

TOWARDS AN APPROPRIATE MANAGEMENT REGIME FOR THE FISHERIES RESOURCES OF UGANDA

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ABSTRACT

A management regime was designed and an implementation plan drawn up for the fisheries resources of Uganda. Uganda's fish resources are quite significant. The exploitation of these resources has expanded greatly during the past few decades. The fishing industry — fisheries, fish processing and fish marketing — is now a major source of income, employment and exports. In addition, fish is the cheapest source of high quality animal protein in Uganda and thus contributes substantially to the nutritional needs of the population. Uganda's fisheries are currently subject to a severe case of the common property problem. Access to the fish resources is for the most part unrestricted. There are few restrictions on fishing methods, and none on harvesting quantity. As a result, the fishery is bound to over expand and has apparently already done so to a significant degree. Therefore, effective planning and management to ensure a socially optimal sustainable yield from the fishery is called for. The design of an appropriate fisheries management program for Uganda must reflect two basic considerations; (a) to achieve economically and socially efficient utilisation of the fish resources and (b) the nation's ability to implement and enforce an advanced fisheries management regime. Since the latter is quite limited, it is not possible to implement an efficient fisheries management system in the Ugandan fisheries right away. Instead it is necessary to initiate a stepwise process of fisheries management improvements that will hopefully end in a fully efficient fisheries management regime in the not too distant future. The following fisheries management measures are designed to deal with the most serious shortcomings of the current no system. Moreover, they are feasible given the current management capability of the fisheries authorities while at the same time constituting the first steps toward a fully efficient fisheries management regime.

- Licensing of all fishing vessels and a limitation of licenses issued.
- Gazetting (and licensing) of all landing sites.
- More effective gear/area restrictions.
- The determination of total allowable catches by species and water-bodies.

These measures will restrict entry into the fishery and thereby limit fishing effort, at least in the short run. Licensing of landing sites followed by a reduction in their number will facilitate the currently inadequate monitoring, surveillance and control of the fishery. More effective gear and area restrictions will enhance the sustainable yield of the fishery. Finally, determination of a total allowable catch will facilitate a more precise utilisation of the biological resources and pave the way toward an output oriented fisheries management system. Taken as a whole, these measures, if implemented, are expected to substantially improve and enhance the biological and economic performance of the fisheries.

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1 INTRODUCTION

1.1 Objective and Rationale

This thesis is about the design and implementation of an appropriate (*multi-species*) exploitation management regime for Uganda fisheries.

The main species on the Uganda fish market are Nile perch, Tilapia and *Rastrineobola argentea*, known locally as "mukene". Other species are also available in limited quantities, varying from place to place and they include *Bagrus*, *Clarias*, *Protopterus*, *Alestes*, *Hydrocynus*, and *Barbus* etc. The fish are marketed fresh or processed, including smoked, sun-dried and fried products.

Uganda's main sources of fish supply for both the domestic and export markets are the districts on Lake Victoria, particularly Mukono, Mpigi, Kalangala, Masaka and Luwero. Lake Kyoga, Albert, George and Edward districts are other major sources of fish. The rural fish market segment is estimated at 55%, of the total market as compared to subsistence consumption at 10%, urban markets at 16%, regional export market at 3% overseas export at 14%, and industrial demand at 2%. The major urban centres within the Lake Victoria belt, namely Kampala, Masaka, Jinja and Entebbe constitute the main domestic market centres for fresh fish. Although considerable fish supplies reach these market nuclei and most of the other district headquarters markets, inadequate supplies reach most of the rural markets

Fish is the cheapest source of high quality animal protein in Uganda and provides over 50% of animal protein consumption. Fish is also a major source of income and an important export commodity. It is estimated that in 1996 US \$ 49 million were earned from fish exports putting it second to coffee in export. The fisheries in Uganda especially in Lakes Victoria, Albert, Edward and George have over the years shifted from multi-species to a few species fishery not unlike those in temperate regions of the world. This has been largely brought about by the introduction of the large and long-lived predator Nile perch (*Lates niloticus*), into lakes Albert, Victoria and Kyoga and the introduction of the Nile tilapia (*Oreochromis niloticus*) into water bodies where did it not exist. Fishing effort has shifted from other species to the introduced species as they appear to have competed successfully with the endemic species and also because of their highly valued flesh for both domestic and export market. Nile perch fillets are now competing with ground fish fillets on the European market. Fishing and fisheries related activities provide employment for about 500,000 Ugandans. In light of the above-mentioned it is prudent to use a management regime with measures that ensure that the resources are exploited at optimal sustainable biological and economic yield levels.

1.2 Geographical and economic setting in relation to Fisheries

Uganda is a landlocked country and lies astride the equator between latitudes $4^{\circ} 12' N$ and $1^{\circ} 29' S$ and longitudes $29^{\circ} 34' E$ and $35^{\circ} O E$.

Uganda has a total surface area of 241,038 km², of which 42,383km² or about 18% are covered by water in the form of lakes and rivers, dams and swamps. The main water bodies are Lake Victoria, Lake Albert, Lake Kyoga, Lakes Edward and George, the Kazinga Channel and Lake Wamala and 165 minor lakes. The main rivers include the Victoria Nile and the Albert Nile (Figure 1).



Figure 1: Map of Uganda

Lake Victoria is shared with Tanzania and Kenya and Lake Albert and Lake Edward are shared with the Democratic Republic of Congo. This poses a major problem when it comes to resource management

Uganda is a leading producer of freshwater fish in Africa. Landing in 1997 is estimated at 218,680 metric tonnes valued at Uganda Shillings 75.8/- billion, approximately US \$ 76 million (Fisheries Department).

1.3 The role of the sub-sector in the national economy.

Uganda is among the poorest countries in the world with a real GDP per capita of 137.3 US \$. (MPED 1997) The country had a stable economy during the 1960s with GDP of 160 US \$ in 1960. This was, however, ruined due to mismanagement by the military regime of the 1970s. Since 1987, government has made deliberate efforts to revive the economy and this has resulted in growth of over 6% per annum (MFPED 1997).

The role of the fisheries sub-sector in the national economy consist of value added to the gross domestic product, and contributions to the balance of payments, employment creation, food security and the living standards of the fisherfolk communities. Fisheries sub-sector activities include fishing, fish handling, processing, fish distribution, fish farming and the support services for research, training and extension and management.

The volume of fish catch grew at 4% p.a. between 1981-1994 and was estimated at 218,680 tons for 1997, well below the peak level of 276,680 tons in 1993. The sub-sector was the second latest export earner at US \$ 49 million after coffee in 1996 excluding unrecorded border trade. However, its contribution to GDP has fallen from 2.5% in 1990 - 1992 to 2.2% in 1996 when agriculture's contribution fell from 54% to 48% (MFPED 1997).

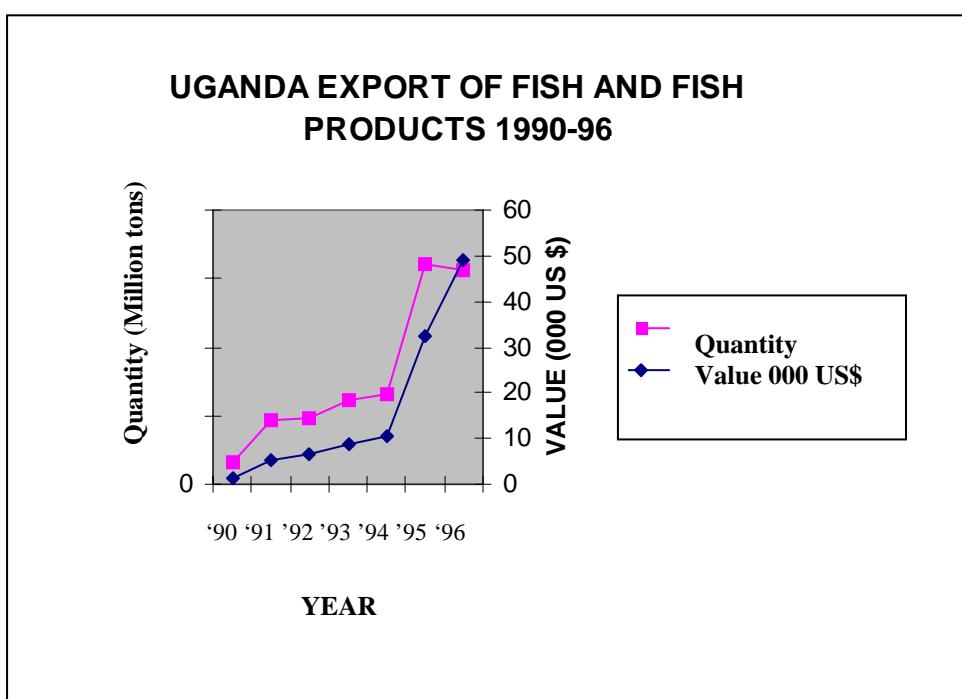


Figure 2: Uganda export of fish products 1990-1996.

The fisheries socio-economic structure is dominated by fishers estimated at 236,000 in 1997 who support the livelihoods of about 1,274,000 people. According to the Fisheries Statistics Information Systems Project in 1987 (Reynolds, *et al.* 1989) the

number of people directly involved in fishing was estimated to be between 70, 000-80,000 (1987/89). It is now estimated at about 150,000 while related activities employ another 150,000. Total direct and indirect employment estimated at about 450,000 persons including all other industrially linked activities (FMPS 1997/98) is.

1.4 Potentials

Value added by the fisheries sub-sector could be through substantial reduction in post harvest losses, more efficient distribution systems, improved quality and effective development of the export market potential.

A maximum potential yield (MPY) of 300,000 MT has been estimated. (Fisheries Department). This can be achieved through better management and utilisation of other species that are not being adequately exploited. Fish species which are abundant but not utilised in some lakes include *Haplochromis* in Lake George, *Rasrtineobola Mukene* in Lakes Victoria and Kyoga, and *Alestes nurse* in Lake Albert.

Uganda has some beautiful fishes in its water bodies e.g. among the Kyoga Minor lakes which can be exploited as ornamental fish for the domestic and export market.

Fish production potential minor lakes are currently underexploited and can be dramatically increased through systematic stocking and promotion of aquaculture production systems.

Aquaculture production in both natural and manmade water bodies is still untapped in most agro-ecological zones and lake basins.

Environmental degradation and resource depletion which limit sustainable fish production can be reversed within the medium term period if appropriate environmental management programs are effectively implemented and fisheries management improved.

The private sector stakeholders have the basic artisanal skills and motivation to modernise the sector provided the Government provides the necessary incentives such as credit schemes. The existing research and extension staff provides a good foundation for a better-organised, motivated and equipped institutional framework for sustainable development. This potential can be substantially enhanced by promoting appropriate mechanisms for community participation.

2 SUB-SECTOR DESCRIPTION STRUCTURE AND PERFORMANCE

2.1 The fisheries resource base:

Fish production in the pre-colonial period was mainly by a few fisherfolk communities living by the lakesides who bartered fish for other food commodities. In the colonial period, fish production was boosted by the introduction of new fishing gears and methods (e.g. a nylon net) and new fish species in most major and minor lakes especially in the 1950s. Fish production increased by six times in 30 years rising from 60,000 tons in 1961 to 245,000 tons in 1990 partly as a result of higher productivity of the lakes but also because of the increased catch effort. In 1983 when production was estimated at 78,000 tons p.a., potential production or Maximum sustainable yield (MSY) was estimated at 150,000 tons, yet by 1990 production had exceeded this level by 55,000 tons.

The fishery is based on the Nile perch; Nile tilapia and *Rastrineobola agentea* (mukene).which are caught by gillnetting and light fishing gear. Other species in order of importance include lungfish, and the catfishes *Bagrus* and *Clarias*.

The recent increases in catches from lakes Kyoga and Victoria are due to introduction of non indigenous fish species especially Nile perch and Nile tilapia plus increased exploitation of *Rastrineobola agentea* (mukene.). The drop in total catch in 1994-95 (Figure 3) is attributed to increased infesters of the lakes Victoria and Kyoga by the water hyacinth, which has reduced fish effort.

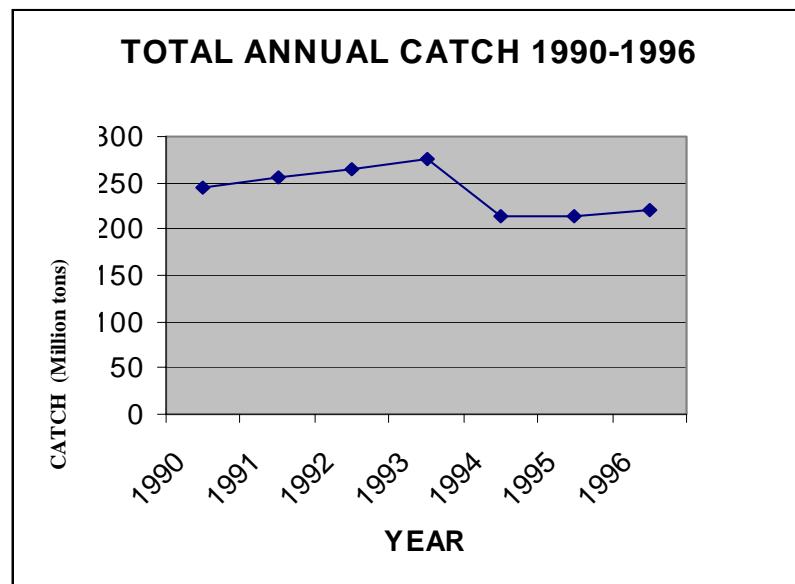


Figure 3: Total annual catch 1990-1996

The distribution of fish catch is dominated by lakes Victoria and Kyoga estimated at 48.1% and 36.3% in 1996 respectively as compared to Albert at 9.8%, Albert Nile 2% and others at 3.8%.

Approximately 60% of the catch comes from lakes that are shared. This poses a major problem when it comes to resource management on shared lakes. Table 1 shows Fish Catch by Water Body 1990 – 1996. Table 2 Commercial Fish catches by Water body, Species, weight and Share 1996 and table 3, Geographical, physical limnological and characteristics of major lakes in Uganda.

Table 1: Fish Catch by Water Body 1990 - 1996 (Million Tons)

YEAR	1990	1991	1992	1993	1994	1995	1996
WATER BODIES							
L.Victoria	119.9	124.7	129.7	134.9	103.0	103.0	106.4
L. Albert	19.5	20.2	21.0	21.8	16.4	16.4	21.9
A. Nile	1.4	1.5	1.5	1.6	4.8	4.7	4.6
L Kyoga	94.9	98.7	102.6	106.7	80.2	80.2	80.6
L Edward &George	5.5	5.7	5.9	6.4	5.2	5.2	4.8
Kazinga channel							
Lawamala							
Others	4.0	4.1	4.2	4.6	3.7	3.7	3.7
TOTAL	245.2	254.9	264.9	276.0	213.3	213.2	220.0

Table 2: Commercial Fish catches by Water body, Species, weight and Share 1996

Species	Lake Victoria		Lake Albert		Lake Kyoga		Albert Nile		Other Waters	
	Catch (tons)	% of total Catch	Catch (tons)	% of total catch	Catch (tons)	% of total catch	catch (tons)	% of total catch	catch (tons)	% of total catch
1.Lates niloticus	65,750.9	61.80	2,843.6	12.94	23,528.4	29.20	599.8	12.9	--	--
2.Oreocromis niloticus	24,760.3	23.30	2,351.3	10.70	51,021.8	63.33	1074	23.2	2400	65
3.Restrine-obola Argentae	13,785.5	12.90	--	--	--	--	--	--	--	--
4. Mormyrids	647.2	0.61	1,793.5	8.16	-	-	-	-	-	-
5. Protopterus	493.9	0.47	-	-	4,390.6	5.45	629.3	13.6	1185	32.3
6. Clarias	234.2	0.23	-	-	823.1	1.02	445	9.6	71.6	2.0
7. Bagrus	11.4	0.02	2,088.4	9.50	279.6	0.35	458.6	9.9	-	-
8. Hydrocymus	-	-	9,792.9	44.57	-	-	-	-	-	-
9.Alestes spp.	-	-	2,302.7	10.48	-	-	-	-	-	-
10.Oreochromis ariabilis	-	-	-	-	520.2	0.65	-	-	-	-
11.Labeo spp.	-	-	-	-	-	-	-249.4	5.4	-	-
12.Others	-	-	-	-	-	-	629.2	13.6	15.6	0.40
TOTAL	106,000		22,000		80600		4.6		3.7	

Source: Fisheries Department Records 1996

Table 3: Limnological, Geographical, Physical and Chemical Characteristics of Major lakes in Uganda.

LAKES	VICTORIA	KYOGA	ALBERT	EDWARD	GEORGE
A: Geographical Factors:					
1. Location(in degrees) Where: S=South N=North E=East	0 20 N-3 0 S,31-34,53 E	1-2,32,20- 34,20E	17-27N,30 25,31 25E	0 04-039S,29 20 30 18E	0 05N-0 05S,30 18E
2. Altitude(metres) (a.s.l.)	1136	1033	618	914	914
3.Surface Area					
(a) Total(km2)	105700	4735	5270	2300	250
(b) Uganda(km2)	31000	4735	2850	670	-
4. Depth					
(a) Maximum(m)	84	10	58	117	7
(b) Minimum(m)	40	2.3	25	34	2.4
5. Volume:					
(a) Total(km3)	-	-	140	90	0.5
(b)Uganda(km3)	-	-	80	78.2	-
6. Length:					
(a) Maximum(km)	400	90	160	90	23
(b) Minimum(km)	240	15	35	40	18
B: Physical and Chemical Factors:					
7. Major in-flowing rivers	4	1	2	4	-
8. Major out-flowing rivers	1	1	1	1	1
9. Surface Temp(0c)	23-28	28	26-29	26	25-35
10.Ph	8-9	7-9	8-9.5	8-9.3	8.5—9.5
11.Conductivity (K20 us/cm)	91-98	90-200	67-73	900-925	165-210
12. Total Ionic Composition(mg/l)	450	272	200	127	-
13.Dissolved Solids(mg/l)	98	-	565	521	264

Source: FAO CIFA

2.1.1 Production capacity and level after 1980

Since then the CPUE has 25.8 kg of fish per canoe per day. (UFFRO Annual Reports, 1970-80). Fishing technology continued to improve in terms of use of improved gear and fishing crafts and their motorization, targeting offshore commercial fish stocks.

The fishing effort increased tremendously. CPUE on Lake Victoria rose after 1980 to 44 kg of fish per canoe per day. The same trend characterised other major lakes. In the subsequent years, the CPUE substantially reduced to about 30 kg of fish per Canoe per day, owing to *excessive fishing effort* in nearly all the major water bodies of Uganda. There is still a continued decline in the CPUE countrywide. (MAAIF and MFPED, Frame Survey, 1988/89).

2.1.2 Fish species

There has been considerable change in fish species and biodiversity. The number of fish species especially in lakes Victoria and Kyoga decreased rapidly following the introduction of Nile perch. Over 60% of the species mostly Haplochromines, have been depleted due to predation by Nile perch. It must be noted however, that the Victoria Ningu, *Labeo victorianus* and tilapias (*Oreochromis esculentus* and *Oreohromis variabilis*) were on the decline even before the introduction of the predator in Lake Victoria and that catches of *Distichodus* and *Citharinus* in Lake Albert started declining in the late fifties mainly due to over-fishing. Stocks of the reverie species e.g. *Labeo victorianus* (Ningu) have diminished due to use of destructive fishing gears and methods. Similarly, catches of *Alestes baremoose*, once a dominant species in Lake Albert fishery, have declined because of use of destructive gears.

2.2 Fishing technology

2.2.1 Historical Development

Many centuries ago, fishing activities were characterised by use of primitive traditional gears such as spears, arrows, fish-pots, and crude fish capture methods, such as capture of fish by hand in shallow waters of lakes, rivers and swamps or fish poisoning with local herbs. However, these types of gears and methods still exist in minor lakes the River Nile Basin and shallower areas of Lake Victoria. This technology was/is at a low level, unproductive and inappropriate for rational exploitation of fish resources. The fishing activity was relatively at a subsistence level (Graham, 1929).

In the early 20th century, foreign traders (e.g. Belgians, Italians, British, Indians) introduced gillnets made of cotton, hemp and flax fibre materials. This trend facilitated technical improvements in the gear and changed primitive technology into artisanal technology. Thus a primitive subsistence fishery was ultimately transformed into an artisan fishery (Hickling, 1961).

In mid-1950s, foreign traders introduced Japanese nylon gillnets which proved more effective in the fishery than the cotton, hemp and flax gillnets. Nylon gillnets gave higher catchability characteristics than any other gears mainly because of higher tensile strength, mesh-size constancy, resistance to abrasion and durability of the nylon fibre material

Today, gillnets became more popular, easily adaptable and accessible than any other commercial gear in the Uganda fishing industry.

2.2.2 Structure of the Artisanal Fisheries

Fishing enterprises vary widely in terms of type and number of gear used, type and number of boats deployed, employment structure and number of fishermen per canoe depend on species targeted and location and range of fishing ground.

Artisan fisheries may be characterised as a *fishing enterprise* that normally comprises one or two fishermen operation, a canoe.

2.2.3 Settlement pattern of fishermen

Fishermen are dispersed all over the fishery areas and reside in the fishing villages located near the landing sites, or on the islands or by the lakeshores.

Therefore, the fishing activities are also dispersed and fishermen enjoy open access fishery all over the lake. Most of the fishery zones are ungazetted. Fish-landing sites on Lake George and Edward and some on Lake Victoria are, however, gazetted.

The number of fishermen frequently varies due to ecological, socio-economic and political factors. Migration of fishermen from one area to another frequently occurs.

In 1996, the total number of fishermen operating on part-time and full-time basis was estimated to be 136,000. The increased fishing pressure using various gears, and the increased fish yields in the fishery waters are indications of the rising number of fishermen in recent years.

2.2.4 Number of canoes and degree of motorization

The artisanal fishermen in some water bodies use “Ssese” wooden-planked canoes, dugout canoes and *parachute* canoes of various types. In 1989/90 the dug-out canoes on Lake Victoria comprised 10% and planked canoes 90% of the total number of fishing boats.

In 1996 the total number of canoes in the fishing industry was estimated to be 34,000, of which about 15% were motorised and 85% non-motorised. This reflects an increase in the degree of motorization, which was estimated at 8% in 1989.

The increased number of canoes and higher degree of motorization (using out-board engines of capacities in the range 3.0-55h.p.) is attributed to greater investment in the fisheries.

2.2.5 Semi industrial Fisheries

Semi-industrial fishing enterprise, employ trawlers. Since 1989, this fishery has been carried out on Lake Victoria by the Sino-Uganda Fisheries Joint Venture Company Limited using two identical pair of trawlers; each vessel powered by 80 h.p. twin inboard motor engine. Commercial trawling was to be done in offshore waters of more than 20m deep, targeting *Lates niloticus*. Other fish species, e.g. *Oreochromis niloticus*, *Bagrus*, are occasional by-catch.

This fishery method is now banned on Lake Victoria by the three riparian states Kenya, Uganda and Tanzania due to its socio-economic implications and adverse impacts on the fish stocks. Despite this ban, trawling is authorised for research and training programmes.

2.2.6 Fishing gear and methods:

The permitted gears commonly used include gill nets, lift-nets, scoop-nets used in light fishing; hook and line gear (hand-lines, fishing rods or tackles) and fish traps.

Gillnet Fishery

Gill nets are currently a major and popular fishing gear widely used for fish capture in the major and minor water bodies. Rigging is normally done using plastic floats or buoyant wood-stems and improvised sinkers (stones or sand wrapped in polyethylene contradicts).

Mounting is generally done by the complete stapling method, using hanging ratios varying from 0.5 to 0.6 that give scope for both gilling and entangling of fish. Mounting technologies vary from place to place with either doubling the net fleet depth in order to minimise escape of demersal fish species, or halving the gill-net depth in shallow waters for effective capture of pelagic fish species.

Gillnets are normally set at dusk and hauled in at dawn. Sometimes fishermen stay overnight in order to guard their nets and fish against rampant theft, or save fuel and time, or manipulate *tycoons* (special clubs used to pound water in order to actively drive fish into the set gill-nets) to increase the catch per unit effort.

Drift gillnetting is commonly practised on Lake Albert, but rarely on other water bodies. The target fish species for the gill net fishery are *Nile Perch*, *Tilapia* species, *Bagrus*, *Clarias*, *Protopterus*, *Alestes*, *Hydrocynus* and many other demersal species.

Longline Fishery

The fishery gradually developed in 1980s for the effective exploitation of predatory fish e.g. *Lates niloticus*, *Protopterus*, *Clarias*, *Bagrus*, etc. Presently, it is widely used on all major water bodies.

A typical gear comprises a long length of a mainline (100-300 m), rigged with monofilament twine (diameter 1.00-2.00 mm) or multi-filament twine (ply 36-60) and bears short snoods (0.3-0.8 m) carrying baited fishhooks

A longline is prepared for setting in the morning or afternoon by a crew or hired men (1-2). Hooks are baited with natural baits (e.g. small live fish, slices of meat, earthworms and insects).

The gear is set late in the afternoon in a predetermined fishing ground and left to fish passively overnight. Hauling is normally done early next morning the quality of fish harvested by this method is usually good.

Fishery by Angling Gear

Handline (the simplest and cheapest gear) is manually operated by one person along the lake beaches or on the riverbanks. Effective angling is done in calm waters early in the morning or evening or on dark nights.

A set of handlines can also be operated as a trolling gear. This is a prospective commercial fishery on Lake Victoria, Kyoga and Albert, targeting predacious species like Nile Perch and *Hydrocynus*.

Fishing rod or tackle is mechanically operated by one man using a reel fixed on a springy plastic rod. Its mainline is baited with a fish lure.

Angling for *Lates niloticus* on Lake Victoria or for *Trout* on River Sipi in Kapchorwa District is a lucrative activity particularly for the foreign tourists who adopt this fishing method.

This method may use live bait and the catching of bait (immature fish) using small mesh-sized gillnets; seine-nets and fish-trap can be detrimental to the fishery.

Fishery by Fish-traps, Baskets and Weirs

Various designs of fish traps, baskets and weirs are used in fishery. Conical traps are used most commonly for catching fish species e.g. *Clarias*, *Barbus*, *Schilbe* in marshy shallow waters of lakes, rivers and in permanent and seasonal swamps. These are particularly used on River Nile, Lake Kyoga, swamps and other minor lakes.

The gear is strategically set as a barrier and fish voluntarily or involuntarily enter it, but their escape is hindered by a special non-return valve or device. Traps set in the river estuaries and papyrus fringes indiscriminately trap fish (*Barbus*, *Alestes*, *Clarias*, *Hydrocyrus*, *Protopterus*, *Labeo*) of all sizes and ages.

Fishing Gear for Rastrineobola argentea Fishery.

The *lift-net*, is a conical net constructed from knotless nylon net webbing bearing hexagonal meshes. Mesh-sizes of its bag range from 5-10 mm.

The lift net is used with light on dark, calm nights. A pair of canoes joined together by planks forming “a catamaran” is used in this fishery. The net is held by an outrigger. A kerosene pressure lamp, attached to the middle of one of the planks, is lit. Another lamp mounted on a small raft connected to the canoe by a rope of about 15 m long, is also lit and slowly pulled towards the canoe, thus, drawing attracted school of fish above a set lift-net, which is quickly scooped up and lights simultaneously extinguished. The fishing process is repeated in the same or another site. This method was introduced from Tanzanian Lake Victoria waters in mid-1980s.

The method targets *Rastrineobola argentea* (Mukene). Other fish such as *Oreochromis niloticus* and *Lates niloticus* are a by-catch in this fishery.

A *coop-net* (typically of diameter 1.5 m and bag length 3.7 m) is widely and most successfully used for catching *Rastrineobola argentea* and other species in most fishery areas, especially on Lake Victoria.

Two modes of setting this gear exist, lamps placed on the canoe and lamps placed on small rafts.

In the first mode the lamps are attached to the front (bow) of the canoe, and the net is lowered into the water; a big school of fish concentrates in the illuminated zone, and is scooped out.

In the second mode, the lamps are set in a straight line (about 200 m long) by connecting the rafts with ropes (at intervals of about 15 m) and positioning them

perpendicular to the shoreline. A fish school is attracted by light and eventually concentrated around the light. The lights are hauled in slowly until they are grouped together close to the shore. One lamp is attached to the canoe so that the lamps on the rafts can be placed in the canoe before scooping without losing the catch.

A *lampara net* is a mosquito seine-net (measuring about 30 m long, 10 m wide). The nylon net webbing bears hexagonal knotless meshes. Presently, fishermen use lampara nets of mesh-sizes ranging from 5 mm to 10 mm. A 5 mm mesh-size net crops immature Mukene (of length range: 19-25 mm SL), and a 10mm mesh size crops mature Mukene (of length range 26-60 mm SL) (Ogutu-Ohwayo *et al* 1994).

Fishery by Perforated Plastic Basins

Perforated basins are extensively used mainly for *Alestes nurse* fishery on Lake Albert. This is an emerging fishery on this lake.

These basins are operated at daytime in shallow, calm waters. Bait in form of dregs of native beer or cassava flour is splattered in water above immersed basins; fish is attracted to feed on bait and is scooped out.

2.3 FISH PROCESSING

2.3.1 Introduction:

About 60% of the fish landed is marketed fresh while 40% are processed using the traditional methods of smoking, light or heavy salting and sun drying.

Industrial processing of fish mainly targets Nile perch for the export market, and has become significant since 1988 when the first fish freezing and filleting plants were established.

2.3.2 Fish Handling

On Board

Most of the fish is caught by gillnetting whereby nets are set in the evening (18:00 - 20:00) and hauled out of the water in the early hours of the morning (5:00 - 7:00). Spoilage of the fish begins as soon as the fish die in the nets. Therefore, in a typical catch there may be fish of varying quality depending on the time the fish was caught. Furthermore to reach rich offshore fishing grounds takes about two to three hours thus increasing duration of quality deterioration.

It is not customary for fishermen to use ice with fish boxes due to the fact that ice may not be readily available and also because in most instances the fishing canoes are too small to accommodate fish boxes. Consequently, the fish is carried in the bottom of the catching vessels, where it may be covered by plastic sheets or vegetation, to the landing sites.

At landing sites

On the islands of Lake Victoria fish is bought by traders who transport it by open larger planked canoes powered by outboard engines of 25 horse power or more to major landing sites on the main land. Sometimes carrier vessels transport fish, passengers and other cargo.

There are no ice plants on the islands and therefore ice can only be used if it is brought from the mainland since there are no ice plants on the islands. Buyers may at times remain on the islands for 2 to 3 days purchasing fish from fishermen before returning to the mainland. If ice is not used then fish will be purchased in the early morning and transported by carrier vessel to the mainland the same day.

When ice is used it is not always used effectively due to insufficient quantities being applied. In some instances large pieces of crushed block of ice are used in transport boats; however, such ice does not effectively chill the fish due to poor fish/ice contact.

Handling at Landing Sites

There is 1250 landing sites in Uganda ranging in size from those having only five canoes to those where about 400 canoes are based (MAAIF 1996. Fisheries Department Annual Report 1995, Entebbe). Most fish is landed on open beaches where there is no ice, potable water, shade nor electricity and where toilet facilities are often inadequate. However, some industrial processing plants have constructed jetties at the factory site and slabs, shade and tables for handling fish at some landing

sites. A few landing sites are also provided with improvised and temporary tables and shade for handling fish for local distribution.

Minimal use of receptacles for fish from the point of capture results in excessive handling and also exposes the fish to heat and contamination, thus increasing their rate of spoilage.

Generally fish is mishandled at every stage along the line. At the landing site fish are often thrown or dragged through the water from the canoes to the beach. Throwing the fish causes bruising of the flesh thus exposing it to micro organisms which accelerates spoilage.

At landing sites fish is distributed fresh to markets and to industrial plants. It may also be processed traditionally at the site by smoking, salting, drying or frying. Some of the fish traditionally processed is of a quality that can not be sold fresh. Industrial processors use insulated Lorries and ice to collect fish at landing sites.

Handling during Transportation

From the landing sites fresh fish destined for the local market is transported by bicycles, open pick-ups, public means and small quantities are carried by people on foot. Handling of fish during transportation to the markets is often poor. People commonly sit on top of fresh fish being transported on open pick-ups. Fish is not transported in boxes but rather in polypropylene bags. On the other hand fish destined for the fish processing factories is, in most instances, transported on ice in insulated vehicles albeit without boxes.

Smoked fish is normally transported either in carton boxes or large woven papyrus baskets. Bundles of cured fish that may weigh up to 100 kg are usually transported by pick-ups, Lorries or buses to the urban wholesale markets. Sun-dried *R. Argenteus*, on the other hand, are packed and transported in polypropylene bags weighing on average 45 kg.

Handling in Market

In most urban markets there are designated places for selling fish. Probably because of the unpleasant smells fish places designated for the selling of fresh fish are usually remote from the centre of the market. In most markets the fish is sold from wooden tables. Nevertheless, there are some markets where fresh fish is retailed from concrete slabs, which are regularly washed.

Use of ice

All the fish processing plants have ice-making facilities. The type most commonly produced is flake. However, some plants opted to acquire block ice-making plants to supplement the flake ice. Block ice requires crushing prior to its use since big lumps can damage the fish. Ideally flake ice would be the most suitable type to use because it is more effective in cooling the fish and its quality is easier to control. However, some processing plants opt to install (supplementary) block ice machines because they are simpler and easier to manage as opposed to flake ice machines which are more delicate and complex from a technical point of view.

2.3.3 Processing

Traditional Processing

Traditional processing (viz, smoking, salting, and sun drying) is a way of preserving fish which cannot be sold fresh. If such fish is processed then it will more than likely fetch a lower price than if it had been sold fresh. For example if fish is smoked the price will be approximately 30% lower than if it were to be sold fresh. Smoking reduces the weight of fish by a factor of 30% yet smoked fish is sold at approximately the same price (per unit weight) as the fresh, if not lower. According to *Reynolds and Mukasa (1991)* it is attributed to the fact that consumers generally prefer fresh fish to cure.

Smoking

In 1995 it was estimated that 86,000 metric tonnes of fish valued at UShs.34.4billion was hot smoked in the country using traditional type kilns (“cover”). A variety of species are smoked at landings on Lakes Albert, Edward and George. Fish smoking is also carried out on the islands and shores of Lake Victoria and at landings on the shores of Lake Kyoga. At some sites around Lake Victoria the discards (heads, frames) from fish processing plants are smoked. At other sites smoking is used as a fallback method to preserve fish rejected by industrial processors or fresh fish that remains unsold irrespective of quality.

The importance of smoking as a means of preservation varies from fishery to fishery, with the amount of fish smoked being dependent on the accessibility of fresh fish markets, the incentives for salted fish production and the quantity and quality of fish landed. Fish may be soft smoked, giving a weight loss of 45% in which case the yield is good but the shelf life is short (4 to 7 days). Prolonged or hard smoking increases the shelf life (up to 3 months), but reduces the yield as the weight loss is 65 to 70%.

Improved Smoking Technology

A lot of work has been done in the past in Uganda to develop and introduce improved, more fuel efficient smoking technology; *Roger (1970) Ward (1990)*. The technologies tried in Uganda have been based on the Altona type kiln and the chockor oven, developed in Ghana in the early 1970s. The benefits of improved smoking technology are seen as better fuel efficiency and better quality products. Ward (1990) reported that when using a chockor design kiln 240 kg of fresh fish can be dried to a 50% weight loss in approximately 8 hours, using 60 kg of dry fuelwood. This would be a reduction in fuel consumption by 55% compared to traditional smoking methods.

Chockor type kilns have been built as demonstration units at some landings on Lakes Edward, George and Victoria. However, uptake of the technology appears for economic, social and technical reasons linked with lack of awareness of the improved technologies. For example the relatively high cost of an improved chockor design of kiln for smoking 240 kg of fresh fish cost approximately US\$150 to construct (Ward, 1990). This compares with the cost a traditional kiln estimated to be between US\$10 and US\$50. In addition one of the problems of chockor type kilns is the fact the at least two people are required in operating it, whereas in the case of a traditional kiln one person is sufficient to operate it.

Salting

Salting of fish is mainly carried out on Lakes Kyoga, Albert, Edward and George, the practice being more predominant on Lake Albert. The fish is usually split open and dry salt applied, sometimes on mats. Consumption of salted fish is chiefly in the north western and Northern parts of the country and a considerable proportion is exported to the Democratic Republic of Congo and Sudan.

Sun drying and salting

Sun drying is mostly used to preserve the small species *Rastrineobola argentea* (mukene), *Haplochromis* spp and *Alestes nurse*, which are usually spread out to dry on the ground. Larger species such as Tilapia are split before drying. Nile perch and *Distichodus* spp (“yellow fish”) are regularly cut and dried in “sheets” at some landing sites on Lake Albert. Infestation.

Industrial Processing and Quality Assurance

Since 1988 industrial processing of fish has become a significant economic activity in Uganda. A total of 20 fish processing plants have never been granted construction permits by the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF). However, so far eleven have been licensed to operate with an approved capacity of about 150 MT per day. All the operating factories are located near the shores of Lake Victoria.

The total daily installed capacity is estimated by industry to be about 250-600 MT raw material. Virtually all the fish processed by the fish factories is obtained from Lake Victoria

The government has allocated an annual total quota of 60,000 MT to be processed for export. In 1996 it was estimated that 14,000 MT of fish and fishery products were exported the main export products of the fish factories are chilled and frozen fillets of Nile perch. Other products exported include frozen, headed and gutted fish and dried fish, swim bladders.

2.3.4 Storage Facilities

Traditionally Processed Fish

At most fish landing sites there are no specific storage facilities for cured fish. However, at some sites along Lake Albert and Lake Kyoga some rooms have been put aside and designated cured fish stores. In most cases cured fish is stored in houses and sheds along with other items.

Industrially Processed Fish

There are no permanent fresh fish storage facilities at any of the fish landing sites. However, fresh fish is at times held on ice in the Lorries of fish factories for up to four days before being transported for processing. The facilities at Entebbe Airport, Uganda’s only international airport are adequate for receiving, storing and unloading

fresh fish. In 1996 fish accounted for 66% of the cargo exported by air from Uganda. The average monthly amount of fish shipped in the last quarter of 1996 was 1040 MT.

2.3.5 *Transportation to Markets*

Being a land locked country; Uganda is to large extent dependent on the passage of goods through neighbouring countries for export to countries outside Africa. Only by air can fisheries products be exported directly to such markets, but the availability of space is sometimes uncertain and the cost of freight is high. Fisheries products destined for non-African markets must be transported by road to the Indian Ocean ports of Mombassa (Kenya) and Dar-es-Salaam (Tanzania).

Industrial processors, however, indicate that exporting fresh fish by air is more profitable than exporting frozen fish by sea. The only market for fresh fish, which is served by direct flights, is the European Union.

2.3.6 *Post-harvest Losses*

Post-harvest fish losses are a feature of most fisheries and distribution chains. Ugandan fisheries are no exception. Post harvest losses are about 20-25 % of the total catch. This is quality loss and not physical loss.

Approximately half of the *Rastrineobola spp* (mukene) dried in Uganda is sold for animal feed. The product sold for animal feed is of an inferior quality to that for human consumption and is sold for approximately half the price of the better quality food grade product. The food grade product sells at mainland landings near Kampala for approximately US\$750 per MT dried weight. Animal feed grade can sell for approximately US\$375 per MT. The annual mukene landing is approximately 14,000 MT. Assuming a 50% weight loss as a result of sun drying approximately 7000 MT of dried mukene is produced each year with a maximum value at landing of US\$250,000. In reality half is sold for a lower price and the loss in revenue to the sector at this stage is estimated to be US\$1.3million annually.

2.4 Marketing

2.4.1 *Channels of Fish Distribution*

Right from its early days, fish marketing has been the least regulated primary products in the country, except for the quality aspects.

An estimated 300,000 people are involved with the different aspects of fish marketing. Different channels of distribution are in use, through which fish is delivered from the producers to the consumers.

Although there are a few cases where consumers obtain their supplies direct from the producers at the landings, by and large they are served by retailers who are often themselves supplied through wholesalers. Artisanal processors buy the catch from producers and sell their products to wholesalers, retailers, households, and institutions or on the regional export markets.

Agents buy the raw fish from producers at the landings and sell to the industrial processors, who sell their products consisting mainly of frozen and chilled fillets of Nile perch mainly on the international export markets but also to some institutions and households on the domestic market.

Others buy from the producers, particularly in the case of "mukene", and use it in preparation of animal and poultry feeds.

2.4.2 Fish Traders

Domestic fish marketing is characterised by a large number of small operators dealing in quantities of fish supply, reflecting a form of competitive market that varies from one situation to another.

Fish traders fall into five categories, namely the exporters, pick-up traders, canoe traders, bicycle vendors and stall operators. Fish marketing activities are dominated by men (78.2%) while participation women are 21.8%, mainly as stall operators.

Fish Traders' Organisations

Marketing is carried out in units consisting mostly of one person. Organisation among fish middlemen is weak, limited to informal groupings for the purpose of representation of the traders to the authorities. Local associations are found mainly among stall operators at some of the permanent urban markets.

The industrial processors, however, are formed into a strong body, the Uganda Fish Processors and Exporters Association. The association enables the members to speak with a common voice particularly on matters concerned with the Government. Generally, although this category of middlemen is fewest in number, they are able to exert significant influence because of their market power and the strength of their organisation.

2.4.3 Financing of Fish Marketing

Resources required in fish marketing operations include transportation equipment, storage facilities, operating capital and labour. However, capital sources among the small-scale domestic market operators are limited, consisting mainly of personal savings.

Loans from credit institutions are not common, reflecting the limited support of these institutions to fish marketing. This is due to the informal nature of most of the activities and lack of collateral. Fish traders have also not benefited from the Government development credit, aimed at promoting small-scale enterprise and strengthening household incomes. Many traders operate through taking credit deliveries of fish supply from producers, effecting payment after sale.

In contrast, however, industrial processors are able to obtain loans from commercial and development banks, as their operations are considered "credit worthy" because they are formal and they have collateral to offer.

2.4.4 Labour Input

The demand for labour is rather limited. Most traders prefer to personally carry out their own operations, including bulking supplies at the beaches, transporting to marketing centres and disposing of the supplies to buyers, primarily to minimise risks and the need for supervision.

Pick-ups, Lorries, bicycles and taxis are the major carriers of fish within the domestic markets. The inter-regional trade in smoked and sun-dried products is also carried out using Lorries and the pick-ups. Refrigerated containers are used in the export of frozen fillets, sent by sea and often air freighted.

2.4.5 Fish prices

Fish prices are generally determined by demand and supply conditions and vary from one water body to another, often fluctuating widely between seasons. However, on Lake Victoria, because of the more stable market facilitated by the steady income from urban populations, good infrastructure and the strong demand by the industrial processing plants, fish prices are stable at around Uganda Shs 1,000 per kg. For Nile Perch, 1,500 per kg. For Tilapia. (Table 4).

Table 4: Average Prices of the Main Commercial Fish Species - 1997.

Species	Nile Perch		Tilapia		Mukene	
	Fresh	Smoked	Fresh	Smoked	Fresh	Sundried
Water Body						
L.Victoria	1,000	1,500	1,500	1,500	-	2,000
L.Kyoga	600	1,000	1,000	1,000	-	1,000
L.Albert	500	-	-	800	-	-
L.George/ Edward	-	-	800		-	

Source: Development Consultants International Limited. 1998. Uganda Fisheries Master Plan Study Project. Survey Data.

Table 5: Average prices per Kg for Nile Perch fillets and by Products, 1996

PRODUCT	LOCAL (SHS)	FOB (US\$)	CIF (US\$)
Frozen Fillet		3.4	3.8
Chilled Fillets	3,000	3.6	5.0
Fish Maws	4,700		
Skin	35		
Trimmings	300		
Fish Frames	120		

Source: Development Consultants International Limited. 1997. Uganda Fisheries Master Plan Study Project. Survey Data.

2.4.6 Fish exports

Fish exports for 1996 were estimated at 15,680 metric tonnes, valued at US \$ 49 million and equivalent to 35,000 MT of fresh weight. This export performance is expected to grow steadily to the ceiling set at 60,000 metric tons per year within the medium term.

Table 6: Uganda's Export of Fish and Fish Products 1990-96

Year	1990	1991	1992	1993	1994	1995	1996
Quantity (Tonnes)	1,664	4,687	4,851	6,138	6,564	16,046	15,680
Value (000 US \$)	1,386	5,313	6,498	8,943	10,403	32,262	49,000

Source: Fisheries Department in Uganda

Much of the export is *cross-border trade*, most of which goes unrecorded. Through this trade, the export market for fresh and smoked fish in Kenya, fresh and smoked Tilapia in Rwanda and that of salted fish in the Republic of Congo is exploited.

There has also been a growing export of frozen fish fillets to the *European, Australia; S.E Asia and Middle East* markets. The trade is promising but sensitive to quality changes. Prospects for future expansion are bright provided the quality requirements are met.

2.5 Social and Gender Issues

Fishing villages in Uganda are at varying levels of permanency and development. While a few, shift from site to site completely, some of them are partly abandoned by some fishermen following seasonal fish migration to new grounds or because depletion of fish stocks.

2.5.1 Communities: Social Issues

Administration. The fishing communities are mainly organised informally. The informal administrative structures are of two types:

- a) About 52% of fishing communities have a head fisherman known as *Gabunga*, chosen by general consensus of the community, through a vote or by virtue of being a land owner or long stay in the area. He enforces discipline in the community, keeps records of fishermen and their fishing gear, and attends to welfare issues of the community (Development Consultants International Limited 1997. Uganda Fisheries Master Plan Study Project. Survey Data). Kitakule (1991) recorded 70% of the Lake Victoria fishing communities as having this kind of administration.
- b) A recent development is the *Fishermen's Management Committees*. These are formal administrations initiated by the Uganda Fisheries and Fish Conservation Association (UFFCA). A committee consists of 11 members 9 of whom are democratically elected by the fishing communities themselves and two are co-opted from among the local

council officials. The committees consist of a chairman, vice-chairman, secretary, treasurer, secretary for planning and development, publicity and information secretary, secretary for women, secretary for youth and secretary for law enforcement and the two co-opted members. About 13% of fishing communities have this kind of administration.

The *Local Council system*, which is a formal administration, is organised by government and exists in a 100% of the communities. In most cases such systems consisted of Village Council (LC I), and Parish Council (LC II). These work closely with other administrations, formal or informal, in solving community problems.

Co-operative Societies mostly exist on paper. About 15% communities have co-operative societies, over 95% of that is not active. Mainly due to lack of good and able leadership i.e. mismanagement and embezzlement of funds.

2.5.2 Cultural Beliefs/Taboos

The following cultural beliefs, among others, used to exist and are still doing in various communities:

The Baganda used to believe that eating Nile Perch would result in development of sores on the body.

Most Banyankole and Batooro do not eat fish as they believe it is “*ebikere byomunyanja*” or frogs of the lake.

The Bagungu do not eat lungfish because of the fins which “look like *breasts*”.

In many parts of the country there is a general belief that spirits do not like women. This can be illustrated with the following superstitions.

Women not permitted to go on fishing boats for if they do men will not catch fish. Women not permitted to step on some islands, such as Luwero Island in Mukono District, for if they do lightening strikes.

Attitudes are however changing especially with regard to eating fish. Cultures and taboos are no longer regarded as a major constraint to fisheries community development effort.

Table 7: Consumers Taboo Connected to Fish Eating by Region

REGION	TABOOS/CULTURE	TOTEM	OTHERS	ALL
Central	29.0	12.9	58.1	100
East	23.2	0	76.0	100
West	15.0	0.7	84.3	100
North	33.3	0	66.7	100
Islands	9.3	8.1	82.6	100
Kampala	25.0	0	75.0	100

Source: Fisheries Resources Research Institute in Uganda (FIRRI), 1994.

2.5.3 Land ownership

Over 90% of the fisher communities live on land which is not theirs - either on private land or government/public land. This leads to insecurity of tenure, which in turn makes it difficult for them to make long term development plans. According to Kitakule *et.al* (1991) 0.1% of Lake Victoria fisherfolk households own land.

Table 8: Land Ownership of Lake Victoria Fisher Households

OWNERSHIP	PERCENT
Own	1
Public Land	12.9
Mailo Land	10
Some one Else's Land	77
Total	100

Source: Development Consultants International Limited 1997. Uganda Fisheries Master Plan Study Project (FMPS). Survey Data.

Migration of young men and women to fishing villages is leading to ghetto-like slum urbanisation at landings which do not have social amenities like schools and health centres.

Table 9: Availability of infrastructure and social services within fishing communities in

FACILITY	FREQUENCY	AVALIBILITY (%)
Piped Water	25	10
Toilet	75	30
Clinics	47	19
Drug shops	112	44.7
Banks	30	12
Primary schools	172	69
Secondary schools	0	0

Source: Development Consultants International Limited. 1997. Uganda Fisheries Master Plan Study Project.(FMPS). Survey Data

Education: The average rate of literacy among the artisanal fish communities is 30%, with most of these having only attained primary school education, regardless of the age group, while less than 1% attended higher institutions. Most of the illiterate members of these communities (85%) are women. (Development Consultants International Limited. 1997. Uganda Fisheries Master Plan Study Project (FMPS)).

Diseases: HIV infection rates are high among fisherfolk. This is due to migrations and some cultural practices such as widow inheritance and wife sharing. In addition, poverty among women has led some women into commercial sex.

Due to poor dwellings, and the abundance of mosquitoes, malaria is also prevalent among fishing communities. Trypanosomiasis is also a problem in areas of Lake Victoria.

2.5.4 Gender and Youth Participation in Fisheries

Fish Production There are seven major categories of participants in fish production. They include the fishermen/women, forming the majority (48%) fish farmers (5%), proprietors (24%), gear manufacturers/repairers (1%), boat builders (7%) and extensionists/administrators (15%). (Development Consultants International Limited. 1997. Uganda Fisheries Master Plan Study Project).

In Uganda's fishing communities, people of different ages are involved in fish production activities. The majority (63.2%) are youth, who are between the ages of 18-35 years, followed by the age bracket 36-45 years (27.7%). These activities occupy the economically most productive age groups. According to the survey results (FMPS 1997), youth participation in capture fisheries production activities is 90%, while that in fish farming activities is 37%. Most involvement by youth in fish farming is in areas of pond construction and harvesting.

Table 10: Age of participants in fish production activities

OCUPATION	AGES YEARS					
	<18	18-25	26-35	36-45	46-55	75-6
Fishermen/women	2	37	71	9	1	-
Fish Farmers	-	1	3	15	2	1
Proprietors	-	-	14	15	2	1
Gear manufacturers Repairs	-	-	-	1	2	-
Boat builders	-					
Extensionists/ administrators	-	3	27	12	2	-
Total	2	44	144	66	17	7
Percentage	0.8	17.6	45.6	26.4	6.8	2.8
Sample size	250					

Source: Development Consultants International Limited. 1997. Uganda Fisheries Master Plan Study Project. (FMPS). Survey Data.

The participation of women in fish production is about 20.1%, 59% of which is in fish farming/aquaculture. The latter is mainly a family activity and the women are involved in the production of feeds and feeding the fish as part of their household activities. Most women's (10.9%) participation in capture fisheries is in form of ownership of nets and boats. They then employ men, especially young people, to fish for them. The women work then remains supervisory, as well as general management of the business.

Table 11: Boat ownership by gender in traditional fishing communities around some lakes in Uganda.

LAKE	OWNERSHIP (%)	
	Male	Female
Victoria	96.5	3.5
Albert	90	10
Edward	88.7	11.3
Kyoga	94.8	5.3
Mburo	78.9	21.2
Kijanebalola	94.9	5.1
Kachera	80	20
Average	89.1	10.9

Source: Development Consultants International Limited. 1997. Uganda Fisheries Master Plan Study Project (FMPS). Survey Data.

Fish Processing

There are two categories of fish processors. These are traditional/artisanal and industrial processors. Artisanal fish processors are part of fish landing communities scattered around the shores of lakes. Fish processing being a capital oriented business, the number of people involved tends to vary from water body to another, depending on fish species and funds for investment.

Generally processors of all ages were involved in fish processing, with the majority being in the age bracket of 18-35. The youth are employed in cleaning, scaling and splitting (95%), sun drying (95%), salting (50%) and smoking (36%).

In most fishing communities' women have a major role in fish processing activities). They are mostly responsible for smoking (62.2%), sun drying (85.1%) and deep-frying (76.7%). Men on the other hand are more involved in salting (88%) and sheeting (100%).

Table 12: Community participation in artisanal fish processing activities by gender around some lakes in Uganda.

Lake	Fish processing activity (%)									
	SK		SD		ST		DF		SH	
	M	W	M	W	M	W	M	W	M	W
Victoria	37.6	62.4	14.6	85.4	84	16	16.1	16.1	83.9	-
Kyoga	25.0	75.0	10	90	90	10	10	10	90	-
Albert	45.0	55.0	20	80	90	10	43.9	43.9	56.1	-
George	43.6	56.4	14.9	85.1	88	12	-	-	-	-
Average	37.8	62.2	14.9	85.1	88	12	23.3	76.7	100	0

The majority of the fishing communities have remained poor mainly due to lack of capability to efficiently participate in the sub-sector especially due lack of credit facilities and investment skills. The world affects and relies on fisheries as a subsistence activity.

2.6 Fisheries Infrastructure

2.6.1 Introduction

Fisheries sub-sector infrastructure includes fish landing sites fish handling facilities, access roads to landing sites, housing accommodation for the fisherfolk, water supply and sanitation facilities. It also includes fish storage facilities, motor engine and boat repair facilities as well as fish marketing facilities. The stakeholders in the development of the sites and their infrastructure are the fisherfolk communities living on the sites and/or in the hinterland as well as outsiders with stakes in fish harvests namely processors, traders, exporters, input suppliers and the local authorities who collect taxes and fees.

2.6.2 Fish Landing Sites

Fish landing sites are points on the lakeshore or riverbank where fishing boats operate. They are also used by other cargo and passenger boats. Landing sites on all significant fisheries are estimated at 1,250, of which only 715 have 15 or more fishing boats. The number of landing sites and fishing villages is constrained by presence of natural harbours, wetlands, and steep escarpments. The number and distribution of the fish landing sites on the country's water bodies is dependent on accessibility to the waters, type of fishing vessel used in the waters and the dominant occupation of the surrounding population.

Generally fish landing sites fall into four categories:

- i) The “gazetted” landing site is a site designated by the Fisheries Department or Local Authority for fish landing, handling and marketing operations.
- ii) The “restricted” landing site normally located in a National Park or a Game Reserve is also gazetted landing site. Expansion and movements to and from the site are restricted by law.
- iii) The “adopted” landing, is a site which, having started as a fish market is later recognised by the local authority as a landing site to be subsequently, gazetted.
- iv) The “casual or temporary” landing site is that which is started on a small scale and ad hoc basis by residents or migratory fishermen and may grow into a permanent landing. Fishing villages vary widely in population size and boat numbers.

The water hyacinth has rendered some existing landing sites completely unusable and deterioration of access roads has done the same in some areas.

Availability and Adequacy of Fish Landing Sites

Records available indicate that there are about 1250 fish landing sites scattered around the country's water bodies (MAAIF 1996. Fisheries Department). The number keeps changing from time to time and season to season. Landing sites with more than 15 operational fishing vessels number 715. Many of these landings were established

without plan. Only 41 are gazetted by Fisheries Department (Report of the Committee of the Marketing of Livestock, Meats, Fish and their Products in Uganda 1996). Some 230 sites have been adopted by Local Authorities (District Fisheries Department Records).

The number of landing sites in use is currently more than adequate. However, the landings are not evenly distributed on the country's water bodies. Figs 2-16 show the locations of the important landing sites in the various districts.

Sites in use are currently more than adequate.

2.6.3 Physical infrastructure at fish landing sites and markets

There are very few fish landings in the country that have physical facilities capable of adequately protecting the fish catch from contamination. Prerequisite structures like jetties, fish receiving, washing, sorting and weighing slabs, and other facilities like ice plants, public toilets, refuse disposal units, portable water supply and environmentally friendly housing are all lacking in most.

The physical infrastructure at some of the older fish landing sites were initially developed by the Fisheries Department but these are now in disrepair (Masese, Kiyindi, Majanji, Wanseko, Katwe, Kahendero, Kasenyi, Lwampanga, Kagwarra, Mugarama, Bugondo, Pingire, Namasale and Bukakata) .

The Fisheries Department cannot maintain the infrastructure due to severe budgetary constraints. The Local Government administrations, which took over these facilities, are also not able to look after them adequately.

The fish processing factories recently took the initiative to put up their own fish handling structures where they purchase their fish. Landings where such facilities are being put up are Kasensero, Namirembe, Ddimo, Lambu, Gerenge, Kasenyi, Kigungu, Katosi, Kiyindi, Bwondha and Bugoto.

Boat yards, boat making and boat repair facilities

There is prolific boat building on some of the landing sites particularly in Lake Victoria. (Four types of fishing vessels are made in the country. These include the "dug-out" canoe, the flat bottomed wide planked canoe referred to as the "Congo barque", the "Ssese" planked canoe and the "double ender" also referred to as "Jaluo".)

Training in boat design and construction has been going on at the Fisheries Training Institute (FTI) for almost thirty years, yet the boat making and repair industry is dominated by untrained artisans who operate from open-air boat yards without any facilities. Their products are not of very high quality.

Engine repairs and spare parts.

Most of the landing sites do not have facilities for repair work on engines and no spare parts. *Fuel and oils* are purchased from fuel stations usually more than 30 km away and those on the islands rely on supplies from the major landing on the mainland closest to them.

Smoking houses and drying racks

At fish landing sites, fish is dried on drying racks consisting of raised wooden platforms. Drying racks are very simple structures that are easy to construct.

Fish Storage at Landings

Fresh, smoked and dried fish storage facilities at landing sites are inadequate. Smoked or dried fish is often stacked away in crude stores in the fish monger's dwelling house. Save for landing sites where there are improvised stores for dried "mukene", there are no proper dried or smoked fish stores at any of the country's landing sites.

Fish handling and storage at local markets

There are no cooling facilities at the urban markets. Fresh fish must be disposed of within a few hours of delivery. At the markets, smoked or dried fish is displayed on raised racks, which allow free aeration of the fish. At the end of the day, unsold fish is stacked away in baskets. In smaller markets at trading centres, smoked or dried fish is often displayed on bare grass or polythene paper spread on the ground thus making it prone to contamination.

The fish processing factories have cooling facilities within their premises, which preserve fish and fish fillets for export.

2.6.4 Transport infrastructure

A good transport infrastructure is important for quick delivery of fresh fish to markets. In the colonial era, and up to early 19s, Uganda had a well-developed transport system. Two decades of political and civil upheavals combined with acute shortages of funds, contributed to severe deterioration of the infrastructure. (International Development Association (IDA) Third Highway Project). 1996-1997.

The transport infrastructure of the country comprises of a relatively dense road network, railway services, an international airport and domestic airfields and water transport. Road transport is by far the most important.

The road network

The national road network is divided into three categories: viz.: classified (highway), feeder and urban roads. Their lengths are:

Classified roads : 8,832 km

Rural Feeder roads : **22,300 km**

Urban roads : 1,000 km

Total **31,132 km**

There is however, a fourth category of minor roads referred to as community (bulungi bwasi) roads whose length is estimated to fall between 25,000 - 30,000 km. Ministry of Works, Transport and Communication (MOWT & C) 1996.

Classified road network

The classified road network is the responsibility of the MOWT&C while rural feeder roads and urban roads are mandated responsibilities of Local Governments. Community roads are constructed and maintained by local communities.

The classified road system falls in three classes: primary, secondary and tertiary. Primary (trunk) roads radiate from Kampala, the capital city, towards the extremities of the country and link up with neighbouring countries. The primary roads are inter-linked with secondary roads, which interconnect districts and centres of economic activity. Tertiary roads serve local population centres or agricultural areas and link them to the network.

The classified road network comprises of 2105-km bitumen surfaced and 6727-km gravel surfaced roads. The classified road network carries over 90% of the country's passenger and freight transport and it accounts for 80% of the total road traffic volume. Classified roads are therefore very important for conveying fish from the lakes to the urban markets. The road network is a key element in the fish distribution system and the development of landing sites and fisher-folk communities. Very few sites are accessed through gazetted roads (e.g. Majanji, Wanseko, Namasale, Bukungu, Kawongo) and the majority are feeder and community roads are often poorly maintained, due to inadequate machinery and finances.

Transportation of fish

The method of transporting fish, the type of container used and the travel time all contribute to the rate of deterioration and subsequent drop in quality of fish. It takes between 4 - 6 hours for freshly caught fish to reach the landing site. Handling, sorting, weighing and exchange with the fishmonger takes up another 2 hours. Unless the fish is under ice, it is susceptible to spoilage.

The rural market is by far the largest market segment for fish. Thereafter distribution of fresh fish is limited to larger urban areas where it is conveyed in 1-ton pick-ups without cooling facilities. In the smaller markets, fresh fish is transported to the market by bicycle in sacks, fish boxes or tied to the bicycle rack. The fish monger on a bicycle can transport his load up to 50 km. Smoked or dried fish is transported by bus, pick up or lorry often packed in sacks or by bicycle in an improvised basket made out of twigs or papyrus.

The price of fish is heavily influenced by the cost of transport. Factors which influence transport costs are distance from the capital, Kampala, condition of the particular road link, effective demand for transport in the area and availability of vehicle servicing facilities, motor spares, mechanics and fuel.

Due to the better condition of roads around L. Victoria and close proximity to the markets, transport costs to and from the L. Victoria landings are much lower compared with those on L. Kyoga, L. Albert, L. George and L. Edward.

Transport costs escalate sharply as the road condition gets rougher. The access roads to distant landing are mainly gravel. Inevitably higher transport costs mitigate against conveyance of small quantities of fish from such landings. Therefore differences and changes in transport costs affect market prices significantly, for example when roads are impassable, the price of fish at the market easily rises to four times the price at the landing.

Lack of appropriate and adequate transport for passengers and goods traffic is another bottleneck to efficient distribution of fish especially on L. Victoria. Lack of good access roads discourages better transport facilities thereby increasing rate of fish spoilage and transportation costs.

2.7 Institutional capacity

2.7.1 Manpower available for Fisheries Management

There are three major cadres of technical staff in the Fisheries Department:

- a) Fisheries Officers (FO) who are normally graduates;
- b) Assistant Fisheries Development Officers (AFDO) who are Diploma Holders; and
- c) Fisheries Assistants (FA) who are Certificate holders.

The last cadre, the FA, are being phased out through training and upgraded to AFDO level.

The graduate staffs are normally recruited from B.Sc. graduates in Zoology. These have to undertake an induction course in fisheries once recruited .They sometimes undergo specialised diploma or higher degree (M.Sc. or Ph.D.) training abroad. The AFDOs and FAs are trained at the Fisheries Training Institute (FTI) at Entebbe.

The number of fisheries staff at the Fisheries Department Headquarters is 28 officers (1 Commissioner, 2 Assistant Commissioners, 4 Principal Fisheries Officers, 6 Senior Fisheries Officers and 24 Fisheries Officers).

At District level each District is supposed to be headed by a District Fisheries Officer. There are 43 Districts in Uganda. Under his charge, the DFO has AFDO's trained in various fisheries disciplines.

Before the decentralisation process, most of the Districts did not have DFO's but had AFDO's and FA's. Following decentralisation, most Districts have reviewed their staffing position and in many cases have recruited District Fisheries Officers but have not retained FA's.

2.7.2 Fisheries research

Uganda has a fully-fledged Fisheries Research Institute (FIRI) located at Jinja. This institution was established in 1948 by the British colonial administration as a regional

organisation in charge of fisheries research throughout East Africa. It subsequently evolved into the regional East African Freshwater Fisheries Research Organisation (EAFFRO) under the East African Community (EAC) and after the break up of EAC it involved into Uganda Freshwater Fisheries Research Organisation (UFFRO) which became FIRI following the creation of NARO.

FIRI's present staffs comprises 14 research officers (4 with Ph.D. and 10 with M.Sc. of whom 4 are on Ph.D. training), 8 Research Assistants (with B.Sc. all of whom are on M.Sc.training), 18 laboratory and marine technicians, administrative finance and maintenance staff.

The staffing position of the institute varies according to program but is generally inadequate to cover the national water bodies. There is also no even distribution of staff among the various disciplines covered by the institute.

International institutions and scientists collaborating in fisheries research

FIRI collaborates with some international organisations and scientists especially from Europe and North America in generating information for management of fisheries and aquatic sciences. A number of NGOs and CBOs are involved in fisheries development activities. These include Care, Vision, Action Aid, and Church of Uganda. These are mainly involved in aquaculture. The largest of these organisations are Uganda National Farmers Association (UNFA) and the Uganda Fish and Fisheries Conservation Association (UFFCA).

UNFA complements the efforts of Ministry of Agriculture Animal Industry and Fisheries in technology transfer. MAAIF, however still retains the prerogative to generate the technology.

UNFA is well established, recognised by government and a number of donor agencies some of whom are already funding their activities e.g. The Royal Danish Government.

UNFA however concentrates only on its members.

2.7.3 Fisheries Associations

There are currently three fisheries associations which assist in co-ordination of activities of the fish farmers/ fishermen.

- a). Uganda Fisheries and Fish Conservation Association" (UFFCA),
- b). Uganda Fishing Union,
- c). Uganda Fish Development Association

2.7.4 Training and Training Institutions

There was a Department of Training and Information in the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF). It developed training plans and conducted training to provide adequate skilled manpower in the ministry. It also produced and

disseminated bulletins and other publications. All the specialised training institutions that were previously run by MAAIF were transferred to the Ministry of Education.

University Training

The National University in Uganda is Makerere University, Kampala. There are no specialised fisheries courses at Makerere University and staff recruited to manage fisheries and carry out fisheries research normally has a general B.Sc. degree in zoology. The Department of Zoology runs a hydrobiology course which mainly covers aspects of limnology and water quality. The Department of Zoology currently runs a M.Sc. course in Fisheries and Aquatic Sciences. Facilities and personnel to run this course are inadequate and the course depends on part-time lecturers from other institutions such as FIRI, FD and FTI.

Fisheries Training Institute (FTI)

Diploma and certificate level staff for the fisheries sector is trained at the Fisheries Training Institute (FTI), which is located in Entebbe and is run by the Ministry of Education in collaboration with the Fisheries Department. It offers diploma courses in fisheries management, aquaculture, fish technology and quality control, gear technology and boat building. Currently there are many graduates from FTI who cannot get employment.

2.8 Role of Government

2.8.1 Mandate of the Department

The Fisheries Department is mandated to ensure the sustainability of the fishery resources at optimal economic levels, and to maintain their availability for both present and future generations. The Department is therefore responsible for the formulation of Government policies in the fisheries sector, development of national plans and strategies to achieve set goals within the policy guidelines, and monitoring and supervising the performance of the Decentralised District Authorities and the Private Sector.

Structure of the Department

The Fisheries Resources Department has two Divisions namely:

- i) Fisheries Production Division, headed by an Assistant Commissioner, and consisting of an Aquaculture section, Water Bodies Section and Statistics Section; and
- ii) Fisheries Regulation and Control Division, also headed by an Assistant Commissioner, with two sections, Fisheries Regulation and Fisheries Control.

2.8.2 Functions of the Fisheries Department

These are as follows:

- i) Drafting and reviewing policies and standards governing the fisheries sub-sector.
- ii) Preparing fisheries regulation and guidelines, and reviewing fisheries legislation.

- iii) Drafting national and zonal plans and strategies for the fisheries sub sector.
- iv) Advising on improved techniques of fish handling, processing, preservation, storage, transportation and marketing, as well as fish product development.
- v) Advising on the application of new skills and more efficient and effective production techniques for fish farming, e.g. site selection, pond design, pond construction, stocking, cropping and management.
- vi) Encouraging the use of improved fishing gear and methods with particular emphasis on mechanisation of fishing canoes and methods.
- vii) Providing advice on the processing and handling of fish for export.
- viii) Collecting, processing and maintaining national data and information on the fisheries sub sector.
- ix) Co-ordinating with neighbouring countries with regard to fishing activities on shared waters.
- x) Monitoring and protecting the health of fish in the national water bodies, controlling aquatic productivity and conserving fish species.
- xi) Controlling and managing fisheries epidemics and disasters.
- xii) Management and enforcement of fisheries regulations, in order to ensure orderly exploitation of fisheries resources.
- xiii) Inspecting the activities of fish processing and marketing firms for compliance with national standards.
- xiv) Halting, reducing and controlling the geographical spread and levels of infestation by principal weeds within all waters inhabited by fish, using environmentally safe techniques.
- xv) Monitoring, inspecting, evaluating and co-ordinating fisheries extension activities in the districts.
- xvi) Providing technical guidance and assistance, including capacity building, to the district fisheries extension personnel, as required.

2.9 Fisheries and related legislation

The concept of managing of the fisheries resource through regulation had been contemplated before the artisanal fishery was established. Several fisheries legislation have been passed, revised and/or amended over the years since 1950. In 1964 during the revision of Uganda Laws, the fisheries of Uganda were provided for under the Fish and Crocodile Act, Chapter 228 and the Trout Protection Act of 1964. In 1996 an Amendment Act redefined some terms and strengthened the provisions of fish and processing of fish and issuing of licenses.

The Fish and Crocodile Act generally makes for the following Provisions.

- a) The control of fishing.
- b) The conservation of fish through limiting of the gear in numbers, size and number of fishing boats. No person may fish in Uganda without a valid fishing vessel license.
- c) The purchase, sale, marketing and processing of fish – through issuing of fishmonger licenses and specific licenses.
- d) The catching and processing of crocodiles and the control of the movement of the skin.
- e) The making of fishing rules under section 43 for better carrying out of the purpose of the Act. The Fisheries Resource department is trying to use the last provision to control the handling of fish or local and export market.

Fisheries regulatory functions are stipulated in the Fisheries Act. These include activities like law enforcement on the lakes and land, licensing, inspection of fish processing establishments and certification of fishery products for export. While most of the extension activities were decentralised, the regulatory functions have remained a responsibility of the centre.

For the purpose of law enforcement the country is divided into five ecological zones which represent the natural water basins and these are: Lake Victoria zone, Lake Albert zone, Lake Kyoga zone, Lake Edward, George and Kazinga Channel Zone and Aswa Zone which covers the Albert. Each zone is manned by a Senior Fisheries officer. The main activities carried out include.

- i) Licensing of fishing vessels and fish processors in liaison with district authorities;
- ii) Checking on the use of illegal fishing methods and prohibited gears.
- iii) Enforcing Fisheries regulations to ensure proper exploitation of the resources.

There is a very serious increase in the use of illegal gears like beach seines, cast nets and more recently the use of poisonous chemicals to catch fish. This leads to catching of immature fish and the destruction of breeding and nursery grounds.

3 THE CURRENT FISHERIES MANAGEMENT REGIME AND ITS SHORTCOMINGS

Fisheries management regime has three components

- 1) Fisheries management system
- 2) The monitoring, control and surveillance system
- 3) The judicial fisheries system

3.1 Fisheries management system.

The current fisheries management system of Uganda is in two parts.

a) The Open access mode of exploitation

A fishing vessel license is a requirement on all water bodies. However access is open because any Ugandan citizen can get a vessel license, as the price is very low. Other controls are also minimal. There are restrictions on the mesh size of gill nets (minimum size 5'' (-127mm)), prohibition of seine and cast nets, poison and explosives. These are applicable to all lakes in Uganda.

b) Restricted access mode of exploitation

The "controlled" mode is applicable to Lakes Edward and George and Kazinga channel, Lake Wamala and Kijenabala. Here there are a fixed number of permitted fishing vessels for each water body. The number of vessel licences has not been increased since the late sixties. Vessel licenses have to be applied for from the Commissioner for Fisheries (CFF) through the District Fisheries Officer.

A vessel license is transferable: A licensee can move to another gazetted landing site (See section 26, 2.6.2 landing sites) on the same water body with permission from the CFF. A licensee can transfer a licence to kith or kin (licenses are like family property rights in the national parks) after seeking permission from the Commissioner. The licence is re-allocated if the fisherman decides to leave the industry.

3.2 The monitoring, control and surveillance system

Monitoring is carried out at the landing places. The type and number of boats (powered/paddle) are recorded by a Fisheries assistant. The catch by species and weight (and average weight per canoe) is recorded in a random sample of vessels. Information on handling, processing, marketing and distribution is also collected from landing sites, processing industries and markets. Monitoring is not carried out at sea.

These data are forwarded to the Fisheries Department for compilation and analysis and used as a guide for future planning in accordance with the government's policy and planning department, MAAIF.

Control and surveillance is carried out by senior Fisheries officers.

3.3 The judicial fisheries system

In accordance with Uganda Laws, Fisheries legislation is provided for under the Fish and Crocodile Act, Chapter 228 and the Trout Protection Act (See section 32, 2.8 Fisheries and related legislation).

The fisheries management system and the monitoring, control and surveillance system is run by the Fisheries Department, Ministry of Agriculture, Animal Industry and Fisheries. The judicial fisheries system is run by the Justice Department, Ministry of Justice and Constitutional Affairs.

3.4 Shortcomings

The fisheries management system.

The restricted access mode works far better than the "open" access mode. The landing sites are few and not scattered. This facilitates monitoring, control and surveillance, the performance of the restricted fishery biologically and economically is much better than that of the open one.

The open access system is a major weakness of the management regime. In Uganda the fishery resource is "open" in the sense that no individual has the right to exclude other fishermen from fishing. From an individual's perspective, leaving fish to grow and reproduce is done at the risk of losing the fish to other fishermen. That is, there is no incentive for the individual fisherman to conserve the resource for the future use since no user has exclusive right to its use. The open access of the fishery is the fundamental cause of the poor economic performance of the fishery and its biological overexploitation. Even with the controlled lakes like Lakes George and Edward where access is limited, problems of overexploitation arise. Restricting access to a specific set of producers does not alleviate the common property problem. If the users in common cooperate and follow regulations for using the resource, problems of overexploitation and conflict can be alleviated. But if they do not, which is usually the case and certainly the case in the "controlled" lakes, overexploitation results.

Improved fishing technology and increased fish prices including new markets have combined to put more pressure on the open access fishery. Rising prices and falling costs have induced more investors and more participants into the fishery. The fishing sector is already large and is threatening to become even larger and its economic viability placed at risk as the resource stock is drawn further down. The gap is widening between what the resource is able to supply and what the fishing sector needs to survive and prosper. In other words the fishery is heading toward a situation where capital's capacity to extract exceeds the resources capacity to produce. This is evidenced by the increased presence of immature fish in the harvest.

From an economic point of view, the basic reason why Government regulations for exploitation of the resource are needed is that, in an unregulated fishery, the decisions made by individual fishers and groups of fisher's results in economic overexploitation. So the "open" mode policy has to be changed to improve and enhance economic performance of the fishery.

The monitoring, control and surveillance system

Control and surveillance lacks effective management and supervisory services. Field staff generally lack basic facilities for execution of their duties. Land and water transport are not available on most of the lakes and basic equipment such as weighing balances and even stationery are not adequate and are often inadequate.

The judicial fisheries system

The current legal framework does not adequately ensure that the biological, economic and social factors affecting the fisheries are taken into account. It does not clearly reflect conservation, access rules, property and use rules, enforcement and dispute resolution. For example conservation regulations mainly make provision for Tilapia and not other species. Even the measures for the conservation of Tilapia are weak.

Those who receive the right to fish should be held accountable for any activity that is not sustainable. Ultimately, the penalty that they must pay for unsustainable behaviour should outweigh the benefit that can be had through such behaviour.

Financial penalties for offences are light and do not act as a deterrent. The prison sentence is not light but offenders are usually warned and set free by the magistrate. Less than 5% of those found guilty are sentenced.

The current judicial system does not back up the fisheries management system and the monitoring, control and surveillance system.

4 TOWARDS AN APPROPRIATE REGIME

4.1 Management measures

The purpose of fisheries management is to regulate exploitation of the fish resources so as to maximise the long-term flow of economic benefit from the resource, rationally at sustainable biological and economic yield levels.

For this purposes a great number of different fisheries management measures have been suggested and tried. Most of these however may be conveniently grouped into two broad classes: (1) biological fisheries management, and (2) economic fisheries management (Figure 4). Economic fisheries management measures may be further divided into (a) direct restrictions and (b) indirect economic management (Arnason R. 1998.)

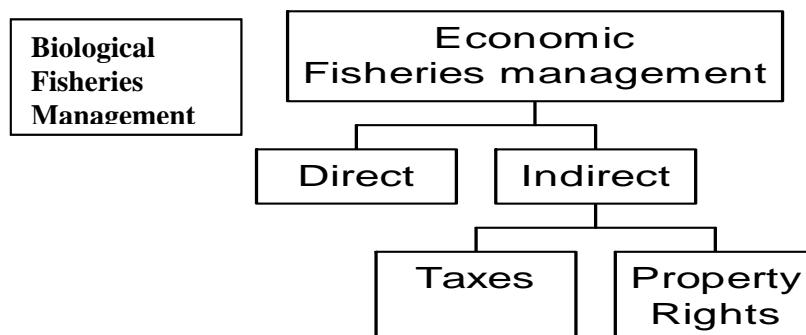


Figure 4: Fisheries management methods: classification (Arnason R. 1998).

4.1.1 *Biological fisheries management.*

These methods are designed to improve the biological yield and are capable of conserving and enhancing fish stocks. They do not however remove the common property right problem. They may sustainably increase the yield, but probably generate a net profit loss.

4.1.2 *Economic fisheries management: direct measures.*

These constrain the inputs or production of outputs in order to increase economic efficiency. Constraints are on fishing effort, fishing gear, vessel type, catch rates, investment, fishing area etc. They do not remove the common property problem. They will to some degree conserve the resources and increase catches. These measures in the long term could result in economic loses.

4.1.3 Economic fisheries management: indirect measures.

The most prominent indirect economic fisheries management measures are (1) corrective taxes and (2) property-right-based instruments such as access licences and individual transferable quotas (ITQ's).

4.1.4 Corrective taxes.

Taxation on catch and inputs can be used. "*In theory tax, can generate full efficiency. For instance the tax revenues (less collection costs) represent pure fisheries rent*" (Arnason R. 1998).

A taxation regime is therefore difficult to mismanage. However it has a shortcoming in that it is virtually impossible to calculate the "correct" tax and it is socially unpopular.

4.1.5 Property right based approach

ITQs, create property rights in the harvesting quantity. This is not a perfect property right. However "it goes a long way towards eliminating the common property nature of fish stocks. Consequently, the common property problem is alleviated and the market system is in a position to generate a reasonable efficient utilisation of the fish stocks" (Arnason R. 1998).

In an appropriately specified ITQ system each fisherman should have a share quota (s) which is permanent, perfectly divisible and transferable. It should try to cater for all fishermen i.e. no exemptions. Once the Total allowable catch is determined (TAC) then the shares can be determined. The value of permanent quota shares reflects the expected fisheries rents given the existing and expected TAC. It follows that in setting the TAC, the fisheries authority only has to: (a) monitor permanent quota share prices on the market and (b) adjust the TAC until the quota prices are maximised (Arnason R. 1998). Although the ITQ system is theoretically efficient and uses the advantages of the market system to the utmost it can give rise to a radical restructuring of the fishing industry that may be socio-politically problematic (Arnason R. 1998). Of all the management systems considered it is obvious that only taxes and property rights work are capable of delivering the full potential economic benefits of the fisheries.

4.2 Combination of management measures to be used in Uganda.

4.2.1 Taxes.

In Uganda taxes and property rights cannot be applied at the moment because of:

(a) Inadequate information on the fisheries resources. Stock assessment information required for the proper planning and management on the major water bodies is inadequate. Also there is limited data on the limnology of the aquatic eco-systems and virtually no data on the primary and secondary productivity processes which is necessary to understand the potential of different water bodies to produce fish. The existing data on fish catches is deficient in coverage and reliability.

(b) Lack of an appropriate regulatory framework especially:-

Reliance on "open access" rather than "controlled access". The fishery is heading to a state where capital's capacity to produce exceeds the resource's capacity to produce.

Laws are old and mainly make provision for Tilapia and not other species. Penalties for offences are light and do not act as a deterrent in most cases. Political intrigues and interests lead to violation of fishing regulations

- (c) Inadequate monitoring, extension and enforcement services:
Field staff generally lack basic facilities for execution of their duties. Land and water transport is not available on most of the lakes
- (d) There is a lack of realisation by resource users of the need for sustainable use of the resource. This is leading to resource depletion by the use of destructive gear and fishing methods, which also destroy breeding grounds and catch immature fish.

(e) Absence of appropriate mechanisms for regional co-operation: This has a negative impact on costs, efficiency and effectiveness of various management mechanisms at a national level. Three of Uganda's large lakes (Victoria, Albert and Edward) are shared with her neighbours but Lake Albert and Lake Edward have no regional co-operation arrangement for their management similar to that of Lake Victoria Fisheries Organisation (LVFO) which *co-ordinates joint* management of the lake by Kenya, Uganda and Tanzania. The LVFO has itself not yet achieved the required capacity for effective co-ordination and harmonisation. Kagera River contributes a major water in-flow into Lake Victoria but Kagera River Basin Organisation (KBO) does not effectively co-ordinate the fisheries and environmental management of the river basin.

There is a need to limit the expansion of the fisheries and to strengthen the monitoring control and surveillance system.

A management regime composed of the following combination of management measures seems to be the most appropriate at the moment and are a stepwise way towards a TAC and ITQ orientated management regime.

- Licensing of all fishing vessels and a limitation of licenses issued.
- Gazetting (and licensing) of all landing sites
- More effective gear/area restrictions.
- The determination of total allowable catches by species and water-bodies.

Along with the above measures the "open access" policy will be reviewed in order to guide and limit fishing effort and facilitate the rational exploitation of the resources at sustainable biological and economic yield levels.

4.2.2 Licensing of fishing vessels

A vessel licence is a requirement. This is not a new measure. The fees for a vessel licence at the moment vary and consequently the fishery is regarded as “Open”. Vessel licence fee will be increased at a rate of 25% per annum with the aim of controlling entry into the fishery.

The number of vessels will be determined through attrition by those who can afford a vessel licence and perform economically.

The number of boats and catch at the beginning and end of this period will be compared to determine what effort is required to achieve the TAC within the perceived maximum potential yield.

4.2.3 Gazetting (and licensing) of all landing sites

Gazetting of landing sites is not new but licensing is (See section 26, 2.6.2 Landing sites). The gazetting and licensing of landing sites is aimed at reducing the number of landings (reduction of fishing effort i.e. number of boats and gear but increased efficiency) and concentrating financial resources on infrastructure development.

Gazetted but unlicensed landing sites will be phased out. The number of gazetted and leased sites will also be determined by attrition as those that do not perform economically will be forced to close. The number of operational sites is expected to stabilise at 50% of the current landing sites, countrywide.

4.2.4 Effective gear/area

More effective gear/area restrictions these are aimed at eliminating / reducing the capture of immature fish and fishing in spawning and nursery grounds. These will include new minimum mesh sizes for various species other than Tilapia for major water bodies and eventually to the number of nets per canoe.

4.3 Expected outcomes

The Expected outcomes of these fishery management measures biological, economic, social and administrative.

4.3.1 Biological.

These will depend on the extent to which the target resource stock is protected from overexploitation.

Limiting licenses and gazetting and technology restrictions will initially reduce total fishing mortality and the productivity of the stock will improve. The reduction in the number of fishing units is expected to proceed slowly causing a relatively slow reduction in total effort. The reduction in total effort will allow the resource stock to grow to a larger size and the total landing increase.

4.3.2 Economic

This will also depend on extent; the fishery achieves its economic potentials, as measured by the economic benefits to harvesters, processors, distributors, marketers and consumers. Evidence on economic performance is generally not available. The

net economic benefits to harvesters, processors, distributors, marketers and consumers will be measured indirectly by measuring changes in outcomes in the harvesting and marketing structure of the fishery.

The new measures will indirectly increase the cost of fishing therefore reducing effort. Fishermen who cannot afford the new cost and those that make an initially loss will drop out. With an initial drop in total catch there will be a drop in the amount which was originally available to the market. This will increase the market price probably by 10%.

With a drop in fishing effort, the stock will start to increase in biomass and more and more fish will be caught with the same effort, but with bigger profit margins in the short term. This will prompt fishermen (and others that join) to invest more capital into new boats, engines and nets until they reach the maximum number of boat (and nets) allowed. Fisherman will make profits, but only marginal ones. A level will be reached where there will be too much fish on the market. Prices will fall and those who find it uneconomical will be forced out, making the fishery moderately profitable in the long run.

4.3.3 Market outcomes

Market outcomes will include changes in prices (levels and seasonal patterns), product quality and forms; product utilisation; product availability patterns (e.g. market gluts and scarcity); imports and exports and consumption patterns.

With the initial drop in supply there will be a high demand for species by the processing industry. The supply will increase gradually bringing in profits lower than the initials ones but still net profits. This will also increase the amount and improved quality of export products. More and better sized fish will be smoked, sun dried, and salted and sun dried for both domestic and export markets. The elimination use i.e. reduction of immature fish which has always been smoked or sun dried and smuggled to The Congo, Rwanda and Kenya will collapse as will be the case to the domestic market.

As the once declining species start appearing more and more on the markets, prices of these will be higher than those of the target species due to demand on the domestic market. With the re-appearance of Haplochromines which were widely used not only as food, but for rituals and medicinal values (e.g. cure for measles) the urge by some fishermen to catch juvenile Tilapia and Lates which are accepted as good substitutes will decline consequently leading to their complete absence in markets.

4.3.4 Social outcomes

Social outcomes sourced effects will include the redistribution of income and wealth, the amount and form of employment formed, cohesion in rural communities, class divisions, and industry attitudes towards regulation

Basically this will cause friction between Government and the segment of the industry that will not be favoured by the new measures. It will also cause perceived inequities, class division among those favoured by the new measures and between those not favoured by the new measures.

Trained labour for handling and processing for better quality fish will become a prerequisite on landing sites. This will cause loss of employment to the current casual force. On the positive side, this move will create employment for the currently unemployed but trained labour from the National Fisheries Training Institute. Graduates were originally absorbed by government, but under the new civil reform act, recruitment into the civil service has been halted.

Fisherman who are forced out, will be given a "package" and helped to resettle in other parts of the country and engage in other economic activities especially agriculture. However most of the fisherman on the main land moved from the interior to engage them in fishing when they observed that those living along the lakeshore were making money from fishing.

Revenue from licensing landings and income tax will be used for the resettlement exercise. A package of US\$ 1500- 2000 is considered as adequate compensation to those who will leave the industry

Friction will exist between government and the processing industry because the new regulation. The new moves will increase efficiency meaning more and high quality fish. This will certainly cause an inflow of *local* and *foreign investment* in fishing and fish processing industry by firms, creating more professional employment in the process.

4.3.5 Administrative

Administrative outcomes include costs and problems, catch and data quality, monitoring and research requirements, and industry co-operation.

Gazetting fish landings will first and foremost facilitate collection of data required in the management and development of the fisheries resources on a *regular basis*. Landing sites will be fewer not as scattered and better staffed. This will facilitate enforcement and provide superior monitoring of catches.

5 IMPLEMENTATION PLAN

5.1 Licensing of all fishing vessels and a limitation of licenses issued

For the purpose of licensing the country will be divided into five ecological zones which represent the natural water basins and these are:

- a) Lake Victoria zone,
- b) Lake Albert zone,
- c) Lake Kyoga zone,
- d) Lake Edward, George and Kazinga Channel Zone and
- e) Aswa Zone which covers the Albert.

Each zone is manned by a Senior Fisheries Officer (Zonal Officer), Control and Regulation Division Fisheries Department.

The Officer will carry out licensing in his zone in liaison with the District Fisheries Officers, Income Tax department officials and district authorities.

Two month before the licensing begins each Zonal officer will brief the DFO's, Income Tax Department officials and district authorities in his Zone on why and how licensing is going to be carried out.

The Zonal officer will give application forms to each district officer who will in turn supply the forms to the Assistant Fisheries Development Officers in charge of gazetted and leased landing sites.

Application forms for vessel licenses will have to be collected from the Assistant Fisheries Development officer in charge of the gazetted landing sites. A non-refundable fee (US\$ 10) for processing will have to be paid. The fee is supposed to limit entry into the fisheries and also pay for the cost of licensing (See section 38, 4.1 Management measures, licensing of fishing vessels) The AFDO will have to inspect the vessel(s).

Applicants will be advised to check on whether their application has been successful or not one month from the date of application.

The application forms will be forwarded to the Zonal officer who in collaboration with the District Officers will determine successful applicants, who will be required to have i) a minimum qualification of "O" level certificate ii) a seaworthy vessel specified for the water body with life preservers and first aid kit iii) the right fishing gear for the water body, and iv) should not have been convicted for any offence under the Fish act in the past two years. (See page 3.1.1 Fisheries management regime fisheries judicial system)

A list of successful applicants will be posted at the office where the application was made along with the dates for licensing.

On the day of licensing the successful applicants will have to come to the landing with his/her boat(s) and gear for final inspection and if he/she meets the requirements will be issued a licence(s) after producing evidence of having paid income tax¹

Footnotes. 1 Originally when licenses were issued the fisherman never got around to paying income tax. The Fisheries Department and the Income Tax Department have made a gentleman's" to include it in the requirements.

An Income Tax revenue officer will be present and an applicant will be able to pay income tax if he/ she have not done so.

The licence number of the vessel will be stencilled onto the boat there and then.

An AFDO, Control and Regulation Division, Fisheries Department vessel inspection unit will be present.

During the issuing of licenses which is expected to take one month for the whole country, the Zonal Officer will co-ordinate the exercise in his/her zone and with District Officers will check landing sites to ensure that it is proceeding as planned.

The licensing exercise is will cost an estimated 12,680 US\$ (see Page 51 appendix i)

5.2 Gazetting (and licensing) of all landing sites

The major landing sites that handle fish purchased by the processing companies that export fish and fish products will be identified by the Department and will be gazetted if not gazetted already.

Other factors that will be taken into account during selection will be total catch handled annually, and infrastructure in place like jetties, fish receiving, washing, sorting and weighing slabs, and other facilities like ice plants, cold storage, public toilets, refuse disposal units and clean water supply.

In the event that the local governments are unable to develop and operate the gazetted landings as stipulated by central government policy these shall be licensed out for private development and operation for a specified period.

Priority will be given to investors, developers or donors involved in the processing and export of fish and fish products.

Investors that are unable to develop the landing in accordance with government stipulation will be allowed to sell his rights to another investor (after consultation with the Technical Advisory Committee).

If an investor so wishes he can buy one or more nearby landings and in consultation with the TAC close some and opt to develop a more favourable one(s) providing enough facilities to cater for traffic from the closed landings.

Field Work Surveys: Selection of landing sites

Two teams will visit all fisheries regions of the country for one week each as follows:

- a) The South-western Team will cover Lakes Chahafi, Kayumbu, Mburo, Kachera, Kijanebolola and Victoria.

- b) The Eastern Region Team will cover Iganga, Kamuli, Busia, Kumi, Mbale, Pallisa and Soroti Districts embracing the eastern shores of L. Victoria, and the eastern parts of Lake Kyoga complex.
- c) The Western Team will cover Lakes Wamala, George, Edward, and Saka Nyabihoko.
- d) The Lake Albert team will cover the western parts of L. Kyoga, and Lake Albert. :
- e) The Kalangala team will visit major landing sites in the Ssesse Islands, which are the major source of fish for overseas exports.
- f) The north-eastern Team will visit Northern parts of L. Kyoga in Lira.
- g) The Albert Nile Team will cover landing sites on Albert Nile And landing sites on L.Albert in Nebi District.

All the six water bodies (Victoria, Kyoga, Albert, Albert Nile, Edward and George) will be covered as well as ten (10) minor lakes

A month before the exercise begins all district fisheries officers will be asked by the Fisheries Headquarters in Entebbe to identify landing sites that they consider most suitable for gazetting and leasing for private development and operation. Guidelines for selection will be provided.

The DFOS should then discuss their findings with their chief administrative officers (CAO) and the District Production Committee (DPC) and forward them to headquarters.

The findings will then be discussed by the teams that are going to survey the landing sites to verify that the selected ones meet the stipulations stated in the guidelines.

Districts Fisheries other will then be informed of the dates the teams will be in their district.

On arrival a team will go to the DFO who will take the team to survey the selected landing sites.

After visiting the landing sites the teams will then have final discussions with the CAO and District Production Committee to come up with the final selection

The Control and Regulation Division will then carry out the necessary legal action to gazette the landing sites.

After gazetting the landing sites will be as licensed.

Selection and award will be conducted by a Technical Advisory Committee.

Teams

Each team will consist of an officer from Control and Regulation, an officer from the Production Division and a civil engineer.

TEAM A	TEAM B
South Western	Eastern Region
Eastern Region	Lake Albert
Kalangala	north-eastern
North-Eastern	Nebbi

The whole exercise to carry out selection, gazetting and licensing will cost an estimated US **\$27.894** (See page 60, appendices ii and iii).

5.3 The determination of total allowable catches by species and water-bodies.

A two day workshop will be held to estimate the TAC.

There will be ten participants, three from the Stock Assessment Unit from the Fisheries Research Institute (FIRI), six from the Fisheries Department and one from the Planning Department, Ministry of Agriculture Animal Industry and Fisheries.

Catch data from as far back as possible for all the major water bodies will analysed. TAC's by water bodies and by species will be estimated. Emphasis will be placed in order of importance on *Lates niloticus* (Nile Perch), Tilapia, *Rastineobla agentae* (Mukene,) the cat fishes *Bagrus* and *Clarias* and the lung fish *Protopterus*.

The total National Allowable Catch will then be estimated adopted and implemented. The Workshop is estimated to cost approximately **US\$ 900** (see page 61, appendix iv).

5.4 Reviewing of the existing regulatory framework

A two day workshop will be conducted to review open access policy and also management measures to be put in place to avoid overexploitation.

All District Fisheries Officers will be asked to send in a brief outline of what they consider are legal constraints with regard to the current fisheries legislation and suggest how these can be overcome (one month).

The Control and Regulation Division will then produce a working document to be used in the workshop. (One month).

The working document will be sent to participants two weeks before the workshop.

Twenty participants are expected. On day one, there will be a general discussion on how best to improve on the current fisheries legislation and recommendations made.

On day two the participants will be divided into four groups and each assigned a particular section of the working document to work on.

Each group will then present its recommendations for inclusion and changes for final discussion and adoption.

After the workshop the Control and Regulation Division will formulate a new Fisheries Act with the aid of the Ministry of justice (one month). The proposed Act will then be passed to Cabinet for passing into law to replace the existing Fish and Crocodile Act, Laws of Uganda, Chapter 228 and the Trout Protection Act Of 1964.

The Workshop will cost approximately US\$ 2.330 (see page 61 appendix v).

5.5 Mechanisms for regional co-operation in the management of shared resources.

Lakes Albert and Edward

A bilateral Environmental Management Program will be prepared for Lake Albert and Edward with the Democratic Republic of Congo.

Meetings between the Fisheries Department of both Republics will be held to harmonise joint management measures for management of the shared fisheries.

Meetings will be held with the Lake Victoria Environmental Management Program Secretariat to draw up a program similar to Lake Victoria for both Lake Albert and Edward and to identify and seek funding for the Program from international funding agencies.

Meetings will be held between the Ministries of Foreign affairs (Regional Cooperation) and agreements to the Implementation of Program. Financial estimates cannot be worked out at the moment.

5.6 Costs and benefits

Currently the potential financial benefit of the catch landed was 218,680 metric tonnes valued at approximately US\$ 76 million in 1997.

Costs

Administrative costs. Issuing of licensees will cost approximately US \$ 12,700 initially. Additional administrative costs of US \$ 10,000 are expected. These are recurrent annual costs. As the measures are deigned to restrict entry and improve efficient utilisation of the stocks the costs will reduce while benefits increase.

Social costs. A "shadow" cost cannot be estimated accurately. The measures are going to be implemented stepwise. Those who cannot perform economically will be phased out gradually and given a financial "package" to engage themselves in other economic activities especially agriculture or aquaculture. Assume that the benefits are 25% of the catch value and the financial benefits are US\$ 17 million after costs if 100 fishermen leave the industry annually and each is given a "package" of US\$ 2,000,. Then US\$ 0.2 million will be used and still leave 16.8 million.

Benefits. There are potentially huge benefits at low costs (Table 14).

For benefits of 1% of the catch value and costs of US\$ 0.200 million 0.560 million is realised as benefit at 25% of the catch value and costs of US\$ 2 million, US\$ 17 million is realised as financial benefit.

Table 13: Cost/ benefit in US\$ million

Benefits		Costs (M. US\$)					
% of catch value M.US\$		0.010	0.050	0.100	0.200	1.000	2.000
1	0.76	0.750	0.710	0.660	0.560	-0.240	-1.240
5	3.800	3.790	3.750	3.700	3.600	2.800	1.800
10	7.600	7.590	7.550	7.500	7.300	6.600	5.600
25	19.000	18.99	18.950	18.900	18.800	18.000	17.000

Over a period of five years the social and political consequences of the measures will be monitored and adjustments that are socially and politically acceptable made. In the long term the social benefits will far outweigh the social costs.

5.7 Conclusion

The "open access" policy of the fisheries management system does not remove the common property problem. This has led to fishery, which is large and is bound to expand. Entry must be restricted to protect it from collapsing. The current legal framework does not adequately ensure that the biological, economic and social factors affecting the fisheries are considered.

The new measures will restrict entry into the fishery therefore limiting effort. Licensing of landings will reduce and concentrate landing sites to facilitate monitoring surveillance and control of the fishery which is at present inadequate due to financial constraints. Financial resources will be concentrated on development of essential infrastructure, now lacking, at the landing sites.

When implemented these measures are expected to improve and enhance the biological and economic performance of the fisheries. The measures will also pave the way towards a TAC and ITQ management system. This will alleviate the common property problem leading to a reasonable efficient utilisation of the fish stocks.

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APPENDIX

i) Financial estimates for licensing of all fishing vessels and a limitation of licenses issued
 Financial

ITEM	UNIT RATE US\$	QUANTITY	COST US\$
Stationery			
Ball Points	3Pkt	15Pkt	45
Pencils	2pkt	15Pkt	30
License books			700
Note pads	2	100	200
Sub total			975
Vehicle operation and maintenance			
Service	200	6	1,200
Fuel	1(litre)	400 x 6	2,400
Lubricants		10% of fuel	240
Sub total			3,840
Allowances			
Officers			
Night	60	10 x 60 x 6	36,000
Safari day	6	15 x 6 x 6	540
Drivers			
Night	30	10 x 30 x 6	1,800
Safari day	3	15 x 3 x 6	270
Sub total			6,210
Contingency	15% (11025)		1,654
Grand total			12,679

ii) Financial estimates for gazetting (and licensing) of all landing sites

ITEM	UNIT RATE US\$	QUANTITY	COST US\$
stationary			
Ball Points	3Pkt	1Pkt	3
Pencils	2pkt	1Pkt	2
Note pads	2	10	20
Sub total			25
Vehicle operation and maintenance			
Service	200	2	400
Fuel	1(litre)	400 x 8 trips	3,200
Lubricants		10% of fuel	320
Sub total			320
			3,920
Allowances			
Officers			
Night	60	6 x 5 x 8	14,400
Safari day	6	8	48
Drivers			
Night	30	2 x 5 x 8	2,400
Safari day	3	8	24
Sub total			16,872
Contingency	15% (20820)		3123
Grand total			23,943

iii) Financial estimates for the Technical Advisory Committee

ITEM	UNIT RATE (US\$)	QUANTITY	COST (US\$)
stationary			
Ball Points	3	1Pkt	3
Pencils	2	1Pkt	2
Note pads	2	12	24
Sub total			29
Honorarium	50	10	500
Transport refund	20	10	200
Sub total			700
Refreshment	3	10	30
Lunch	10	10	100
Sub total			130
Contingency	15% (859)		128.85
Grand total			987.85

The Committee is expected to sit four times at an estimated cost of **US \$3,951** (987.85x4)

The whole exercise to carry out selection, gazetting and leasing will cost an estimated **US \$27,894** (23,943 +3,951)

iv) Financial estimates to determine total allowable catches by species and water-bodies

ITEM	UNIT RATE (US\$)	QUANTITY	COST (US\$)
stationary			
Ball Points	3	1Pkt	3
Pencils	2	1Pkt	2
Floppies	25	1Pkt	25
Photo copy paper	6	2 reams	12
Note pads	2	12	24
Sub total			66
Allowances	60	3 x 2	360
Safari day	6	3 x 2	36
Transport refund	20	3	60
Sub total			456
Refreshment	3	10 x 2	60
Lunch	10	10 x 2	200
Sub total			260
Contingency	15% of(782)		117
Grand total			899

The Workshop will cost approximately **US\$ 900**

v) Financial Estimate for the reviewing of the existing regulatory framework

ITEM	UNIT RATE (US\$)	QUANTITY	COST (US\$)
stationary			
Ball Points	3	2Pkt	6
Pencils	2	1Pkt	2
Floppies	25	1Pkt	25
Photo copy paper	6	4 reams	24
File covers	2	22	44
Note pads	2	22	44
Sub total			145
Allowances	60	10 x 2	1200
Safari day	6	10 x 1	60
Transport refund	20	10	200
Sub total			1,460
Refreshment	3	20 x 2	120
Lunch	10	20 x 2	400
Sub total			420
Contingency	15% of(2025)		304
Grand total			2,329

The Workshop will cost approximately **US\$ 2,330**