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9. ABSTRACT

An evaluation of existing U.S.A.I.D. technical assistance to the Lake Victoria Fisheries Project of the East African Freshwater Fisheries Organization (EAFFRO). EAFFRO has determined the existence of offshore demersal stocks (mainly Haplochromis) that could be exploited; annual yield has been estimated at 200,000 tons, or about twice the present harvest of inshore waters. The present concern is that offshore mechanized fishing may have detrimental effects upon the heavily exploited inshore stocks. EAFFRO's research activities appear too ambitious for the available staff, and it is felt that EAFFRO will not be able to provide management guidelines in time to avoid competition between the traditional inshore and proposed trawl fishery. The assessment of the proposal trawl fishery has not been emphasized sufficiently in the work plans of the U.S.A.I.D. biologist. There have been insufficient communication and cooperation between EAFFRO personnel at all levels and fisheries department personnel, and the information being produced appears not to be in a form and of a type that can be used readily by the people directly involved in the development and management of the fishery.

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# **An Evaluation of USAID Technical Assistance to the EAFFRO Lake Victoria Fisheries Project**

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**International Center for Marine Resource Development**



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Fig. 1. This Nile perch will be processed on the lake's shore and resold several times before it is consumed. The profit generated at each level is probably less than 10 percent of the selling price.

## 1. Introduction

In response to a request by the USAID/RDOEA\* office, an evaluation of existing AID technical assistance to the Lake Victoria Fisheries Project of the East African Freshwater Fisheries Organization (EAFFRO) was conducted from October 28 to November 15, 1974. The objectives were to provide RDOEA with evaluations of (1.) existing research activities and what the likely product of these will be by the end of the project in 1977; (2.) personnel requirements for the project; (3.) commodity and other support requirements; and (4.) the extent to which EAFFRO is proceeding to play an important role in the development and management of the Lake Victoria fisheries.

The principal sources of information used in preparing this report were (1.) published reports dealing with fish catch statistics, yield indices, marketing statistical surveys, cost and earnings surveys, and the general biology of Lake Victoria's fishery resources; (2.) interviews with USAID Regional Development and Agricultural Officers and a review of RDOEA project files; and (3.) interviews with USAID biologists and EAFFRO staff during visits to Kisumu (4 days) and Mwanza (2 days).

Significant contributions to the success of this evaluation were made by Dr. J.K. Okedi and Messrs. B. Wanjala and J. Nhwani of EAFFRO; USAID biologists, Drs. J. Rinne and G. Martin, and Messrs. A. Barker and R. Scully; and Messrs. C. Ramsay and C. Husick of USAID/RDOEA.

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### The Fisheries of Lake Victoria

Lake Characteristics. Lake Victoria, the second largest lake in the world, with a surface area of 68,635 square kilometers, lies in a plateau between the eastern and western series of rifts in East Africa. The countries of Kenya, Uganda and Tanzania border the lake with Kenya controlling 8 percent; Uganda, 42 percent; and Tanzania, 50 percent, of the lake area. The saucer-shaped basin has relatively high rims to the east and west and low watersheds to the north and south. Lake Victoria now empties to the north where it forms the Victoria Nile. Inflow into the system is mainly from the Kagera River; however, rainfall during the periods of March-May and October-November accounts for the majority of water income. The lake at present has a stable water level with inflow being balanced by evaporation and outflow (2, 5, 9).

\*United States Agency for International Development/Regional Development Office, East Africa.

Fisheries in Lake Victoria. The fisheries can be best described as multi-species and tri-national. Presently there are 177 known fish species (4); however, the commercial catch is dominated by two cichlid genera (*Tilapia* and *Haplochromis*) and several non-cichlid species (*Bagrus sp.*, *Clarias sp.*, *Protopterus sp.*, and *Synodontis sp.*). The three more highly valued species, *Tilapia*, *Bagrus* and *Clarias*, comprise about 52 percent of the total catch and *Haplochromis*, about 24 percent (6). By our estimates, the three more valued species comprise over two-thirds of the value of the total catch which currently is about 335 million shillings (U.S. \$47.9 million)\* annually.

Fishing activity is currently inshore and fairly continuous around the lake. Approximately 60,000 to 70,000 people are employed by the fishing industry (8). In 1969 fishermen were earning about 1,800 shillings per year (U.S. \$257), a level consistent with earnings of an unskilled laborer in the region (8).

The artisanal fishermen principally use synthetic multi-fiber gill nets which account for some 90 percent of the total catch (8). Other gear includes beach seines and long lures. Beach seining is increasing, especially with the relatively small-meshed "mosquito" seines in Kenyan waters. These gear are operated out of "Sesse" (planked) canoes, powered by paddles or sail, and in a few, but growing number of, cases by outboard motor. In 1972 a total of 11,300 canoes were estimated to be operating on the lake: 4,000 each in Kenya and Tanzania, and 3,300 in Uganda. An average canoe with three men has been estimated to catch about 13,000 pounds of fish per year (10).

The existing efficient distribution and marketing system is being supplemented in some areas by modern cold storage facilities which will allow wider marketing and distribution. Local fishmongers, who play such a large part in the marketing and distribution chain, earned in 1969 little more than fishermen, i.e., approximately 2,000 shillings per year, or U.S. \$286 (8).

It is generally considered that the inshore waters constitute approximately 18.8 percent of the total lake surface area and support about 29 percent of its fish biomass. At least 95 percent of the *Tilapia* are concentrated inshore. Other commercial taxa (*Bagrus*, *Clarias*, *Haplochromis* and *Synodontis*) have a greater distribution by weight in the offshore areas. Therefore it is possible that the declining harvest of inshore waters might be supplemented by developing offshore fisheries.

\*These rough calculations are based on total annual landings of 110,000 metric tons (2), 58,000 of which are assumed to be made up of three more valued species with a retail market price of 4 shillings per kilo. The remaining catch is assumed to retail for 2 shillings per kilo.

Unexploited offshore demersal stocks (mainly *Haplochromis*) were determined to exist by lake-wide exploratory bottom trawling with the research vessel *Ibis* of the United National Development Project (UNDP) from January 1969 to March 1971. Annual potential fish yield from offshore waters has been estimated at 200,000 tons, or about twice the present harvest of inshore waters (10). The present concern is that offshore fishing may have detrimental effects upon the already heavily exploited inshore stocks. Rapid development of a trawl fishery could cause severe damage to the artisanal fishery.

The fishery resources of the Kavirondo Gulf in Kenya are very likely being overfished. The 1969-70 landings totalled 18,500 tons from approximately 13,000 fishermen. Some species have been nearly eliminated from the commercial catch (*Labeo*, *Mormyrus*, *Schilbe*, and *Synodontis*) while catches of *Clarias*, *Protopterus* and *Barbus* are being maintained or are declining. Overfishing has generally been attributed to: (1.) increased fishing pressure; (2.) increased use of small mesh gill nets (especially after the lifting of the five-inch minimum mesh size restriction in 1960); (3.) indiscriminate use of beach seines in certain areas; and (4.) use of monofilament nets in some areas.

The obvious conclusion is that the biological potential of the resource is decreasing.

Tanzania controls 50 percent of Lake Victoria. This portion of the lake has been described as being the most productive, and for a number of reasons the fisheries in this area are developing rapidly. In 1969-70 approximately 12,000 fishermen had a catch of 48,292 tons, which consisted mainly of *Tilapia*, *Eaprus* and *Haplochromis*. While it appears likely that the stocks of *Tilapia* are overfished, a large under-exploited reserve of *Haplochromis* exists in offshore waters (greater than 30 meters).

Likewise, Uganda inshore waters appear to be heavily exploited. An estimated 25,000 fishermen landed 42,000 tons of fish (mainly *Tilapia*) in 1969-70. Any increase in catch must come from the largely untapped offshore stocks of *Haplochromis*.

Current regulations of inshore fisheries vary from country to country. In Tanzania there are apparently no restrictions on the minimum mesh size for gill nets. However, using monofilament nets is banned as well as "beating" the water in order to drive fish into a net. In 1960 Kenya rescinded the five-inch (12.7 centimeters) minimum mesh size but retained a closed season on beach seining from March to August. In Uganda there are apparently no gill mesh restrictions; however, beach seining is not permitted.



The East African Freshwater Fisheries Research Organization (EAFFRO)

Headquartered in Jinja, Uganda, EAFFRO was founded in 1946. It is an agency of the East African Community and is charged with assisting the member-states of the Community, Kenya, Tanzania and Uganda, in the study and management of freshwater fish. The actual planning for development and management of freshwater fisheries, however, is carried out by the individual states. EAFFRO also provides information to the member-states upon request and to the Lake Victoria Fisheries Commission, which advises the Community on problems of development of the lake's fisheries.

EAFFRO headquarters currently has a staff of about 90 people including six fisheries biologists, one chemist, one statistician, and one economist in training status. *The African Journal of Tropical Hydrobiology and Fisheries* is published here. Physical facilities include laboratories, aquaria and a library. The research vessel *Ilala* was docked at Kisumu during our visit, but is scheduled to return to Jinja in the near future.

The two EAFFRO substations are located at Kisumu, Kenya, and Mwanza, Tanzania. The Kisumu substation has a staff of 28, which includes four fishery research officers (two USAID experts and their counterparts), five laboratory assistants, one secretary, one clerical officer, one driver, and 16 other supporting staff members.

The substation is housed in a ten-room, single-story structure located in a residential section near the center of Kisumu. These quarters are presently being rented. A new substation complex is being planned adjacent to the Kenya Department of Fisheries on the lake shore. Land for this purpose has already been obtained and construction is expected to begin in the near future.

The substation has one Toyota Land Cruiser for field trips and other transportation needs. Other major equipment includes a fiberglass canoe nine meters long powered by a 20-horsepower outboard motor, one beach seine 600 meters long, two gill net fleets of 22 nets each, and a minimum of laboratory equipment.

The Kenya Department of Fisheries has nine small ponds and several small tanks which the substation is using for its age and growth, and tagging mortality experiments.

The Mwanza substation has a staff of 18, including three fishery research officers (two USAID experts and one counterpart), three laboratory assistants, four fishermen, one stenographer, one clerical officer, one senior accounts clerk, one driver and four temporary laborers (watchmen, etc.).

The substation is currently housed in a small, single-room building located in the Tanzania Fisheries Division compound. New quarters are under construction on the lake shores at Nyegezi, seven miles from Mwanza, adjacent to the Tanzanian Freshwater Fisheries Research Institute. These new facilities are expected to be available for use by April 1975. In addition, the substation has access to the two trawlers 14 meters long owned by the Fisheries Division of the Ministry of Natural Resources and Tourism. One trawler is located at Mwanza and the other at Nyegezi.

#### USAID Technical Assistance Project

The USAID/East African Freshwater Fisheries Project began in 1973. Its stated goal is to "help the East African Community and its partner states devise long range programs to develop, harvest and protect fish stocks in such a way as to assure a continuous and increased supply of fish protein for the people of East Africa." The four-year project calls for USAID to provide 16 man-years of technical services by U.S. fishery biologists, six man-months of consulting by U.S. specialists, and 11 man-years of U.S. participant training for East Africans in the field of fisheries biology. In addition, the project was budgeted to provide \$59,000 for commodities, e.g., laboratory equipment and supplies, during the 1974 fiscal year.

The provision of the above services, training and commodities is intended to strengthen EAFFRO by supporting and increasing its ability to conduct research on commercially important fish species in Lake Victoria and other East African lakes and rivers.

The project was designed to produce by mid-1977 maintenance, and possibly an increase, of practical results from EAFFRO's research program when the U.S. biologists depart.

The project has progressed through approximately one-third of its intended four-year life. Three fishery biologists and one biostatistician provided by USAID are currently working in EAFFRO. Two are stationed at the Kisumu substation and two at Mwanza. Six man-years of U.S. participant training have been provided so far. Two East Africans have completed their U.S. training and returned to EAFFRO and two are currently enrolled in such training. Two additional participants are expected to be enrolled shortly.

A large number of commodities are currently under order. These mainly consist of laboratory equipment, books and periodicals.

The exact nature of the USAID Project for the period 1975-77 has yet to be determined. For recommendations on the future size and composition of the project, see Chapter 4, Summary and Recommendations.

### Other Technical Assistance Projects

The UNDP/FAO Lake Victoria Fisheries Research Project began in 1967. Information on the magnitude of the manpower, equipment and financial support provided EAFFRO by the project was not made available. As a cooperative effort with EAFFRO, the project was designed to develop the fisheries industry of Lake Victoria. The first phase of the project, described in Chapter 2, was completed in 1972, at which time the project was terminated. Reinstatement of the project is currently being negotiated, but at this writing it is not possible to predict a likely outcome.

In addition, Canada provided training for one EAFFRO biologist during the period 1967-68. From 1970-72, Norway provided EAFFRO with two sociologists and the training of master fishermen. Sweden contributed one biologist during 1969-70, and Japan may be asked to train fishery technicians.

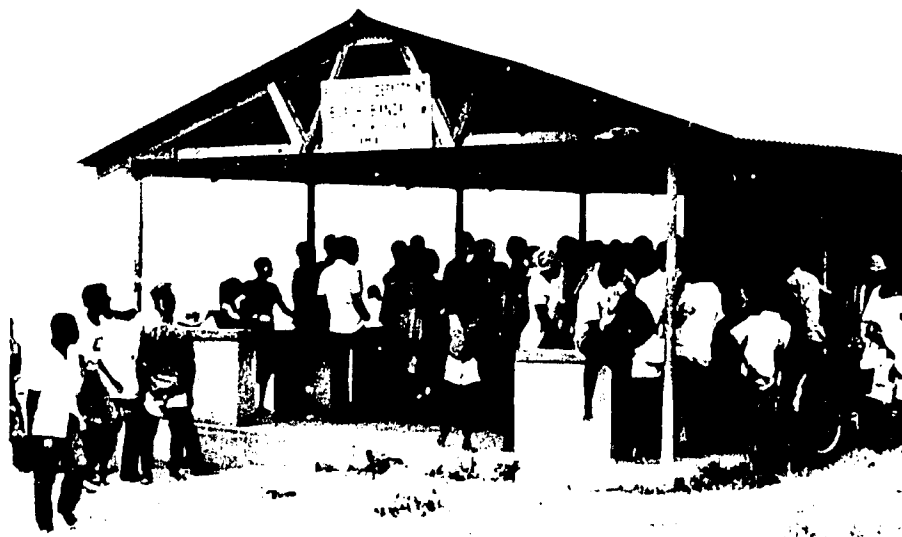


Fig. 2. Cooperatives have been established for selling and processing the catch. Fish are "auctioned" with the more valuable species selling for 3 to 4 shillings per kilogram.

## 2. Lake Victoria Fisheries Research Activities

The research activities on Lake Victoria are coordinated by EAFFRO and involve input by the Fishery Department of each country, the UNDP and other assistance programs.

### East African Freshwater Fisheries Research Organization

EAFFRO is following a classical sequence of research activities which leads through three phases of work. Phase 1 usually involves some initial estimate of the stock size and species composition. This presumably will lead to some estimate of "potential yield." Phase 2 is pursued if the early estimates of yield are of sufficient magnitude to encourage development of a fishery. It involves studies to insure the rational exploitation of the resource, including activities such as collection of basic biological, economic and sociological data and continued assessment of the stock. Phase 3 involves monitoring stocks as they are subjected to fishing and evaluating proposals for regulating the fishery.

Stock assessment work for the inshore fishery is in Phase 3, and for the offshore stocks, it is in Phase 2. A complicating factor is the possible biological, economic and sociological effects of the proposed offshore fishery on the already heavily exploited inshore artisanal fishery. This could present problems which would not necessarily fit into any specific phase of work.

The Lake Victoria research programs proposed for the triennium 1973-75 are described briefly below. These activities are conducted either from the Jinja main station and/or the Kisumu and Mwanza substations. Presently there are two USAID biologists at each substation assisting the EAFFRO staff.

Resource Evaluation: Kisumu Substation. The *Tilapia* stocks of Kavirondo Gulf have been heavily exploited in recent years and their contribution to the catch is low. Experimental gill netting and beach seining are being done to determine the efficiency of these types of gear on the population. The purpose is to formulate effective management regulations. In addition, the station is engaged in age, growth and tagging studies, and is making basic statistical analyses on catch and effort data.

Resource Evaluation: Mwanza Substation. Basic biological studies on commercially important species are continuing as well as experimental fishing using gill and trawl nets.

Using *Ibis* trawl catches, stock assessment studies are providing estimates of the available fish stocks and their distribution. Studies are planned to evaluate the effects of commercial trawling on these stocks.

Haplochromis Research Program. Offshore stocks are largely Haplochromis species. Several aspects are being considered. Taxonomic studies using immunological and electrophoretic techniques are being proposed. Biomass studies based on *Ibis* trawl catches and purse-seining are planned. Basic biological data will be collected and used as a base line for comparisons as the proposed commercial trawling operation develops.

Limnological/Aquatic Pollution Program. Collection of basic limnological data is proposed for predictive and management purposes. Also the current level of pollutants, particularly toxic metals, in the lake will be monitored.

Basic Biology and Feeding Habits of Predatory Fishes in Lake Victoria. These studies include the important predators of Lake Victoria: *Lates nilotica*, *Clarias sp.*, *Synodontis sp.*, and *Bagrus sp.*

Engraulis Investigations. Commercial fishing, using "mosquito seines," for this species is increasing in the lake. Present studies will assess the status of fishing in Kenyan and Tanzanian waters.

Economic Studies. Little economic analysis is currently being conducted; however, an evaluation of data from the catch-assessment survey is expected to resume as well as studies of costs and earnings, and marketing and distribution.

#### Other Research Activities

UNDP/FAO Lake Victoria Freshwater Fisheries Project. This project existed from 1967-1972 and was cancelled as it was to begin its second phase. The first and completed phase of their work involved obtaining rough estimates of the magnitude, location and species composition of the fish stocks, their potential yield, and an evaluation of gear that might be used for harvesting these stocks (13). Among other things, these researchers examined the economic feasibility of trawling for the offshore Haplochromis stocks and processing the resultant catch into fish meal.

Phase 2 of this study was to estimate the (1.) temporal and spatial distribution of the stocks; (2.) expected fluctuations in abundance and associated catch rates; (3.) boundaries of distinct stocks; (4.) effects of alternative development paths on existing fisheries; (5.) effectiveness, in economic and social terms, of alternative harvesting methods; (6.) expected trends in catch rates as the fishery develops; (7.) sensitivity of the fish community to different fishing pressure; (8.) structure of the fish community and its dynamics; (9.) consequences of conservation constraints on economic development; and (10.) information needed for future management.

While this second phase may not be carried out by UNDP, it represents a useful guide to research in this area. It appears to be a carefully thought-out plan, and EAFFRO would benefit greatly if it were carried through. Indeed, without the assistance of UNDP/FAO, EAFFRO currently may not have the resources to accomplish all of the above. This is where USAID and other technical assistance programs can make a notable contribution.

Norwegian Technical Assistance. As far as can be determined the only research of NORAD, a Norwegian technical assistance project, was a socio-economic study of the potential impact of trawling on the existing fishery in the Kenyan waters of Lake Victoria. This study (7) predicted that a sophisticated trawler and fishmeal operation would have a substantial negative social and economic impact on existing fishing communities.

Kenyan Department of Fisheries. The Department of Fisheries, Ministry of Wildlife and Tourism, collects catch data (weight and value) on a routine basis at selected landing sites. Another major function is licensing fishing vessels and fishermen. The department's direct management efforts consist only of enforcing beach seine regulations. Current policy is to encourage expansion of the fishery, and the department is engaging in the construction and sale of larger and better fishing vessels, powered by small inboard motors.

Other than collecting data, the Department engages in no fisheries research activities on Lake Victoria. These data, however, are forwarded to the Ministry of Planning and Economic Development where they may be analyzed to formulate policy relating to the development and management of the fishery.

Tanzanian Fisheries Division. The Fisheries Division of the Ministry of Natural Resources and Tourism is responsible for managing Tanzania's freshwater fisheries. Current activities include ensuring all fishing boats are registered by registering those that are not, licensing fishermen and collecting catch statistics (weight and value) at selected landing sites, and taking an annual census of boats, fishermen, and gear by type. The division is also involved in extension work, i.e., advising fishermen on improved methods, gear, and equipment.

There are four fisheries division offices on Lake Victoria. The offices at Bukoba, Musoma, and Mwanza are concerned primarily with the above management and extension activities. The office at Nyegezi operates the Freshwater Fisheries Institute, a bilateral Tanzanian-Netherlands technical assistance project, which began in 1967. The Institute engages in both research and training. The training consists of short-term courses for Tanzanian fisheries administrators, and research currently focuses on fisheries biology and economics.

Economic studies have examined the feasibility of alternative harvesting, processing, and marketing methods for the *Haplochromis* species. Research to date supports the conclusion that large-scale trawling is the most efficient harvesting method for the Tanzanian part of Lake Victoria. Economists currently are determining whether or not the market in sun-dried *Haplochromis* is strong enough to support a trawler-based operation. Preliminary results indicate a good market for the high quality dried product, which is selling at the (estimated) cost-covering price of 0.67 shillings per kilogram (U.S. \$0.05 per pound). Fishmeal production has also been considered; however, there is serious question about its viability, and this likely will not be developed on a commercial scale in the near future.

Using the trawler *Mirna*, the biological studies have focused on assessing the abundance and distribution of fish populations in Tanzanian waters. Trawling is primarily inshore at depths of 20 meters or less for table fish. In 1973 cod ends of 20, 60, 75 and 90 millimeters were tried. Experimental trawling was hampered by restrictions imposed by the need for fish by the Institute's marketing and processing projects. A relatively large quantity of fresh fish was needed, and much of the trawling was with the larger cod ends for this purpose. Also the Institute found unworkable an earlier agreement with EAFFRO to help supply numbers as well as weights of the species caught.

Aquaculture research with Tilapia hybrids (*Tilapia zillii* x *T. ananassomii*) is continuing in ponds and cages. One significant observation is that the sex ratio of this hybrid cross was reported to be 100 percent males.

Ugandan Fisheries Department. The Fisheries Department, Ministry of Animal Resources, has its headquarters at Entebbe. Two regional stations of the department are also on Lake Victoria, one at Entebbe for the eastern region and another at Masaka for the western region. Each regional station is responsible for enforcing gear regulations and licensing canoes. The fisheries officers at these stations regularly survey catches in the region, to sample the number of canoes and species composition by number and weight, and to estimate the ex-vessel value of the landings. In addition to these routine activities, the officers carry out special surveys and research (e.g., stock assessment, and experimental fishing and gear demonstrations), analyze the above catch statistics and experiment with alternative processing and storage techniques.

Attached to the headquarters at Entebbe is a fish processing section of the department. Here a food technologist experiments with alternative processing methods, e.g., smoking, drying, meal and canning. And near Kampala, at Kajansi, is the Fisheries Experimental Station where three or four fisheries officers culture fish and perform other experiments.

### 3. Evaluation of USAID/East African Technical Assistance Project

EAFFRO is charged with providing advice and relevant information relating to the development and management of freshwater fisheries of East Africa. By lending support to EAFFRO, USAID intends to help the East African Community devise long-range programs to assure a continuous and increased supply of fish protein.

To recapitulate, the objectives of the following evaluation are to provide an assessment of (1.) existing research design and activities, and the likely end product of these by the project's end in 1977; (2.) personnel requirements; (3.) commodity and other support requirements; and (4.) the extent to which EAFFRO is proceeding to play an important role in the development and management of the Lake Victoria fishery.

Before proceeding with the evaluation, a brief summary of the role of research in the development and management of fisheries will be developed to lend perspective to the task.

#### Role of Research in Fisheries Development and Management

An unexploited fishery is obviously a complicated phenomenon, consisting of multiple species of fish that reproduce, grow, compete with and prey upon each other in a dynamic environment constantly influenced by forces of nature. As man enters the scene to exploit the fishery resource, the dimensions of the phenomenon are increased manifold; just as the resource is part of a larger environment which largely governs its behavior or characteristics, man's relationship to the resource is shaped by a set of economic, social, cultural, legal and political forces which characterize his environment.

To develop and manage a fishery requires more than an academic understanding of the resource, man, and their environments. To develop and manage the fisheries of large water bodies means directly influencing man by changing his behavior and the environment in which he functions. For example, development often requires injecting into the system capital, training, and greater economic incentives, and removing from it cultural barriers at critical points in order to encourage the growth of employment, incomes, protein consumption and foreign exchange earnings and to meet other desirable ends. Management may involve restricting the influx of labor and capital by, *inter alia*, creating legal barriers to entry into the fishery. Therefore, in addition to understanding how the system functions, one must be able to determine with some reasonable degree of accuracy the best means of influencing the system to attain the desired ends. Since these ends involve man and his environment, the major body of information required is about man and his environment.



This is not to say that information regarding the resource is minor or not essential. Knowledge of the resource and its environment is critical, a necessary condition for the successful management and development of the fishery. But as a research effort is developed to provide the relevant body of information, a significant portion of the effort should include information relating to the economic, social, legal and political features of the system.

Another important feature of research effort is the degree of precision required. To initiate development, only a rough approximation of the potential yield is necessary. Gulland has suggested within  $\pm 50$  percent of the actual is sufficient (5). Complete, precise, detailed information is necessary neither to initiate development nor to initiate management of the fishery.

Often qualitative information will suffice in the initial stages. For example, if development of an offshore trawl fishery is likely to harm the inshore artisanal fishery, means must be devised to prevent or offset such harmful effects. These means might be legal, such as regulations forbidding fishing in near-shore waters and selling in local markets. Exploring these alternatives requires research in a number of areas. And the scope and depth of the investigations are dictated first and foremost by the problem at hand, not by intellectual curiosity.

What is required is a broad, more superficial understanding of the entire industry and its environment: a general understanding of (1.) the fishery resource, (2.) the economics of harvesting and marketing the fishery products, and (3.) any other economic, social, cultural, legal and political factors influencing man's behavior in this instance. That is, an appropriate research effort is broad-based, proceeding on all fronts at once, identifying critical information gaps that are holding up development and management efforts. Moreover, the information produced should be in a form and of a type readily usable by the people directly involved in the development and management of the fishery.

To produce this body of readily usable information, the researchers must be in routine contact with those they wish to serve. This can be accomplished by attending meetings of the fisheries departments and of any other persons involved in the development and management of the fishery, and by frequent discussions with these persons regarding the nature and type of research being carried out. Unfortunately, we saw little evidence that EAFFRO personnel consult with fisheries department personnel on a routine basis. There appears to be little appreciation of EAFFRO's activities by department personnel. To rectify this situation, EAFFRO must strengthen and further develop its cooperation and communications with the fisheries departments and other entities involved in the development and management of the fishery.

In summary, the appropriate research effort should be broad-based, spanning several research disciplines: oriented toward problem solving, and flexible enough to respond quickly to critical questions of fishery development and management. This approach, it should be noted, is in stark contrast to the classical academic approach to fisheries research.

#### Project Design

The planned Lake Victoria research activities of EAFFRO for the triennium 1973-75 appear too ambitious for the available staff and existing logistical support. Also, the organization appears to be "locked-in" to a classical approach to fishery research activities that we believe will not provide the required information in time to manage the already heavily exploited inshore and proposed commercial trawl fishery.

The proposed trawl fishery for Lake Victoria will create research and management problems that are somewhat unique to freshwater fisheries. In this respect the potential competition between the inshore and offshore fisheries in catching fish and in marketing the catch could very well spell the demise of the artisanal fishery. In our opinion these problems have not been sufficiently emphasized in the work plans of the USAID biologists.

In our recommendations for continued AID support we suggest modifications in existing work schedules to include:

A biological and economic evaluation of proposals for extending the range of traditional fishermen.

Through monitoring the expanding mechanized fishery, assessments of catch per unit of effort, species composition of the catch, areas fished, trawling costs and earnings, and market impact and its effect on artisanal fishermen's earnings.

An expanded tagging program to distinguish sub-populations from the inshore and offshore areas.

A comprehensive survey of all existing economic-related research and, from existing data, an analysis of the structure and functioning of the present fishery.

Competition between the traditional and developing mechanized fishery can be demonstrated as these data are accumulated on the species that are being fished. Specific regulations can then be recommended to protect the traditional fishery, or at least lessen the pains of transition.

### Personnel and Research

The project is currently providing EAFFRO with three fisheries biologists and one bio-statistician. These four specialists have been conducting research on age and growth of the fish populations, passive and active gear, and catch and effort statistics for the fishery. This research is now evaluated with recommendations for future research for the period 1975-1977.

Age and Growth (Kisumu Substation). To date a tremendous amount of effort has been devoted to the collection of hard parts (e.g., spines, vertebrae and otolithes) of *Bagrus*, *Clarias* and *Synodontis*, and scales of *Tilapia* for age determination. Sampling in offshore waters has been hindered by scheduling and maintenance problems with the available trawlers. In addition *Tilapia* from Kavirondo Gulf have been stocked in eight earthen ponds to determine their growth rate, tag retention and mortality. Beach seines are used to obtain fish for tagging (one two-week trip each month). Approximately 5,000 fish have been tagged, primarily in Kenyan waters, with rewards being offered for returned tags. To date an insufficient number of tags have been returned for estimates of movement and migration patterns.

We recommend that technical assistance in this general area be continued in 1975-1977, but with the following modifications:

Methods for age and growth determinations should be deleted. Although we realize that growth information is an essential component of yield equations, we question whether or not aging techniques can be developed in time, and, if so, whether yield estimates can reasonably be applied to a complex multi-species fishery.

The tagging program should be expanded, e.g., to include Tanzania's waters, and this operation should be tied to the monitoring of the existing inshore trawling operation.

In this respect the practicality of proposals for inshore trawling using light, inboard trawlers should be investigated. These studies could provide data not presently available for recommending how best to proceed in developing and regulating a mechanized fishery on the lake.

Statistical Analysis (Kisumu Substation). Catch data from commercial landings in Kenya, Uganda and Tanzania, and from experimental trawling (*Ibis*, 1969-1970) were prepared for computer summation and analysis. Month-to-month fluctuations in the catch show that movements, and possibly migrations, are a very important characteristic of the fished stocks. These analyses are being updated and improved as adjustments for gear are incorporated. Trends in the species composition of the commercial catch also have been identified.

It appears that the important analyses will be completed not later than January 1976. Therefore, EAFFRO/USAID may wish to consider an alternative to a full two-year contract for a statistician. One alternative would be to hire a fisheries biologist with a strong background in statistical methods. This individual could complete the statistical analyses in progress and assist in the assessment of the fishery. Duties would include (1.) designing experiments on a trial basis to test the effectiveness of various regulations that might be imposed on the inshore fishery, and (2.) assisting in the evaluation of the tagging studies. Another alternative would be to extend the contract of the present fishery statistician until January 1976.

Passive Gear Research (Mwanza Substation). Experimental gill netting using a variety of mesh sizes and an assessment of the size and species composition of the commercial catch are progressing. Progress, however, has been hampered by lack of logistical support. The Mwanza substation has only one vehicle, and it is not readily available for field work. Also, the described duties for this position are beyond the abilities of any one individual, even with adequate transportation.

We recommend that the position be continued through 1977 on the condition that EAFFRO realistically support the project. This would include the addition of a suitable vehicle designated for field studies and the assignment of one additional laboratory technician. The USAID biologist has performed admirably under the circumstances, and we recommend that his services be retained through 1977.

Active Gear Research (Mwanza Substation). For a number of reasons the performance of the USAID biologist has been less than satisfactory. These reasons for the most part have been beyond his control. At this writing he will resign his position in January 1975.

At least two trawlers are available for research purposes in Mwanza, although scheduling and mechanical difficulties have seriously interfered with their use. Trawl catches were to be analyzed for catch per unit-of-effort, species composition, and basic biological characteristics of the fished stocks. In addition, an inventory of beach seining was to be undertaken and the species composition of the catch recorded. By comparing the commercial landings with experimental seining, seine selectivity, and thus the effect of seining on recruitment, was to be determined.

We recommend that the position be continued with added emphasis on the rapidly expanding trawl fishery in Tanzanian waters. Besides the trawlers being constructed locally, two 50-foot (15 meters), 10-ton capacity, Danish-built trawlers are scheduled to arrive before January 1975. An extremely disturbing fact is that the locally built trawlers do not have the size or power to fish in the deeper, offshore waters. Also, it appears likely that the Danish-built trawlers will be fishing for "table fish" since no shore-based facility is presently under construction for processing fish meal. Regulations are urgently needed on when and where mechanized fishing will be permitted to ensure that the inshore fishery will endure.

Additional Personnel: Fisheries Economist. EAFFRO currently has no experienced fisheries economist on its staff. A substantial amount of economic analysis was carried out by the UNDP/FAO project during the period 1967-72. This and other completed economic research need not be repeated in most cases. However, successful development and management of the fishery requires continuous monitoring of economic data and analysis of critical economic questions as they arise.

EAFFRO does recognize the need for on-going economic research. It currently has on its staff in Jinja a recent Makerere University graduate, at the bachelor degree level, in economic and statistics. His ambitious program for 1975-76 includes some interesting and pertinent issues. Given that the individual has no research experience outside his course work and probably is in need of more analytical skills that could be acquired with advanced training, the guidance and assistance of an experienced fisheries economist would be very useful in shaping the exact nature of his future research. Without such guidance the results may be only marginally useful to EAFFRO.

For these reasons we recommend EAFFRO acquire the services of an experienced fisheries economist. If UNDP/FAO does not return to provide such economic research input--as seems likely at this writing--then USAID is a logical and excellent source from which to fill this critical gap.

One obvious means for filling this gap is for USAID to provide an economist to EAFFRO for the period 1975-77. We feel this position ranks fourth in priority after the three fisheries biologists, and this economist could be stationed in Kisumu if the project is not expanded beyond the current four positions. Although we were not able to visit the headquarters of EAFFRO, we believe stationing the economist in Jinja would be only marginally advantageous. This is largely due to our view of the economist's work activities. He should be in regular contact with the decision-makers in the capitols of all three countries, with the collectors of economic-related data on the lake, and with all others engaged in economic research for Lake Victoria. This, of course, would require a substantial amount of travel and time spent in Jinja and locations other than Kisumu.

There are other alternatives for providing economic research input, which may or may not be acceptable to USAID. One is to hire a U.S. fisheries economist consultant to spend one month twice a year in East Africa, advising EAFFRO on research activities. The program might be combined with sending the host country personnel to the United States for a three to four months' course in fishery economics and other relevant studies. If this alternative is chosen, the U.S. economist should possess considerable familiarity with fisheries economics either through extensive training in the area or through experience.

Limnologist/Aquatic Pollution Specialist. EAFFRO has requested two additional technical assistants for the period 1975-77: a limnologist to provide data for predictive and management purposes, and an aquatic pollution specialist to establish current and potential sources of pollution.

We believe that the Lake Victoria fishery investigation should include basic limnological studies that are directly related to the management of the resource. However, it is our opinion that basic physio-chemical characteristics of the water that might influence the distribution of fish can be obtained incidentally to gathering biological data. Our experience has been that in-depth limnological studies are time-consuming and, within the remaining two years of scheduled USAID assistance, would not provide the type of information needed for devising short-term management strategy.

Moreover, domestic and industrial pollutants now entering Lake Victoria do not appear to be causing a serious problem in fish production. If such a situation does occur, the source of pollution is usually easily recognized. Admittedly the chronic effects of various pollutants on Lake Victoria's fish populations are not known. However, an East African is scheduled for Master of Science training in limnology, and we believe that studies of this type can be initiated upon his return. As a result, we do not recommend USAID provide a limnologist at this time.

#### Equipment

The project has ordered from the United States a substantial amount of equipment, laboratory supplies and books. At this writing most items have been purchased and are being prepared for shipment. But the list includes a number of items that will be difficult, if not impossible, to repair locally. Therefore, funding for the 1975-77 period should include sufficient monies for spare parts and general repairs. Additional requests for equipment should include a statement indicating the availability of local maintenance.

Books and other publications should be sent to the Jinja library for cataloging and then loaned as needed to the sub-stations. Also EAFFRO should use the library facilities of the East Africa University system.



Fig. 3. Fishermen landing their catch are besieged by fishmongers.

#### 4. Summary and Recommendations

##### Summary

1. An evaluation of existing USAID technical assistance to EAFFRO's Lake Victoria fisheries project was conducted from October 28 to November 15, 1974. Recommendations for USAID assistance for the period 1975-77 are offered.

2. EAFFRO has determined the existence of offshore demersal stocks (mainly *Haplochromis*) that could be exploited; annual yield has been estimated at 200,000 tons, or about twice the present harvest of inshore waters.

3. The present concern is that offshore mechanized fishing may have detrimental effects upon the heavily exploited inshore stocks.

4. EAFFRO's research activities appear too ambitious for the available staff, and in our opinion EAFFRO will not be able to provide management guidelines in time to avoid competition between the traditional inshore and proposed trawl fishery. In our opinion the assessment of the proposed trawl fishery has not been sufficiently emphasized in the work plans of the USAID biologist.

5. There have been insufficient communication and cooperation between EAFFRO personnel at all levels and fisheries department personnel, and the information being produced appears not to be in a form and of a type that can be readily used by the people directly involved in the development and management of the fishery.

##### Recommendations

1. For the period 1975-77 work schedule of USAID biologists should emphasize: (a.) evaluating proposals for extending the range and fishing habits of traditional fishermen; (b.) monitoring of the expanding trawl fishery to include areas fished, catch per unit-of-effort and species composition of the catch; and (c.) expanding the present tagging program to find out if distinct subpopulations exist.

2. The present USAID positions (three biologists, one biostatistician) should be continued, but additional technical assistance in the areas of limnology-aquatic pollution should be given a low priority.



3. The services of an experienced fisheries economist should be made available to EAFFRO to assist in making recommendations for the development and management of the fishery. If constraints limit the number of technicians to the present level of four, then the economist should be given preference over the bio-statistician.

4. Equipment requests for the period 1975-77 should include some indication of the in-country capability for maintenance.

5. EAFFRO should develop further and strengthen its communication and cooperation with the individual fisheries departments at all levels by encouraging all of its research staff to (a.) attend regular meetings of the three countries' fisheries departments, and (b.) routinely consult with the departments' personnel on the nature of their research activities. The goal of each researcher is, of course, to produce results relevant to the problems faced by these developers and managers of the fisheries.



Fig. 4. "Sesse" canoe fishermen with a large lung fish (*Protopterus* species) in Kavirondo Gulf, Kenya.

## 5. Itinerary

October 28-November 15, 1974

October 28	Arrived in Arusha, Tanzania; met with USAID officials, Regional Development Office for East Africa
October 30	Travelled to Nairobi, Kenya
October 31	Travelled to Kisumu, Kenya
November 1-3	Conferred with USAID biologists and EAFFRO counterparts
November 4	Travelled to Mwanza, Tanzania
November 5	Conferred with USAID biologists and EAFFRO counterparts
November 6	Returned to Kisumu, Kenya
November 7-9	Conferred with USAID biologists and EAFFRO counterpart
November 10	Returned to Nairobi, Kenya
November 11-14	Prepared report
November 15	Held final meeting with USAID and EAFFRO personnel

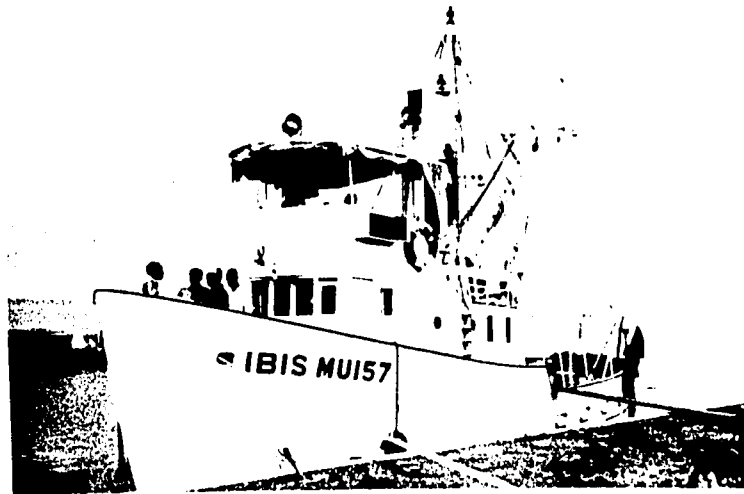


Fig. 5. The EAFFRO/UNDP trawler, *Ibis*.



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