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**Fishing Practices Special Study
(FPSS)
Final Report**

A Record of the Zambian
Fishing Gears used in
Lake Tanganyika
at the turn of the millennium

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**Pollution Control and Other Measures to Protect Biodiversity
in Lake Tanganyika (RAF/92/G32)**

**Lutte contre la pollution et autres mesures visant à protéger
la biodiversité du Lac Tanganyika (RAF/92/G32)**

Le Projet sur la diversité biologique du lac Tanganyika a été formulé pour aider les quatre Etats riverains (Burundi, Congo, Tanzanie et Zambie) à élaborer un système efficace et durable pour gérer et conserver la diversité biologique du lac Tanganyika dans un avenir prévisible. Il est financé par le GEF (Fonds pour l'environnement mondial) par le biais du Programme des Nations Unies pour le développement (PNUD)”

The Lake Tanganyika Biodiversity Project has been formulated to help the four riparian states (Burundi, Congo, Tanzania and Zambia) produce an effective and sustainable system for managing and conserving the biodiversity of Lake Tanganyika into the foreseeable future. It is funded by the Global Environmental Facility through the United Nations Development Programme.



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1. INTRODUCTION

The Fishing Practices Special Study of the Lake Tanganyika Biodiversity Project in 1999 and 2000 did a brief survey of the Fishing Methods employed in the fisheries of that Zambia. This was part of the lake-wide survey of fishing gears undertaken to coincide with the Millennium. This report is a record, for posterity, of the gears found.

The field work concentrated on fishing gears that are used by small scale commercial and subsistence fishermen. These are of particular interest as it is presumed to be these fishermen, rather "Industrial" fishermen, that threaten the biodiversity of the of the lake.

The fishermen targeting sardines and pelagic fishes have been exhaustively studied by other researches, particularly the FAO Lake Tanganyika Research Project and its predecessor projects, which have spent the best part of half a century developing and looking at the various aspects of the commercial fisheries of the lake.

Zambia has been surveyed in the past, though these surveys have tended to concentrate on the larger, and more visible gears. FPSS resurveyed in 1999/2000, based on habitat, so as to find the many different types of gear in use there.

1.1 Fishing gear materials

1.1.1 Sources of gears

In Zambia there are local manufacturers (& repackers) of gear, but little of their gear gets to Mpulungu on the lake. Most of the gear in Mpulungu is from China or Korea, imported by way of Tanzania. In Nsumbu, on the SW Arm of the lake there is more Zambian manufactured gear, particularly gill nets, and even some nets coming in from the Democratic Republic of Congo, notable by their colour (blue).

A survey of the gears available in Mpulungu was made and the results are given at the end of this report in an appendix.

2. THE FISHING GEARS OF ZAMBIA

2.1 Gears used on the lake.

Table 2.1 Fishing Methods and Gears of Lake Tanganyika

Method	Gear	Target species	Comment
Without tools	By hand. Opportunistically of fish in drying ponds and paddies. Usually an adjunct to agricultural activities	Clarias mainly	These are all very low intensity fisheries
	With extensions to the hand. Machetes, stones and sticks in shallow waters adjoining the lake	Clarias mainly	
Stupefying devices	Plant poisons	Totally non selective Illegal	Already illegal and not common in the lake itself
Lines	Vertical hand lines (demersal fish,)	Mixed littoral	Cheap and plentiful
	Pole and line.	Juvenile mixed littoral <i>Clarias spp</i> and <i>O Tanganicae</i> in swamps	Ubiquitous. Cheap.
	Vertical hand line (jigging, epi-pelagic, un-baited)	Day – <i>Limnothrissa miodon</i> Night – <i>Luciolates stappersii</i>	Cheap and plentiful
	Vertical hand line (jigging, meso-pelagic, un-baited)	<i>Luciolates stappersii</i>	Some examples in the Zambian part of the lake.
	Bottom set long lines	Mixed littoral and sub littoral	Cheap and plentiful
	Staked lines	Riverine species	Very rare. Lufubu
	Sport fishing	<i>Luciolates spp</i> <i>Boulengerocromis microlepis</i> <i>Hydrocynus goliath</i> Golden Nile perch !	Sport fishing in Nsombo National Park is important for biodiversity and the local economy. Elsewhere it is insignificant.
Traps, barriers etc	Bottom set non return traps (in swamps and rivers) Several designs on a theme	<i>Clarias sp</i> and <i>Tilapine</i> species	Not very common in Zambia
	Pelagic non return fish traps	<i>Dinotopterus cunningtoni</i>	Used in the pelagic zone
	Tubular traps	<i>Clarias sp</i>	In rivers leading to the lake. Targets lake species moving up or down river depending on season.
	Barrier/Labyrinth traps	<i>Clarias</i> etc	In reed beds in Zambia. More common in wet season
	Fish Fences and Fish Weirs	<i>Clarias sp</i> etc	In rivers connecting to the lake only. Often associated with traps.
	Scoop net (hand operated in reed beds)	<i>Clarias sp</i>	Rare gear in Zambia
Seine nets	The Day Beach seine	Mixed littoral	The threat to biodiversity is assumed but not proven; though it appears that locally biodiversity is affected by this method.
	Beach seine with lamps at night	<i>S tanganicae</i>	

Method	Gear	Target species	Comment
Surrounding nets	Purse seine (in the Industrial Fishery with separate light boats)	<i>L. stappersii</i>	Zambia only
	Ring Nets (Chiromila seine)	<i>S. tanganycae</i>	Only found in Nsumbu region of Zambia
	Surround net with divers (Aquarium fish)	Mixed	Aquarium fish
Lift nets	Lift net, one, two and three boats	<i>S. tanganycae</i>	Very uncommon in Zambia, but common elsewhere
Gill nets	Bottom Set gillnets	Mixed littoral. Selective	Locally the numbers of gill nets targeting the littoral and sublittoral give cause for concern.
	Floating Gill net	River and estuary	Not common gear
	Encircling gill net (with boat and divers)	Littoral	Used in aquarium fish trade
	Drive in gill net	Mixed littoral	Only ones seen in Zambia have illegal mesh sizes
	Seined gill net	Mixed littoral	An attempt to get round the local ban on encircling gill nets with frightening device
	Staked gill net	Now probably not used	Used near reed beds

2.2 Without gear

Fishing without gear means picking up the fish with the hands, or with very simple instruments such as a stick, machete or iron hook which has the effect of lengthening the hand.

The fisheries without gear noted in Zambia have been as follows:

2.2.1 By hand

People capture fish by hand, normally catfish, (*Clarias sp.*), particularly, but any fish in practice, in the ponds, rice paddies and swamps adjoining the lake. Any subsistence level farmer or fisherman takes advantage of a fish trapped in a drying pond at the beginning of the dry season, or when migrating overland (*Clarias gariepinus*). These catches are incidental to agricultural subsistence activities and are not generally significant. Many individuals who farm land adjacent to the lake admit to benefiting from these opportunist captures.

2.2.2 Extensions to the hand

The use of extensions to the hand to assist in the capture by hand of the fish. This is widespread. For example in the wet season Zambian fishermen of Kakula Village set out with machetes to search the swamps of Chituta bay for migrating fish, and the fishermen of the Chisala River in Zambia use axe handles as clubs to capture *Clarias sp.*

2.3 Stupefying devices

2.3.1 Plant poisons

Plant poisons stupefy fish by directly affecting their respiration in some way. In that the use of any poison in the lake is illegal it is very difficult to obtain accurate information on the use of plant poisons.

In Zambia in rivers running into the lake and other inland waters poisoning is carried out, but not reportedly in the lake itself.

In Zambia the plants used for fish poisoning are¹:-

Scientific Name	Local or common name	Toxic part used
<i>Dolichos sp</i>	No local name given	roots
<i>Tephrosia sp</i>	No local name given	leaves and pods
<i>Syzgium guineese</i> subsp	No local name given	bark chips
	Giant euphorbia	whole plant
	Kancense	tuber
	Cantulia	fruit
	Kantemya	leaves and roots

2.4 Lines

The principle of using a line is that the fish voluntarily takes a bait of some sort and cannot spit it out before being removed from the water. In Lake Tanganyika hooks are used on the lines. The hook can be baited or unbaited, barbed or barbless.

On Lake Tanganyika all hooks are curved (in the shape of a "hook") and made of steel². There are no circle hooks or gorges in use. Some hooks are home made and do not have a barb, but the majority are shop bought, manufactured by Mustad™ of Norway. One other brand, Eagle™, made by Maruto of Japan is also sometimes available. All the commercial hooks are Kirbed (have an offset crook, and coated against corrosion, usually with a blueing material, but sometimes they are tinned or bronzed. Mustad™ hooks are available round the lake in Sizes 1- 20 (20=smallest), with sizes 8 – 20 being most commonly used.

A variety of lines are available. For hand lines nylon monofilament is preferred. For bottom lines multifilament of Polyethylene, Nylon or recycled twine from motor car tyres is popular.

2.4.1 Vertical hand lines

Vertical hand lines, "simple lines" are one of the most basic forms of fishing, requiring just a baited hook, a weight and a piece of line. The fishing operation takes place from any platform, usually a boat out in the lake.

In Lake Tanganyika the line used is nearly always nylon (PA) monofilament. (PE monofilament, from unravelled PE multifilament has been observed as has single strand PE film from Mealie Meal sacks). The line is stored on any convenient line holder, which can be an old float, a bit of polystyrene, a soft drink bottle, a bit of cork or a specially made line holder, usually in an H shape. The length of the line depends on the depth to be fished.

Crews of cargo vessels in Mpulungu Harbour fish with simple lines when in harbour. They just throw a baited hook on a weighted line over the side of the boat.

¹ Data from the MotoMoto Museum in M'bala

² Petit (1997) reports an almost circular hook from Zambia, on deep-set long lines for *Bagridae spp.* FPSS 1999/2000 found no such hooks

The majority of simple lines are used by fishermen from small boats, either dugout or planked. They can be found in every village on the lakeside. They are extremely common.

The gear depends on the fisherman's preference, and there are many variations on the general theme. Usually between 1 and 4 Mustad™ kirbed hooks of size 8-12 are attached on short droppers (8-15cm), and weighted with a stone or other weight tied in to the line with rubber inner tube or directly to the mainline. Sometimes lead weights are used. Old spark plugs, vehicle parts, a drill bit and bits of reinforcing rod have also been noted.

Baits observed by FPSS in 1999 and 2000 in vertical hand line fishing are:-

- Worms dug up in damp soils adjacent to the lake; a preferred bait as anyone can do this; used throughout the lake.
- Soap. This can be moulded in the hand into a ball of the appropriate size for the hook being used
 - yellow laundry soap made in Tanzania
 - blue and white laundry soap made in Tanzania
- Small chiclids, other tilapine fishes and sardines
- Barley grains (from the brewery in Bujumbura, used by fishermen off Burundian cargo boats in Mpulungu Harbour)

And as ground bait

- Brewery waste (from the Bujumbura brewery used off vessels in the harbour at Mpulungu)

Fishing takes place in all depths where fish live (up to 200m in the southern part of the lake where the oxygenated zone is deepest).

The target species depends on the depth and the substrate. Nearly all of the fish in Lake Tanganyika will accept a bait, even those usually reported to be herbivores. That said however, an individual fisherman knows at what depth and on what substrate he is going to catch a particular species, so the fishermen can target what they wish to catch.

Line fishing is selective in that very small fish will not get caught on a large hook. However there are vast numbers of hand lines, with a very large number of hook sizes available, fishing in most depths and substrates, so it is safe to assume that all carnivorous demersal species at most stages of their life cycles are being caught.

Hand lines contribute to the general fishing effort round the lake. In highly populated areas there are many hand lines, and their catches are probably contributory to the decline in numbers of fish in these areas.

2.4.2 Pole and line

Pole and line fishing is ubiquitous in inhabited reaches of the coastline of the lake and throughout Zambia.

The gear is used by male children of school age, many of whom are not attending school for one reason or another. During school holidays there is a noticeable increase in the number of pole and line fishers, indicating that many fishers do actually attend school when it is term time. Some young adults also pole and line fish.

The pole is about a metre and usually of wood. The line is up to 10 times the length of the pole and the hook (s) is launched by swinging it round the head (sometimes to one side of the body) and releasing it. (See a typical example from Zambia in Gear Plan 1). The pole is used as a striking device, increasing the length of the hand, and serves to jerk the fish out of the water and onto the shore behind. It can also be used to jerk the line, especially if unbaited hooks are being used, to give some action to the hook and attract the fish. It is also used as a storage device for the line.

The crews of some Congolese refugee cargo boats, fishing from the wharves and their boats in Mpulungu harbour³, use as line holders and poles, sticks cut from nearby trees with nails or pegs in them, the line being strung round the nails/pegs. These sticks are sometimes decorated with ornate designs. They are also used to cast or retrieve the hook. The length of the line however is far greater than other pole and line examples, and reflects the fact that they are fishing with the gear in various locations, and off the boats themselves, quite far up from the water.

The best areas for fishing are close to “features”; the margins of reed beds, clear areas in weedy areas, paddy fields, wharves and harbours (where accessible) and in the small streams that run into the lake. However many villages do not have such features, so the children just fish in the margins.

The species composition of the catch depends on the substrate being fished.

As a general rule it seems that the catch volume is dictated by quantity required rather than time or quantity available. A fisherman will continue to fish until enough fish has been caught to satisfy the requirements of the day. Typically the catch is between 300 and 500 grammes, and presumably this is considered enough to feed the average family, or provide the necessary proteinaceous addition to the menu for the day. The catch is taken home and cooked whole, usually fried, and though small in weight is important to the diet of many marginal households.

2.4.3 Vertical hand line, jigging (epipelagic and littoral)

Many fishermen use jugged vertical hand lines to catch pelagic fish in the surface layers of the lake, or in shallow water. The fish see the moving hook, and mistaking it for prey bite at it and are hooked so they cannot escape.

The line for a sardine jigging line is monofilament, of varying sizes, but typically 0.7mmØ; with a lead or stone weight, though spark plugs and engine parts are also used. Up to 18 Kirby hooks size 14 - 16 are attached, on 5-8cm droppers at 12-18cm spacing. The hooks are completely bare. The line is let over the side of a boat in the epipelagic zone and jugged until fish are caught. The depth that fishing is done depends on trial and error, finding where the fish are, but is more than 8 meters, down to 20m. In the littoral zone it is jugged just above the bottom, in water of up to 30m.

Once the line is at the appropriate depth the line is jugged up and down with the hand, until fish are felt to be attached, after which it is retrieved into the boat and the fish removed.

Epipelagic jigging is done in the day and the target is *Limnothrissa miodon*. Fishing occurs in the late afternoon and early morning, when the fish [presumably] are aggregated in the epipelagic zone, (Coulter 1991). Evening fishing ceases when the light intensity reduces with the onset of night (the fish cannot see the hook ?); and morning fishing when the sun rises and the schools disperse to the depths. Thus the period available for epipelagic fishing is very limited.

Sardines do not aggregate everywhere, nor at full moon, and can be difficult to locate. As a result only really experienced fishermen go out fishing just for *L miodon*. Most fishermen go fishing with baited vertical hand lines, and if a *L miodon* is captured on one of the larger hooks of the vertical hand line on the way up from the bottom, the fisherman will immediately swap to his smaller hooked sardine jigging line and start fishing for sardines instead. Some fishermen just use their bottom vertical hand line to jig for sardines, but the two gears have different numbers of hooks on them, and of different sizes of hooks; the vertical hand line for bottom species thus not being an effective way of catching *Limnothrissa miodon*.

³ Mpulungu Harbour is officially a no fishing zone

Because of the size of *Limnothrissa miodon*, and the limited time available for catching them, catches are not large. Even pulling in 6 to 8 fish with each haul, and hauling every 2 minutes, in an hour one has only caught 210 fish – a small bucket full.

In the littoral zone jigging without bait is also widely practised. The target is *S tanganyicae* and any other carnivorous demersal fishes, such as *Bathybates ferox*. The line is let to the bottom and then retrieved far enough that on the “down” cycle of the jigging movement the weight reaches to just above the bottom. The gear is a standard vertical hand line, used to jig instead of with bait.

The boat used is typically a one or two man planked canoe, paddle powered and with perhaps a sail. Dugout canoes are also used. This type of fishing occurs throughout the lake. Exact catch figures are unavailable. The method is small scale and does not much threaten the stocks or biodiversity generally.

2.4.4 Vertical hand line, jigging, unbaited (Mesopelagic)

This method of catching *Luciolates stappersii* is widely practised in the SW arm of the Zambian part of the lake (with a depth of more than 250m), and in the SE arm where deep water is reasonably close to the shore.

The gear used in Zambia is a nylon monofilament of diameter of 0.8mm. 16 hooks are placed on a line of more than 150m. The gear is jigged at depths of between 100 and 150m, in the mesopelagic zone. Fishing is done during the early morning daylight hours. There are typically two people per boat, but single handed canoes are not uncommon. Zambian boats leave the village at 3.00am and return at 10.00am. The boats catch significantly less *L stappersii* than in other parts of the lake, but fishermen take the opportunity to use the same gear to fish for *L mariae* at great depth, using whole small littoral fish as bait (the gear is then not jigging gear, and becomes a vertical hand line). Their catch is a mix of *L stappersii* and, from the deep bottom fishing, *L mariae*, all of which is smoked.

The boats used in Zambia are small, 5 – 6m, planked with frames. There is no sail.

This method (mesopelagic jigging) is only targeting *Luciolates stappersii* and as such is not considered to be a threat to biodiversity.

2.4.5 Bottom set long lines

The fishing principle in all bottom set long lines is that a long line is laid along the bottom. Attached to this long line are shorter branch lines with baited hooks on. The fish takes the hook and cannot get off. In Zambia the mainline and the branch lines are usually, but by no means always, monofilament of the same breaking strain.

The hook size varies with the target species and substrate. No two long lines round the lake are the same. The line is weighted at each end with a stone or iron vehicle part. A float, usually of bark or polystyrene, though sometimes of wood, is attached to one end, with enough spare line to reach the surface from the bottom.

The fisherman chooses his fishing area using his experience of where there are no snags and there is a likelihood of a good catch. After a period (soak time) the line is hauled and any fish that have been hooked retrieved. This period depends on location, but typically lines are set in the evening and retrieved in the morning. They are then taken home, repaired if necessary, (sometimes rebaited at home), and then reset again in the evening. Some fishermen fishing offshore for large catfish and *Luciolates angustifrons* use a gaff made of reinforcing rod to assist them to bring the fish into the boat.

The baits that have been seen used by long line operators include:-

- Worms, dug from the lake shore

- Soap. This can be moulded in the hand into a ball of the appropriate size for the hook being used
 - yellow laundry soap made in Tanzania
 - blue and white laundry soap made in Tanzania
- Sardines
- If a fisherman wishes to catch lake turtles (a protected species), the lines should be baited with meat, preferably beef, but goat will serve.

When not in use or for hauling and shooting the gear, the lines are stored in any available container. Old wooden fish boxes are popular, but half plastic 20 litre jerry cans, old cooking pots and even half plastic footballs have all been noted.

A boat is needed to set the line. These are usually the common planked paddling boats with frames of between 4.5 and 6 meters that are found in abundance round the lake. Dugout canoes can also be used.

One fisherman is all that is needed to shoot and haul a long line. Thus most boats only have one fisherman on board. Sometimes however, especially if another fishing method is to be used on the same trip, two people occupy the boat.

The target species are large tilapine fishes including *Boulengerochromis microlepis*, catfish, *Bathybates sp* and *Luciolates angustifrons* and *L. mariae*. These find a ready market fresh among the relatively affluent commercial class in towns, can be smoked, and can also, of course, be consumed by the fisherman and his family.

Given the size of the hooks commonly used in the fishery, the majority of the small chichlids (<15cm) and small tilapine fishes would not be caught.

2.4.6 Staked lines

A staked line is a set line with one hook, anchored firmly to a stake with the baited hook in the water. The line is unattended.

Of interest is that one example of this gear was observed which employed a twine made from the strands of film polyethylene from mealie meal sacks. Three strands are woven together and the twine is knotted together every 20 – 30 cm to allow a longer twine to be constructed than just that of the length of the film polyethylene. The resultant strand of twine is between two (2) to four (4) metres in length and is tied to a pole stuck firmly in the reed bank.

The hooks of size number 6 are preferred. The target and catch are *Clarias sp*.

In the Lufubu River, at a fishing camp approximately one kilometre upstream from the lake, the Zambian FPSS team found a staked line. Unfortunately a return visit to re-check the gear and measure and photograph it was unsuccessful as the National Parks Authority had ejected all the fishermen from the banks of the Lufubu in that area, and burned to the ground their fishing camps. The remains of one staked line was observed, stuck forlornly into the bank at the site of an old fishing camp; this one was employing a Polyethylene 280d/15 multifilament as the mainline, but most of the line was lost and there was no end tackle.

One can conclude that at least two of these gears were operating in the Lufubu River until the end of 1999.

2.4.7 Sport fishing

Sport fishing is included here because

- It is permitted in Nsumbu National Park, on payment of the appropriate fee.
- It is one way in which Lake Tanganyika's aquatic biodiversity can generate international currency for National Parks, thus contributing economically to conservation.

Sport fishermen use the following methods on the lake (nearly always with a rod and line to control the end tackle and store the line)

- Epi pelagic trolling
- Demersal trolling
- Vertical bottom line with baited hooks
- Mid water vertical line fishing with baited hooks and float
- Dead baiting (using a whole dead fish as bait in one of the practices above)
- Live baiting (using a whole live fish, usually trolled or on a vertical line)
- Fly fishing

Sport fishermen are in reality very inefficient fishermen, being prepared to spend relatively vast sums on very low returns, the catch merely serving to enhance the fisherman's self-esteem. The catch is minimal in quantity and of mature fish. The variety of the gears used to achieve this meagre return reflects their large budgets, imagination and vanity more than their actual fishing needs. As sports-fishermen know, fancy gear catches fishermen, not fish.

The target fish are *Luciolates angustifrons* and *Hydrocynus goliath*, the giant tiger-fish, though the latter is rare and difficult to catch. Fishermen also feel fulfilled with the capture of the "English fish", *Boulengerochromis microlepis*, and of particular rarity and attraction to sport fishermen at Nsumbu is the presence in Nkamba Bay of the fabled "Golden" Nile Perch of Lake Tanganyika, several examples of which can be seen affixed to the walls of the lodges. This is a local variety of *Luciolates angustifrons* which is golden yellow when alive. The colour fades rapidly on death. Not many are captured.

Once a year the Zambia National Game Fishing Competition is held and the lodges are full for two weeks. At Christmas and Easter the lodges are also full.

The sport fishery in Nsumbu National Park in Zambia is a commercial enterprise, in that the lodges charge visitors, most of whom fly in from The Republic of South Africa, for the pleasure of persecuting the stocks of the national park with rod and line. The lodges materially assist the National Park authorities in their efforts to stop fishing in the protected parts of the lake. It is in the interests of the lodges that the fish are preserved, for Nsumbu is poor in four footed game and a long way from anywhere. Without fish there would be few visitors. In addition to paying the lodges the fishermen pay ZK5000/day to the park authorities⁴.

Whilst the catch of sport fishermen does not much affect biodiversity, sport fishing is the mainstay of the 2 lodges located in Nsumbu, and through them provides employment and income to the local populations. It is revenues from the fishing visitors that help protect the reserves' lake resources, and so in this manner sport fishing actually protects biodiversity.

2.5 Traps

2.5.1 Bottom set non return traps

The principle of non return trap fishing is that the fish enter the trap voluntarily and then are unable to find their way out due to a device which stops them exiting.

Reeds are used to make non return traps in the Kalambo River region of Zambia/Tanzania and Rattan woven traps also exist (usually without non return device and probably not actually in the Lake itself). Congolese refugees on cargo boats in Mpulungu Harbour use wire. Variations in individual construction abound. The non-return traps in the Zambia section of the Lake are very different from those in the Burundi/Congo frontier area, in the Ruzisi Delta, being more closely woven in reed, and longer relative to their width.

The entrance to the commonest type of non return trap found in Zambia is not central. The fish have to swim upwards, into the funnel of the non return device, and then once they have

⁴ A trifling sum compared to the price of transport to and a night in the lodge with drinks and meals.

passed through the funnel, drop down into the body of the trap. They then do not swim up, to the entrance of the trap which is near the top, to try and escape. When the time comes to remove the fish the fisherman removes the trap from the water, turns the trap upside down and removes the fish by hand.

The wire traps made by Congolese in Mpulungu have a central entrance.

The traps are usually, but by no means always, checked every 24 hours. They can be left for days, since the fish do not escape and do not die and spoil. The target species are catfish and tilapine fishes.

Bait is often used. In streams where there is one approach, and the trap fills this approach, then bait is not necessary. In reedy areas and swamps balls of cooked manioc or maize flour are used. Where it is available brewing waste is preferred. Fish itself is rarely used.

The catch is alive when collected and is also very saleable, because of its freshness and size.

2.5.2 Pelagic non-return fish traps

Near Kabyolwe village, on the border of Nsumbu Game Reserve in Zambia, approx 2 km East of the village; the FPSS in 1999 found a Pelagic fish trap. This was situated about 120 meters offshore from a rocky shore in a small bay. Under a very large float made of about 20 sticks (~9-12cm Ø and 1.4m long) was strung 4 yards (3.68m) under water, by two ropes of liana, a large three chambered trap. The trap was attached to the bottom, this being in 45 yards (41.4m) of water depth, the weight being a large stone, and the rope being further lengths of liana.

The trap was made of wicker work, bamboo lattice work bound with bark lashings, with square meshes of about 10cm x 15 cm. The whole appears to have been made of 3 baskets woven together with the mouths of each basket joined in the middle. Thus the trap was three chambered. Each chamber was approximately 1.6m long by 85cm round. One end of each chamber was woven over in the manner of a basket.

Where the three baskets were connected together the triangular gap in the uppermost side had been woven over and there was attached to the middle a bunch of grass and the liana ropes to the float. On the underside the entrance is woven so as to be circular. The rope to the weight is attached to the side of the entrance. Inside the "foyer" of the trap are three non return entrances, made of sharpened sticks, one for each of the three chambers (or baskets) of the trap. Inside the trap were 9 large(8-12 kg) *Dinotopterus cunningtoni*, a large catfish, eight in one chamber and one in another. The third chamber had been broken into and the fish inside stolen. The trap had been there from Sunday to Tuesday, two days soak time.

The mode of operation is that the trap is placed in a likely place, and the fish arrive. They, despite being catfish, and bottom lovers who usually live amongst big stones, swim up the rope to the trap, and enter it. The fisherman supposed that this was because they liked the shade created by the trap and the grass on top. The grass on the top of the trap had been put there to increase the shade. The fish are removed from the three discrete chambers through a small patch in the wickerwork at the top of each chamber, which has to be undone each time for the purpose. The fisherman uses a spear to remove the fish, though the spear was not available for inspection.

The fisherman reported that there used to be a lot of this type of trap in Zambia, but only a few people now knew how to make them and they were dying out. Two others in addition to the one at Kabyolwe were recorded in the water off Chisanza village in the SE Arm in Jan 2000. There are now perhaps 4 or 5 in the country. They last 6 months and the rainy season is the best time to use them.

They are very rare gear, but seem to be very efficient at catching adult *Dinotopterus cunningtoni*. Were there a large number of them, they may pose a threat to this species, but given that they are so rare, they are more a curiosity than a threat to biodiversity.

These traps (two chambered but otherwise similar) are described in a report by the Game and Fisheries Department of Zambia in 1965⁵ as such:-

The Chisowe is a basket trap with three sections. A central hall section, easily entered by fish, leads off by funnels into two side sections, which are said not to be baited. The trap operates either on the bottom or in mid water. Fish are said to swim up the anchor rope for an unknown reason and enter the trap. This trap catches Dinotopterus exclusively.

This method of fishing also has a tradition of fishing attached to it. Persons using this method are apparently unable to shake hands for if they do the victim will die and will thereafter drive fish into the trap for the fisherman.

2.5.3 Tubular traps

Tubular traps restrain the catch by the pressure of the water flow restricting the fishes ability to swim out of the trap.

The method requires quite a strong current or a fish weir to increase the current. Near the lake, only one tubular trap was found on the Zambian side of the Kalambo river in Zambia.

This tubular trap without non return device ,set in one of the side streams of the river in the valley of the Kalambo, approx 2 km upstream from the lake. A barrier of stones is placed across the stream and in the middle is placed a tubular trap. The fish are thus directed down the trap. The fish enter and cannot return or escape due to the strength of the flow of water into the trap.

The trap is conical, 1.60cm long and 40cm wide at the mouth. The trap tapers down to the other "thin" end where the reeds of which it is made are tied together. The reeds are fastened to a circular wooden hoop (of Ø 2cm wood) at the open end with strips of bark. There is only one hoop, about 5 cm from the entrance. The reeds are fastened together further down the net 6 further times with bark lashings, though there are no further supporting hoops. Through the base of the trap, 10cm back from the entrance, is thrust a 105cm pole of wood, 35cm sticking out each side of the trap. This is used to jam the trap into the stones that make up the guide/barrier in the stream.

During the dry season the fish down the river towards the lake and are caught in the trap facing upstream. In the wet season large numbers of traps are placed facing downstream, to catch fish migrating up the river. These have a non return device but are otherwise similar.

Several others examples of this kind of trap (some with non return devices) were observed by the FPSS in 1999/2000, but never in situ. They were always being used as decorations in Hotels and Lodges.

2.5.4 Labyrinth traps

A barrier/labyrinth trap catches fish by them entering the trap voluntarily and then not being able to find their way out. The fish are guided into the trap by the sides of the trap which often have fences attached to them (not in Lake Tanganyika).

A simple labyrinth trap was found in the reed beds at the mouth of the Kalambo river in Zambia. This is a wet season gear and there would typically be 6 or 8 of these constructed in the wet season. The trap was V shaped, made of reeds and with each arm of the V 308cm long on the outside. The entrance was 6cm wide at the base of the V., (see Gear Plan 2).

⁵ Republic of Zambia. Ministry of Lands and Natural Resources. Game and Fisheries Department (1965) Fisheries Research Bulletin 1963-64.

Another labyrinth trap, a heart shaped one was observed in Kapata village, Chituta Bay, Zambia. It was reported that in the middle of the wet season, about 6 were built in the village. The trap is built in a channel in a reed bed. It is made of a sheet of reeds, held together with rubberised nylon multifilament twine of approx 1.0mm Ø removed from worn out car tyres. The reed wall is supported by 9 wooden posts driven into the mud of the reed bed, and attached to the reed wall with further lengths of rubberised nylon from car tyres. From above, in plan view, the trap is heart shaped (♥) with the entrance to the trap being in the bottom of the V of the top of the heart shape. The opening is restricted to the bottom 10cm of the reed wall, and is relatively small, being about 5 cm across at the widest. The trap is built so that the entrance faces towards the main body of the lake, so the trap catches fish entering the reed bed from the lake. (To breed ?). The reeds used for the reed wall are approximately 1.8 meters long (including the sections under the water and stuck in the mud), and the posts used to hold the structure up are 1m – 1.20m long. The trap itself is 1.6m long and 1.2 metres wide.

These traps are wet season traps, particularly effective when the water level has risen from its dry season low. The target species are *Clarias sp* and Tilapine species. Ten kilos in 24 hours is a good catch. The fish are removed from the trap using a small scoop net. Some theft of fish from these traps is reported.

2.5.5 Fish fences and fish weirs

Fish fences and fish weirs are usually associated with fish traps, or some method of restraining the fish once it has passed over or through the weir, or been herded by the fish fence.

Three fish fences and weirs have been noted by FPSS 1999/2000 in Zambia. These are:-

- A fish fence on the Lunzua river, at Simumbele village upstream from Kapata village near Mpulungu. This was seen in the dry season, (October 1999), when the stream was low, and was a remnant of the fence built in the wet season of early 1999. Exactly how this fence worked is hazy, but it presumably is used in association with woven rattan type tubular traps, common in the interior of Zambia.
- A similar type of weir was reported (early Jan 2000) to be placed on the upstream Lufubu ("where the water runs fast") several miles upstream from Kabyolwe village. The weir blocks the river completely, and raises the level of the water upstream of the weir by (in this case) about 15cm above the downstream side. The water flow is directed through three sluices, each of which is blocked with a tubular trap, (which filters all but the smallest fishes). This weir/trap construction was said to be the cause of a complete absence of fish from the upper reaches of the Lufubu, and was destroyed in late January 2000 by the National Parks Authority, as it was operating in the Nsumbu National Park.
- In the Kalambo a tubular trap in conjunction with a barrier (fence) of stones was noted and is described above.

The weirs on the Zambian part of the lake are said to target *Alestes sp* and *Clarias spp*.

Where fish weirs block off the whole water flow, and filter all the fish passing down the river into traps, they pose a serious threat to the populations of fish in the rivers where they are placed. Several species travel up rivers to breed, or travel from rivers to the lake. All of these would be filtered by the weirs and traps on their journeys down the river to the lake. In any legislation that may be enacted in response to concerns on overfishing or biodiversity, the use of fish weirs in conjunction with traps should be included.

2.6 Bag nets

The principle is that the fish are filtered from the water by the mesh of the net, which is swept through the water.

2.6.1 Scoop net (hand operated)

Scoop nets are used in the reed beds of Zambia. The hoop is about 35cm diameter with a mesh of approximately one inch made of 210d/30 and used in the wet season for the capture of *Clarias sp.* The fish are seen before capture. The FPSS in 1999 found one example, in Chituta bay, which because of the dry season was not in use and in bad repair.

2.7 Seine nets

A seine net sweeps an area. The fish are typically herded into the path of the net by draw lines which increases the area affected by the seine. Beach seine nets concentrate the fish against a beach, and may have a bag into which the fish are further concentrated.

2.7.1 Beach seine (day)

The principle behind a beach seine is that an area of the lake off the beach is enclosed by the net and the draw lines, which are paid out from a boat. The boat returns to the beach and the draw lines on each side are then hauled in by manpower which concentrates the fish in the path of the net section in a herding action. Eventually the draw lines are completely hauled in and only the net is left in the water, with the fish concentrated in it. Then the two wings of the seine are hauled and the fish are further concentrated into the centre of the net. This central section of the net is then pulled up onto the beach and the fish removed.⁶

Sometimes the boat is used to provide extra floatation to the bunt of the net, particularly if a bag is incorporated in the net design.

In many areas the seine is not operated on one beach only, but is very mobile, the boat and haulers moving from beach to beach, up and down the coastline, fishing wherever possible.

On Lake Tanganyika there is no mechanisation of the hauling and manpower has to be collected in sufficient numbers to operate the gear. A minimum of 6 people are needed on the small seines, but some of the larger seines may require up to 20. In urban or village settings there is nearly always a large crowd looking on and willing to assist for the chance of a few free fish.

The beach seines on the lake are very basic pieces of equipment. They are very large though and they catch a lot of fish. Typically they are about 80m long and have rope draw lines of about 200m each side. Large ones may be 250m with up to 1.5 km of draw line on each side⁷. A typical example from Zambia is illustrated in Net Plan 3.

A beach seine can only be operated from a beach or over mud, as the groundrope slides over the bottom and hitches on any obstruction. Also they are habitually used in the littoral and sub-littoral, as this is the area nearest to the beach. They are used all year round, and day and night, but usually during the day. Ownership of a beach seine is usually by an individual; they are in principle expensive to make. The owner may not even be a fisherman, merely a business man. The crew are then hired in. Sometimes families or co-operating groups of people (usually related) own a seine and it is operated by a larger group, the extra hands being either close relatives, friends or passers by. The ownership and operation of a Beach Seine in Zambia is described in Petit (1997)

In Zambia the nets are really tatty, as there are very few sources of net; the operators of beach seines rely on the industrial fishing companies for all their supplies of netting. The companies sell off old nets or surplus nets, sometimes by the kilo, and these are bought and used to make and repair the Zambian beach seines. Since the fishermen cannot control what netting is available, they take what they can and shoot panels into the net when and where

⁶ Note that with a beach seine an **area** of shallow water is swept, unlike purse seines, which sweep a chosen **volume** of water.

⁷ Petit (1997) reports a beach seine net in Zambia with 2 km draw lines.

appropriate. The Zambian beach seines, with different mesh sizes and colours of netting, come to look like a patchwork quilt.

The catch from the beach seines is comprised of littoral fish (the littoral is where they are operated). Any fish that gets in the way of a seine is caught; since the bunt or bag is usually 8 or 10mm mesh little escapes. The net is towed over the bottom all the way in from the position where it is shot. Catches vary considerably depending on the amount of fishing that has been going on on the beach being used. More beach seining means fewer fish (as would be expected) and virgin grounds (such as encountered by poachers in the National Parks) can yield up to 600 kilos in one haul (with many mature fish).

In Zambia beach seines are banned everywhere except on Lake Tanganyika.

2.7.2 Light assisted beach seine

Whilst in theory any seine can be used at night, using lamps to attract the fish to the area to be swept and into the path of the net as it is pulled in, is a distinct method and there are seines developed to do this specially. The target fish are sardines, prawns and immature sardine and the mesh of the wings of the nets are correspondingly low (~6-8mm), as compared to a standard "day" beach seine (~20-35mm).

In Zambia according to Petit (1997):-

Light boats leave the shore at dusk, gather fish and come back to the inshore zone where the beach seine is cast. They aim at catching Clupeids. The nets are made of stretched meshes of 10 and 8 mm mostly, the one used widely round the Lake for the lift-net. The difference is the intensive use of mosquito nets for the pocket or even for the net. In Chituta, one seine was nearly made only of mosquito net.

In Zambia in 1999, at a village called Kasisi near Mpulungu the nets observed by FPSS were constructed of a variety of mesh sizes and mesh type, including "Mojji" circular mesh netting. Many panels of irregular shapes are stitched together. In the wings the mesh sizes are larger, of 45mm and 35mm stretched mesh nylon knotless netting. The mesh sizes reduce towards the central bunt, with panels of 10mm, 8mm and 6mm being employed. In the bunt itself mosquito netting is used, with some panels of sheet nylon, probably nylon bed sheets from the local second hand clothes stores, of "0"mm mesh size⁸. There are no gaps, and even phytoplankton would be caught. All the other netting was knotless except the 35mm and 45mm in the wings. All the netting except the nylon sheets and mosquito netting was sourced from the Purse Seine companies who sell off old nets. Ropes were a variety of sizes, 12 – 14mm polypropylene being the dominant type in this seine. This is sourced from purse seine companies also. Floats were of various sizes, plastic doughnut shape with hole larger than headline. Weights were irregular shaped rocks (~750gms) from the nearby hill (thus prismatic as this is the crystalline structure in the region) attached to the footrope by a 15cm dropper of bark rope. The draw lines were polypropylene rope of 12mm, 90m and 80m long. No wooden wing spreader is used on this net. (The other two seines in the village had spreaders). The net floats and only touches the bottom when it gets near to the shore and a by-catch of littoral species are caught then.

These seines are sometimes used during the day if a sardine shoal is observed passing by and are on occasion used during the day (though not in Kasisi village) to catch mixed littoral fishes. Of course with these small mesh nets little escapes.

One owner employs others to assist with the hauling, for a small monetary reward. (detailed in Petit 1997 for Nsumbu area of Zambia) Fish is sold fresh (or dried if a large amount) locally. The catch, as evidenced by what is laid out drying in Kasisi, is immature sardines and small prawns. The nets in this village are very poor quality and made up of so many panels and different sizes of mesh that a proper net plan could not be attempted.

⁸ Netting less than 8mm is illegal in seines in Zambia. This seine was less than 400m from Fisheries Department Mpulungu

The catch varies considerably, with moon phase, season, and turbidity. Recently in some Zambian areas of the lake catches from light assisted beach seines have been so low that the owners have given up and gone into farming and trading. Petit (1997) reports catches of 2 – 5 kilos per haul. Not enough to cover the kerosene used in the lights.

The lamps used by fishermen are not all on boats, and many are just kerosene pressure lamps on floats. This enables a light boat to have more than one set of lights, which increases the light boats effectiveness.

In Zambia, sometimes the fish do not follow the light boats into the shallow water near the beach and the beach seine operators are in a bit of a pickle. They cannot beach seine the light attracted sardines. When this happens frequently the fishermen will modify their beach seine to make a small shallow water purse seine, so as to be able to reach their prey. This modified beach seine is called a “mutobi” in Zambia.

2.8 Surrounding nets

2.8.1 Industrial purse seine

Industrial purse seining has been much studied by the Research for the Management of the Fisheries on Lake Tanganyika. A FINNIDA/FAO project, and a serious student of the industry would be best advised to study their reports in depth.

A simple description of the industrial fishery method and gear, with a net plan, is given by Andrianos, E (1976). Not much has changed, the fishing operators being a conservative lot. If anything the nets have become simpler, though many of the vessels have now been equipped with power blocks to assist hauling the net.

The industry used to be based in Burundi, but moved to Zambia during the 1980s and early 1990s as it became increasing unprofitable to operate in the North of the lake.

In Mpulungu the boats, towing between 2 and 6 light boats, leave port in the late afternoon and steam to the fishing grounds (which in late 1999 were about 30 miles North West of Mpulungu). Once there the seiner illuminates its fish attracting lights. If any fish are aggregated then the fishing operation starts. If not the boat moves on and tries again. Once fish are found then the light boats are released, and start up their own attraction lights (generator powered). The seiner also illuminates its lights. After a period, dependant on the moon and the whim of the captain, two of the light boats move to the seiner. The seiner turns off its main lights and the fish attracted to the seiners lights remains with the light boats. The seiner then shoots the purse seine round the two light boats, purses it and retrieves the net using a hydraulic power block and electric winches, operated by the skipper and 7-8 men. Some older boats without power blocks used a two boat system and more extensive manpower to haul the net.

The catch is between nothing and 4 tonnes, typically 200-400 kg, and is bought aboard using a brail. The operation is then repeated with the other light boats. Up to 4 hauls can be made in a night, particularly by the boats equipped with a net hauler. Just before dawn the boats head home, arriving in port sometime after 8.00am. In 1999 the boats averaged less than 750kg per trip over the year.

The boats stop operating for 4-6 days over the full moon period, as the fish are not aggregated adequately

In December 1999 there were 29 vessels registered in Zambia, with thirteen operating regularly in Zambian waters from Mpulungu. A further 6 vessels operated by two companies were based near Nsumbo village in the SW arm. Some vessels were registered to fish in Congolese waters at the south of the lake, a license costing US\$1,000 per company, regardless of how many boats were being employed.

This fishery, originally targeted the pelagic sardines, *Limnothrissa miodon* and *Stolothrissa tanganicae*. The sardines made up 80% of the catch, with the majority of the balance being *Luciolates stappersii*, a predator on the sardines which presumably persecuted the sardines pelagically at night. In Zambian waters the catch in the industrial fishery in the SE arm is now (early 2000) 99.52% *Luciolates stappersii*, and 0.25% sardines *Limnothrissa miodon* and *Stolothrissa tanganicae* are caught. The balance are "others" and *Luciolates mariae* and *L angustifrons*. In the SW arm of the lake, the catch is 23% *S tanganicae* and 75% *L Stappersii*. There has thus been a dramatic drop in the sardine catch, as a proportion of the whole catch, and also in gross weight.

It is reported (R of Z DoF 1981) that the *Luciolates stappersii* sustain themselves mainly on mid water pelagic shrimps, *Palamon moorei* and *Limnocaridina parvula*, instead of sardines for most of the year in Zambian waters. Indeed quite large amounts of mid-water pelagic shrimps are caught in light assisted beach seines in Zambia in the wet season.

The *L stappersii* that feed on the *S tanganicae*, for at least some of the year, used to be predated on by the larger *Lates* species. These larger predators have just about disappeared from the catch, and it may be that the lack of predation on *L stappersii* has allowed the *L stappersii* to proliferate and their predation has reduced the sardines.

There are two further theories (Dorr 1999) regarding the cause of the decline in numbers of *Stolothrissa* in the Southern part of the lake:

- *Luciolates stappersii* feeds on *Stolothrissa* larvae and fry and has been increasing in numbers since the 1970s; the combination of fishing pressure on *Stolothrissa* plus predation by *Luciolates* caused the decline
- *Stolothrissa* is an offshore, cool-water species during adult life, average lake water temperature has risen a degree (from 23 to 24 C) in the last 20 years, therefore, temperature increases may have also contributed to its decline

Of note also is the fact that the Purse Seine fleet in Mpulungu in the SE arm has not caught any significant amount of sardines for nearly 5 years. One would expect that if the decline in the sardine catch is due to fishing then the stocks would have recovered to some extent in the meantime, but this seems not to have occurred.

Local fishermen still catch significant amounts of *Stolothrissa tanganicae* using Chiromila seines⁹ in inshore waters near Nsumbu in the SW arm of the Southern lake, as do the Purse seine fleets based there.

In addition to changes in catch composition the industrial catch has declined from about 6000 tonnes per year in 1992 to 4,000 tonnes per year in 1998. It should be noted that this is less than 4% of the total catch from the lake.

Exactly what has occurred over the last 8-12 years in Zambia regarding the relative abundance and the predator prey relationships between *Luciolates stappersii* and the sardines and prawns is unclear. However it is obvious that a fundamental change has occurred.

Mpulungu is regarded by the Zambian public as a fishing port on Lake Tanganyika. Justifiably so. The purse seine industry is the major employer in Mpulungu. Each vessel has a crew of 12-15 and there are 13 -15 vessels operating nightly – more than 150 employees directly employed in the catching operation. No less than a hundred and fifty more are employed as workers and casual labour by the companies, in the freezing and processing of the catch, its marketing and transport. In addition more than 200 men and women rely on the fishing companies to sell them surplus catch for resale, or for the crew share to provide income to the households through sales. For a lacustrine town of 16,000 people to have nearly 500 wage earners (3% of the total population, and possibly up to 20% of those with wage earnings of any sort) in the purse seine fishing industry makes it a most important industry and employer in the town, and a backbone of the urban economy. This immense contribution to the economic well

⁹ Ring nets

being of this remote and underdeveloped region should not be overlooked in the haste of inadequately informed "conservationists" to condemn the industry for supposed, but not proven, overfishing of the sardines.

2.8.2 Shallow water purse seine

The shallow water purse seine is a beach seine for sardines, modified for use in shallow water when the fish do not follow the light boats to the shore, and so cannot be trapped by a conventional beach seine. It is only found commonly in Zambia. The fish will not come in close to the shore if they can see the bottom, which occurs when there is a combination of effects; the moon providing light and the water being particularly clear.

In essence the net is the same as a light assisted beach seine for sardines, as used throughout the lake. The net is modified by the addition of rings along the footrope and a line of the beach seine is used as a pursing line through these rings. The net is then shot in water away from the beach and pursed as in a purse seine, round the light boats that have aggregated the fish. The water that this can be used in is not deep, as the net is relatively small, both in depth and length, so cannot be used in open water.

The method catches the same target fish as a night operated beach seine targeting sardines.

2.8.3 Ring nets

A Chiromila seine is a ring net. A hybrid between a lampara net and a purse seine. The net is pictured in the FAO Catalogue of Small Scale Fishing Gears and described in Coulter (1992). There is confusion over the name, with various authors calling it a seine or a purse seine. It is here called a ring net because it is one. It is only used in Zambia, and targets sardines in open water.

Petit (1997) describes its use as such:-

Light boats leave the shore with dusk and their owners generally work with one precise net. Generally after 22.00, the boat carrying the crew and the net (often a boat formally used to carry a purse seine is reconverted into a Chilimira fishing unit) leaves the shore and roams among the light boats until the captain chooses one to make the haul, then the next one, etc. Net pullers are generally 12-14, so more than for Kapenta seines (8-10) as the Chirimila net is bigger and heavier than a Kapenta seine. The catch is shared half for the net owner and half for the owner of the light boat. Agreements between the net owner and the net puller vary but generally, once deducted the costs (Chilimira boats have an outboard engine), half the profit remaining is due to the crew. Crew members reported that they were happy with the income "in the past" but those have decreased to very low shares following several years of bad catches.

In Nsumbu or Kasakalawe, most of the Chilimira were belonging to traders and not to farmers, as they are expensive. The SS have shown that Chilimira and light boats owners make considerable profits during good years but crew members are among the lowest labourers in the fishing community.

Raw data for 9 months in 1999 from Nsumbu in the SW arm (unpublished from DOF in Mpulungu) shows:-

- Boats fish 266 days per year (Extrapolated figure)
- Average catch 359 kg/day
- Average 3.76 light boats each. Range 2 - 7
- Average 3.6 draws per night. Range 2 – 6
- Average catch per draw ~ 100kg
- Extrapolated catch per unit per year. 95.5 tonnes
- ~16 seines in Zambia ~ 1500 tonnes per year

The nets are the basis of the sardine fishing industry in the Nsumbu region and contribute immensely to the economy there.

2.8.4 Underwater seine (aquarium fish trade)

This net is a vary simple piece of 4mm knotless netting which is used only in the Aquarium fish trade in Zambia. The width and length of the net were not recorded by FPSS as no nets were available to be measured. The net is set under water at a depth of 40m in a curved form. Two divers or more go down and drive the fish into the net. The fish are trapped by the net and removed with a scoop net. When the fish is captured it is kept in a 200 litre plastic container which has small holes drilled in it and is covered with a piece of 10mm netting on the mouth. This container is used to store the fish in deep water and to decompress them.

The species targeted are:-

Cyphlotilapia frontosa

Benthochromis tricot

Greenwoodochromis sp

Gnathochromis sp

and other related species

Divers usually fish at about 40m deep. They do sometimes go down to 70m deep, and given that there are no decompression facilities anywhere near Lake Tanganyika, mortalities among the fishermen are to be expected.

This is really a very minor activity in the scheme of things. The Aquarium fish trade does not seem to be flourishing, and the numbers of fish being extracted are very small compared to what is being removed by other fishermen using other gears.

There are rumours of the breeding programmes of Lake Tanganyika chichlids in the USA, which would seriously reduce the profitability of live fish exports from the region, as the breeding programmes are aimed at those fish with the highest value. Similarly modern techniques of cloning may pose a serious threat to the livelihood of the wild fish collectors.

2.9 Lift nets

A lift net is a sheet of netting, or shaped bag of netting, placed under the water and lifted up when fish swim voluntarily between the net and the surface.

This gear is not covered in detail here as only one lift net was observed by FPSS in Zambia in 1999/2000, and that was owned by an expatriate bar owner and bon-viveur. In May 2000, the LTR project reported five lift nets operating in Zambia (Reynolds, pers. com.). There do not seem to be enough sardines about to justify their high running costs. Zambian fishermen tend to use ring nets and light assisted beach seines in any case.

2.10 Gill nets

The principle of the gill net is that the fish swims into the net and is caught by its head, on the gill covers, in a mesh. There are a variety of types, but in all the catching principle is the same. Even those gill nets typically called "encircling" rely on the fish getting trapped in the mesh of the net. (Some large fish are also caught incidentally in encircling gill nets, and are not gilled, but these are the minority of the catch). In general therefore the size of the fish that will be caught is related to the size of the mesh of the net, in that a fish with a big head will not be able to get its head and gills stuck in a small mesh; and a small fish will merely swim through a large mesh.

In Zambia on Lake Tanganyika most gillnets are bought in local markets and stores. The main source of origin is China. Most Zambian nets come into the country from Tanzania.

Gill nets are nearly always set from boats. The preferred substrate is flat, either rock, shingle, sand, or mud. The edges of reed beds are preferred if reed beds are available. Gill nets are also used in rice paddies, swamps and feeder streams. Anywhere where the net is likely to be caught up and damaged is avoided. In suitable substrates in Zambia, such as Chituta Bay, they are very common.

All gill nets observed are made from nylon multifilament, usually 210d/2 210d/4 or 210d/6. The headropes and footropes are usually the same material as the net, though some have 210d/15, (See net plans 15, 16, 17 and 18) A variety of float materials are used, depending on mesh size (and hence depth of net). Larger nets tend to have cork or plastic floats, whereas very small nets use squares of Flip Flop sandal material or bark. The weights are nearly always variously sized stones attached with inner tube or bark lashings. Floatline weights are usually pieces of vehicle, gearbox parts predominating, or larger stones. Lashings are universally strips of inner tube. Ropes are usually a sennit of recycled old netting, plaited or tied in with a series of half hitches using 210d/6 multifilament, their diameter related to the task they are to do.

2.10.1 Bottom set gill nets

There are a series of mesh sizes for set gillnets. The nets are targeting two distinct zones. The littoral demersal from the depth of the net to about 45m depth, and the deeper demersal waters offshore above the anoxic zone. The pelagic water column in the lake is not generally targeted by gill nets. In the littoral demersal the target fishes are chliclids and tilapine fishes, whereas off shore the targets are larger catfish and Nile perch. The common mesh sizes used are:-

In the littoral –	1, 1.5, 2, 2.5, and 3 inches
In the shelf areas -	5, 7, 8 and up to 11 inches

The lengths of the nets in use can be quite dramatic. Nets of 500 to 600 metres are typical and others of more than a kilometre are not infrequently found.

The nets are set from a paddled planked canoe, with two to three fishermen. With few exceptions the net is left to soak overnight, the net and the catch being collected in the morning. If there are fish merchants on the beach wishing to buy the fish then the fisherman may clean his net on the beach and sell the catch immediately (taking some for himself and his family). Alternatively, if the village is some way from the landing beach, the net and the catch may be returned to the village of the fisherman, both being fairly light, and the net cleaned there. The fisherman will also tend to mend his net at home in the village, rather than on the beach.

The choice of fishing area is typically described by the fishermen as “at random”. At random it may be, but within boundaries and limits set by the tenacity of the fisherman to paddle, depth, biotype and shipping lanes. Observation in the field reveals that small mesh (<50mm stretched mesh) gill netting is usually undertaken within a few hundred metres of the shore (otherwise it gets too deep in most places); and not more than three kilometres along the coast from the beach where the fisherman is based. The larger mesh nets are set straight out from the village, and the fishermen, from experience, have discovered the appropriate depth for their quarry, and where to find this depth. Nevertheless they paddle the minimum distance possible, the float usually still being visible in the distance from the shore. It all depends on the topography of the lake bottom at that particular village.

2.10.2 Floating gill net

The net is set across the river Lufubu with one person in a boat moving from one end to another keeping the net in position as it drifts. The net can drift many hundreds of meters down the river before being retrieved.

The fish species caught are mainly Characids, which live in tributaries and marshes.

Only one (1) drifting/floating net was recorded at Masansa fishing camp. A return visit to Masansa fishing camp to accurately measure this gear in December 1999 was unsuccessful as the National Parks Authorities had burnt down the fishing camp, since the Lufubu River is part of Nsumbu National Park, and the fishermen living there were naturally assumed to be fishing in the river.

This net would appear to be a serious threat to biodiversity in the river where it is used, to those fish travelling up or down the river for breeding purposes, or other inhabitants of the habitat. The net sweeps the whole water column in the river for a considerable distance, presumably catching all of the target fish in its path, since it has a variety of mesh sizes.

2.10.3 Encircling gill net (with boat and divers)

The method is used in shallow water by the aquarium trade in Zambia. A monofilament gill net is used in shallow water. It has half inch mesh size, 9m in length and 1.5m in depth. When an area rich in fish is found the net is set round the area and divers with aqualungs drive the fish out of their hiding places and they are gilled in the net

The species targeted are:-

- *Tropheus moorii*
- *Eretmodus sp*
- and just about anything else

Wire framed fish cages covered with 10mm netting is used to store the fish in shallow water. Plastic bags are also used for storage to avoid bruising and loss of scales.

2.10.4 Encircling gill net (without boat)

A net being used for encircling fish in the shallows was observed in Musende bay near Mpulungu in Zambia. It appeared to be about 15m long and was only half inch mesh size. It was very similar to the nets used in the aquarium trade underwater with divers (indeed it may have been one). It was impossible to measure this as the operators were extremely hostile once they realised that an interest was being taken in the net. This may be because the legal mesh size for monofilament nets is 120mm in Zambia and the fishermen were aware of this.

2.10.5 Dragged gill net with listening device

This is a Zambian fishing gear that seems to be no longer used on Lake Tanganyika. It is included here merely for interest.

The fisherman goes out in a one man paddling canoe, and using his paddle as a "sonar" device, locates a shoal of *Limnotilapia dardenii*. *L. dardenii* apparently grunt in a characteristic way when in shoals, and it is this sound that he is listening for. Using his knowledge of the fishes habits, and the information from the sound of the shoal gathered by his paddle, he can work out which way the shoal is moving.

He then paddles his boat in front of the shoal, and lowers a gillnet with its footrope attached to a weighted (with 3 stones) wooden pole (~5m long) to the bottom. From each end of the pole there is a bark rope strung to a central towing point, forming a triangle of the pole and the two ropes. This triangle is about 1.5m high at its apex. The net is slung inside this triangle. The apex of the triangle is attached to the boat by a rope. The fisherman then drags the framed gill net in the direction of the moving fish, and the fish are gilled.

It was impossible to find any of these gears in use, so an exact description is not given here.

The practice of listening for fish with a paddle is seemingly well known among traditional fishermen; usually aged ones.

2.10.6 Drive in gill nets

It has been reported to FPSS that in Zambia a night-time drive in gill net fishery has started near Chisanza to the NE of Mpulungu. The gear is a bottom set gillnet, set in shallow water, and the fish are frightened into the net by lights. The net is set in the dark and then the light lit.

The canoe with the light passes down the net about 10m from the net. The fish are frightened by the light, swim away from it, and become meshed in the gill net. FPSS was unable to locate any of these gears so was unable to measure them or interview the fishermen involved.

2.10.7 Seined gill net

Using the principle of a gill net, the seined gillnet is an attempt to get round the enforcement of the local bans on the use of encircling gillnets in Zambia.

This is a truly unusual method, not mentioned in von Brandt (1972), nor in the FAO Catalogue of Small Scale Fishing Gear (1975). It appears to be relatively new in Zambia. The fish are gilled so the method is still correctly classified as a gill net, though the manner of operation is like a seine. The method is only applicable in areas of shallow water, with a sandy, unobstructed bottom. Chituta Bay being a very appropriate place.

The gear consists of a gill net, with draw lines, like a seine. An example measured in Kapata village, Chituta Bay, near Mpulungu, was made up of 5 x 50 yards sections of 3" stretched mesh net connected together and hung in at approximately 66%, giving an operating length of 150 metres of net. The net was 26 meshes deep, and at each end there was a spreader of 65m, made of wood, weighted at the bottom with a stone.. (This sheet netting is available from many stores in the nearby Mpulungu market). The headline and footrope are made up of 380d/15 3 strand polyethylene twine, interspersed with sections of 210d/36 nylon three strand. (The nylon is preferred as it is easier to work with and stronger, though is more expensive). The floats are cork/bark, conical. 6cm deep and 7 cm across the wide end. At the sharp end a hole is drilled through which the headline is threaded. One is attached to the net every 3 metres. The weights are stone, prismatic shaped, attached with rubber inner tube lashings. 120 – 200 gms. A typical stone was 14 x 3.4 x 1.8 cm. Similarly with the floats one is attached every 3 metres. The size of the weights compared to the floatation provided by the floats indicates that the net is very definitely meant to stick to the bottom.

Draw lines are attached to the spreaders at each end of the net. These are made of bark rope of 8.5 – 9.5 cm Ø, two strand. This is very cheap being only KW¹⁰ 4500 per 100 meters, and manufacturers of this rope (men) bring it to the village to sell. One draw line is 200m and the other 150m. The difference in lengths is explained by the fact that when the net and draw line is paid out from the boat (see description of method below) the float is attached to the 150m draw line. This is paid out, then the net and the boat returns to the float, paying out the 200m draw line as it goes, to pick up the end of the first (150m) draw line. Since, in the words of one antediluvian fisherman, "*it is very difficult to paddle a straight line at night*" an extra 50m of draw line is allowed to ensure that there is enough for the boat to reach the float, and the start of the first draw line, to begin the retrieve of the gear.

The gear is used at night from a paddling canoe. Two fishermen operate the gear. The substrate must be fine sand/mud and unobstructed. The boat travels to an appropriate area of depth 8-10m. One draw line is attached to a float with a small lamp on it (not to attract fish, merely to indicate the float). The boat then heads off paying out the draw line in a rough circular fashion. After the draw line is shot the net follows and then the draw line on the other side, the boat meanwhile continuing in its circular path, eventually ending up back at the float which is the start of the first draw line. The two fishermen then pull in the draw lines and the net to the boat. Fish are frightened by the draw lines into the path of the net and, if of an appropriate size, are gilled. The boat is not anchored during the operation. The procedure is repeated until a suitable amount of fish has been caught, 10 to 15 times, yielding 20 – 25 kg (FPSS did not measure the catch, this figure is derived from the fisherman). Target species are reported to be *Boulengerocromis microlepis* and *Limnotilapia dardennei*, among others.

15 of these gears were reported in the Kapata village and there would presumably be more in the other villages round Chituta Bay. It does however seem that these gears are restricted to the Chituta Bay area and areas north with suitable substrate, as no others were found by FPSS near Mpulungu or in the Western arm.

¹⁰ 2400ZK=1 \$US at this time

The gears are locally a threat to biodiversity in that gill nets are identified as one of the major contributors to excessive fishing effort round the lake.

2.10.8 Staked gill nets

These gill nets are described in a report by the Game and Fisheries Department of Zambia in 1965 as such:-

The “Mbwa” and “Itapi” nets are very similar but are named differently in different areas. They are made up of heavy grade nylon with an 8” stretched mesh and are normally about 50 yards long. The net has no corks or leads but is fence like in that bottom and footropes are held apart by poles at 4-foot intervals. The two end poles are very long and these are pushed into the mud from the surface and hold the net upright. It is a moderately successful net usually catching large Nshinga (*Dinotopterus cunningtoni*) and Poloko (*Auchenoglanis occidentalis*). Traditionally only chosen people may use the net and there is a great deal of prescribed ceremony in its use. It is said that any pregnant woman seeing the net is liable to abort.

It was also generally acknowledged that any menstruating woman stepping on these nets during construction will bleed to death, though this belief seems to have now died out; with the nets perhaps ?

The FPSS survey in Zambia in 1999 did not find these. Apparently¹¹ there are just not enough large fish left in this bit of the lake to justify their use.

¹¹ Martin Pierce Pers comm

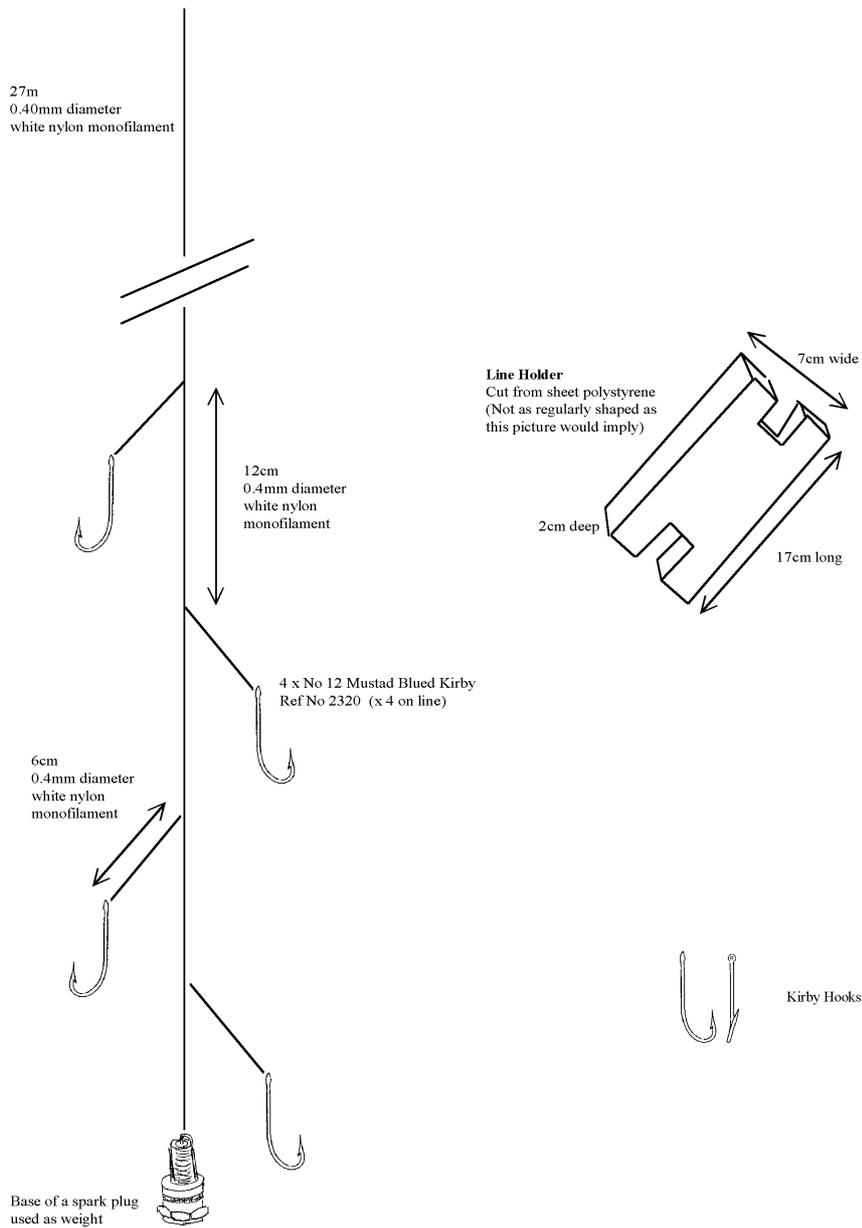
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4. GEAR PLANS

Vertical Hand line
 Demersal fish
 Lake Tanganyika. Kasisi, Mpulungu, Zambia

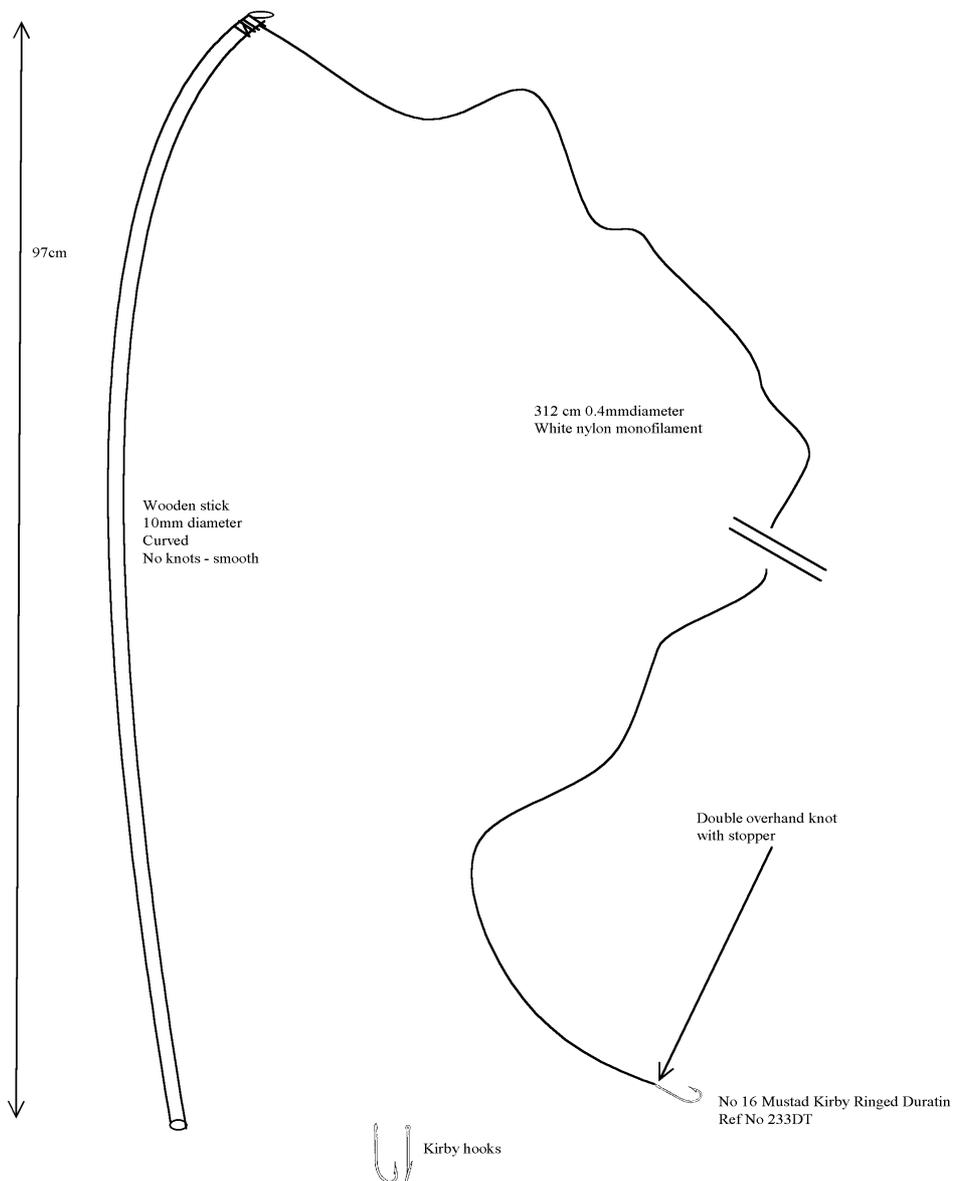
Boat 5.2m
 1 fishermen
 Bait: worms & sardine



Gear Plan 1. Vertical hand line for mixed littoral fish

Pole and line
Small Littoral Fishes
Lake Tanganyika. Kasisi, Mpulungu, Zambia

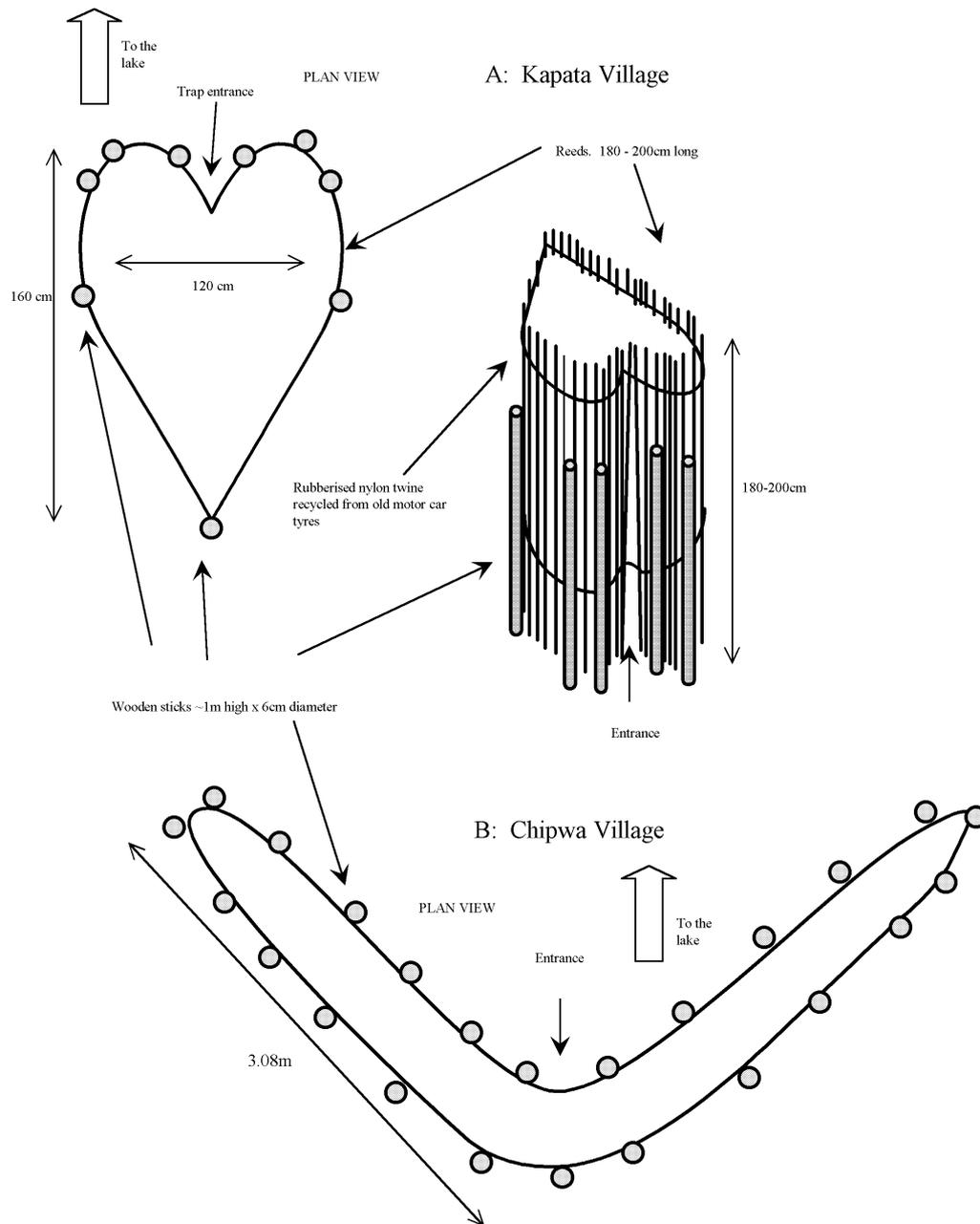
No boat
1 fishermen (usually child)
Bait: Maize meal, worms & sardine



Gear Plan 2. Pole and line from Zambia

Barrier Labrinth Traps
 Tilapiaine Fishes & *Clarius sp*
 a) Lake Tanganyika. Kapata, Mpulungu, Zambia
 b) Lake Tanganyika. Chipwa, Zambia

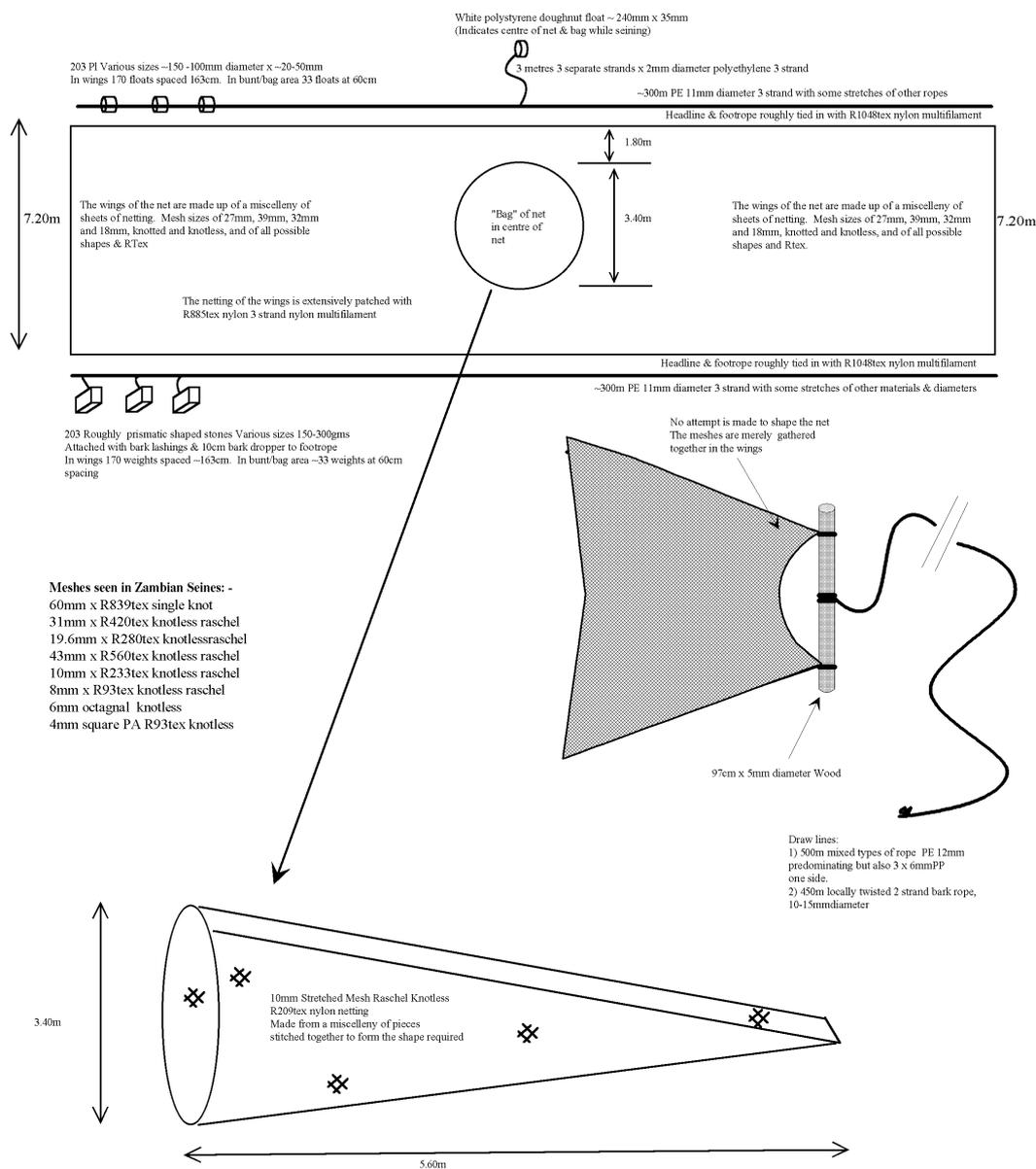
Used in reedy areas
 1 fishermen



Gear Plan 3. Plans of labyrinth traps from Zambia

Beach seine. With bag.
 All littoral fishes. Daytime only.
 Lake Tanganyika. Chanzimu, Mpulungu, Zambia

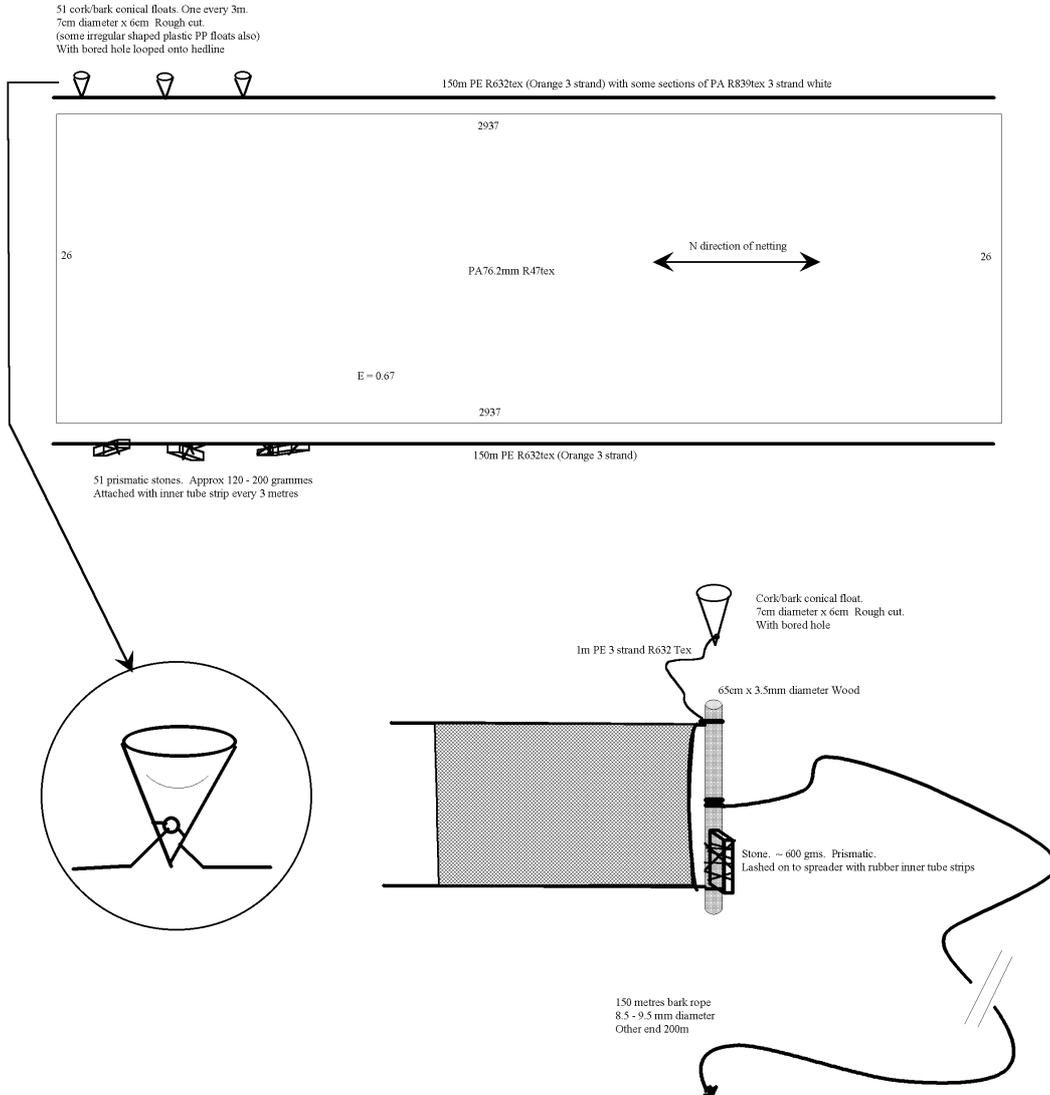
Boat 5.5 metre wood planked
 with paddles
 10-12 fishermen



Gear Plan 4. Beach seine with bag

Gill net (seined)
 Mixed fish (target *Boulengerocromis microlepis*
 & *Limnotilapia dardennei*)
 Lake Tanganyika. Kapata Beach.
 Mpulungu, Zambia

Boat planked 5.1m
 2 man operated
 Used like a seine in water
 of 8-12m deep on sandy
 substrate



Gear Plan 5. Seined gill net

5. FISHING GEAR PRICES

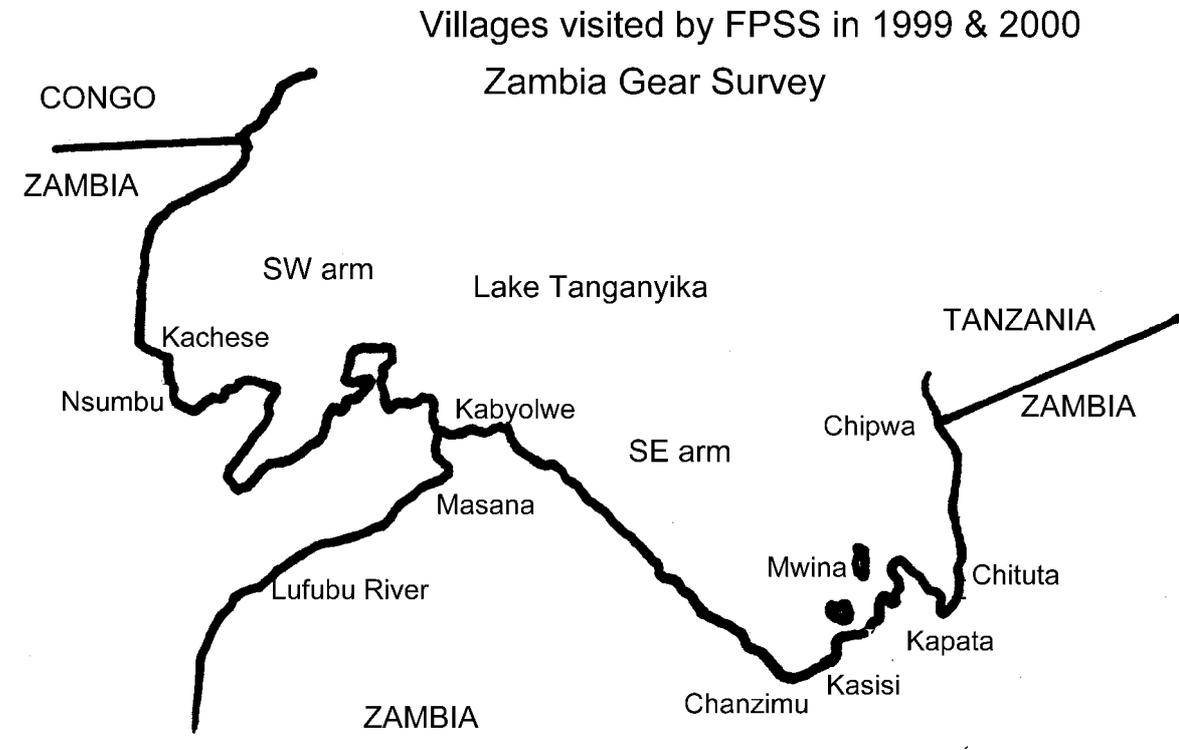
Mpulungu. Zambia 28/10/99
US\$ = 2490 Zambian Kwacha.

Location	Gear	Manufacturer	Specification	Price Zambian Kwacha
Kalambo store The store manager said the gear was very old and would be more expensive when reordered	Gill net (nylon multi)	Nikwazi Manufacturing Co Ltd, PO Box 360106, Kafue, Zambia Ordered through stores' wholesaler	89mm (3 ½") stretched mesh 210d/6 90m x 25md	38500
			3" stretched mesh. 210d/4 90m x 20md	35000
	Twine (nylon multi)		3 strand 210d/36 500gm bobbin	18500
			3 strand 210d/18 500gm bobbin	18500
			3 strand 210d/9 500gm bobbin	18500
3 strand 210d/18 200gm bobbin	8500			
N'Gwenya Market Judas' Store. Large market stall with good stock of trade goods and fishing requisities All the gears in N'Gwenya market sourced in Tanzania	Gill net (nylon ulti)	Goldfish Brand (in Chinese). Made in China	3" stretched mesh. 210d/2 50 yards x 26md. Double selvege	5500
			2½" stretched mesh. 210d/2 50 yards x 26md. Double selvege	
	Nylon Monofilament	Yusung Industrial, Korea	100 yards Ø 0.4mm. In connected coils of 100m	2500
			100 yards Ø 0.7mm In connected coils of 100m	3500
			100 yards Ø 0.8mm. In connected coils of 100m	
	Twines (nylon multi)	Goldfish Brand (in Chinese). Made in China	210d/6 200 gm bobbin	2000
			210d/18 200 gm bobbin	
			210d/24 200 gm bobbin	
	Unknown	380d/15 100gm Polyethylene hanks	1500	
	Hooks	Mustad. Norway	No 13 Kirby Ringed and Blued Ref 2320	100
No 12 Kirby Ringed and Blued Ref 2320			120	
Un-named stall. Mixed goods and fishing requisites	Gill Net (nylon multi)	Goldfish Brand (in Chinese). Made in China	1" stretched mesh. 210d/2 50 yards x 26md	5000
Un-Named stall Female owner.	Gill net (nylon multi)	Goldfish Brand (in Chinese). Made in China	2½" stretched mesh. 210d/2 50 yards x 26md	5000

Mixed trade goods and fishing requisites	Nylon Monofilament	Yusung Industrial, Korea	100 yards Ø 0.4mm. In connected coils of 100m	2500
			100 yards Ø 0.5mm In connected coils of 100 m	
			100 yards Ø 0.8mm. In connected coils of 100m	4000
	Twines(nylon multi)	Goldfish Brand (in Chinese). Made in China	210d/3 200 gm bobbin	3000
			210d/6 200 gm bobbin	
			210d/18 200 gm bobbin	
			210d/36 200 gm bobbin	
	Hooks	Mustad. Norway	No 13 Kirby Ringed and Blued Ref 2320	100
			No 12 Kirby Ringed and Blued Ref 2320	150
No 8 Kirby Ringed and blued Ref 2320			200	
Un-named stall Sells bicycle spare parts	Lead weights	Home made. Zambia	145gm. Conical. 6cm high. Cast in paper cone set in sand into which molten lead is poured. Battery derived lead.	500
Jessies stall Sells bicycle spare parts	Lead weights	Imported	450 gms. Purse seine weights. Probably stolen from Purse seine companies.	1000
Stall run by Sikazwe Humphrey. Mixed trade goods and fishing requisites	Hooks	Mustad. Norway	No 13 Kirby Ringed and Blued Ref 2320	100
No 14 Kirby Ringed and Blued Ref 2320				
No 16 Kirby Ringed, Duratin Ref 233DT				
No 18 Kirby Ringed, Duratin Ref 233DT				
Purse seine companies Old purse nets	Purse seine nets	Korea, Taiwan and South Africa	Pieces of old purse seines. By Auction or sometimes by tender. Sold by the kilo of mesh.	Up to 15000/kg

6. RECORDS OF VILLAGE VISITS MADE BY FPSS TEAM

October, November, December 1999 and Jan 2000



Village name Kasisi
Date 28/10/99
Time of day: Mid afternoon

Description: Urban. In Mpulungu itself. Musende Bay. 16 houses made of reeds and grass plus ancillary buildings. Population reported to be 105 people. Temporary nature of village due to the fact that they are not permitted to build permanent buildings there by the local council. Many of the inhabitants have other houses in Muzabwe and Musende villages across Musende Bay.

Habitat: Small rocky beach with reeds

Boats: 12 planked canoes. One 9.9hp outboard on planked transport boat

GEARS IN USE.

3 X BEACH SEINE for use at night with lights on floats targeting Kapenta (*Stolothrissa tanganyicae*). The nets are constructed of a variety of mesh sizes and mesh type, including "Moji" circular mesh netting. Many panels of irregular shapes are stitched together. In the wings the mesh sizes are larger, of 45mm and 35mm stretched mesh nylon knotless netting. The mesh sizes reduce towards the central bunt, with panels of 10mm, 8mm and 6mm being employed. In the bunt itself mosquito netting is used, with some panels of sheet nylon, probably nylon bedsheets from the local second hand clothes stores, of 0mm mesh size. There are no gaps, and even phytoplankton would be caught. Netting less than 8mm is illegal in seines in Zambia. This seine is less than 400m from Fisheries Department Mpulungu. All

the other netting is knotless except the 35mm and 45mm in the wings. All the netting except the muslin and mosquito netting was sourced from the Purse Seine companies who sell off old nets. Ropes are a variety of sizes, 12 – 14mm polypropylene being the dominant type in this seine. This is sourced from purse seine companies also. Floats are of various sizes, plastic doughnut shape with hole larger than headline. Weights are irregular shaped rocks (~750gms) from the nearby hill (thus prismatic) attached to the footrope by a 15cm dropper of bark rope. The draw lines are polypropylene rope of 12mm, 90m and 80m long. No wooden wing spreader is used on this net. (The other two seines in the village had spreaders). These seines are sometimes used during the day if a kapenta (*Stolothrissa tanganicae*) shoal is observed passing by. One owner employs others to assist with the hauling, for a small monetary reward. (see Philip Petits' reports from Zambia) Fish sold fresh (or dried if a large amount) locally. Some small fish drying areas in the village. The nets in this village are very poor quality and made up of so many panels and different sizes of mesh that a proper net plan could not be attempted.

NUMEROUS POLE AND LINES

The pole of a measured pole and line was Ø10mm, 97cm long and curved in an arc. It was wooden (not bamboo or reed), without significant knots and of equal diameter all its length. The line was Ø 0.4mm x 312cm long nylon monofilament. The hook was a barbed No 16 Mustad Kirby Ringed, Duratin, attached with a double overhand slip knot. The bait was small kapenta sardines, n-shima (mealie meal) or worms dug up in the damp areas near the lake. No catch was observed. Fish autoconsumed. Fishermen children and youths exclusively.

NUMEROUS HANDLINES

A measured handline consisted of a line holder of 2cm thick polystyrene, shaped into an “H”, approximately 17cm long and 7cm wide. Onto this holder was coiled 25-30m of Ø 0.4mm monofilament nylon. The weight consisted of the bottom end (inside the cylinder section) of a spark plug, tied onto the nylon by the spark generator. Four No 12 Mustad Kirby Ringed and blued hooks were attached to the main line above the weight on droppers of Nylon Mono Ø 0.4mm of 7cm at intervals of 12cm. All knots were blood knots. The bait was reported to be worms or kapenta.

BOTTOM SET GILL NETS

5 people were reported to have gill nets in the village. They have between 6 and 10 gillnets each, but in effect only one of these is used at a time. The rest are under repair or abandoned as too difficult to repair. Mesh sizes of 2 and 3 inch were observed. Nets were reported to be between 750 and 2000 yards long (495 and 1232 yards long when hung in at E =0.66). The length of one 2 inch net was said to be 650 yards, but this was 13 x 50 yard sections, and so hung in at E=0.66, the net would have been 430 yards. 26 mesh deep. Headline and footrope both 380d/15 polypropylene 3 strand. Net hung on with 210d/2 Nylon multifilament. The floats were bits of wood and the weights local stones, both tied in with bark rope. Nets hung with the N direction lengthways. Double selvege. Made in China. Obtained from local market. These nets are set in the evening and retrieved in the morning. No catch was observed.

It would seem therefore that no less than 2275 meters of gill net are being set every night in the area near the village.

Village name	Chanzimu		
Date	02/11/99	Time of day:	Noon

Description: Semi-Urban. About 5 km out of Mpulungu itself in Musende Bay. 5 houses made of brick with another 5 habitations made of reeds and numerous ancillary buildings. Population reported to be 30 people. No agriculture to speak of though village has plenty of goats and chickens. The population is reported to depend on fishing for income and food.

Habitat: Long rocky beach interspersed with reed beds

Boats: 8 planked canoes. One transport boat moored off shore. No O/B engines in evidence.

GEARS IN USE.

2 X BEACH SEINE for use at night with lights on floats targeting Kapenta (*Stolothrissa tanganicae*).

One of these beach seines was not in the village as the owner had gone away to another place where there was better fishing.

1 X BEACH SEINE with bag for use during the day for mixed fishes.

This seine was measured and a net plan produced. See attached Figure I. The net plan is not as complete as would have been liked due to the net being made up of a patchwork of panels of mesh, of different mesh sizes and shapes, some knotted and some knotless, making it impossible to measure accurately every panel. The seine has a bag in the middle of the net.

POLE AND LINES

No children used pole and line in the village. This is unusual.

HANDLINES

2 types.

1. VERTICAL HAND LINE FOR JIGGING (x 2 in the village). Consists of 100m (when new, now shorter) of 0.4mm white nylon monofilament on half a doughnut float. No swivel. 3 hooks. Mustad Kirby Ringed Blued No 12 hooks, set at 15 cm intervals on 4.5cm of double (twisted) 0.4mm Ø white nylon monofilament droppers. Weight attached to nylon with a 3cm length of 2mm wide polyethylene split film (from a maize sack). Weight consisted of two 15gm lead weights, sheet lead with a hole in the top for the line attachment. No swivel on line. Gear used for *Lates stappersii* and *Limnothrissa miodon*.

2. VERTICAL HAND LINE FOR DEEP SPECIES (notably *Cyphotilapia frontosa* and *Lates spp*) (x 6 in the village)

A measured handline consisted of a line holder of roughly cylindrical polystyrene, approx 20cm long and 12 cm in diameter. Onto this was wound approximately 200 metres of 380d/15 polyethylene three strand line, to which was attached a swivel. This swivel connected to 28.85m of nylon white monofilament Ø 0.80mm. 14 hooks were attached to the mainline on 7cm droppers spaced at 22cm. Each hook was a Mustad Kirby ringed Blued No 12. A 135gm conical lead weight was attached to the bottom of the line.

The bait is kapenta and the gear is fished in water of 80 to 100m depth.

BOTTOM SET GILL

No gill nets were used in the village. The rocky nature of the substrate being given as the reason.

Village name

Chipwa

Date

06/11/99

Time of day:

Forenoon

Description: A village of about 200 people at the mouth of the Kalambo river. Long sandy beach ending at the north end with reed beds associated with the Kalambo river, the other end disappears into occasional bunches of reeds. Rich agriculture in Kalambo flood plain, rice, manioc, bananas and maize.. River constitutes the border with Tanzania. Border not policed. Tanzanian children use the Zambian side school.

Habitat:

Sandy beach with large shallow bay resultant from sediments from the Kalambo river

Boats:

14 planked canoes but more probably dispersed in reed beds.
No outboards

GEARS IN USE.

NO BEACH SEINES TARGETING KAPENTA (*Stolothrissa tanganyicae*).

Fishermen come from other villages and fish on the beach for Kapenta, but the village does not itself have any beach seines. The fishermen use their boats as light boats for the visiting Kapenta fishermen, in return for a share of the catch. In the words of the headman the villages do not have a "complete set". The catch from these visiting beach seiners is sold to the women of the village who dry the sardines on drying areas scattered through the village.

NO DAY BEACH SEINES TARGETING MIXED FISH.

Fishermen come from other villages and fish on the beach for mixed fish, using day seines, but the village does not itself have any day beach seines. Villages assist the visitors for a share of the catch.

NUMEROUS POLE AND LINES

Three children were observed fishing in the Kalambo river using reed poles of 1m30cm long with approximately 5m of Ø 0.4mm white nylon monofilament with a Mustad Kirby Duratin Ringed No 16 hook. The bait was worm dug from the gravel of the river margins. There were reported to be large numbers of these pole and line fishermen in the village.

NO HANDLINES

Nobody uses handlines, either for jigging for sardines or for bottom fishing.

BOTTOM SET GILL NETS

1 person was reported to have a gill net in the village.

TRAPS

Two types of traps were in use.

A BARRIER/LABYRINTH TRAP in the reed beds at the mouth of the Kalambo river. This is a wet season gear and there would typically be 6 or 8 of these constructed in the wet season. The trap was V shaped, made of reeds and with each arm of the V 308cm long on the outside. The entrance was 6cm wide at the base of the V. See Figure 2.

A TUBULAR TRAP without retaining device set in one of the side streams of the Kalambo river in the valley of the Kalambo, approx 2 km upstream. A barrier of stones is placed across the stream and in the middle is placed a tubular trap. The flow of the stream is thus directed down the trap. The fish enter and cannot return or escape due to the strength of the flow of water into the trap. The trap is conical, 1.60cm long and 40cm wide at the mouth. The trap tapers down to the other "thin" end where the reeds of which it is made are tied together. The reeds are fastened to a circular wooden hoop (of Ø 2cm wood) at the open end with strips of bark. There is only one hoop, about 5 cm from the entrance. The reeds are fastened together further down the net 6 further times with bark lashings, though there are no further supporting hoops. Through the base of the trap, 10cm back from the entrance, is thrust a 105cm pole of wood, 35cm sticking out each side of the trap. This is used to jam the trap into the stones that make up the guide/barrier in the stream. During the dry season the fish migrate down the river towards the lake and are caught in the trap facing upstream. In the wet season large numbers of traps are placed facing downstream, to catch fish migrating up the river. The catching mechanism of the wet season traps was not identified; presumably they require a non return mechanism, since they are lying in line with the river flow direction.

Village name

Kapata beach

Date

03/11/99

Time of day:

Lunchtime

Description:

Beach about 500m from Kapata village. Beach about 500m long bordered by reeds at each end. Large reed beds all round the area. Looks out onto Chituta Bay, a large shallow bay bordered by reed beds and with large amounts of water weed in the shallower areas. Used to

be a Hippopotamus haunt, but they have all been eaten or have moved. As a result reeds have proliferated in the margins. No permanent buildings on the beach but about 50 people live there all the time. Another 100 or so adults in the main village (not visited). Some from the main village also use the beach for fishing. Also migratory Kapenta fishermen come and camp on the beach. In the wet season the rise in the water level reduces the size of the beach considerably, squeezing the population into a relatively small area. The beach has been known to be completely covered in a very wet wet season. Distant about 12 km East from Mpulungu by boat. No road connection, though well worn paths lead to the town. There is agriculture in the inland areas but this is mostly practised by the people who live in the inland village, rather than the fishermen on the beach, who rely on fishing for their sustenance.

Habitat: Sandy beach bordered by reed beds, on shallow bay of sand and mud. The bay is completely surrounded by reed beds and there is a lot of subsurface water weed

Boats: 28 planked canoes
No O/B engines in evidence.

GEARS IN USE.

2 X BEACH SEINE for use at night with lights on floats targeting Kapenta (*Stolothrissa tanganicae*). No bag in these beach seines. No mosquito or muslin in the bunt. 8mm knotless nylon being the smallest mesh. Using tilly (as kerosene pressure lamps are locally known) lamps, two on one float per shoot, the fishermen shoot the Kapenta seine up to 10 times per night.

If a passing Kapenta school is spotted then these nets might be used during the day.

Many migratory fishermen had recently left the village and gone nearer to Mpulungu where the fishing was better.

1 X BEACH SEINE with bag for use during the day for mixed fishes.

The main difference observable between a beach seine "for fish", and that for Kapenta is that a beach seine for fish has in its wings meshes of up to 35mm (~1½ inches), and sometimes has a bag or pocket in the bunt, with a much smaller mesh size, such as 8 or 10mm; whereas in a Kapenta seine there are no "large meshes", the largest mesh usually encountered is 12mm, and often the whole net is made up of 10 and 8mm knotless mesh.

POLE AND LINES

Many children used pole and line in the village. The respondents were unwilling to put a number on them, saying that most did. As in typical Zambian villages there were a lot of children hanging about.

VERTICAL HAND LINE FOR DEEP SPECIES. Reported to be used by ¾ of the village (~45 ?) Used in the shallow waters of the bay.

BOTTOM SET GILL

A popular method with 30 being reported as being regularly used. These of different mesh sizes. The average length being of 20 lengths of 50 yards connected (26md), resulting in a net approximately 650 yards long. If only half the gill nets in the village are being set every night then this results in no less than 8 km of gill net being set every night.

BOTTOM SEINED GILL NET

15 reported in the village. This is a truly unusual method, not mentioned in von Brandt¹², nor in the FAO catalogue of small scale fishing gear¹³. It appears to be relatively new in Zambia, and the Fisheries Department staff have not seen the gear, though know that it exists. The fish are gilled so the method is still correctly classified as a gill net, though the manner of

¹² Brandt, A von (1972) – Fish Catching Methods of the World. Fishing News Books, London

¹³ FAO. (1975) - FAO Catalogue of Small Scale Fishing Gear. Fishing News Books, London

operation is like a seine. The method is only applicable in areas of shallow water, with a sandy, unobstructed bottom. Chituta Bay being a very appropriate place.

The gear consists of a gill net, with draw lines and wooden spreaders like a seine. The example measured was made up of 5 x 50 yards sections of 3" stretched mesh net connected together and hung in at approximately 66%, giving an operating length of 150 metres of net. The net was 26 meshes deep, and at each end there was a spreader of 65m, made of wood, weighted at the bottom with a stone.. (This sheet netting is available from many stores in the nearby Mpulungu market). The headline and footrope are made up of 380d/15 3 strand polyethylene twine, interspersed with sections of 210d/36 nylon three strand. (The nylon is preferred as it is easier to work with and stronger than Polyethylene, though is more expensive).

The floats are cork/bark, conical. 6cm deep and 7 cm across the wide end. At the sharp end a hole is drilled through which the headline is threaded. One is attached to the net every 3 metres. The weights are stone, prismatic shaped, attached with rubber inner tube lashings. 120 – 200 gms. A typical stone was 14 x 3.4 x 1.8 cm. Similarly with the floats one is attached every 3 metres. The size of the weights compared to the floatation provided by the floats indicates that the net is very definitely meant to stick to the bottom. See Figure 3.

Draw lines are attached to the spreaders at each end of the net. The draw lines are made of bark rope of 8.5 – 9.5 cm Ø, two strand. This is very cheap being only KW 4500 per 100 meters, and manufacturers of this rope (men) bring it to the village to sell. One draw line is 200m and the other 150m. The difference in lengths is explained by the fact that when the net and draw line is payed out from the boat (see description of method below) the float is attached to the 150m draw line. This is paid out, then the net and the boat returns to the float, paying out the 200m draw line as it goes, to pick up the end of the first (150m) draw line. Since, in the words of one antediluvian fisherman, "it is very difficult to paddle a straight line at night" an extra 50m of draw line is allowed to ensure that there is enough for the boat to reach the float, and the start of the first draw line, to begin the retrieve of the gear.

The gear is used at night from a paddling canoe. Two fishermen operate the gear. The substrate must be fine sand/mud and unobstructed. The boat travels to an appropriate area of depth 8-10m. One draw line is attached to a float with a small lamp on it (not to attract fish, merely to indicate the float). The boat then heads off paying out the draw line in a rough circular fashion. After the draw line is shot the net follows and then the draw line on the other side, the boat meanwhile continuing in its circular path, eventually ending up back at the float which is the start of the first draw line. The two fishermen then pull in the draw lines and the net to the boat. Fish are frightened by the draw lines into the path of the net and, if of an appropriate size, are gilled. The boat is not anchored during the operation. The procedure is repeated until a suitable amount of fish has been caught. Target species are reported to be *Boulengerocromis microlepis* and *Limnotilapia dardennei*, among others.

BARRIER TRAP - LABRYNTH TRAPS

One of these traps was observed, and it was reported that in the middle of the wet season, 6 were typically built in the village. The trap is built in a channel in a reed bed. It is made of a sheet of reeds, held together with rubberised nylon multifilament twine of approx 1.0mm Ø removed from worn out car tyres. The reed wall is supported by 9 wooden posts driven into the mud of the reed bed, and attached to the reed wall with further lengths of rubberised nylon from car tyres. From above, in plan view, the trap is heart shaped (♥) with the entrance to the trap being in the bottom of the V of the top of the heart shape. The opening is restricted to the bottom 10cm of the reed wall, and is relatively small, being about 5 cm across at the widest. The trap is built so that the entrance faces towards the main body of the lake, so the trap catches fish entering the reed bed from the lake. (To breed ?).

The reeds used for the reed wall are approximately 2 meters long, and the posts used to hold the structure up are 1m – 1.20m long. The trap itself is 1.6m long and 1.2 metres wide. Figure 2.

The trap is a wet season trap, particularly effective when the water level has risen from its dry season low. The target species are *Clarius* sp and Tilapine species. Ten kilos in 24 hours is

a good catch. The fish are removed from the trap using a small scoop net. Some theft of fish from these traps is reported.

Village name **Chituta**
Date 06/11/99 Time of day: Early Afternoon

Description: It was impossible to ascertain the size of the village. The headman was away. The people were suspicious. All information received was sketchy and should be treated with caution.

Habitat: Reedy. An extensive sand beach in 1997 was now overgrown with reeds. The landing place was muddy with about 10m of sand/mud only, in the reed beds.

Boats: 2 planked canoes observed but more probably dispersed in reed beds. Villages declined to place a number on them
No outboards observed

GEARS IN USE.

NO POLE AND LINES

Children do not use pole and line as they fear crocodiles in the reeds.

HANDLINES

Half the male population was reported to have handlines for bottom fishing. No jigging for *Limnothrissa miodon* was done

BOTTOM SET GILL NETS

Three quarters of the households were said to have gill nets.

FISHING WITHOUT GEAR

The villages commented that in the wet season they used machetes to capture fish in the reed beds

SCOOP NETS

One scoop net, with the pole missing, for catching fish in reed beds in the wet season was shown to the FPSS team.

NO SEINES are used in the village. There is no suitable beach.

Village name **Mwina Village. Mutondwe Island**
Date 03/11/99 Time of day: Mid afternoon

Description: Village on island 5km from Mpulungu town. Approximately 200 people live there, plus children. More people used to live there until the Kapenta sardine fishery collapsed in 1995 after which they moved out to town mostly. A clinic and a school in the village. No agriculture except mango and papaw trees. Some chickens, goats and pigeons. No income earning except fishing. Many cement hard standings from the old days when the kapenta industry was very active. People depend absolutely on fishing.

Beaches gravel with reedy patches. Not all area suitable for beach seining as some areas have rocks and other obstructions.

Biotype: Gravel and rock beaches on southern part of island.

Boats: 18 - 20 planked canoes
One O/B engine observed.

GEARS IN USE.

5 X BEACH SEINE for use at night with lights on floats targeting Kapenta (*Stolothrissa tanganicae*).

The standard Zambian Kapenta seine, used with lights, is the mainstay of the economy in this village. There used to be more seines and more people, but with the decline in the Kapenta fishery there are now only 5 left.

If a passing Kapenta school is spotted then these nets might be used during the day.

1 X BEACH SEINE with bag for use during the day for mixed fishes.

Large meshes of 32 and 25mm predominated in this seine, but the bag was 10mm knotless nylon. This net had a footrope of 12mm PE 3 strand and lead weights from a purse seine sold by the industrial fleet. The fishermen complained that there was no supplier of seine net in the Mpulungu area, so when they got their hands on a bit of net of whatever mesh size from the Industrial purse seine fleet, they had to shoot this into their existing net and shape it to fit, rather than going out and buying what they wanted in shape and mesh size from a net supplier.

POLE AND LINES

Many children used pole and line in the village.

VERTICAL HAND LINE for deep species and for jigging in midwater for *Limnothrissa miodon*. Reported to be used by $\frac{3}{4}$ of the men in the village

A very common method. Lines are really multi-purpose in that if kapenta are present they will soon get hooked up on a bottom set hook as it is returned to the surface. The fisherman then starts using the same gear in 10 – 15m depth and jigging for kapenta.

BOTTOM SET GILL

Only two people were reported to have bottom set gill nets. The rocky substrate being unsuitable.

FISHING GEAR AT THE NSUMBU SANDY BEACH.

VILLAGE VISIT: Nsumbu Sandy Beach,(Muchanga).

DATE: 8th December 1999.

TIME OF VISIT: Afternoon.

FISHERMAN INTERVIEWED: Mr Gondwe..

LUSENGA NET.

This gear was introduced in the 1950`s most likely in 1958.It is a scoop net. It is no longer in use. The circumference was reported to have been around 25metres.The meshes range from 6mm to 8mm but 6mm was predominant. One scoop could catch as much as 160kg of Kapenta. The net could also scoop bycatch of Nkupi (*Boulengerochromis microlepis*), Nsonga (*Grammatotria lemarii*), Nile perch (*Lates angustifrons* and *Lates mariae*.) Three people operated the net. The person to operate the net was positioned in front of the boat, the water bailer in the middle, the coxswain behind. The middle person also helped the person in front to operate the net. Operation done at night with lights, in the old days flaming torches were used.

LONG LINES.

Approximately 15 people have long lines at the sandy beach in Nsumbu. This gear is exclusively owned by certain people at the sandy beach. This gear is designed and targeted for big fish species like Nkupi, (*Boulengerochromis microlepis*), Malembela (*Bathybates* sp), Inshinga (*Dinotopterus cunningtoni*), and Imonde, (*Chrisichytys brachnema*). The numbers of hooks on the line could go up to as much as 2000.This is an overnight bottom set gear and sinkers are placed at 3 metres intervals. The hooks are placed at 2 ½ metre intervals. The popular hook sizes are numbers 8 and 12 The line material is either made from strings ("fibre") from worn-out vehicle tyres or nylon bought from local suppliers. One long line can be

as much as 5 Kilometres. Others are shorter. No evidence of a long line was seen at the sandy beach.

HAND LINES.

This is a very popular fishing gear at the sandy beach. Numerous people have hand lines. The possible maximum depth the line goes was reported to be as much as 110metres.

This gear is popular for Nkupi (*Boulengerochromis microlepis*), Pamba (*Lates angustifrons* and *Lates mariae*). This gear is not designed for small cichlids.

BEACH SEINES. (For Kapenta. *Stolothrissa tanganicae*)

There are about 7 beach seines for kapenta at the sandy beach in Nsumbu. The material for the beach seines is polystyrene. The beach seines do not have knots in the mesh and they are purchased from the industrial fishing companies. Second hand nets and sometimes new ones are bought from industrial fishing companies.

BEACH SEINE (For fish.).

There are four (4) people with beach seines for fish at the sandy beach. The bag at the centre has 8mm and 10mm mesh sizes. The meshes for the seine net are 2½-inch mesh sizes.

RING NETS. (Chiromila seine)

Seven people own ring nets at the sandy beach. There are six ring nets at the sandy beach. There were three Ring nets spread on the beach in evidence. The measurements were recorded as 86metres in length and 33metres in breadth as diameter measured from the centre. This gear is effective for Kapenta. Ring nets go deeper and wider than other gears used for Kapenta fishing. The mesh sizes for the ring nets at the beach are 8mm and 10mm.

The net in evidence was bought from Andreas fisheries in Mpulungu. It has 10mm mesh size mounted with sinkers and floaters at approximately 1metre interval. Sinkers are lead weights, with rings made from iron and the net has a footrope. The sinkers are factory manufactured specifically for nets. The net has no knots.

GILLNETS AT THE KACHESE ROCKY BEACH.

DESCRIPTION.

The fishing camp is situated on the raised rocky beach. There is a high wall of hardened soil forming a cliff running parallel to the shore at Kachese fishing camp.

The houses are completely made of grass. There are 9 gillnet fishermen at Kachese.

HABITAT.

There is scrub growing on the flat land above the cliff. There is no cultivation on the rocky beach and the stretch is too narrow.

GEARS USED.

Gillnet fishermen in Nsumbu are concentrated at the rocky beach at Kachese. The gillnets used have mesh sizes 63mm and 76mm and are multifilament. The nets are locally manufactured from Nkwazi. They have knots. The sinkers (stones) and floats are placed at 2metres apart.

The nets are for the fishing of cichlids and other littoral dwelling fishes e.g. Bagridae family and Claridae family.

FISHING GEAR USED IN THE CHISALA RIVER.

The number of fishermen who actually fish in this river is not known. The fishermen in this river mostly come from the Shikapampa village.

BIOTYPE.

The river Chisala flows into Lake Tanganyika with its mouth in Nsumbu about 400 metres from the sandy beach.

The river surroundings has reeds growing and is often inundated with water during the rainy season.

GEARS USED.

A fisherman that spears and clubs said (handles for axes) are used in the Chiasala river lagoons when dry season sets in to catch Clarias species of fish. Traps are also used on the upper reaches of the Chisala River.

VILLAGE NAME: Masansa fishing camp on the right bank of Lufubu river.

DATE: 10th November 1999.

DESCRIPTION. The camp is situated on the raised river bank on lower reaches of the Lufubu river within walking distance from the main village at Kabyolwe. The fishing camp has two temporary houses made from grass and reeds. One house is used for drying fish and the other as a bedroom. The camp is exclusively for fishermen and a trader processing fish was found.

HABITAT.

Thick riverine grass and reeds with lagoons on both sides of the river banks. The surrounding place gets inundated with water during the rainy season.

BOATS.

Four (4) dug out and one(1) planked canoes.

GEARS USED.

DRIFTING AND FLOATING GILLNET.(Local name Sensenta.)

Drifting and floating gillnet locally called Sensenta designed from locally manufactured gillnets at Nkwazi. A multifilament gill net ranging from ply 9 to ply 6 with a variety of mesh sizes. The mesh sizes found on the Sensenta drift net are 76mm,89mm and 104mm. There are a maximum of 80 meshes vertical (depth). The drift net goes up to 90m in length. Floats are set at 4 metres apart with sinkers (stones) at 2metres apart. The material used as floaters are "Packaging cartons" for refrigerators and other electronic equipment.

It is a top set net drifting with the water current during the rainy season when there are high flows.

The net is set across the river Lufubu with one person in a boat moving from one end to another keeping the net in position as it drifts. The fish species caught are mainly characids.

One (1) drift net was recorded at Masansa fishing camp.

GILLNETS.

There were four ordinary multifilament gillnets recorded at Masansa. The length of each gillnet is 50 yards as manufactured in the factory. The gillnets are not locally manufactured but imported ones. The two mesh sizes used are 63mm and 76mm. The depth of the gillnets is 26 mesh sizes. The size of the mounting rope is 210d/6. The size of netting material is ply number 2. (210d/2) Sinkers (local stones) are placed at 2 metres apart. The net catches mostly *Citharinus gibbosus*.

Four(4) gillnets were with a total length of approximately 800 metres were recorded.

POLE AND LINE.(DAY NIGHT).

Operated from the shore with pole and line hook. One hook on the line is used. The dominant size of the hook used is size 14. The size of the line used is 0.4 mm in diameter.

The Characids are mostly the caught using pole and line during day time. The bait used is n'shima (ugali).

STAKED LINE.(NIGHT TIME).

The size of the hook is larger than day time pole and line hooks. The size number 6 is preferred and thick strand of mealie meal bags film, polyethylene. The film from mealie meal bags are woven together to form a single strand and knotted at intervals of 20-30cm.

The strand can be two (2) to four (4) metres in length tied to a pole stuck firmly in the reed bank. The Clarias species are mostly caught.

VILLAGE NAME: Kabyolwe. Lufubu river entrance.

DATE: 11th November 1999.

DESCRIPTION Temporary houses made from grass and reeds are closer to the shore. Permanent houses are farther away from the shore and the roofs are made of grass. The southern part of the village has more temporary houses made from grass. Temporary houses are built by Kapenta fishermen and are more of seasonal houses. Numerous planked canoes are available at the Kabyolwe. The population at Kabyolwe is about 200 people.

HABITAT.

The shoreline is covered with long grass. Short grass farther away from the shore. Cassava fields are seen on the slopes of the mountain behind. The northern side of the village is bordered with the Lufubu river and grown with reeds.

GEARS USED.

There are various gears used at Kabyolwe village. The village fishes both from the Lufubu and lake Tanganyika but fishing from lake Tanganyika is predominant.

GILLNETS SET ACROSS THE RIVER LUFUBU.

Some gill nets are set across the river to catch fish swimming upstream. This is done mainly during the rainy season. The mesh sizes used are 63mm,76mm,85mm,102mm. These are locally manufactured nets by Nkwazi. The imported ones come from China and the mesh sizes used are 63mm and 76mm.

DRIFTING AND FLOATING NET (LOCAL NAME SENSENTA).

The net is locally manufactured by Nkwazi. The net is set upstream on lower reaches of the Lufubu river. The gear is a drift net which drifts with the water current. The mesh sizes used are 89mm and 76mm. The mesh sizes are dependent on the season. Larger mesh sizes are prevalent in the rainy season. The depth of the net ranges from 89 to 50 meshes.

DROP LINE.

There are numerous drop lines at Kabyolwe and almost every household has a drop line. The drop line hook size used is number 6. The material used for the drop line is a size number 6 polythene film from mealie meal bags. The maximum length of the line is 10m. The maximum number of films to make a strand is dependent on the desired size of line required. The line is set overnight in the Lufubu river where *Clarias* species are caught.

POLE AND LINE.

Mostly used by children and a common gear used to catch fish from Lake Tanganyika. This is not widely used in Lufubu but is used in Lake Tanganyika by the children at Kabyolwe village. The size of the hooks used is number 14 and a monofilament line size diameter 0.4 and length about 10m.

GILLNETS.

Gillnets with sizes 63mm,76mm,89mm,102mm are used at the mouth of the Lufubu river. The 63mm and 76mm nets with material ply number 6 and ply 9 are imported from China whereas 89mm and 102mm are locally manufactured from Nkwazi. The nets are bottom set and set in lake Tanganyika near the mouth of the Lufubu river. The sinkers and the floaters are placed at 2 metres apart.

The species of the fish targeted is *Citharinus gibbosus* and *Hydrosanus vittatus* around November and December.

FLOATING DRIFT NET AT LUFUBU RIVER MOUTH (LOCAL NAME, SENSENTA).

The net drifts with water current from the river high flows. It is a top set net. The Net has a number of mesh sizes the following were reported to be dominant sizes 63mm,76mm, 89mm and 102mm.

The depth of the net has meshes up to 80 with length ranging from 65m –70m.

No net was found as evidence.

The net is operated by one planked canoe with one or two people moving from one end to another .

DROP LINE (PELAGIC WATERS).

Every household has a drop line .Every line has about 6 hooks. The average depth for every line is 100metres The hook sizes used in the pelagic are numbers,11,12 and 13.The line sizes seen were 2.5 and 3.

One drop line was seen and measured. The length of the line was about 100metres.The fish caught by jigging is *Cyphotilapia frontosa*. The line is meant for hooking *Cyphotilapia frontosa*.

DROP LINE (LITTORAL WATERS).

Numerous of the lines were reported to be owned by every household.

The hook sizes on one line are numbers 14, 15 and 20.

The fish is popularly caught by jigging is *Grammatotria lemarii*.

LONG LINE (LOCAL NAME,KABAMBA).

Long lines were reported to be used by some fishermen but not popular. No long line was seen as evidence. It was said that two fishermen have long lines at Kabyolwe. The gear is set either during night or daytime. The lines are said to be as long as 300metres with size number 10 or 12 hooks. They are bottom set lines and the line is made from polyethylene film of mealie bags material. No baits are used on the lines.

CATFISH TRAP. (*Dinotopterus cunningtoni*) LOCAL NAME FOR TRAP,CHISOWI).

This gear is a characteristic of old people. Three large basket like structures were found at shore before they were assembled into the final fish trap. The material used are sticks of the local species of shrub called Inseketi. The maximum diameter of sticks measured is 2cm.The sticks are flexible when fresh.

The traps are assembled and tied together and set in midwater of depths not greater than 10-25m.The trap is anchored with a stone to prevent drifting.

Funnels made of twigs and bark are placed inside each of the basket structures (traps) to prevent trapped fish from swimming out. The traps are set with mouth downwards. It takes 5-7 days to check for the fish trapped.

The fish species caught is *Dinotopterus cunningtoni* in the Claridae family.

Village name

Kabyolwe

Date

21/12/99

Time of day: 1.00pm

Description:

Visit made to follow up earlier visit to Lufubu River and environs. Kabyolwe is a large village near the Nsumbu National Park. In the village is a man who fishes with pelagic traps. The man was located and showed the FPSS team his trap.

Biotype: Sandy beach with large reed beds. Formed by mouth of Lufubu river

Gear observed

POLE AND LINES FISHERMEN (CHILDREN)

Various children fishing with pole and line. Time of day was inappropriate for pole and line fishing in that normally this happens either in the afternoon or the evening.

TRAPS

Near the village, approx 2 km East, about 120 meters offshore from a rocky shore in a small bay was a large float made of about 20 sticks (~9-12cm Ø and 1.4m long). Strung below this, 4 yards (3.68m) under water was attached, by two ropes of liana, a large three chambered trap. The trap was further attached to the bottom, this being in 45 yards (41.4m) of water depth, the weight being a large stone, and the rope being further lengths of liana.

The trap was made of wicker work, bamboo lattice work bound with bark lashings, with square meshes of about 10cm x 15 cm. The whole appears to have been made of 3 baskets woven together with the mouths of each basket joined in the middle, forming another chamber, the

entrance. Thus the trap was four chambered, an entrance and 3 capture chambers. Each chamber was approximately 1.6m long by 85cm round. One end of each chamber was woven over in the manner of a basket.

Where the three baskets were connected together the triangular gap in the uppermost side had been woven over and there was attached to the middle a bunch of grass and the liana ropes to the float.

On the underside the entrance is woven so as to be circular. The rope to the weight is attached to the side of the entrance.

Inside the "foyer" of the trap are three non return entrances, made of sharpened sticks, one for each of the three capture chambers (or baskets) of the trap.

Inside the trap were 9 large *Dinotopterus cunningtoni*, a large catfish, eight in one chamber and one in another. The third chamber had been broken into and the fish inside stolen. The trap had been there from Sunday to Tuesday, two days soak time.

The mode of operation is that the trap is placed in a likely place, and the fish arrive. They, despite being catfish, and bottom lovers who usually live amongst big stones, swim up the rope to the trap, and enter it. The fisherman supposed that this was because they liked the shade created by the trap and the grass on top. The grass on the top of the trap had been put there to increase the shade.

The fish are removed from the three discrete chambers through a small patch in the wickerwork at the top of each chamber, which has to be undone each time for the purpose. The fisherman uses a spear to remove the fish, though the spear was not available for inspection.

The fisherman reported that there used to be a lot of this type of trap in Zambia, but only a few people now knew how to make them and they were dying out. There are now perhaps 4 or 5 in the country. They last 6 months and the rainy season is the best time to use them.

Village name **Up the Lufubu River**
Date 21/12/99 Time of day: 2.00pm

Description: Visit made to follow up earlier visit to Lufubu River and environs.

Habitat: River. Papyrus, swamp. Game reserve one side. Game protected area the other.

GEAR OBSERVED

NO ACTIVE GEAR.

All fishing camps along the river had been burnt down by the National Parks and Wildlife authorities.

Remnants of one staked line seen on river bank.

A passing canoe occupant confirmed that there were now no fishing camps within reasonable distance.

Village name **Sunshine Fisheries (Aquarium fish trader, Mpulungu)**
Date 5/1/00 Time of day: 2.00pm

Description: Aquarium fish trader

The team of the FPSS visited Sunshine Fishing Company to survey the gears used on ornamental fishing.

Two types of nets were found. Surround net and monofilament Gillnet. A scoop net was used as an auxiliary gear.

The surround net was not seen but was on a fishing ground somewhere. It has a 4mm mesh size. The width and length of the net were not recorded. It is set under water in the depth of 40m in a curved form. Two divers or more go down and drive the fish into the net most of the fish is pushed in a curved net to capture it easily.

When the fish is captured it is kept in a plastic container which has small hole around it and is covered with a piece of 10mm netting on the mouth. This container is used to store the fish in deep water and to decompress them.

The species targeted are:-

- Cyphlotilapia frontosa
- Benthochromis tricoti
- Greenwoodochromis sp
- Gnathochromis sp
- and other related species

Monofilament gill net is used in shallow water. It has half inch mesh size, 9m in length and 1.5m in depth. When a school of fish is spotted then the net is cast ahead of the school and then the fish is driven into the net by divers.

The species targeted are:-

- Tropheus moorii
- Eretmodus sp
- and just about anything else

Wire framed fish cages covered with 10mm netting is used to store the fish in shallow water. Plastic bags are also used for storage to avoid bruising and loss of scales.

All the fish caught is used for aquarium purposes only. The diver, Mr Mwape, said he would go down to 70m deep.