lake Victoria.

Yet, the fishermen were sent to Karungu and neighbouring beaches to main-

in pieces as tension mounted between the local fishermen and the police.

Fishing sources said the trawler owners boasted that they had met permission from "above" to fish in the lake.

The fishermen complained that the Government might lose its fish and destroyed their

SOCIO-ECONOMIC IMPACTS OF TRAWLING IN LAKE VICTORIA

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Introduction

Trawling is a unique technique of harvesting fish on Lake Victoria. It is a modern method requiring relatively high capital investment and is capable of using complex scientific gadgets in monitoring and hauling fish. The fish caught by an average trawler may be many times what a local fishing unit may produce. Therefore, a trawler will yield higher catch per unit of labour and time input in a fishing operation than the traditional fishing boats. There is an official ban in place on commercial trawling in all three East African countries. Despite this, illegal trawling has persisted, presumably with the tacit knowledge of the government officers responsible for enforcing the ban. It appears that the incentives and profits attained in trawling are so high that some trawler owners continue in the business even at the risk of being prosecuted.

Alternatively it may be that trawler owners are very powerful and influential people in business or in the civil service. Evidence shows that among the initial owners of trawl boats in Kenya were top government officials, including a Cabinet Minister and an Assistant Director of Fisheries living in the lake region.

The profit motives and the powerful forces in the trawler industry effectively ensured that "disused" and non-performing vessels previously owned by the government of Kenya for the delivery of social services, in patrolling the lake and transporting passengers and goods, were purchased by private businessmen and renovated into trawlers. In this way, vessels owned by the Fisheries Department, Kenya Police, Ministry of Health, Customs Department and Kenya Railways were not repaired to continue in Government services, but sold off to rich and powerful individuals to be converted into trawlers.

Govt to resolve row over trawlers

By JOHN OYWA

The Government is demarcating parts of Lake Victoria to resolve rivalry between Nyanza fishermen and trawler owners, the Provincial Commissioner, Mr Joseph Kaguthi, has said.

Mr Kaguthi said a recent fracas between fishermen in Karungu Bay, police and trawler owners was caused by the absence of demarcations to indicate the restricted areas for trawler fishing.

However, the PC said that the Karungu beach fishermen, whose nets worth more than Sh500,000 were reportedly destroyed by trawlers last Saturday, were partly to blame for "casting their nets too far into the waters."

But he warned that any trawler found to have deliberately destroyed the nets would be banned from the lake.

"We are demarcating the lake to avoid further fighting between local and trawler fishermen and Government officials are already going round the lake in a motor-boat for the purpose," Mr Kaguthi told reporters in Homa

Bay.

He said trawlers were not permitted to fish within Winam Gulf and within five nautical miles of the shoreline.

Mr Kaguthi said the situation at Karungu Bay was now normal after a three-day stand-off between local fishermen and policemen guarding trawlers.

The PC warned fishermen against resorting to lawlessness and appealed to them to allow the trawlers to use their fish-landing beaches.

He said only six trawlers were currently fishing in the lake and that they were too few to "finish [the] fish."

The PC instructed chiefs, their assistants and fisheries officers to ensure that fishing nets were properly designed to avoid over-exploitation.

In Saturday's incidents fishermen at Karungu rioted over the presence of trawlers at the beach and stoned policemen who tried to disperse them.

Sources said yesterday that tension was still high although the trawlers had sailed away.

(Daily Nation, 7 October 1993)

Trawling, being a non-selective fishing method, can destroy the biodiversity and ecology of the lake. It can interfere with the stability of the water columns and remove much of the primitive but ecologically useful bottom dwelling micro-organisms. The small meshed codends can as well harvest immature and juvenile fish, and even their eggs. Trawling can therefore be sustainably done only in an environment where there is sufficient information concerning fish stocks, their breeding patterns, the movement of fish and the delicate ecological balances of the particular water body. Even then, the long-term success of trawl fishery will ultimately depend on the existence of sound management systems to control over-fishing and other potential damages by trawlers.

Unfortunately, the situation on Lake Victoria today lacks in both conditions: There is neither adequate information to decide on useful and effective interventions nor the management capacity to successfully implement those steps. The changes in fish species, weather, water quality and biological factors in the lake, as well as the effects of the water hyacinth on some critical parts of the lake, have reduced the accuracy of the traditional pool of knowledge on the lake's ecology, fish breeding patterns and migration.

Even if such information was available, trawler operators have no incentives or obligation to avoid fishing in the particularly delicate areas of the lake, which often are the richest in fish stocks. In a competitive production and market system where there is little restriction on the exploitation of the primary resource, each competitor will aim at using as much of the resource as possible so as to maximize profits. Thus, in the absence of strict regulations on their operation, each trawler operator will fish in areas that are likely to have higher densities of fish populations, irrespective of the damage it may cause to the ecosystem of the lake. As was pointed out by James Siwo Mbuga earlier in this publication, uncontrolled trawling in the 1970s and 1980s may have played a major role in the disappearance of certain indigenous fish species of Lake Victoria, including some of the haplochromines. With its delicate ecosystem, lack of sufficient information on important parameters and the absence of a working

management plan, Lake Victoria may not be the ideal environment for commercial trawling.

A Background to the Trawling Controversy on Lake Victoria (1967-1979)

The controversy surrounding trawling on Lake Victoria began in the mid-1960s. The then Lake Victoria Fisheries Research Project (LVFRP), implemented jointly by the East African Freshwater Fisheries Organization (EAFFRO), the United Nations Development Program (UNDP) and the Food and Agriculture Organization (FAO), carried out a stock assessment of the fisheries of Lake Victoria in 1967. The study concluded that there was sufficient quantity of haplochromines, which could make possible an annual harvest of about 100,000 tons without adversely affecting the stock. Other species could allow a further sustainable harvest of about 15,000 - 20,000 tons per year. Further more, the study report indicated that the Haplochromis species - a small bony fish "with little value" to local consumers - could not be readily distributed along the existing marketing channels. Thus, it concluded, haplochromines provided a large untapped supply of fish for which there was very little demand (Nyholm and Whiting, 1971).

Two recommendations were made. First, that a fleet of trawlers, each at least 40ft long, should be established to harvest the unused fish stocks. In line with this, a fishmeal industry should also be developed to convert the large quantities of Haplochromis species to be harvested. The report observed that there existed large demand for fishmeal both in East Africa and abroad. The trawler-fishmeal complex could thus reduce fish imports and earn foreign exchange for the region.

A second phase of LVFRP, which included a sociological study component, was initiated in 1971. Broadly, the task of the sociologist was to forecast what effect the trawler-fishmeal industry would have on the fishing communities of Lake Victoria. The second phase project report concluded that, in many ways, there would be direct competition and conflicts between trawlers and the local fishermen. Rather than trawlers, it recommended that intermediate fishing technology owned by local fishermen be developed for exploiting the fisheries resources (Jansen, 1977; LVFRP, 1973).

Thus two types of contrasting proposals emerged from LVFRP. The first phase emphasized the advantages of a capital intensive trawler-fishmeal industry while the second phase argued for the development of an intermediate technology, which could co-exist with the traditional fishing systems. Despite this, all three countries made the choice of developing a trawler-fishmeal industry.

Tanzania was the first country to introduce modern trawlers on Lake Victoria for commercial purposes. In 1973-74 the state owned Nyanza Fisheries Corporation of Tanzania acquired 4 large and well-equipped trawlers financed under the Dutch Government aid scheme. Soon after, the Ugandan Government allowed some private businessmen to establish a trawling industry. Almost simultaneously, in 1974 the Kenyan Government allowed a privately owned company, Aquarius Enterprises, to establish a trawler-fishmeal industry based on the Lake Victoria fisheries.

Aquarius Enterprises was a share company, with majority of the shares owned by a few Kenyan businessmen and Government officials. In order to acquire the technical skill and foreign capital needed to set up the industry, the company made contact with industrialized countries. In particular, it sought financial and technical assistance from the Norwegian development agency, NORAD. The company proposed a joint venture with one or more Norwegian companies, where the latter would supply 10 trawlers, fish processing equipment and technical personnel. The Norwegian enterprises, in this regard, would own about half the shares of the joint company. The Fisheries Development Corporation of Norway (FIDECO), which was a consortium of 30 private Norwegian Companies supported by NORAD, showed interest in the project. However, further evaluation of the project by NORAD, particularly on the potential conflicts with local fishermen, made it withdraw support for the project. Without NORAD assistance FIDECO had no other choice and pulled out of the trawler-fishmeal venture, and the project never took off as planned (Jansen, 1977).

Other reports indicate that a few trawlers operated before 1970 in Port Victoria, Kisumu and Mbita, mainly to harvest tilapines. These vessels, renovated from existing boats, were small and isolated and therefore caused insignificant impact on the fisheries. Including these, the history of trawling on Lake Victoria has many examples of how national and international business interests converge to override the development goals of the fishery for the benefit of local fishing communities.

Concern about Trawling after 1980

The scenario in 1960s was quite different from the situation after 1980. In the former, trawling was proposed by biologists as a way to harvest the unused stocks of haplochromines, which then constituted 70-80% of the fish biomass of Lake Victoria. Three decades later, the haplochromine populations have drastically declined, probably due to predation and over exploitation, to less than 2% of the catch from the lake. Nile perch, hardly seen in Lake Victoria before 1970, now constitutes nearly half of the catch, and is the major target of modern trawlers. Trawling after 1980 has been carried out purely for profit motives, without any biological basis, particularly on the size of existing fish stocks. For this reason the East African governments instituted a complete ban on trawling on Lake Victoria at the beginning of this decade. Despite the ban, there is concern that trawling has continued. Meanwhile many arguments have been put forward for and against trawling, without reaching a consensus (Jansen 1973; Othina and Osewe-Odera, 1996).

The Case for Trawling

Proponents of trawling have pointed out many advantages of trawling over the other fishing methods. These positive attributes of a trawl fishery are well illustrated by Mbuga in this publication. First, trawlers are able to catch and land fresh quality fish. Many of the fish processing factories in Kenya, Uganda and Tanzania face serious difficulties in exporting fillets to the European Union and other developed countries as a result of fish quality related reasons. Therefore, a fishing method which can guarantee the landing of high quality fish clearly has advantages.

However, observation on most fish landing beaches and interviews with fishermen indicate that much of fish contamination and spoilage actually occurs in post-landing fish handling stages. Fish harvesting methods such as beach seining and drift netting (locally referred to as tembea) have become more prevalent in recent past. As opposed to other techniques of targeting Nile perch and tilapia involving set nets or lines, the two methods above are performed while fishermen are attending them all the time. This ensures that fish is quickly removed from the traps, loaded into the boat and delivered to the landing beach while still in good quality state.

Due to rising incidences of theft of fishing gear, including the fish caught in them, fishermen have increased the surveillance of their set nets in a day, and immediately collect the caught fish. Thus, even fish landed from these gears is of good quality.

Fishermen attempt to further reduce spoilage of fish on the boats by keeping the vessels clean and dry. They also cover the fish with wet sack-cloth or other material to provide shade, enabling fish to stay fresh for longer period. These methods, though very modest, assist the traditional fishermen to land fish in a relatively good state. Higher quality of fish could be achieved if fishermen had ice on their boats for keeping fish. The private sector, in particular, the fish processing industry, could be involved in producing the ice and transporting it to the landing beaches. Already some of the factories take ice to selected beaches, though primarily to use in their own boats and trucks. However, this is inadequate and there is a need to make and distribute more ice, even to independent fishermen. The relevant governmental and non-governmental organizations have a role in designing suitable ice containers which can fit in artisanal fishing vessels.

The second argument for trawling is that trawl boats generate direct and indirect employment, and are efficient. As stated earlier by Mbuga, trawlers attain higher catch rates per unit of labour and time used in fishing than artisanal fishing boats. A counter argument though, is that the capital investment in a trawler is immensely higher than in an ordinary boat. Consequently, the operational costs, especially

on fuel and wages are much more in trawling than in other fishing methods using traditional boats. Each artisanal fishing boat in the Kenyan waters of Lake Victoria has about 4 crew and can catch 100kg. In comparison, one trawler employs nearly twice the number of crew and catches 8-10 times as much fish as an ordinary boat. Based on this estimation, it will take at least eight artisanal boats, employing about thirty people to catch the same amount of fish as an average trawler fishing in the same area. Even though some assumptions have been made, it is evident that more jobs could be created in the traditional fishing systems than in trawling.

The Lake region already faces serious problems of unemployment. In this regard, trawlers, which catch more fish per unit effort but use more capital than labour in their operations, are of less value to local communities than the traditional boats, which are lower yielding, but create more employment. Since trawlers were banned on the Lake nearly a decade ago, there has been an increase in the number of artisanal fishing boats in the Kenyan part of the lake. A recent survey showed that close to 75% of boats currently fishing in the area were introduced within this decade. If trawlers were to be permitted, some of these boats could be easily displaced from the fishery. It is therefore apparent that job security for communities living around the lake could be ensured through increased use of artisanal boats rather than by legalizing trawlers (KMFRI, 1998).

Thirdly, it is argued that trawlers are the only vessels able to fish in the open waters 5 nautical miles beyond the Nyanza gulf. These areas, it is pointed out, are too deep and have strong under currents and bad weather which traditional boats cannot withstand. Perhaps due to this factor, the previous legislation permitted trawling, but only within the open waters. The reality though is that the open waters is hardly an attractive fishing ground to trawlers. Despite being clearly restricted to stay outside the gulf, trawlers concentrated their activities in the rich fishing grounds within the gulf, for example, the Migori-Kuja rivers delta and the Asembo-Uyoma Bay area. The Nyanza gulf has continued to host most of the illegally operating trawl boats.

Fishermen neglected – mayor

By KENNETH OGOSIA
and CHURCHILL OTIENO

Kisumu Mayor Lawrence Oile yesterday said that trawler owners in Lake Victoria were backed by powerful people and accused the Government of failing to protect fishermen.

Mayor Oile said Kenyan fish suffered the same fate in international markets where it was being sold as a third-rate commodity.

Speaking at a youth seminar organised by OSIENALA (Friends of Lake Victoria) at a Kisumu hotel, he said fish should be handled carefully.

He told fishermen not to throw fish aimlessly from canoes because that affected their internal composition.

The civic boss told the youth to protect themselves against Aids but called for a change of attitude towards Aids victims.

He called for innovativeness among the youth and asked them to discard the "white-collar job syndrome", by seeking self-employment.

The Mayor urged Kenyans to emulate countries such as Japan, UK and Russia where, he said,

people were concerned about their environment.

He said the Kisumu bus park was filthy yet those working there took no measures to protect themselves against the pollution menace.

Mayor Oile said the council stood accused over the pollution of Lake Victoria, through industrial waste getting into the lake and rivers.

However, he said, not much could be done as the equipment for alleviating the dangers of pollution were being vandalised.

However, from next year, crude oil traders would be made to pay an environmental tax, he said.

The mayor said the international community had identified the youth and women as the only groups that could be entrusted with financial aid because they had shown commitment to development.

The seminar is meant to sensitise the youth to the merits of self-employment and the possibility of financial assistance by the United Nations Development Programme.

(Daily Nation, 7 September 1994)

In contrast, many artisanal fishermen have attempted to move further offshore in search of fish. With water hyacinth covering a large part of the gulf, this trend will continue, irrespective of the hardships they face in the outer waters. Recently introduced fishing methods on the lake, such as drift netting, are largely carried out in the open waters. Therefore, even if trawlers were permitted but restricted to the open waters, it is just a matter of time before serious conflicts would occur between them and fishermen in those areas.

Some of the positive spin-offs of trawlers discussed by Mbuga in the earlier sections of this publication are evidently not exclusive to trawlers. While it is possible that beaches where trawlers land and sell fish may have achieved growth and development of business activities, infrastructure and services, it is also true that this has taken place, even at a faster pace, in some of the beaches where only artisanal fishermen operate. Beaches such as Uhanya and

Wichlum in Kenya, which are used strictly by local fishermen to land their boats, are in fact bigger and more developed than Asat and Madundu which are home to some of the trawlers. The growth and development of a beach is due to a number of factors and cannot fairly be attributed to any single cause.

Unlike the artisanal fishermen who may fish primarily for the local market, trawlers aim first at serving the fish processing and exporting industry. They will only sell by-catch, undersized or spoilt fish to the local traders and processor. With enlargement on mesh sizes of trawl nets (which must be a necessary condition in case trawlers are allowed to operate) there will be greater selectivity of the size and species of fish caught, thus making trawlers even less relevant to the artisanal fish processing and marketing systems.

The Socio-economic Disadvantages of Trawling

As previously explained by Modesta Medard in this publication, trawling can have many negative socio-economic effects on local communities around the lake. For the purpose of this paper the socio-economic impacts of trawling have been summarized into four areas: employment, income, food security and the community's social values and traditions.

(i) Effects on Rural Employment

As earlier illustrated, the artisanal fishing systems are able to create more employment opportunities than can be achieved by trawling. It is estimated that about 30,000-40,000 people are employed in fish harvesting in the Kenyan part of Lake Victoria. An even higher number of local people are involved in artisanal fish processing and distribution. The livelihood of the majority of these groups has, for generations, depended on the fish caught by traditional boats.

In the traditional system, many fishermen own the boats they operate and are therefore self-employed. A survey of fishermen carried out in early 1998 on Lake Victoria revealed that about 60% of the fishing boat owners have one vessel each. As estimated earlier, these fishermen can employ 4 fishing crew on each of these boats. A less but significant proportion of boat owners,

about a quarter of them, own two boats each. Every one of these boat owners can therefore employ about 8 fishing crew. Another 10% of boat owners have 3 boats each, and can thus employ nearly 12 crew each. The large number of traditional fishing boats in the fishery, estimated at over 8,000 in the Kenyan part of the lake, and their distribution, and versatility, makes them ideal for creating rural employment. This is important especially since, according to our survey, over 60% of fishers have no more than primary level of education, which gives them very little chance of gainful employment in the urban sector (KMFRI, 1998).

The traditional boats are also able to supply fish, and therefore support the artisanal fish processing and trade in many different and remote rural villages and urban centres. In this way, the employment created in the post-harvest sectors of the fishery is distributed to many local people in many areas.

In contrast, trawlers are few and can only land in certain suitable beaches. They each employ more crew than an ordinary boat could but, as pointed out earlier, they use much less labour to land a given tonnage of fish than the traditional vessels. The trawlers, in this way, are more technically efficient but are less useful in creating and distributing jobs. Trawlers concentrate their activities in a few places only, and therefore are unlikely to support fish processing and trade activities in most rural villages. In addition, trawlers are in business principally to supply fish to the urban-based fish processing factories. An increase in number of trawlers on the lake would see an increase in fish going for industrial processing rather than for local trade. The trawler-industry linkage therefore diminishes their importance in generating employment in the artisanal fish processing and marketing in the rural sector.

(ii) Impact on Rural Incomes

Employees in a trawl boat usually work for a wage, which may be fixed or variable depending on the level of catch. The profit motive is therefore an important factor in the amount of effort they expend in their operations. Much of the income from trawling though goes to the trawler owner, who often is not a practicing fisherman. The wages in a trawler may be much higher than what the crew in an ordinary boat gets. However, only a few fishermen can benefit from these wages, and in only a few areas, compared to the traditional boats which can provide sustained incomes to many fishers in diverse regions of the lake. Workers in the traditional boats also earn a daily or monthly wage. In contrast to trawlers, artisanal boat owners are often themselves actively involved in fishing, which in most cases is their chief occupation.

The system for distributing income among the workers in the traditional fishing system is quite informal. In most cases, the earning from the fish catch is shared out between the boat owner and crew, each group taking a set percentage. About 80% of fishers, according to our survey, earn from such an arrangement. In other cases, the crew and boat owner each provide gear on the boat, and each earns from fish caught in their gear, while they only share the cost of boat maintenance. These two remuneration systems, which are the most common in the fishery, ensure that the income is fairly shared out. Most boat owners take home less than half of fish caught by the boats, the other 50% going to the crew. For fishermen owning only one boat each, this amount is just sufficient to meet the household's subsistence needs.

Out of the lake, many artisanal fish processors and traders in different areas, who obtain fish from traditional boats, are also able to earn a sustained income. In recent years, however, some of these processors and traders have lost employment and income as more fish goes for industrial processing. If trawlers are allowed to operate, more fish will go to the factories, thus displacing the fishermen and those engaged in fish distribution.

(iii) Contribution to Local Food Insecurity

The local communities around Lake Victoria are among the most food insecure. Despite the large quantity of fish harvested on the lake, much of the fish is taken away from the region for export or fishmeal production. A survey conducted in 1997 revealed that almost all mature Nile perch landed on Lake Victoria shores goes to factories for processing and export. Only juvenile Nile perch or that rejected by factories plus skeletons of Nile perch remain behind for local consumption. Similarly, over half of Dagaa goes to fishmeal factories. Thus, there is hardly adequate fish available in the local markets. Even when there is fish, local households do not have the purchasing power to compete with factories. Hence, food insecurity is a real issue in the rural areas around the lake (Abila and Jansen, 1997).

The traditional fishing systems ensured that some portions of fish remained behind for local consumers. With modernization, this is bound to change. Trawlers will catalyze this change by transferring more fish from the local markets to the factories.

It was earlier stated by Mbuga that trawling may have contributed to the disappearance of certain indigenous species in the 1980s. Some of these species were cherished as special foods by local communities. The species diversity of the lake at the time therefore ensured food liked by different groups. Since the ban on trawling, and facilitated by the emergence of water hyacinth weed which provide a hide-out from predators, some of the disappeared species are re-emerging. If trawling is re-established some of these species will be fished out again, thus contributing to food insecurity.

(iv) The Effects on Community Social Values

To many local fishermen, fishing is a traditional way of life, far removed from the narrow commercial interest. Rules have been put in place in the local management systems to govern the fishing activities. In some areas, such rules are enforced by the beach or village management committees and fisheries scouts and they define who may fish in a particular areas, which areas should be protected for fish breeding, what times fishermen go out fishing and return, the size of net meshes allowed and

the size of fish which should be caught, among other things.

Trawler owners and operators do not see themselves as part of the local communities, and do not feel obliged to follow the set rules. On the other hand, the local beach authorities feel that regulation of trawling is above their mandate. Therefore, trawler operators disobey most existing rules - they fish at the wrong places, at the wrong times using wrong mesh-size nets.

The consequence of this is that there have been many incidences of conflicts between trawler operators and local fishermen. These occur because trawlers have destroyed fishermen's nets and lines or when trawlers land too much fish on a local beach, thus depressing prices paid to beach fishermen. Conflicts may also arise when trawlers fish in some of the bays protected by local authorities for fish breeding and when they catch too much juvenile fish.

Conclusion

The operations of trawlers do not in any way complement the activities in the artisanal fishery. Instead trawlers, if permitted, can easily substitute many of the traditional boats. The still largely artisanal fishery of Lake Victoria therefore stands to gain very little, but suffer more, if trawling is legally re-established on the lake.

Trawling on Lake Victoria is still quite limited. Trawlers land only 10-15 tons of Nile perch daily in Kenya. This is just about 5-10% of the fish processed by factories for export (Abila and Jansen, 1997). The details of trawling operations in Uganda and Tanzania is not very clear, but given the similarity in the ownership, structure and interests in the fish processing industry in the three countries, it is unlikely that the trawling situation is very different from Kenya. If the ban on trawling continues, the artisanal fishermen will be somehow protected and they can continue depending on fishing for their livelihood. Should the ban be lifted, there is likely to be an increase in conflicts in the lake. The beneficiaries of such a step will be the fish processing factories and the consumers of their fish products in the developed world. The losers will definitely be the artisanal fishermen, the traditional fish processors and traders as well as local fish consumers.

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