

ADP/FS-SF

9 June, 1988

The Commissioner for Fisheries
P.O. Box 4
Entebbe

Dear Sir:

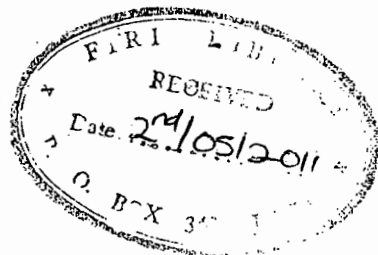
We are submitting the enclosed pre-feasibility study entitled "A Pilot Family-Operated Fish Cage Project in Lake Kyoga", for your appraisal and appropriate action.

This Project is being proposed as the third strategy on the "adaptive management" scheme designed for the enhancement of the declining fisheries of Lake Kyoga Complex.

Sincerely yours,


P.R. MANACOP
Fisheries Stock Assessment Specialist

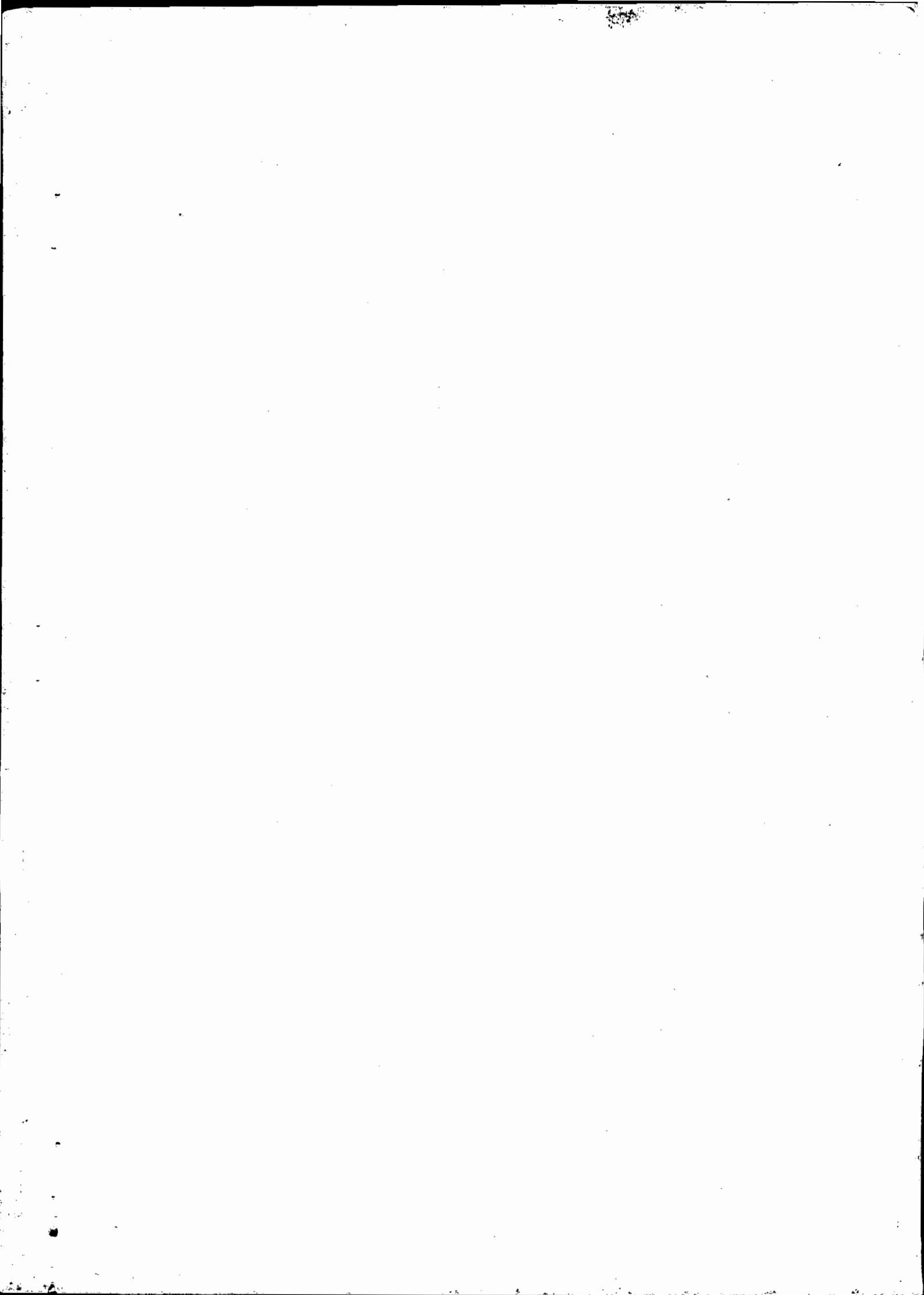
c.c. Mr. L.J. Sprowles, ADP Team Leader
Mr. D.G. Mukiibi, Deputy Project Leader ✓



IFAD-WORLD BANK
AGRICULTURAL DEVELOPMENT PROJECT
FISHERY SURVEY UNIT

A PILOT FAMILY-OPERATED FISH
CAGE PROJECT
IN
LAKE KYOGA

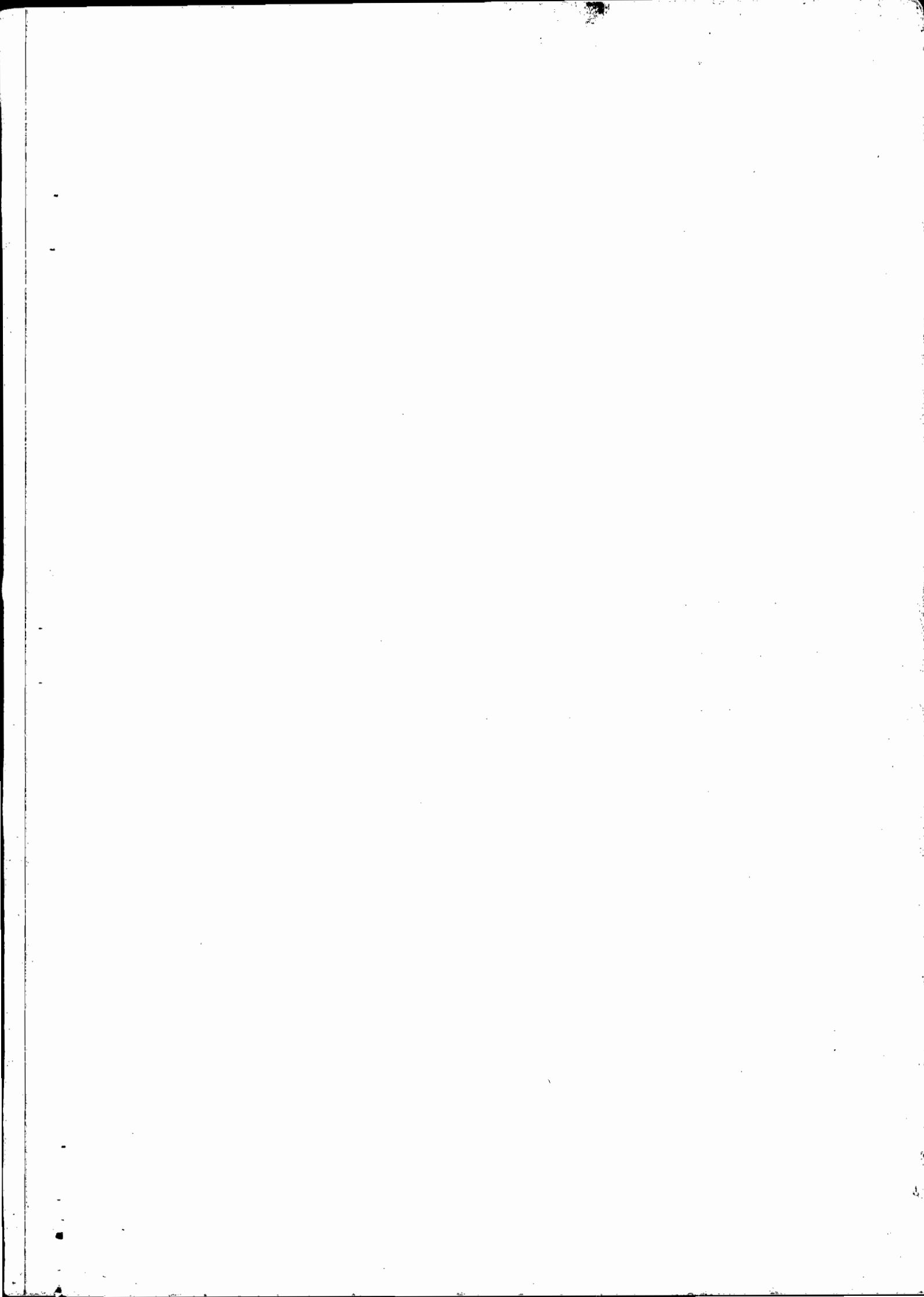
MINISTRY OF ANIMAL INDUSTRY AND FISHERIES
FISHERIES DEPARTMENT
P.O. BOX 4
ENTEBBE, UGANDA



AGRICULTURAL DEVELOPMENT PROJECT
FISHERY SURVEY UNIT

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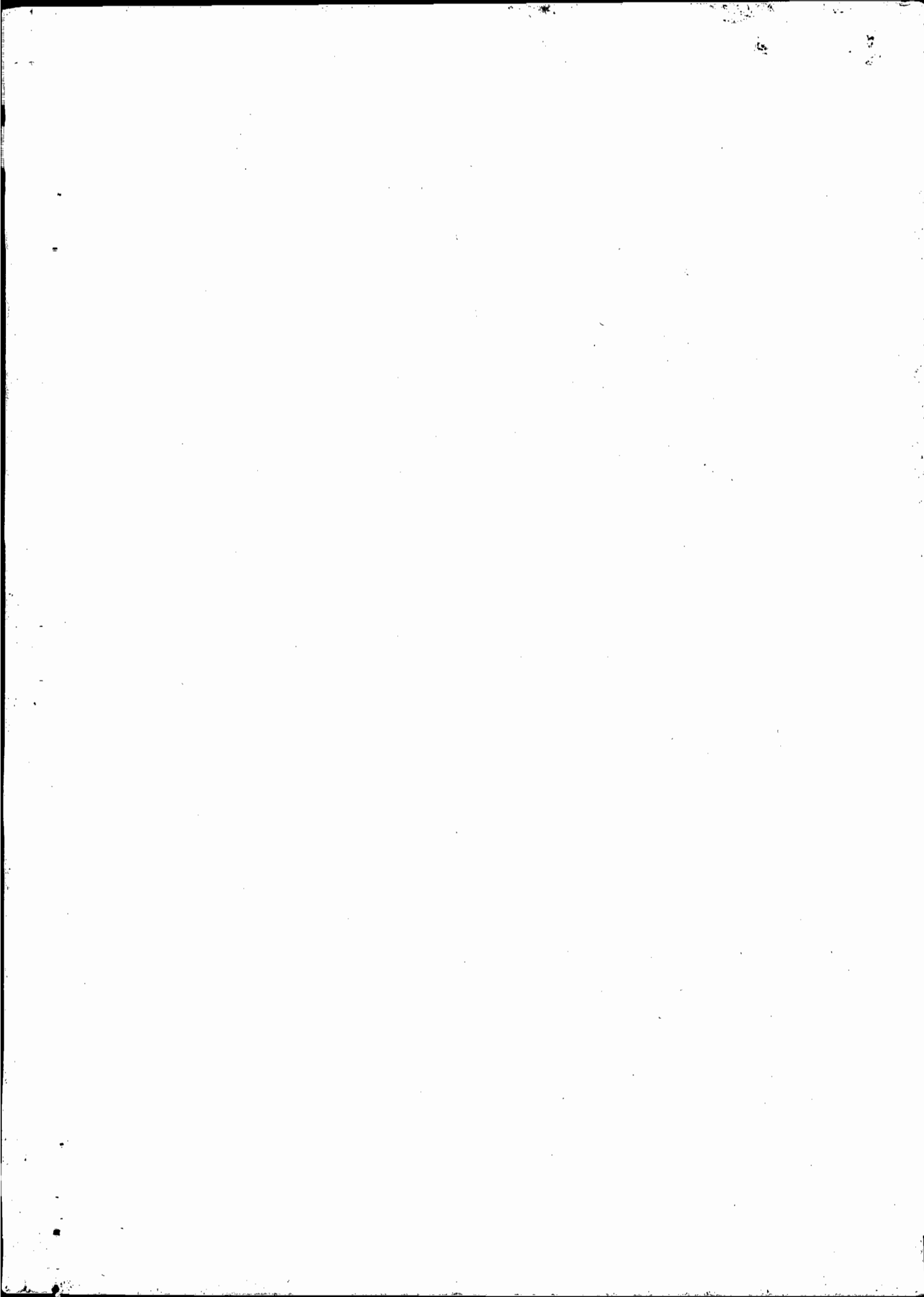


I N T R O D U C T I O N

The culture of fish in cage and pen is a comparatively new project in Uganda although it has been successfully practiced commercially in the Philippines in the raising of Tilapia and carps. As a technology transfer scheme the project is being proposed as an alternative employment both for fishermen and farmers in the rural and fishing communities around the Lake Kyoga Complex. The project can be operated as family enterprise, by cooperatives or by fishery corporations, as possible income -producing business ventures.

The suitable project sites in the Lake Kyoga Complex are extensive and are barely or not all utilized. The species suitable for pen and cage culture are also available locally which are represented by the Nile Tilapia (Oreochromis niloticus) and the common carp (Cyprinus carpio).

The project will be pilot tested in order to determine its technical feasibility economic viability and social desirability before it can be adopted as a prospective investment enterprise. The other requirements for successful implementation of the project should include provisions for liberal terms of financing from the local Banks including expertise support from the Department of Fisheries and/or the Uganda Freshwater Fisheries Research Organisation (UFFRO).



A PILOT FAMILY-OPERATED FISH CAGE PROJECT IN LAKE KYOGA

I- Rationale:- The declining fishery of Lake Kyoga Complex could result in some socio-economic problems of the fishermen who might be displaced in the event of the institution of a maximum limit of the number of operating fishing boats in the lake. In any event this project could serve as one of the alternative employment venues for any displaced fishermen. As a regular income producing project it can be operated as a Family enterprise, by cooperatives and/or by Fishery Corporation as an integrated aquaculture project.

II- Goals and objectives

The goal of this project is to eventually establish an alternative or supplementary venue of employment for the small fishermen including possibly farmers living in the perimeter of Lake Kyoga Complex.

The specific objectives are:

1. To test/demonstrate the technical feasibility, economic viability and social desirability of the project in Lake Kyoga Complex.
2. To test, in addition to the Nile Tilapia and the Common carp, other indigenous fin fishes for cage culture.
3. To test the variously available supplementary feeds such as rice bran, wheat bran, maize bran including the use of shrimps, snails, clams and mussels which are abundant in Lake Kyoga and are not being utilized fully by the livestock industry.
4. To serve as a training facility both for Fishery Development and Extension Officers including the private sector especially the small fishermen who may get interested in this project.
5. Last but not least, to create an investment climate and to produce the economic data base through pilot testing/operations of this Project.

* A pre-feasibility study prepared by P.K. Munnop, Fishery Management Specialist, Fishery Survey Unit, IFAD-World Bank Agricultural Development Project, Jinja, Uganda - May 10, 1968.

III- Nature and location of Project

The project will consist of rearing of fish in floating cages made of nylon netting which will be held by wooden stakes in two to three meters depth of water. This project will be primarily a family-operated enterprise although it can be undertaken as a commercial venture. by fishery cooperatives or corporations in similar equatorial/tropical areas.

The project will be located in the lower reaches of Victoria Nile in the Subcounty of Galiraya, Bugerere County. The site specific will be around the former Fish landing of Namalere, which will be determined after some hydro-biological study of the definite site.

Site-specific requirements and location

- I. Site-specific location:- The site-specific location requirements are as follows:
 - a) Location - The cages should be located in a sheltered site from the prevailing winds, free from river flood waters and agricultural and industrial pollutants. A site with a good exchange of lake water should be preferred in order to provide adequate dissolved oxygen and constant removal of metabolites emanating from faecal matter and unutilized feeds by the fish stock.
 - b) Accessibility - The site should be readily accessible by land and/or by water in order to facilitate delivery of inputs and marketing of the products.
 - c) Depth of water - The depth of the lake water should be at least two to three meters if the cage nets are to be installed on fixed wooden posts. If they are to be installed as floating cages, the depth could be within reasonable depth upto 10 meters. Otherwise installation cost will be too high due to the use of various types of floats, such as bamboos, rafts, barrel, stylofám or rubber tyreess

- 3 -
- d) Type of bottom - The type of bottom should consist of hard mud and sand devoid of rocks and gravels. Deep mud, organic ooze and or floating suds of papyrus should be avoided.

 - e) Supply of artificial and natural supplementary feed - The site should be within reasonable distance from the supply of artificial supplementary feeds (various types of agricultural industrial by-products) including natural feeds (shrimps, snails, clams and mussels).

 - f) Security - The site should be located in secured areas to minimize poachers and/or possible military operations.

IV- Techno-economic justifications

I. Technical

- a) The suitable species for cage culture, namely; the Nile Tilapia (Oreochromis niloticus) and the common carp (Cyprinus carpio) could be easily propagated and are locally available in Uganda.
- b) The suitable project sites, such as finger coves, sounds and the large river systems (Mpologoma and Victoria Nile) flowing into Lake Kyoga Complex are extensive and are not being utilized presently except for some river fishing.
- c) These suitable project sites are readily accessible either by land or water through existing fish landings in the Lake and along Victoria Nile. The by-products from the local agro industries consisting of rice, maize, wheat bran, peanut meal and brewery wastes are available for
- d) The by-products from the local agro industries consisting of rice, maize, wheat bran, peanut meal and brewery wastes are available for feed formulation. Natural supplementary feeds such as shrimps, snails, clams and mussels which are abundantly available in the Lake which are not or barely utilized.
- e) Construction and accessory materials such as Eucalyptus wooden poles are locally available both in Forest or private Forest Reserves.
- f) Expertise assistance could be provided by The Fisheries Department and/or the UFFRO.

2. Economic and Social benefits

- a) Project has been successfully practiced both as a Family-operated or commercial ventures in many freshwater lakes and reservoirs in the Philippines (Encarnation E.N. and Tiongson, F.A., 1983; Mane,

- b) Project could provide an alternative employment to any displaced fishermen or farmer in the fishing and farming communities around the Lake Kyoga Complex.
- c) Project will maximize the utilization of the numerous and extensive resources consisting of finger coves, sounds and river system of Lake Kyoga Complex.
- d) It will create an investment climate, after a successful pilot testing, for business entrepreneurs including the individual family operators and fishery cooperatives.
- e) It could contribute to increased fish production in the fishing and farming villages thereby improving the nutritional requirement in terms of cheap animal protein.
- f) Since this Project will generally produce small-sized fish, ranging from 300 to 500 grms, it will find a ready market in the rural communities. These sizes are also suitable for the production of sun-dried products as the smaller size fish gets easily dried under the sun.
- g) The Project, when nationally adopted, will trigger the development of linkage industries such as the growing of wood postings, feed industries including the manufacture of special size of meshes nettings both for this highly potential Project.

V- Description of Project Components -

The Project will consist of two components, namely:

1. Grow-out cage and
2. Nursery cage.

The supporting equipment includes a four-meter dinghy - non-motorized.

- I- The Grow-out Cage - Fig. 1 - shows the schematic layout of the grow-out cage net. The cage is like an inverted mosquito net, rectangular in shape, measuring about 30 meters long by 10 meters wide and about 3 meters deep. The entire netting is either made of nylon or polythene, knotted or knotless, with a mesh opening of about 1.0 cm. bar mesh. A cage cover made of the same netting, is provided for protection from bird predators and at the time minimize the escape of fish.

- 2- The nursery cage - Fig. 2 - shows the schematic design and lay-out of the nursery cage which is constructed in the same manner as the grow-out cage. The only difference is the size and type of netting materials used. It measures about 5m. long by 3 by 2 meters deep and is made entirely of mosquito type of polythene netting with mesh opening of about 2 mm. mesh. Like the grow-out cage a cage cover made of the same materials of the nursery cage is also provided especially protection from bird predation. /for

VI- Construction and installation

- I- Construction - The construction of the net cages could be done by a regular net maker. The nettings are hung on a 50% ratio in order to provide good circulation of the lake water and elimination of accumulated fecal wastes and unconsumed food of the fish stock. The cage is strengthened by polythene rope ribbings of about 7 mm in diameter and the headrope of about one cm in diameter.

2. Installation - The installation of a family-operated fish cage project can be done by two men and completed in one day with the use of a dinghy. After the specific site has been located all the materials are assembled at the loading point. The wooden posts are sharpened at the butt-end points in order to facilitate embedding same in the mud bottom. The grow-out cage is first to be installed, followed by the nursery cage. To strengthen the cage structure wooden/bamboo braces are tied around the wooden posts about a meter high from the water line. Then the cage net are secured along the peripheral brace. To stretched the cage vertically and horizontally the lead line are tied securely to each wooden post. The net is now ready for stocking of fry/fingerlings. The nursery cage is installed in the same fashion as the grow-out cage. However, it is usually installed on the leeward side of the grow-out cage in order to be sheltered from the prevailing winds/waves. The net cover is installed after stocking of the fish.

VII- Management and Operation

- I. Stocking of the net cages - The recommended size of fingerlings to be stocked is about 5 mcm. TL or bigger so that they will not escape the cage net. However, if the available fingerlings/fry are less than 5 cm. TL they should be reared first in the nursery cage until they reach stockable size.

2. Stocking density and combination of species - The recommended stocking density, with supplementary feeding, is from 50 to 100 per cu. m., and the species ratio is 70 to 80 per cent of the Nile Tilapia and 20 to 30 per cent of the common carp.

3. Feeding - Aside from natural food (planktonic and benthic organisms the Nile Tilapia and common carp feed on a variety of food stuff such as Azolla, leaves of sweet potato, Ipomea rept reptans, Leucaena and by-products of Agro-industries (rice, maize, wheat bran, cassava and brewery wastes). The stock should be fed intensively in order to attain maximum growth and survival. A low-cost supplementary feed can be formulated which contain 75 per cent rice bran and 25 per cent fish meall which can be administered in the following manner (Galman, 1983).

- (a) Measure roughly combined weight of fish by multiplying the average weight of each fish with the total number of fish in the cage. The average weight can be obtained by weighing a number equivalent to 10% of the standing fish stock in the cage.
- (b) For the first month, feed the fish with an amount of 5% of their combined weight.
- (c) On the second month 4% ration and on the third month and monthly thereafter use 2% to 3% ration.

4. Dispensing of feed - The feed should be dispensed in crumbles which can be prepared by partially cooking the feed mixture. These crumbles are placed in floating feeding trays made of one meter square bamboo or wooden frame, provided with about half cm. mesh netting. The fish stock feed from the bottom of the floating tray with a minimum spillage of feed. To provide a uniform feeding of the fish stock it will require about five feeding trays to serve a cage of 300 square meter size.

5. Frequency of feeding - For effective and uniform feedingg of the fish stock, three to five times a day feeding schedules should be done. Feed as much as can be consumed in about thirty minutes at every feeding time.

6. Maintenance of the fish cages - To minimize pitfalls such as fish escapes, mortalities, bird predation and poaching, regular inspection and repair of cages should be maintained. Both the environment and the standing fish stock should be ~~regularly~~ monitored. One or two hours a day can be sufficient to check the cages, fish stock and the environment.

In case of an impending storm the cage should be tied securely and the top cover installed. If any incidence of mortality occurs, the fish stock should be checked. Diseased fish could be detected by their slow movement and usually keep away from the shoal. The sick fish should be scoped out and treated. They may be dipped in a concentrated salt solution for 5 to 15 minutes.

Cages should be cleaned regularly by removing debris attaching on the walls and thick algae that may occlude the net meshes. Tears and holes should be repaired right away to prevent escapes or entry of predators.

7. Harvesting and marketing - Harvesting of fish cage can be done by two men. Partial harvesting or thinning out the stock is started when the desired marketable size is reached which usually occurs on the fourth or fifth month. Harvesting is done with use of the dinghy which is positioned along one end of the cage, As the floatline and headline are released from the supporting wooden posts the net is hauled-in on the dinghy until the fish is concentrated at the opposite end. Here the fish is ~~scoped out with~~ with a scoop net. The marketable size are separated and the under-sized ones are returned into the cage.

VIII- The Products

The principal products of the Project will consist of marketable size fresh fish. The secondary products will consist of fry/fingerlings and shimps. The fry/fingerlings of the Nile Tilapia will come from the salvaged fry which are naturally produced from the extraneous spawning of the growing stock in the grow-out cage. The Nile Tilapia start to spawn on the fourth and fifth month.

They are collected and placed in the nursery cage for the second cropping. The shrimps, on the other hand, are gathered with a scoop net from/brush shelters. These shrimps will, however be used in feed formulation of supplementary feed for the fish stock.

X- The Market -

On account of the small-sized fish produced from cage culture, ranging from 300 to 500 grams each (about two to three pieces to a kilo) this type of product will readily find acceptance in the rural villages and also for the fish drying (bambala) establishments. These sizes may not be acceptable in the towns and cities of Uganda as the population preferred the one to two kilo sizes. The individual weight of the fish stock could be further improved by better feed formulation and regular maintenance of the net cages in order to provide good circulation of the lake water including the elimination of accumulated metabolites.

XI- Economic Aspects

The estimated investment cost and net return of the Project is summarized as follows:

	<u>U Shs</u>
1- Capital investment -----	200,000
2- Annual operating expense -----	144,000
3- Annual gross income (minimum level) -----	275,000
4- Annual net income -----	67,000
5- Percentage return on investment -----	34.0%
6- Recovery period -----	Approx. three to four years

Summary and Recommendations

- 1- The Family Cage operated fish culture project is a comparatively new venture in Uganda although it has been successfully practiced as an individual, cooperative or cooperation enterprise in the Philippines. It has a bright prospects for development in Lake Kyoga and possibly in other lakes of the Country.
- 2- Suitable Project sites and species for culture in cage are not only a vaila ble but acceptable by the consuming public. The Nile Tilapia (Oreochromis niloticus is one of the principals fisheries of the major and minor lakes of Uganda.
- 3- The Project is technically feasible, financially viable and socially desirable. It is one of plausible alternative which could attract fishermen to non-fishing activities as a stable employment.
- 4- The Project is recommended for pilot testing before it is adopted for implementation, where expertise and liberal financing should be provided for/the local financing institutions. /by
- 5- It is further recommended this Project be pilot tested by integrating same with the two other proposed development project, namely: (I) Integrated lake based aquaculture project and (2) artificial reefs. The last two projects are designed for biological enhancement of the fisheries of Lake Kyoga which could lead to increased yield.

R E F E R E N C E S

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- 8- Gahman, O.R. 1984: Maximizing Production and Profit in Tilapia Farming Aquaculture Potentials of Gintong Buyanja . Paper read in Seminar workshop on Gintong Biyaya sponsored by Technical Foundation on Oct. 12-14, 1984. TRCF Building. In Gil Puyal Av. Makate, Manila

- 5- Percentage return on capital investment ----- 34.0%
- 6- Recovery period Approx. 3 to 4 years.

Financial, technical and price assumptions

- 1- Production per cage of 600 cu. m. (minimum) ----- 5,000 kg
per annum
 - 2- Number of croppings - once a year, although partial
harvesting is done to thin our the fish stock
 - 3- Price per kilo - Ushs 45
 - 4- Stocking density, 50 fingerlings per cu. m.
 - 5- Loan interest - 25% per annum
 - 6- Recovery - 80%
 - 7- Cost estimates as of May 10, 1988
-

TABLE I

Cost Estimate of Investment and Income for a Family -Operated Cage Project

	<u>U Shs</u>
I- Capital Investment	
a) One dinghy 4 m. l.) -----	10,000
b) One set of cage net (30 by 10 by 3 m.) -----	150,000
c) One set of nursery cage net (5 by 3 by 1.5 m.) -----	10,000
d) Accessory materials (30 wooden posts @ Ushs 150) -----	4,500
e) Miscellaneous (wood braces, dip nets, cooking vats, etc) -----	5,500
f) Working capital -----	<u>20,000</u>
Total capital investment	<u>200,000</u>
2- Annual operating expenses	
a) Labour (supplied mainly by the family household) -----	2,000
b) Emergency labour -----	2,000
c) Supplies and materials	
1) Supplementary feeds, 2 tons @ Ushs 50 -----	10,000
2) Miscellaneous (firewood, twines, wooden posts) ---	3,000
d) Fixed charges	
1) Interest on loan 25% of Ushs 200,000) -----	50,000
2) Maintenance and repair (10%) -----	9,000
3) Depreciation (10 to 30%) -----	52,000
4) Marketing costs (5%) -----	<u>11,250</u>
	137,250
Contingency (15%) -----	<u>20,550</u>
Total annual operating	157,800
say -----	158,000
3- Annual gross income	
Minimum level (5,000 kg @ Ushs 45) -----	225,000
4- Annual net income	
a) Annual gross income -----	225,000
b) Annual operating expense -----	<u>158,000</u>
c) Annual net income	67,000