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

**A Record Of The Tanzanian
Fishing Gears Used In Kigoma Region
Of 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

As part of the LTBP the FPSS in 1999 & 2000 undertook studies in the Kigoma region of Tanzania on the Fishing Methods employed in the fisheries of Lake Tanganyika. This was part of an ongoing programme to assess the threat posed to Biodiversity by fishing practices. It was considered appropriate to record the gears in use at the end of the millennium, and if possible ascertain whether they posed a threat to biodiversity. The project also examined fish catches.

2. METHODOLOGY

The FPSS team in 1998-2000 in Tanzania consisted of two staff. Mr Hamza Mabochi and Mr Omari Kashushu. These two staff undertook regular catch sampling in 4 locations down the Kigoma Region coastline from 1998 to 2000. Samples of the catch of a variety of gears were taken and the lengths of each of the fish in the sample was recorded, as was its species and a subjective assessment of maturity. In addition the total catch and various other parameters of the gear and boats used were recorded. The raw data was inserted into a database and briefly interpreted. The results of these researches are recorded in Appendix 1.

After October 1999 until February 2000 a series of trips were made with the newly appointed FPSS facilitator (Mr Robert Lindley) to investigate the gears in use on the lake in the Kigoma region. Visits were made to:-

- Katonga – near Kigoma
- Villages South of Gombe stream NP (Between Kigoma & the NP)
- Villages North of Gombe Stream NP (to Burundi border)
- Luiche Delta area
- Ujiji beach
- Malagarasi Delta region
- Villages adjoining Mahale NP (North & South)

The visit notes for these trips are contained in Appendix 2. The various gears found were recorded, some were measured if of interest, and where appropriate a net plan made. These net plans are in Appendix 3. The body of this report is the results of this survey of fishing gears.

In addition the work in the villages the FPSS undertook a brief survey of the prices of fishing gears available in Kigoma market. The results of this survey are in Appendix 4.

3. RESULTS OF THE SURVEY

The FPSS found 28 fishing gears in use in the Kigoma Region. Each of these gears is subject to individual variation as the owners of fishing gear usually make their own gear, and no two make their gear exactly the same.

Of the 28 gears only 9 were really important, measured by their numbers and catch. These are:-

1. **Beach seine** - catches & targets littoral fishes (Can be used day or night). Usually has larger meshes in the wings than in the bunt or bag. Banned in Tanzania. (not generally enforced)
2. **Light Assisted Beach Seine** - targets sardines which are attracted to kerosine pressure lights at night. Usually has 8mm or 10mm mesh throughout. This can also be used in the day and not much escapes due to the mesh size. Banned in Tanzania. (not generally enforced).
3. **Bottom Set Gill net** - set net, various mesh sizes and depths. Ubiquitous. Cheap. All countries have mesh size restrictions.
4. **Encircling gill net** = m'timbo or splashing water or tam tam (not a ring net) Like a gill net but deeper and used in a circle with draw lines from a boat with a frightening device. Catches different fish from the bottom set gill nets. Different

mesh sizes for night and day. Banned in all 4 countries of the lake. (Enforced only in Zambia).

5. **Lift nets** – which can be one, two or three boat. By catch volume these are the most important on the lake generally, and the backbone of the Artisanal fishery in Tanzania
6. **Simple Lines** – which includes vertical hand lines. Used everywhere round the lake. Baited hooks, targeting fish on or near the bottom
7. **Jigged Lines** – mainly for *Lates stappersii*. With 50 or more hooks. Used in the day in deep waters. Not baited. Very important for the economy of some villages, particularly N Tanzania.
8. **Bottom Set Long lines** – which are lines with 40 – 400 baited hooks which are laid along the bottom from a boat. Everywhere where there is a snag free bottom substrate. Deltas and the like.
9. **Pole and line** – used mainly by children fishing the margins of the lake. Very important in that there are vast numbers of them and they target juvenile littoral species.

The FPSS studies did not indicate that any gear was particularly “bad”, for biodiversity or otherwise. All gears kill fish. Where there are lots of people there are lots of gears of various sorts and these all catch fish. Thus where there are lots of people who fish there are less fish than in un-fished areas.

The beach seine ban in Tanzania is a matter of concern to those it affects, but since it has not been enforced it is difficult to assess changes in catches of other gears with time. Anecdotally there have been no noticeable changes.

4. THE FISHING GEARS OF THE KIGOMA REGION OF LAKE TANGANYIKA AT THE START OF THE THIRD MILLENIUM

4.1 Summary of Fishing Methods and Gears used in the Kigoma Region of Tanzania

Method	Gear	Where located/observed by FPSS	Target species	Comment
Without tools	By hand. Opportunistically of fish in drying ponds & paddies. Usually an adjunct to agricultural activities	Everywhere with shallow margins. Ujiji	Clarias mainly	These are all very low intensity fisheries
	With extensions to the hand. Machetes, stones and sticks in shallow waters adjoining the lake	Everywhere with shallow margins. Ujiji	Clarias mainly	
Grappling or wounding gear	Fish spears, barbed or barbless	Upper luiche	Clarias mainly	
Stupefying devices	Plant poisons	Not seen	Totally non selective. Illegal	Already illegal & not common
	Chemical poisons	Not seen	Totally non selective. Illegal	Only use of pesticide in 1992 in Tanzania reported. Gives the fish consumer violent headaches, so not popular. Suspected that practice continues.
Lines	Vertical hand lines (demersal fish,)	Everywhere	Mixed littoral	Cheap and plentiful
	Pole & line.	Everywhere	Juvenile mixed littoral <i>Clarias spp</i> & <i>O Tanganicae</i> in swamps	Ubiquitous. Cheap. Only protein source for some families
	Vertical hand line (baited, mesopelagic)	North of Gombe	Luciolates sp	Not commonly used
	Vertical hand line (jigging, epi-pelagic, un-baited)	Everywhere	Day – <i>Limnothrissa miodon</i> Night – <i>Luciolates stappersii</i>	Cheap and plentiful

Method	Gear	Where located/observed by FPSS	Target species	Comment
	Vertical hand line (jigging, meso-pelagic, un-baited)	Everywhere. North of Gombe. Mahale. Kigoma.	Luciolates stappersii	1800 tonne/year fishery in N Tanzania.
	Bottom set long lines	Delta fans etc. Luiche, Ujiji, Mahale.	Mixed littoral & sub littoral	Cheap and plentiful
	Floating lines	Swamp Malagarasi		
	Bottom trolling	Delta fans. Ujiji	Luciolates angustifrons Boulengerochromis microlepis	
	Surface trolling	North of Gombe	Luciolates mariae	
Traps, barriers etc	Bottom set non return traps (in swamps & reed beds) Several designs on a theme	Swamps. Malagarasi	<i>Clarias sp</i> & <i>Tilapine</i> species	May become serious for BIOS in biotope
Bag nets	Scoop net – Lusenga.	Malagarasi	Juvenile <i>S tanganyicae</i>	Sardine fishery. Only catches immature sardines in shallow water.
	Scoop net (hand operated in reed beds)	Malagarasi	<i>Clarias sp</i>	Rare gear
Dragged gears	Dragged scoop nets (mousquitaire)	North of Gombe	Juvenile <i>S tanganyicae</i>	Sardine fishery. Only catches immature sardines and incidental immature ciclids
Seine nets	The Day Beach seine	Every where with suitable flat substrate	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	Everywhere with suitable substrate	<i>S tanganyicae</i>	
	Open water seine (development of Encircling Gill net)	Malagarasi	Mixed littoral	Very similar to an Encircling Gill net. The same threat to bio-diversity exists
Surrounding nets	Purse seine (in the Industrial Fishery with separate light boats)	Kigoma ?	<i>L stappersii</i>	

Method	Gear	Where located/observed by FPSS	Target species	Comment
Lift nets	Lift net, one, two and three boats	Everywhere with access to deep water.	S tanganicae	The basis of the Sardine fishery
Falling gear	Cast nets	Malagarasi	O tanganicae & Labeo sp	Not common gear
Gill nets	Bottom Set gillnets	Everywhere	Mixed littoral. Selective	Locally the numbers of gill nets targeting the littoral and sub littoral give cause for concern.
	Floating Gill net	Swamps Malagarasi. Luiche	River and estuary	Not common gear
	Encircling gill net (with boat & frightening device) day & night	Everywhere with suitable flat substrate	Mixed littoral	Locally the numbers of encircling gill nets targeting the littoral and sub littoral give cause for concern.
	Reed float gill net placed round <i>Tilapia</i> nets	Swamps Malagarasi	Tilapine fishes	Targets nests in reed beds and swamps

4.2 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 were:-

4.2.1 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.

4.2.2 Extensions to the hand

The use of extensions to the hand to assist in the capture by hand of the fish. This is widespread. In November 1999 the Tanzanian FPSS team, whilst in the company of the distinguished taxonomist Dr Tyson Roberts, was able to witness *Clarias sp* being collected by hand with the use of sticks and stones whilst the fish were crossing a flooded road near the beach in Ujiji, just south of Kigoma. This was in the middle of a tremendous thunderstorm. The activity was undertaken by youths and mature men, and the fish pursued with great gusto through the shallow water. For an opportunistic fishing activity like this was the catch, of in excess of 10 kg between 5 men, must have made a welcome addition to the diet.

4.3 Grappling or wounding gears

4.3.1 Fish spears

Grappling and wounding gears restrain the fish by grappling, squeezing, piercing, transfixing or wounding the fish. The distinguishing feature of the method is that the spear or grappling gear restrains the fish. The point of the spear also remains on the pole. (If the point becomes detached and is attached to a string or rope the gear is a harpoon)

In Tanzania spears are relatively rare. Spear fishing can be both a solitary and a communal fishing method, with up to 20 people in a line moving through the swampy area. In upstream Luiche, near Kigoma in Tanzania, a group of 12 fishermen consisted of employed people who gathered together on occasional spare days to fish with spears in the swamp. Spear fishing in this case being both an entertainment and a chance to acquire something for the pot: and what better way to spend a weekend!

The spears are made locally from scrap and can be sourced from any reasonable local forge – such as the ones in Ujiji near Kigoma.

Catch rates have not been ascertained directly though the species targeted, because of the method used, must be large in size and are presumably are catfish.

This fishing method seems to pose no serious threat to biodiversity.

4.4 Stupefying Devices

4.4.1 Plant Poisons

Plant poisons stupefy fish by directly affecting their respiration in some way. There are thousands of plants that are used for fish poisoning throughout the world and the plant poisons in use in the Kigoma region of Lake Tanganyika were not identified.

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.

Plant poisons probably are occasionally used in Tanzania in rivers, estuaries and swamps, including the Malagarasi River area. It was impossible to actually confirm this.

Despite the fact that fish poisoning using plants is totally non-selective and occurs in areas of greatest biodiversity it is relatively rare and as such is not a problem, for biodiversity nor in simple terms.

4.4.2 Chemical poisons

All the comments above about obtaining data on Plant poisons apply to Chemical poisons.

One single incidence of fish poisoning using chemical poisons has been reported; by a LTBP Socio-Economic Special Studies investigation in Tanzania during 1996 at the River Mungonya¹ that the agricultural pesticide Thiodon™ had been used in the river in 1970, the fishermen using 5 litres of pesticide to obtain the desired result. This fish caught by this method smelled badly and gave the consumers headaches, so was not exactly popular. According to the report, fishing with poison was subsequently made illegal and the practice was discontinued.

The FPSS in 1999 and 2000 did not uncover the continued use of chemical poisons in Tanzania. It would be hoped that this fishing gear is no longer used.

4.5 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 Tanzania all hooks are curved (in the shape of a “hook”) and made of steel. 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, see Figure 3, and coated against corrosion., usually with a blueing material, but sometimes they are tinned or bronzed. Flat end hooks are common in some parts of Tanzania and are attached with an array of home grown knots. Ringed hooks are usually attached with a double overhand knot or a blood knot. Home made hooks are always flat ended. Mustad™ hooks are available in Kigoma 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.

4.5.1 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. Interestingly very few people use simple lines from the shore in Tanzania, perhaps because of problems with snags when retrieving the line.

The line used is nearly always nylon (PA) monofilament. (PE monofilament, from unraveled PE multifilament has been observed as has single strand PE film from Mealie Meal sacks). The sizes of monofilament available in the nearby stores affect the sizes used. However as the gear is hauled by hand, lines of 0.7mmØ – 0.9mm Ø are preferred to the smaller lines, as thicker lines gives more of a grip. 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.

¹ Lake Tanganyika Biodiversity Project. GEF-RAF/92/G32 (1996). Fishing in the River Mungonya at Bubango Kigoma Rural District, Tanzania. Socio-Economic Special Studies (SESS)

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 & 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. A yellow laundry soap and a blue & white soap are made in Tanzania and used extensively.
- Small cichlids, other tilapine fishes & sardines.

And as ground bait

- Palm oil residues

Fishing takes place in all depths where fish live. 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.

4.5.2 Pole and Line

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

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. Anecdotally some children are sent out in the morning by their parents to catch lunch. A preponderance of school children can be noted. All fishermen are male.

The pole and line basic gear varies with geography but in Tanzania the pole is short and not usually of reed. 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. 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 an 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 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.

Youths may take advantage of boats moored offshore, by swimming out to them and using them as platforms for pole and line fishing, but now in deeper water. They catch a mix of

littoral species, but larger fish due to the deeper water, with *Oreochromis tanganyicae* predominating.

The species composition of the catch depends on the substrate being fished. The catch of a pair of children fishing with pole and lines on the rocky beach at Zashe Village, north of Gombe Stream National Park was observed in November 1999 and the species in the catch were:-

Pseudosimochromis curvifrons
Xenotilapia sp
Lobochilotes labiatus
Cyathopharynx furcifer
(All Juveniles)

Another child fisherman in the same area, using worms as bait, had a catch consisting of :-

Limnotilapia dardennii
Simochromis diagramma
Petrochromis famula
Lamprologus callipterus
Telmatochromis temporalis

A completely different catch composition though from the same biotope just a few kilometres down the coast in Mwamgongo. It seems that the method will catch all carnivorous fishes in the near littoral, many of these being juveniles of cichlids who spend the early part of their life there.

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. In any case a catch of more than 500 grammes is seldom encountered. The catch is not generally sold though an offer to buy will seldom be refused. The catch is taken home and cooked whole, usually fried, and though small in weight, has been indicated through interview to be important to the diet of many marginal households. Indeed, in some households where the father is absent or dead this may be the primary protein component of the household diet.

The importance of these "little fishermen" appears to have been completely ignored in socio-economic surveys by LTBP and LTR in the past, and indeed the joint PRAs that FPSS undertook with SESS as part of the LTBP in 1997 do not mention children fishing the margins.

These multitudes of young fishermen are catching such small fish and in such numbers that this fishing practice seems to pose a very real threat to biodiversity. However there really are vast numbers of these little fish in the shallow littoral, no fish in the catch is particularly rare and the fishermen only fish a small proportion of the available lakeside habitat. Thus apart from locally in highly populated areas it is unlikely that at present the method is a generalised threat to biodiversity in Tanzania. With increased population settlement covering more of the lakeside, and with continuing poverty, this type of fishing may become very serious for biodiversity, merely due to the huge effort of the multitudes of children.

In some areas, where large fish are accessible to a pole and line, the pole and line gear used can be much heavier and with a larger hook. The method then becomes an adult activity. An area where this takes place is Malagarasi delta in Tanzania, where the line is multifilament R350tex nylon with a Mustad No 8 tinned Kirby hook. The poles taper from 17mmØ to 6mmØ and are about 2.5m. The line 3 times the length of the pole. Bait is fish flesh. This is a much more substantial gear than the "children's" gear described above, and is used for *Clarias sp* and *Oreochromis tanganyicae* in the rivers and swamps there. In these areas the catch is smoked for sale inland. Fishing is an adjunct to agriculture in the areas where this pole and line activity takes place.

4.5.3 Vertical Hand line, baited (mesopelagic)

Some of the fishermen involved in the lift net fishery target in northern Tanzania employ their idle time whilst waiting for the target species (*Stolothrissa tanganicae*) to aggregate round the lights, by fishing for the large predators of the lake with baited lines. These are *Luciolates mariae* (with some *L. angustifrons*). These fish are attracted to the lights because they aggregate their prey.

The gear is 20 to 30 hooks on a vertical line. White nylon monofilament Ø0.65mm mainline and droppers. Each hook on an 8cm dropper and spaced about 65cm apart. The weight is Ø 25mm reinforcing rod cut to 20cm lengths, with a whipping and loop to attach the essentially smooth reinforcing rod to the mainline.

The line is kept on a softwood "H" shaped holder, with the hooks inserted into the wood to avoid tangling.

When fishing from a lift net boat the line is threaded through a loop on the end of one of the long wooden spreaders for the lift net and then lowered into the water to the required depth, which was said to be 100m, though that is the depth of the deepest hook, the shallowest hook would be 70m or less. The spreader of the lift net acts as a bite indicator, in that it "nods" when a fish is caught. Several fish can be caught at one time. *Stolothrissa tanganicae* is used as bait.

This method is only used when the lift fishery is going on, so not during the period of the full moon.

Only *Luciolates mariae* and the occasional *L. angustifrons* are caught using this method.

This method is not common. Only one example was found by the FPSS teams, at the north end of Zashes village, near the Burundi border, though others were reported to be in use.

Catch rates are unknown.

4.5.4 Vertical hand line, jigging (epipelagic & 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. Removing the fish is the longest part of the operation, and the lines sometimes become tangled in a manner that would credit to Gordius, wasting many minutes of potential fishing time in their untangling.

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. Evening fishing ceases when the light intensity reduces with the onset of night 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; the vertical hand line for bottom species thus not being an effective way of catching *Limnothrissa miodon*.

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.

Epipelagic jigging is also reported (Petit 1997) to be used around light boats in the sardine fishery in Tanzania and the target is then *Luciolates stappersii* which are attracted to the lights. This activity is of annoyance to lift net fishermen who resent the presence of these interlopers, especially if their hooks become entangled with the lift net, though the same method is used by lift net crews to catch *L stappersii* when waiting for sardines to aggregate to the lights.

In the littoral zone jigging without bait is also widely practised. The target is *S tanganicae* 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.

4.5.5 Vertical hand line, jigging, unbaited (Mesopelagic)

This handline fishery for *Luciolates stappersii* in N Tanzania does not appear as a significant fishing method of the lake except that it is briefly mentioned in Petit (1997) as occurring in Mtanga, south of Gombe Park, but only as a gear of minor importance; and it only receives passing mention elsewhere. FPSS in November 1999 noted it as a vary large and productive fishery, between Gombe and the Burundi border. It was also noted in Kigoma and South of Kigoma to Mahale.

In Tanzania the gear consists of a hand line of 150m length Nylon white monofilament Ø 0.70mm. The weight is a piece of iron reinforcing bar, 20 cm long x Ø20mm, whipped with nylon PA white mono Ø 0.70mm with one whipping used as a loop. To this the mainline of mono is attached. On the mainline 60 x size 12 Mustad Kirby ringed and blued hooks are attached on droppers of 6 cm at a spacing of 60cm. The line is kept on a soft wood line holder into which the hooks are stuck to avoid their tangling up. In some examples of the gear the shanks of the hooks are covered with strips of toothpaste (Colgate™) tube metal, metallic side out, rolled round the hook, to improve its visibility. (See net Plan No 1).

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 two people per boat. Fishing is unaffected by moon phase.

In Mid-November 1999 the FPSS team in Mwangongo, Tanzania, observed from a nearby hill, 75 boats sailing home from the fishing grounds at 3.00pm, though more were coming into view all the time, and given the distances involved many would be out of view heading for more distant villages. (Not all of these 75 vessels were from Mwangongo²) Estimates of the numbers of these boats varies, but it seems that up to 200 are available to fish in the area North of Gombe Stream National Park to the border with Burundi. The sail powered boats had

² A 1999 Draft SESS survey of Mwangongo reported 20 boats and 40 fishermen.

left during the early night (1-2am) and paddled/sailed into the lake towards the South West, returning between 12 noon and 4.00pm. A trip length of 10-15 hours. It takes 2-3 hours to reach the fishing grounds by sail, which is faster than paddling. The fishing grounds are in the very deepest parts of the lake – more than 1000m deep.

Wholesale fish are 20 Kg for 5000/= . An average two fisherman trip was (reported by some fishermen) to expect to earn up to 40,000/=TZ per day. This is equivalent to more than 80 kilos of fish per boat per day. The observed average catches seemed to be smaller, 15 – 30 kg, rather than the 80 kilos that this earnings estimate would imply. The beginning of the wet season is reported as the best time for fishing *L. stappersii* in this manner, so these catches could be expected to be the peak, rather than the norm

Despite this, the reported number of boats in N Tanzania (200 boats) catching a conservative 15 kilos a day is 3 tonnes per day of *Luciolates stappersii* being landed in the relatively small distance between Gombe National Park and the Burundi border. Even allowing for seasonal variations and variations in effort this is probably a significant fishery of more than 1000 tonnes/year in this limited area. Over the the rest of Tanzania the catch must be much be larger since these fishermen exist everywhere.

The gear is not new, and has been used for about 30 years. Who discovered that the *L. stappersii* lived at such great depth, in the relatively distant parts of the lake, is unknown.

The boats have a sail to use whenever there is wind. In the morning there may (or may not be) a land breeze, which helps the boats out to the depths of the lake. In the afternoon the sea (lake ?) breeze brings them home. The boats used are small, 5 – 6m, planked without frames. Three seats, one at the stern, one in the bows and one in the beam of the boat, provide stiffening for the boat. In the forward seat is a hole for the sail with a wooden step nailed onto the bottom of the boat. The lateen sail is made from PE sacking stitched together. Stormy weather is the greatest fear of the fishermen. Many of the vessels have attachments allowing them to be used as light boats for the lift net, or sardine beach seine fishery, which would presumably reduce the number of boats fishing when the Lift net and Light Assisted Beach Seine fleets are working (and hence the catch).

The fish landed in Mwamgongo is either sold fresh for immediate consumption or (mostly) bought by women who smoke it and send it to markets inland, mainly East of Gombe Stream National Park, rather than south to Kigoma or North to Burundi. The large amount of fish smoking going on in these villages may explain in some way the hills denuded of trees inland.

This method is only targeting *Luciolates stappersii* and as such is not considered to be a threat to biodiversity. Its importance in socio-economic terms for the villages where it is practised is however high, as it provides a large amount of income to the inhabitants, and employment for women who smoke and market the fish.

4.5.6 Bottom set long lines

Bottom set long lines are common in areas of extensive muddy and sandy bottom such as the Malagarasi and Luiche Deltas in Kigoma District. Deep flat rocky areas are an acceptable substrate for long lining if there no obstructions, but on substrates with boulders they are not effective as the lines get caught up too much.

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. The mainline and the branch lines are usually, but by no means always, monofilament of the same breaking strain.

The number of hooks varies with the individual fisherman; lines with 300 hooks are common. The hook size varies with the target species and substrate. Some of the hooks are locally made and barbless. The length of the floatline varies with the depth to be fished. 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 layout of a bottom set long line from Ujiji can be found in Net Plan 2

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. This pattern has variations. In Luiche Delta near Kigoma, the line may not be removed often from the water at all; merely being checked, with the catch removed, and the hooks rebaited, twice a day (morning & evening), giving a soak time of 12 hours between checking

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

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 be noted.

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.

A boat is needed to set the line. These are usually the common planked paddling boats with or without frames of between 4.5 and 6 meters that are found in abundance round the lake. Dugout canoes can also be used.

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 cichlids (<15cm) and small tilapine fishes would not be caught.

4.5.7 Floating lines

This is a gear set in reedy areas for a variety of swamp and reed loving species.

It is a very simple gear, consisting of a line of 210d/15 nylon multifilament of 60cm attached with a Ringed Tinned Kirby Mustad size 9 hook, to a balsa like (green & freshly cut) float. (see Gear Plan 3). The gear is baited with bits of *Tilapia sp* and *Clarias sp*. It is set in the swamp in waters of 1m – 1.20m.

Fish targeted are:-

- Polypterus aethiopicus*
- Polypterus ornatipinnis*
- Oreochromis tanganicae*
- 2 x *Clarias sp*

All swamp species

The gear has only been observed in the Malagarasi River. One fisherman in a dugout canoe. He had 30 sets of gear in his canoe and was just off to set them. There are no doubt others in the region who use the same method; but FPSS did not find them.

In that there are not a lot of these gears operating in the lake, the threat that they pose to biodiversity can be assumed to be very limited.

4.5.8 Bottom trolling

Another method not often seen in the commercial fishery (but use in sport fishing) is bottom trolling.

The gear consists of a commercial spinner, with one kirbed hook attached to 0.7mmØ mono PA - 9m. The line leads to a round stone of approx 150gms bound in mesh of nylon inner tube. To the stone is attached 90m of Ø0.7mm mono PA and then the holder of wood in shape of an H. (see Gear Plan 4)

The spinner and stone are paid out behind a one man paddling canoe whilst the fisherman is paddling on the way to set a long line. The stone runs along bottom, which must be sand and free of obstructions (the hook is moving over the bottom). The depth the gear is set in varies but is typically 10 - 30m, and the amount of line paid out depends on the depth (the longer the more line). It would appear that the stone raises a cloud of dust; fish investigating this come across the spinner and take it³.

Target fishes are *Luciolates angustifrons & mariae* and *Boulengerochromis microlepis*

The method has only been seen being used in Ujiji in Tanzania, on the Luiche Delta fan and only one fisherman there has a set of gear.

Such a rare gear poses no threat to biodiversity.

4.5.9 Surface trolling

Surface trolling gear is not common at all. This gear is used by 3 people in Z Ashe village in N Tanzania. Nowhere else was it found, but presumably were a more thorough beach survey of adjoining villages to be done than the time, manpower and budget of FPSS 1999/2000 allowed.

The gear measured by FPSS in 1999 consisted of 19 hooks, spaced at 670cm apart on 16cm droppers of Ø0.8mm white nylon monofilament, attached to mainline of Ø0.9mm nylon white monofilament.

A PP foam doughnut shaped float is attached at far end of line, 296cm behind last hook. The line is trolled behind a paddling boat with the first hook 15m behind stern. No 9 Mustad Kirby Ringed and Blued hooks are used. (see Gear Plan 5). Hooks and line are stored on a H shaped piece of wood, with the hooks embedded in the soft wood to stop tangles.

Sardine is used as bait.

The gear is used by trolling at night round the area of the light boats of the lift net fishery. The target species is adult *Luciolates mariae* only.

The vessel used is a two man paddling canoe.

³ A very similar method, using a retrieved line, is used in Europe for catching flounders in estuaries

4.6 Traps

4.6.1 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.

The commonest non return trap in Tanzania is conical and made of bamboo or wooden sticks. There is an ornate funnel entrance in bamboo and mesh, or sticks, formed round a steel or wooden hoop. The trap size may vary, both in length and circumference, but is typically about 70cm long and with a diameter at the "fat" end of about 50cm. The entrance to the commonest type of trap is not central. The fish have to swim upwards, into the funnel of the non return device, and then once they have 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.

Variations in individual construction abound. Most fishermen make their own. These traps are usually set in swamps and lakes adjoining the rather than in the main water body itself.

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 large tilapine fishes. Small fishes can escape one of these traps, as the mesh size is typically 45 – 50mm.

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.

Fish fences may be used in conjunction with these non return traps, to concentrate the fish into the trap.

Typically one fisherman owns 30 – 50 traps.

The catch is alive when collected and is also very saleable, because of its freshness and size. Despite this much of the catch in remote areas is smoked, merely because there is inadequate transport.

There is apparently some problem of theft from traps, as they are left unattended.

In that the smaller fishes of interest to Biodiversity are not trapped, and only large adult fish caught, unless there are very large numbers then there should be little problem with their effect on Biodiversity. Tanzania does not have concentrations of traps like in some other parts of the lake.

4.7 Bag nets

The principle of a scoop net is that the fish are filtered from the water in a bag of netting kept open by a frame, which is moved through the water by the fisherman. There are two types of bag net being operated in Tanzania on Lake Tanganyika.

4.7.1 Lusenga

A lusenga is a large scoop net for immature sardines, with a wooden frame and a bag made of what is locally called "mosquito netting". The principle is that the fish are filtered from the water by the mesh of the net, which they enter more or less voluntarily, or at least do not make much effort to escape.

The scoop net frame is kept on the beach and the bag kept rolled up in the house. The bag being relatively expensive to make and is liable to theft. The diameter of the opening of a lusenga is typically less than 3m, 2.5m – 2.75m being common. The opening is not quite circular, being slightly taller than wide. The depth of a lusenga bag varies but is typically about 3.5m. The handle is of variable length, commensurate with the size of the opening (larger nets have larger handles), but typically 5-7m.

When the time has come to fish the fisherman takes the bag from the house and attaches it to his frame on the beach, using 210d/45 twine or similar. He uses a 2 man paddle canoe with a pressure kerosene lamp on a holder in the bows and attracts immature sardines in waters close to the beach. These are led by the boat into shallower water which tends to concentrate the fish since they keep clear of the bottom. The fish are then scooped out of the water using the net on a pivot on the side of the boat.

Larger sardines are absent from the catch, as they evade the net, and most other species are not attracted to the lights. The catch thus tends to consist of juvenile sardines. It should be emphasised that this kind of gear cannot catch large fish as they swim out of the way of the net. A forced increase in the size of the mesh would make the fishing gear inoperable, because then the target fish, small pelagics, would get through the mesh and almost nothing would be caught.

Bags for these nets are really tatty, and are made from numerous pieces of netting, sewn together to form a bag shape.

Lusenga fishing is dependent on lights. At the period of the full moon, when the moonlight intensity is highest, the lamps used to attract the fish do not work and fishing is suspended. Thus lusenga fishing works only about 75% of the time.

The numbers of Lusenga nets seems to be decline.

4.7.2 Scoop net (Hand operated)

These are scoop nets that are used in reedy areas to catch catfish and tilapine fishes.

In Tanzania small scoop nets have been found (Petit 1997) used in conjunction with lights in a drive in fishery at night, where a sleeping fish is located using lights. The scoop net is placed behind the fish and a paddle is struck onto the water, frightening the fish into the net.

4.8 Dragged gear

The principle of dragged gear is that the passive fish are filtered by the active net which does not necessarily have to have a frame.

4.8.1 Dragged bag net (Mousquitaire)

This is a dragged gear made of genuine mosquito netting (mesh size about 1.5mm) with a rectangular entrance and a long bag behind. Although some of these nets are made from sewn sheets of mosquito netting, which is available in the larger towns, many are made from Chinese made mosquito nets that can be bought in most street-side markets and town stores round the lake. (see Gear Plan 6).

The two sides of the net are fastened to poles by which the mouth of the net is held open. One fisherman takes each pole and the bag net is dragged along in the margins of the lake (in less than the depth of the mouth of the net).

The gear is very portable, and usually carried rolled up on the poles used to drag the net and keep the mouth open. Fishermen patrol the beach margins and when a school of fry is sighted they unfurl the net and proceed to drag it through the fish school.

The catch is almost exclusively immature sardines, though some immature fish of other species are also taken. May and June are particularly productive as the fry of *S. tanganyicae* are in the margins.

Subsistence fishermen tend to fish until they have caught a predetermined amount of fish. When the bucket, casserole or plastic bag or other receptacle is suitably full they roll up the gear and go home. They are generally fishing for the pot rather than for commercial purposes. Some artisanal fishermen fish for sales and catch considerably more. Petit (1997) comments that Mosquito nets can catch up to 10kg/day. Apparently the catch rate is dependent on the season. The method is illegal as it violates mesh size regulations.

This is an important adjunct to the diet for some lacustrine families.

4.9 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. Open water seines usually have a bag and are operated from a boat.

There are three basic designs used in the Kigoma region:-

1. A beach seine for sandy beaches
2. A beach seine for use exclusively with lamps at night
3. An open water seine net with bag developed from an encircling gill net, operated from a boat and using a frightening device, at night. (Illegal).

4.9.1 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.

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 side.

A beach seine can only be operated from a beach or over solid 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. They may not even be a fisherman, merely a business man. The crew are 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 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.

Catches vary considerably depending on the amount of fishing that has been going 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). FPSS Tanzania data from 1998-2000 gave an average catch rate of 39.82kg/day off 2 hauls.

In Tanzania beach seines are banned, by a law that came into effect in January 1998. In 2000, though everyone knows about the ban, it is not being enforced and beach seines can be seen throughout the Tanzanian zone of the lake.

4.9.2 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).

This gear is fully described in Petit (1997), particularly with regard to Gombe Park. It is now banned in Tanzania, though the ban is widely disregarded.

Fish are attracted to lights on light boats. These boats bring the fish closer to the shore, where they are accessible to the net. The net is set from a boat. The net floats until it reaches shallow water when it starts to pick up littoral species of interest to biodiversity. However the by-catch of littoral species is not great, and only in those areas where there is intensive use of light assisted beach seines would this be a problem for biodiversity. Catches can be as low as 2 kilos a haul, though the net will be hauled several times a night.

4.9.3 Open water seine (with frightening device)

The open water seine has a bag and the fish are caught in the bag rather than the net (hence it is a seine not a gill net). It is used during the night.

This net is very similar to an encircling gillnet. It is operated in the same way, using a boat and a frightening device. It is operated at night. The major difference is the bag in the net, which catches the fish. Only one of these seines was seen by FPSS in 1999, near the Malagarasi Delta in Tanzania, being operated by Congolese refugees.. It is thus not an important gear.

This is locally known also as a "mtimbo" by the local fishermen though it is not the same as a classic mtimbo which is an encircling gill net and uses a different principle for the capture of the fish.

The details of the net are given in Gear Plan 7. The catch is very similar to that of the Encircling Gill net.

4.10 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, having been attracted by lights.

4.10.1 Single boat, catamaran and trimaran lift nets

Though this is one of the most important gears used on the lake, it is not covered in detail here as it is a gear targeting pelagic species in the pelagic zone; and has been the subject of much research by the Research for the Management of the Fisheries on Lake Tanganyika a FINNIDA/FAO project.

In Lake Tanganyika there are varying degrees of development of this gear, from a simple sheet of netting, utilised at night by only one boat with poles acting as spreaders in water of less than 20m with 2 or 3 lamps to attract the fish; to sophisticated 'Apollo' nets, with the vessels of the catamaran further apart and with bigger and better nets and more lights, and accompanying light boats to enhance the attraction of the fish. 3 boat "Apollos" have also been developed as the catch from a lift net increases disproportionately quickly with any increase in the size of the net. These various gears are described in detail by Petit (1995).

The gear is described well in a series of document, notably the FAO Catalogue of Small Scale Fishing Gears, where a two boat catamaran with its net is impeccably illustrated. Similarly it is covered in Petit (1997), Petit (1995) in the reports of the LTR project, and in FAO reports from the early 1970s.

The economics of the operation have been covered in Petit (1995), and the whole trade in sardines, the majority from lift net fishing, by LTR in its numerous reports.

Catch rates average 200 kilos per night, a figure derived from 80 hauls examined by FPSS in Tanzania (Kigoma) in 1998-2000.

Despite this it seems that many observers still think of lift nets as a "small scale method". The literature emphasises the catch and the economics and the importance of the lift net industry but seems not to emphasise the sheer size of the gear in use in the sophisticated two and three boat fishery. This gear is staggeringly expensive for poverty stricken lacustrine peoples, and the fish produced is the mainstay of the economy in many villages

As a result of this gear not affecting the littoral at all, and even the simplest and smallest lift nets operating in relatively deep water away from the shore, where the fish are concentrated with lights, the gear does not catch littoral fish except for the occasional unfortunate specimen. It is not considered to be a direct threat to biodiversity.

4.11 Falling Gear

The fish is covered by the gear from above so that it cannot escape.

4.11.1 Cast nets

A cast net covers the fish with netting which is thrown out in a circle by the fisherman. This is done in shallow water so that the fish is held between the bottom and the net.

Despite cast nets being common in most parts of Africa, their use in Lake Tanganyika is most limited. Indeed only one was found on Lake Tanganyika by FPSS in 1999/2000. This was in the Malagarasi delta, south of Kigoma in Tanzania. It was home made by the fisherman using nylon multifilament (See Gear Plan 8). The desired shape had been achieved by increasing the size of the meshes of the net from the top to the bottom from about 22mm stretched mesh to about 55mm stretched mesh (though the mesh sizes in the net were not regular).

The net was fished from a small dugout canoe in the lesser creeks of the delta. The target was *Labeo sp* and *Oreochromis tanganyicae* which was later smoked and wholesaled to buyers from Kigoma.

This gear is not common and does not appear to pose any threat to biodiversity.

4.12 Gill nets

The principle of the gill net is that the fish swims into the net and is caught by its head, 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 & gills stuck in a small mesh; and a small fish will merely swim through a large mesh.

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. Areas of cut reed are particularly damaging to encircling gill nets

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.

4.12.1 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 ciclids 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 (see net plan 16). In front of some of the villages round the lake up to 12 km of net might typically be set every night.

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.

There is no tradition of setting a net in a place and then returning at set intervals to check the catch and remove the fish. The net is always retrieved to be cleaned.

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.

The range of mesh sizes employed indicates that all sizes of ciclids and tilapine fishes above about 10cm length (those caught by the smallest nets employed, the 1 inch nets) are being persecuted. It is not so much that the fishing gear is in itself dangerous to biodiversity, but that the sheer size of the gill net fishery, the kilometres of net placed nightly and the wide range of mesh sizes employed is such that all fishes apart from the very smallest in the littoral are being very heavily fished.

In Ujiji in November 1999 FPSS found the following gill nets, all of which were set every night except during celebratory times or times of sickness; (~260 days/year)

No	Mesh size	Mesh size (mm)	No pieces	Length Stretched (yds)	Length hung (Yds)	Length hung (m)	Comment
1	5	127	30	1500	990	900.9	
2	6	152.4	15	750	495	450.45	
3	5	127	20	1000	660	600.6	
4	3	76.2	15	750	495	450.45	
5	4	101.6	15	750	495	450.45	
6	3	76.2	15	750	495	450.45	
7	1	25.4	20	1000	660	600.6	
8	2	50.8	10	500	330	300.3	
9	3	76.2	20	1000	660	600.6	
10	6	152.4	20	1000	660	600.6	
11	2.5	63.5	13	650	429	390.39	
12	2	50.8	15	750	495	450.45	
13	3	76.2	20	1000	660	600.6	
14	3	76.2	20	1000	660	600.6	
15	3	76.2	20	1000	660	600.6	
16	2.5	63.5	20	1000	660	600.6	
1	Not surveyed but present in village				594	540.54	Estimate
2					594	540.54	Estimate
3					594	540.54	Estimate
4					594	540.54	Estimate
5					594	540.54	Estimate
			Total length in Yards		12474		
			Total length in metres		11351.34	11351.34	

These gears, when placed in a box and carried home, appear very small and insignificant. One kilometre of one inch gill net will fit into a small sack or fish box and can be carried off by a small child. This may be why they have seldom excited interest in researchers and statisticians.

4.12.2 Floating Gill Net

This is not a common gear, and is used in swamps and rivers associated with the lake rather than in the lake itself.

In November 1999 in the Luiche Delta in Tanzania one floating gill net (2" x 26md, length ~ 35m) was observed by the FPSS in the swamp, threaded between the weed clumps. The net had no weights on the footrope which was 210d/2 nylon multifilament, and the floats were bark, attached to the headline by loops in the headline itself. The headline was 210d/2 nylon monofilament.

One Tilapini was observed in the net. The net was not attended and the owner was not in the swamp at the time, so further enquiries could not be made.

4.12.3 Encircling gill net (with boat & frightening device)

An encircling gill net is a gill net with draw lines, shot round an area and then retrieved. The draw lines frighten fish inwards which allows them to be encircled and then gilled in the net. The gear is used from a boat with 3 people. A frightening device is used, with one crewman manipulating the frightening device whilst the other two draw in the draw lines. The frightening device is similar to that shown in Net Plan 7 for an open water drive in seine. Some fish larger than can be gilled in the mesh are sometimes caught. The gear thus has some of the characteristics of a seine net. However as the fish are generally caught by gilling, it is classified as a gill net

The FPSS in 1997 conducted a study on the "Mtimbo" fishery in Lugunga camp south of Kigoma in Tanzania. The report on this was produced in 1997 (Petit (Ed) 1997) and should be referred to for a very detailed description of this gear and its use, and the Lugunga village area.

This gear is mistakenly referred to by Petit (1995, 1997) as a ring net. It does not have rings on the footrope, nor is it used in open water.

There are two types:-

- For use by day. With a mesh size of 1½"
- For use by night. With a mesh size of 2 – 2½"

Encircling gillnets are generally perceived to be a "bad" gear. This is because they are used in conjunction with a frightening device and they are presumed to catch more than ordinary gill nets. The lack of knowledge on the actual effects of using encircling nets is acknowledged by Petit (1997) , and no research has been done in the intervening 3 years. The FPSS then (1997) opined that the small mesh encircling nets were more damaging than the large mesh ones as they are used in shallower water.

Catch figures for the gear are given in Appendix 3, and the sizes of the various species caught at also listed for different mesh sizes.

4.12.4 Reed floated gillnet for Tilapia

In the Malagarasi delta in Tanzania, at Mwambani Fishing Camp, the FPSS in 1999 found a fisherman who had (reportedly x 100) small nets for fishing tilapia nests. These were un-weighted made of a piece of 210d/2 white PA nylon 3" gill net, 15 meshes by 26 meshes. The 15 mesh sides (top and bottom) being double selvedged. A piece of commercial netting cut from a gill net. On the headline were 5 reeds as floats/spikes, the outer two being used as spikes to hold the net in place and the inner three as floats to keep the top of the net at the surface. Reed Ø = 7mm. See net plan 9.

The use of the net was that it is placed next to tilapia nests. The end reeds are spiked into clumps of vegetation or the muddy bottom substrate, and the mesh stretched between them, with the three inner floats holding the net from sinking. The bottom, unweighted edge of the net is pushed into the mud/vegetation substrate using another reed so that it reaches the bottom.

Male Tilapia return to the nest after the disturbance and are meshed. Female Tilapia visiting the nests are meshed. Male tilapia will take over an empty nest, so the fishermen can continue to use a nest, even when he has caught the male and the female, since the nest replenishes.

The method is called "Matela" in the local language.

A description of this method is given by Petit (Ed) 1997 in a report on a joint BLOSS/FPSS visit to Luiche delta, though the description of the gear employed is at variance with the account given here, in that there are only two reed floats, and that the name is "Butela"

These nets are not widespread. The man interviewed by FPSS in 1999 appeared to be the only person using this method in the whole Malagarasi delta. Petit mentions that there may be 5 people doing this in the Luiche in 1997.

4.12.5 Drive in gill nets

This is a gill net into which the fish are driven, though the net is static, unlike an encircling gill net.

One of these was observed in the Luiche delta in Tanzania by FPSS in 1999. It was 2½" mesh size, 210d/2 multifilament and 26mesh deep. (This netting is available in local stores in Kigoma and Ujiji). Reeds are used as floats. The reeds are about 90m long. A 60cm reed attached to the headline of 210d/6 every 1.2m. Each reed float is juxtapositioned with a D size torch/radio battery, attached to the 210d/6 footrope with rubber inner tube bindings.

This daylight method involves setting the net parallel with the reed bed edge, approximately 1 metre from the reeds. The boat is then paddled along the line of the net about 10m into the lake, and the paddle beaten on the water to frighten the fish into the net. The net is then retrieved, and the gilled fish removed. The net is deep enough to cover the whole water column from bottom to surface.

The catch was observed, one small *Oreochromis tanganyicae*. No estimate of the days catch was made.

The same drive in fishery apparently also exists in reverse, with the fish being frightened out of the reed beds by people splashing and jumping about in the reeds, into a similar gill net set by boat or on foot along the outside margin of the reed bed.

In Kigoma bay, a night time drive in fishery exists whereby a bottom set gillnet is placed in shallow water about 15m from the shore. A paddling canoe then passes very close to the shore, with the two fishermen inside rhythmically banging their paddles on the canoe sides, chanting and singing, the noise produced being either melodic or chaotic, depending on the abilities of the fishermen and the opinion of the listener. This cacophony drives the fish, who presumably were slumbering in the shallows, into the set net offshore as they attempt to escape into the depths.

None of these drive in methods are very common, and for fish seem to present no more of a threat than other gill nets.

5. REFERENCES & FPSS REPORTS

- Brandt, A von (1972) – Fish Catching Methods of the World. Fishing News Books, London
- Coulter, G (Ed) (1991) Lake Tanganyika and its life. British Museum (Natural History) Natural History Museum Publications, Oxford University Press, UK
- Dorr, J (1999) Unpublished. Lake Tanganyika Biodiversity Project. GEF-RAF/92/G32 Fishing Practices Special Study (FPSS) Work Plan
- FAO. (1975) - FAO Catalogue of Small Scale Fishing Gear. Fishing News Books, London
- Hanek, G (1994) – Management of Lake Tanganyika Fisheries Resources. GCP/INT/271/FIN-TD/25 Research for the Management of the Fisheries on Lake Tanganyika. FINNIDA/FAO Lake Tanganyika Biodiversity Project. GEF-RAF/92/G32 (1996). Fishing in the River Mungonya at Bubango Kigoma Rural District, Tanzania. Socio-Economic Special Studies (SESS)
- Mabochi, H; Marwa, B; Kashushu O, Tambwe S. (Undated) Lake Tanganyika Biodiversity Project. GEF-RAF/92/G32. The fishing activity in Ujiji field survey (9/11/1997) (in Swahili)
- Mabochi, H; Marwa, B; Kashushu O, Tambwe S. (Undated) Lake Tanganyika Biodiversity Project. GEF-RAF/92/G32. The fishing activity in Ujiji field survey (9/11/1997) (in Swahili)
- Mabochi, H; Marwa, B; Kashushu O, Tambwe S. (Undated) Lake Tanganyika Biodiversity Project. GEF-RAF/92/G32. Katonga Special Study (14/11/97). Kaseke (16/11/97).(in Swahili)
- Marwa B, Kashushu O, and Mabochi H. (1997) Lake Tanganyika Biodiversity Project. GEF-RAF/92/G32 (December 1997). A follow up report at Mtanga.
- Marwa, B; Mabochi, H; Kashushu, O (Undated) Lake Tanganyika Biodiversity Project. GEF-RAF/92/G32. The fishing activity in Lugunga field survey (9/11/1997) (in Swahili)
- Marwa, B; Mabochi, H; Kashushu, O; (1997) Lake Tanganyika Biodiversity Project. GEF-RAF/92/G32. Kaseke and Ujiji report
- Marwa, N (1998) Lake Tanganyika Biodiversity Project. GEF-RAF/92/G32 (1997). National Workshop on Sectoral Problem Review. Fishing Practices and Gears.
- Petit P (Ed); Mambona C; Kissaka M, Kashushu O; and Hamisi J. Lake Tanganyika Biodiversity Project. GEF-RAF/92/G32 (1997). Report of the “Mtimbo” Fishery, Lugunga, Kigoma Region, Tanzania. Fishing Practices Special Study (FPSS)
- Petit P (Ed); Marwa B; Kissaka M, Kashushu O; and Tanbwe KS. Lake Tanganyika Biodiversity Project. GEF-RAF/92/G32 (1997). Report of Participatory Rural Appraisals in Mtanga Village, Kigoma District, Tanzania. Fishing Practices Special Study (FPSS)
- Petit, P (1995) - Les Pecheries du secteur Burundais du Lac Tanganyika; Evolution durant les années 80 et situation actuelle. PhD Thesis. Institute National Polytechnique de Toulouse.
- Petit, P. (1997) - Lake Tanganyika Biodiversity Project. GEF-RAF/92/G32. Report of Preliminary Participatory Rural Appraisals in Zambia: Kasakalawe, Nsumbu & Kapata Villages. Fishing Practices Special Study (FPSS)
- Petit,P (1994) Tanganyika – Burundi Ufundi wasKazi ya maji ujuzi wa waroaji(in Swahili)
- Petit, P, (1997) Lake Tanganyika Biodiversity Project. GEF-RAF/92/G32 (November 1997). FPSS Report. Part I: Survey on Fishing Practices and the related socio-economic aspects. Training Exercise at Ujiji, Katonga and Kaseke. Part II: Participatory Rural Appraisals in Tanzania. Lugunga Fishing Camp, June 1997. Part III. Participatory Rural Appraisals in Tanzania, Kirando Ward, August 1977. Part III. Appendices and data from the SS. Fishing Practices Special Study (FPSS)
- Petit, P, (1997) Lake Tanganyika Biodiversity Project. GEF-RAF/92/G32 (March 1997). FPSS Report. Part I: Participatory Rural Appraisals in Tanzania. Mtanga Village. January 1997. Part II Participatory Rural appraisals in Zambia. Kasakalawe, Nsumbu and Kapata Villages. Februray 1997. Part III Notes on the Biodiversity Impact Score and other features relevant to LTBP objectives. Part III. Appendices and data from the SS. Fishing Practices Special Study (FPSS)
- Tanzania United Republic of. Gazette of, (1984) The Fisheries Act 1970 (in Swahili)

6. APPENDICES

6.1 Appendix 1. Retail Fishing Gear Prices. Kigoma, Mpulungu, Bujumbura

17/11/99 US\$ = 787 Tanzanian shillings

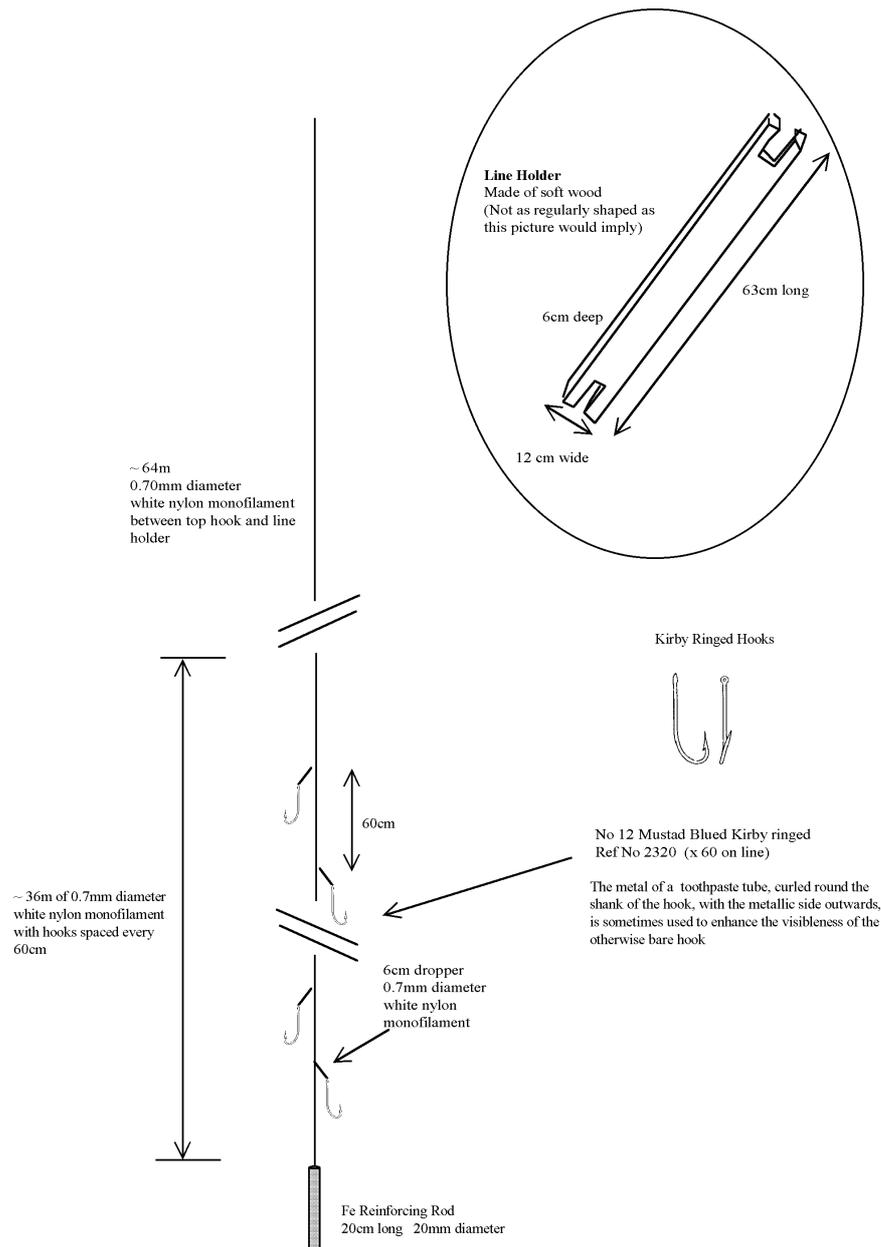
Location	Gear	Manufacturer	Gear specification	Price TZ Sh
GHN Enterprises, Phone 4160 Kigoma Specialises in Lift net and beach seine netting and lights. Stated that a beach seine requires 300 pieces of 210d/4 x 800mesh deep x 100m to make.	Lift net netting	Namyang Corporation, PO Box 126, Pusan, Korea. Tel (51) 4130071/5 Fax: (51) 413 2400/7020	Nylon Raschel Knotless Netting Red 210/d4 x 8mm stretched mesh 800md x 100m panel of netting (6.4m x 100m)	460.000/=TZ
	Ropes		6mm Ø PE 3 strand brown x 200m	15000/= TZ
			10mm Ø PE 3 strand white x 200m	32000/= TZ
			10mm Ø PE 3 strand brown x 200m	35000/= TZ
			12mm Ø PE 3strand brown x 200m	42000/= TZ
			14mm Ø PE 3strand brown x 200m	47000/= TZ
	Twine		210d/6 8oz bobbin	3000/= TZ
			210d/9 8oz bobbin	3000/= TZ
			210d/10 500 gm bobbin	5000/= TZ
			210d/15 8oz bobbin	3000/= TZ
			210d/36 500 gm bobbin	5000/= TZ
Pressure Lantern	Egret Brand Shanghai Light Industrial Products, Import & Export Corporation China	1 Lamp	16000/= TZ	
Pressure Light glass		1 Dozen	16000/= TZ	
Jan Mohamed Box 12 Kigoma	Mosquito Net	Unknown	1 m x 50 m roll	38000/= TZ
Hasani G Najafi Box 229 Kigoma	Gill Nets	China	210d/2 Nylon 2 inch x 26 md x 50 yards Double selvege	1200/= TZ
			210d/2 Nylon 2inch x 26md x 50 yards Double selvege	1200/= TZ
			210d/3 Nylon 2½inch x 26md x 50 yards Double selvege	1200/= TZ
			210d/3 Nylon 3 inch x 26md x 50 yards Double selvege	1200/= TZ
New Stores Box 1323 Kigoma This shop has the best selection of fishing gears in Kigoma.	Gill Net	China	210d/ 3 Nylon 4 inch x 26 x 100yards Double selvege	3400/= TZ
			210d/3 Nylon 3½ inch x 26 x 90yards Double selvege	3400/= TZ
		Chapa Simba Tanzania Fish Net Industries Ltd Box 21005 DSM	210d/9 63mm x 26md x 45 yards	7000/= TZ
	Fishing Hooks	Mustad Made in Norway	Kirby Ringed & Duratin Size 9 x 100 Pc (Sizes 1 ---20 available)	2400/= TZ
	Fishing Lines	Tunny Fishing Brand China	0.60mm x 100yards nylon monofilament in 4 hanks of 25yards (Sizes 0.3--- 1.0 mm available, prices vary with size)	300- 1500/= Tz
Mending Twines	China	210d/ 2-White Nylon multifilament-100gm bobbin (Sizes 210d/2 – 210d/60 available, all same price)	600/= TZ	

Location	Gear	Manufacturer	Gear specification	Price TZ Sh
RISASI MOTORS Plot no 149 Lumumba Road Kigoma	Out Board Engines	YAMAHA JAPAN	HP 2	504,000/= TZ
			HP 5	924,000/= TZ
			HP 8	1,200,000/= TZ
			HP 9.9	1,380,000/= TZ
			HP 15	1,440,000/= TZ
			HP 25	2 040,000/= TZ
			HP 40	2,340,000/= TZ
			HP 48	3,000,000/= TZ
			HP 55	3,120,000/= TZ
			HP 75	3,840,000/= TZ
			HP 85	5,160,000/= TZ
			HP 115	6,300,000/= TZ
Market Stall	Fish Hooks	Eagle Brand Maruto Japan Quality No 1270	Kirby sea hook ringed & bronzed No 17 1 box of 100	1800/= TZ
			Kirby sea hook ringed & bronzed No 14 1 box of 100	2200/= TZ
			Kirby sea hook ringed & bronzed No 13 1 box of 100	2400/= TZ
	Staples	Locally manufactured	2 inch staple for boat building	18/=TZ

6.2 Appendix 2 Gear Plans

Vertical Hand line.
Lates stappersii
 Lake Tanganyika. Zashe, N Tanzania

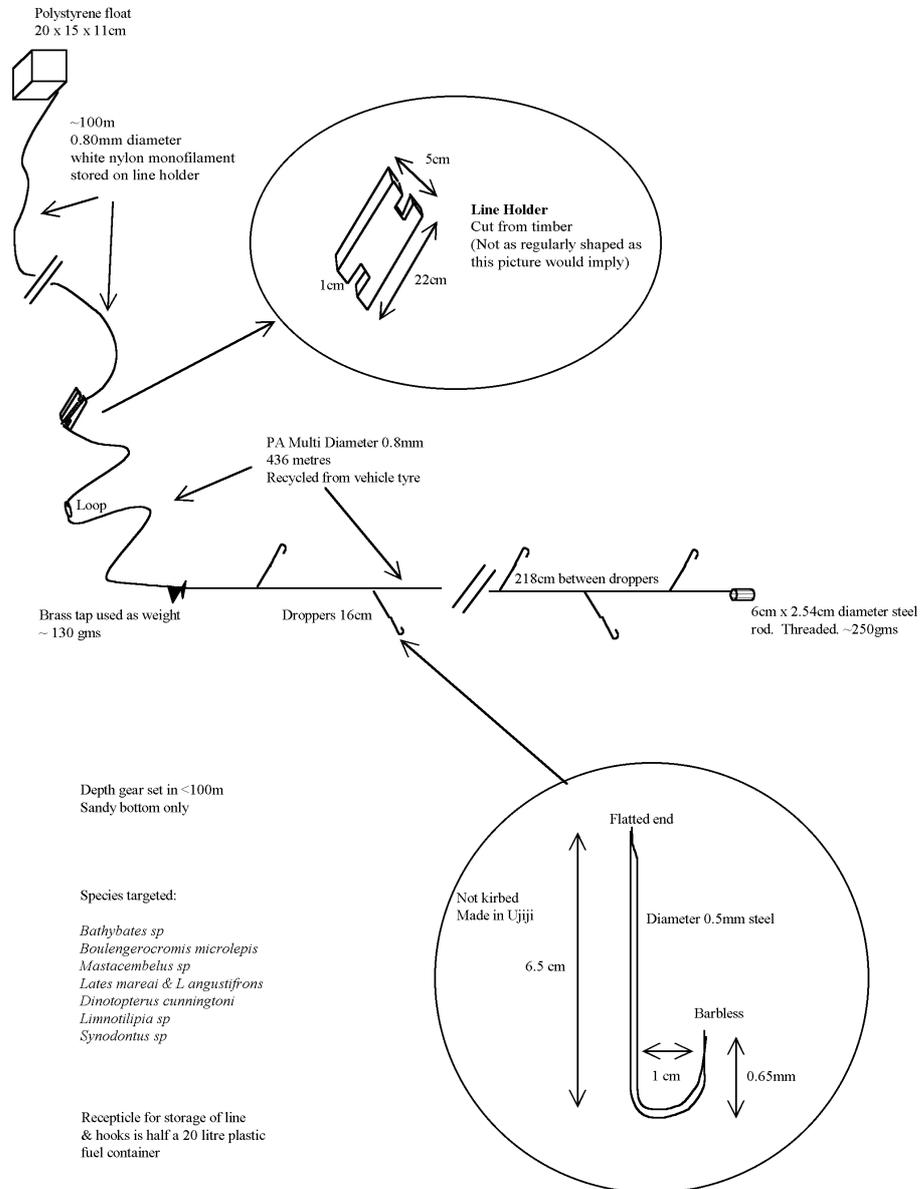
Boat 5.2m. Sail & paddles
 2 fishermen
 Unbaited. Offshore pelagic zone



Gear Plan 1. Mesopelagic jigging line

Bottom set long line. Daytime.
 Tilapine Fishes & catfish
 Lake Tanganyika. Ujiji, Tanzania

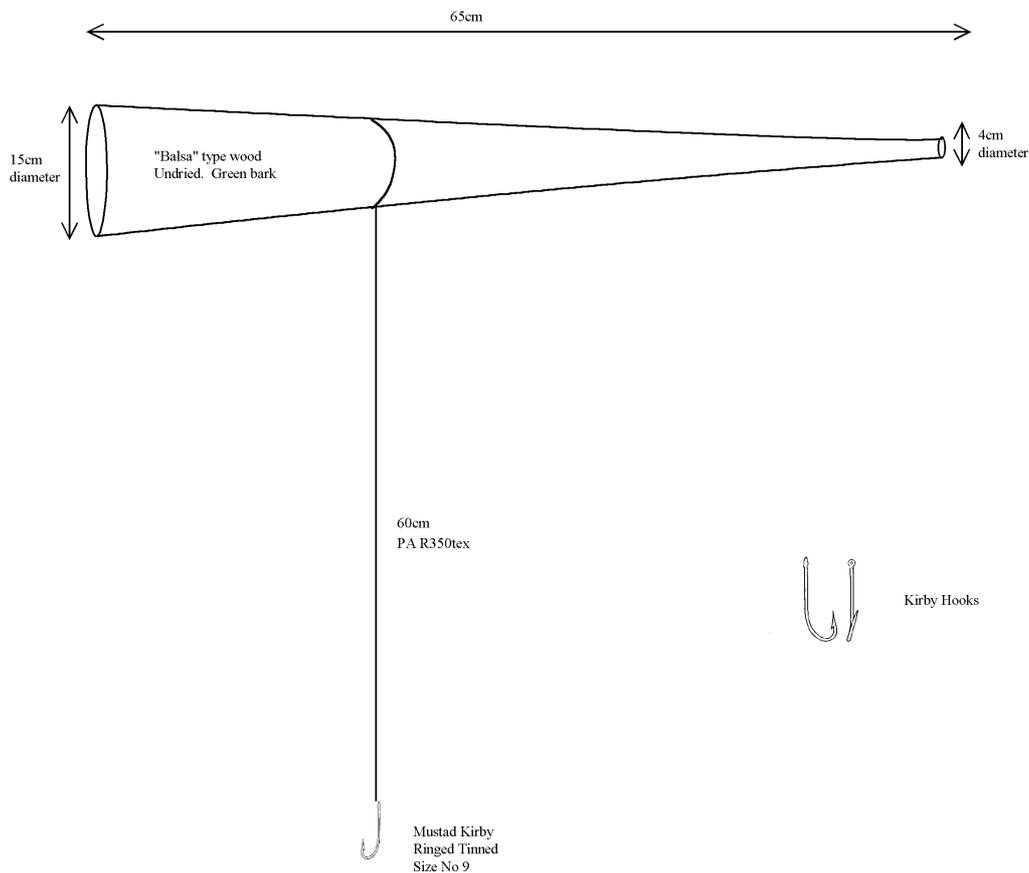
Dugout canoe 5m
 1 fishermen
 Bait: Sardine



Gear Plan 2. A long line from Tanzania

Mid water vertical line. Daytime.
Tilapine Fishes & catfish
Lake Tanganyika. Malagarasi Delta, Tanzania
Set in swamps and reed beds of less than 1.20m depth

Dugout canoe 5m
1 fishermen
Bait: Cubes of Tilapine fish and
Clarius sp flesh

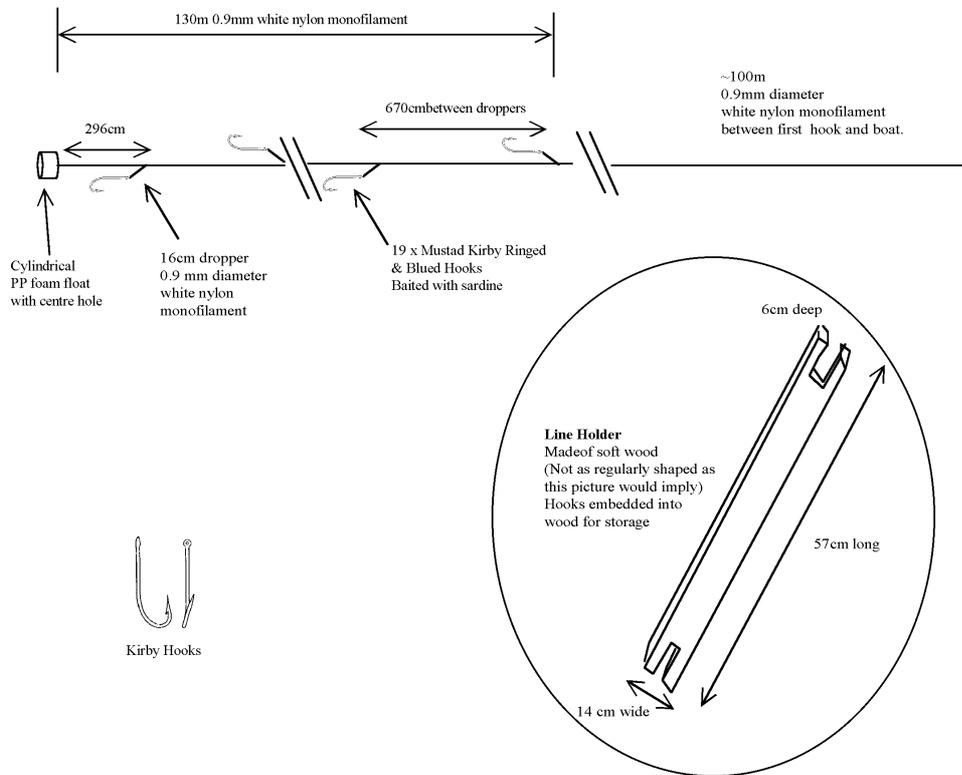


Target species:
Polypterus aethiopicus
Polypterus ornatipinnis
Oreochromis tanganyicae
2 x *Clarius sp*

Gear Plan 3. A mid water set line

Hand line Baited. Surface Trolling.
Lates mariae, *L. angustifrons*
 Near light boats associated with the lift net fishery
 Lake Tanganyika. Zashé. N Tanzania

Planked canoe ~5.5m
 2 fishermen with paddles
Stolothrissa tanganyicae bait



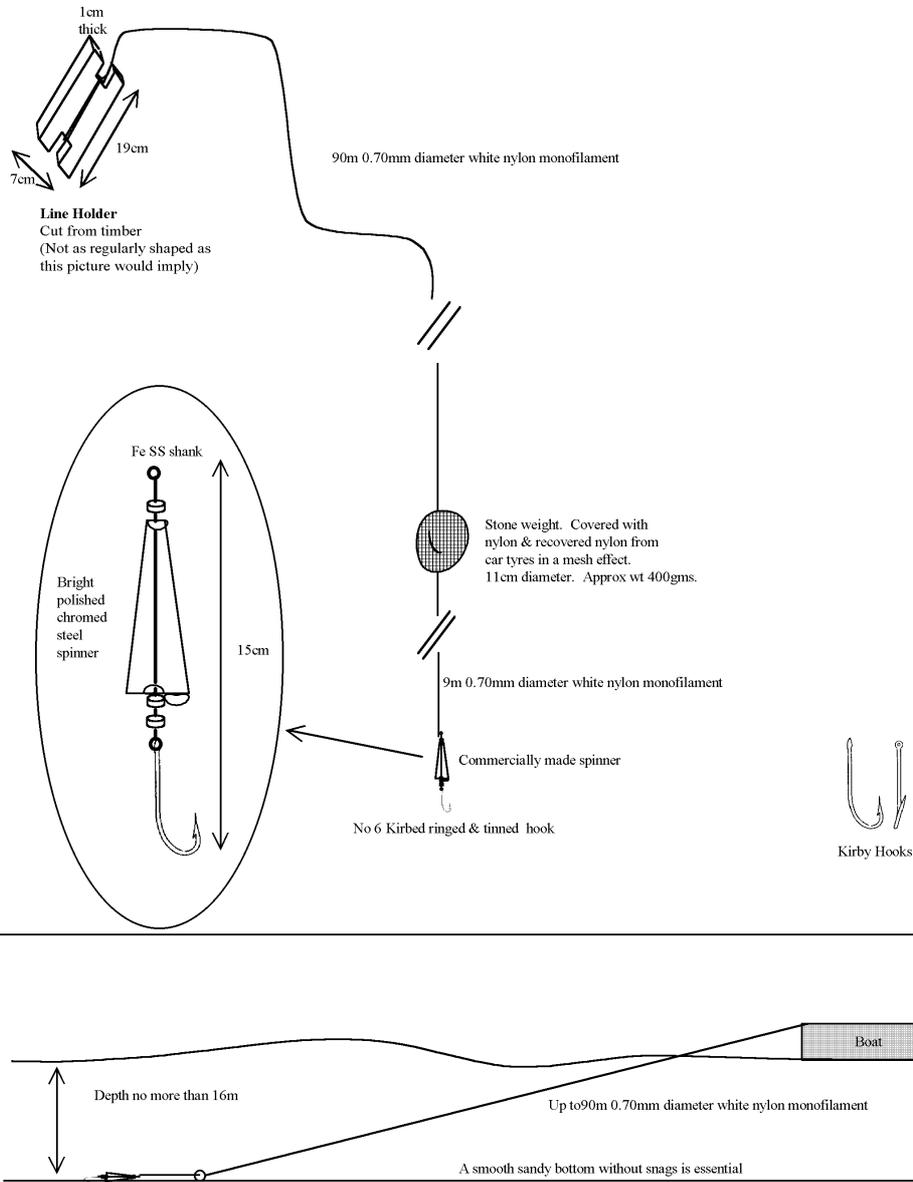
The line is trolled at night in areas near to the lights of boats engaged in the lift net fishery *Stolothrissa tanganyicae* are attracted to the lift net lights and the *Lates spp.*, which are the target for this gear, follow their prey to the vicinity.



Gear Plan 4. Surface trolling gear

Bottom Trolling. Daytime.
Lates mariae, *L. angustifrons* &
Boulengerocromis microlepis
 Lake Tanganyika. Ujiji, Tanzania

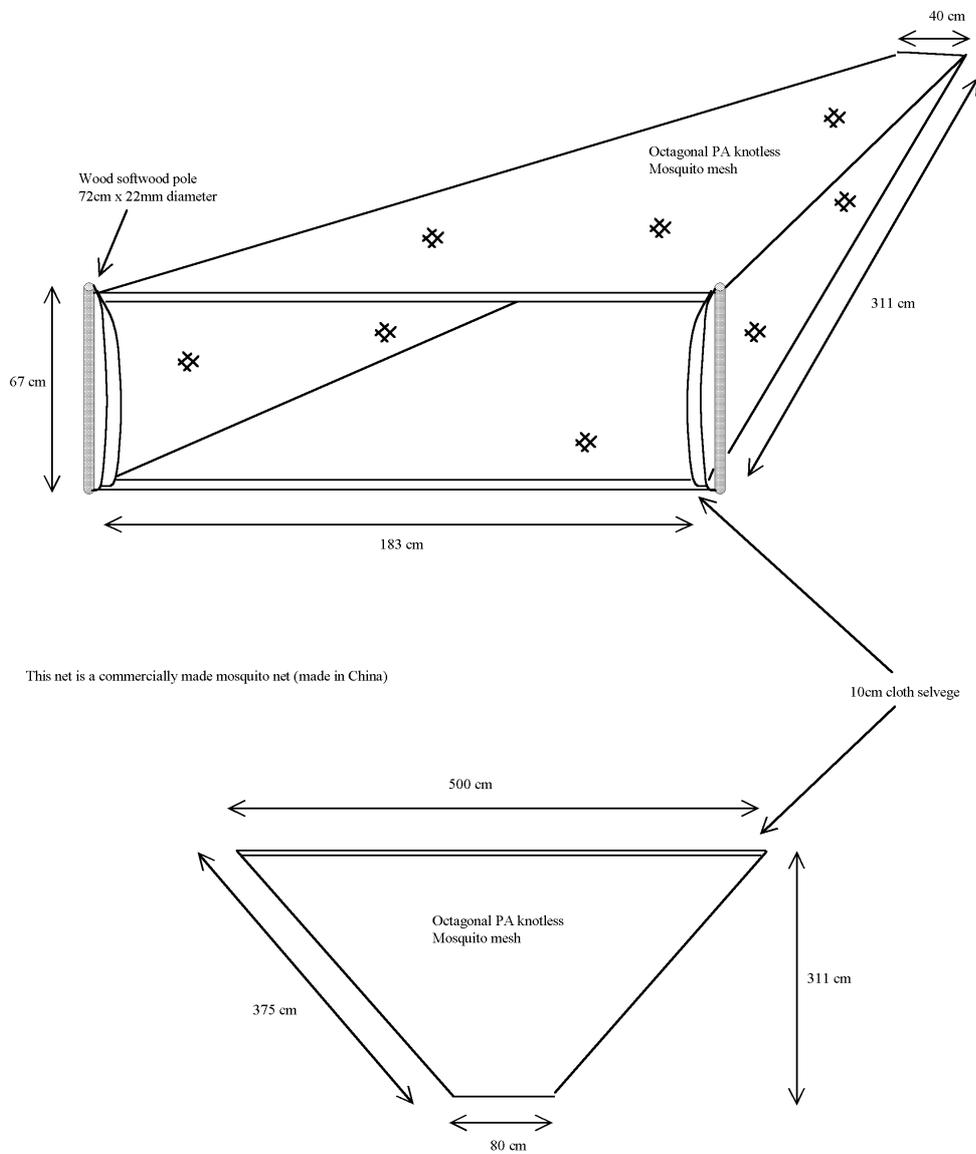
Planked canoe 5.2m
 1 fishermen with paddle
 Artificial bait



Gear Plan 5. Bottom trolling gear

Dragged bagnet.
Stolothrissa tanganyicae fry.
 Lake Tanganyika. Zashé. N Tanzania

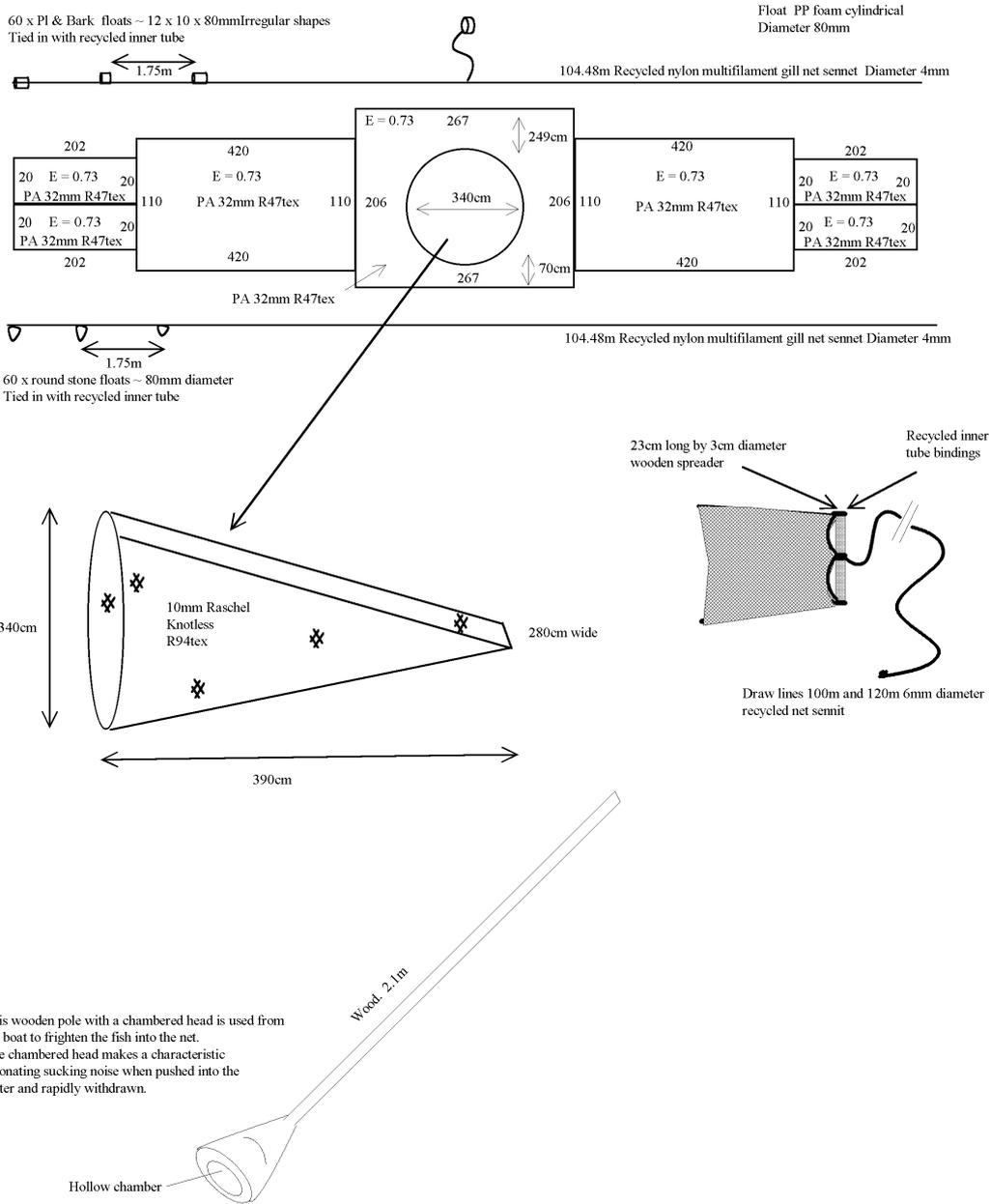
Two pre-teenage children
 Shallow littoral <1m



Gear Plan 6. Dragged bag net

Drive in Seine
 Mainly Cichlids and small mixed fishes
 Lake Tanganyika, Tanzania.
 Lunguna fishing Camp, Malagarasi Delta

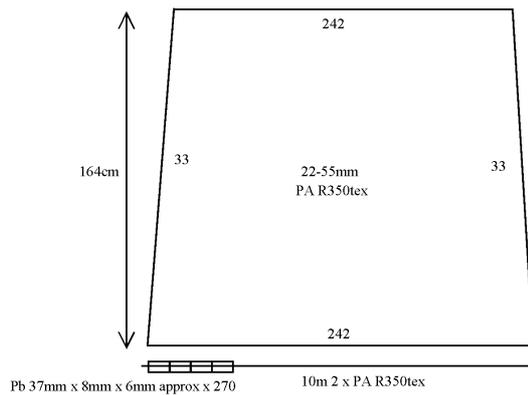
Boat 5.5 metre wood planked
 3 fishermen with paddles
 Muddy substrate
 Depths to 5.5m



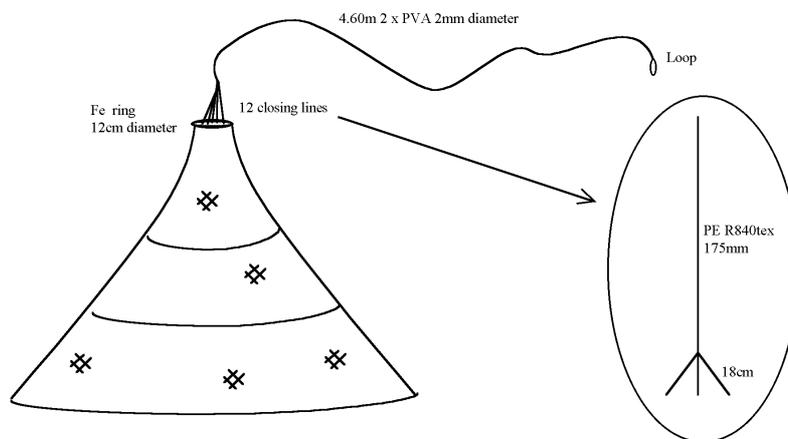
Gear Plan 7. Drive in open water seine

Cast net with closing line (Home made)
Labeo sp & *Oreochromis tanganyicae* (predominant)
 Lake Tanganyika. Tanzania. Malagarasi delta

Boat 5.5 metre wood planked
 1 fisherman with paddles
 Muddy substrate.



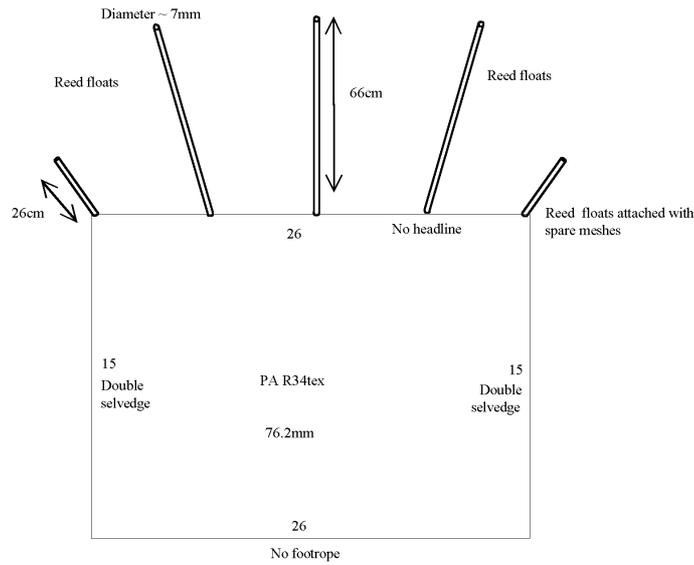
A very slight shaping of the netting is achieved by altering the size of the stretched mesh size from top to bottom of the net.



Gear Plan 8. Cast net

Gill net
 Nests of Tilapine species
 Lake Tanganyika. Malagarasi Delta.
 Mwambani Fishing Camp

No Boat
 One fisherman



The two outer reed floats serve to anchor the net in the substrate of reeds, mud and weed.
 The inner three floats are used as floats
 The gear is set near or round nests of Tilapine species
 The gear is locally known as Matela

Gear Plan 9. Gill net. Tilapia nets

6.3 Appendix 3. Gross catches and Fish species and lengths from beach landing samples FPSS 1998/1999

Catch by various gears (kg), per haul and day

Method	No of hauls sampled	Total Catch/day	Hauls per day	Average catch/haul
Encircling gill nets	31	27.8	11	2.49
Beach Seine (Day)	29	39.82	2.06	19.25
Lift net	80	207.57	1.97	105
Lusenga (scoop/bag net)	3	18.33	1.33	13.75
Long line	2	12.5	1	
Trap	1	17	1	

Fish species in the catch

Gear	Mesh size	Hauls	Species	Lmax	Lmin	Mean L	SE	N
Trap		5	Lates mariae	44.0	33.0	38.5	5.5	2
			Oreochromis tanganicae	30.0	19.0	24.9	0.4	61
			Tilapia rendalli	36.0	22.0	26.0	1.0	14
			Tilapia spp	36.0	20.0	26.8	0.5	42
Scoop net	6.0	3	Limnothrissa miodon	9.5	3.7	6.9	0.1	110
Longline		1	Bathybates spp	44.0	28.0	34.3	1.5	10
			Boulengerochromis microlepis	46.0	20.0	35.5	2.5	10
			Malapterurus electricus	30.0	30.0	30.0	0.0	1
Lift net	6.0	2	Lates stappersii	37.6	24.5	33.8	1.1	10
			Limnothrissa miodon	6.2	3.9	4.9	0.1	41
			Stolothrissa tanganicae	5.4	3.0	4.0	0.1	34
Lift net	8.0	77	Lates stappersii	42.0	5.6	19.3	0.3	899
			Limnothrissa miodon	14.2	9.0	11.3	0.1	115
			Stolothrissa tanganicae	17.0	3.2	7.8	0.0	2394
Lift net	10.0	1	Lates stappersii	32.0	11.0	21.1	1.0	27

Gear	Mesh size	Hauls	Species	Lmax	Lmin	Mean L	SE	N
Hand line		4	Bathybates minor	19.0	18.0	18.3	0.3	1
			Boulengerochromis microlepis	23.0	20.0	20.8	0.8	1
			Cyphotilapia frontosa	18.3	11.3	14.5	1.6	1
			Grammatotria lemarii	18.5	13.0	15.1	0.4	3
			Hydrocynus alestes	24.5	24.5	24.5		3
			Lamprologus callipterus	12.5	11.0	11.9	0.2	4
			Limnothrissa miodon	13.0	11.5	12.4	0.2	4
			Neolamprologus meeli	27.0	13.0	19.4	1.4	6
			Pseudosimochromis curvifrons	18.5	17.0	17.8	0.4	7
			Stolothrissa tanganicae	10.4	10.4	10.4		10
			Synodontis spp	10.0	10.0	10.0		10
Tylochromis polylepis	17.0	15.0	15.9	0.3	18			
Gill net	25.4	1	Ctenochromis horei	12.0	10.0	11.3	0.2	8
			Hippopotamyrus discorhynchus	13.6	13.6	13.6		1
			Lates mariae	16.0	14.0	14.8	0.2	8
			Limnotilapia dardennei	11.5	11.5	11.5		1
			Oreochromis tanganicae	9.6	9.3	9.5	0.2	2
			Pseudosimochromis curvifrons	10.5	10.5	10.5	0.0	2
			Schilbe spp	16.1	16.1	16.1		1
Gill net	50.8	11	Barbus spp	37.5	15.0	24.5	1.9	14
			Bathybates graueri	24.0	16.0	20.2	0.7	13
			Bathybates spp	38.0	16.0	22.2	1.4	21
			Boulengerochromis microlepis	49.5	18.0	27.4	3.8	9
			Chrysichthys sianenna	24.0	10.0	18.6	0.8	27
			Clarias spp	29.0	24.0	25.8	1.1	4
			Cyathopharynx furcifer	19.5	9.6	14.7	1.0	11
			Cyphotilapia frontosa	17.0	15.0	16.0	1.0	2
			Dinotopterus cunningtoni	85.0	74.0	79.5	5.5	2
			Grammatotria lemarii	11.0	11.0	11.0		1
			Labeo spp	26.0	21.5	23.2	0.7	6
			Lates mariae	33.0	16.7	23.8	0.9	24
			Limnotilapia dardennei	26.0	18.0	21.3	0.7	13
			Malapterurus electricus	31.0	31.0	31.0	0.0	1
			Mastacembelus cunningtoni	61.0	36.0	48.3	2.3	10
			Mormyrus longirostris	31.5	18.0	23.5	4.1	3
			Neolamprologus meeli	24.5	20.5	22.5	2.0	2
			Oreochromis tanganicae	29.5	12.5	19.2	1.3	20
			Pseudosimochromis curvifrons	15.0	13.0	13.6	0.4	5
			Simochromis diagramma	15.0	15.0	15.0		1
			Stolothrissa tanganicae	17.1	17.1	17.1		1
			Synodontis spp	23.0	10.0	13.7	0.8	23

Gear	Mesh size	Hauls	Species	Lmax	Lmin	Mean L	SE	N	
Gill net	57.5	3	Xenochromis hecqui	24.0	9.4	15.7	1.6	13	
			Xenotilapia spp	13.0	7.0	8.3	0.2	42	
			Auchenoglanis occidentalis	31.0	27.0	29.0	1.2	3	
			Bathybates spp	30.5	20.0	22.1	1.4	7	
			Boulengerochromis microlepis	25.1	22.6	23.9	0.7	3	
			Chrysichthys sianenna	21.0	13.5	16.3	1.2	6	
			Hydrocynus alestes	27.7	21.9	23.9	1.9	3	
			Lates mariae	35.0	17.0	23.5	0.9	22	
			Lates mariae						
			Synodontis spp	28.0	23.0	24.7	1.7	3	
Tilapia spp	19.0	14.5	16.0	0.4	11				
Tylochromis polylepis	23.6	20.0	21.5	1.1	3				
Gill net	63.5	8	Acapoeta tanganicae	43.0	21.0	32.0	6.1	4	
			Auchenoglanis occidentalis	52.0	22.0	32.3	3.7	9	
			Bagrus spp	29.0	13.6	19.5	4.8	3	
			Bathybates spp	30.7	20.0	25.1	0.6	15	
			Boulengerochromis microlepis	38.0	19.0	25.3	1.2	20	
			Chrysichthys graueri	31.0	25.0	28.0	3.0	2	
			Chrysichthys sianenna	21.2	12.0	16.3	1.7	6	
			Clarias spp	74.0	60.0	67.0	7.0	2	
			Cyathopharynx furcifer	18.0	17.0	17.5	0.3	4	
			Hydrocynus alestes	35.0	30.0	32.3	1.5	3	
			Hydrocynus goliath	27.0	24.5	25.3	0.8	3	
			Lates mariae	30.5	14.0	22.3	0.7	29	
			Lates stappersii	28.0	28.0	28.0		1	
			Limnothrissa miodon	12.0	11.0	11.7	0.3	3	
			Limnotilapia dardennei	23.5	15.5	20.4	0.5	21	
			Lobochilotes labiatus	19.0	17.2	18.1	0.4	4	
			Malapterurus electricus	38.0	31.0	34.5	3.5	2	
			Mastacembelus cunningtoni	53.2	46.0	49.6	1.5	4	
			Mormyrus longirostris	30.0	27.0	28.5	1.5	2	
			Neolamprologus meeli	26.5	26.5	26.5	0.0	1	
			Oreochromis tanganicae	30.0	16.0	18.9	0.9	14	
			Pseudosimochromis curvifrons	16.5	15.5	16.0	0.5	2	
			Synodontis multipunctatus	22.0	12.0	16.6	1.8	5	
			Synodontis spp	22.0	12.5	17.3	4.8	2	
			Tilapia spp	19.5	14.0	16.0	0.5	13	
			Tylochromis polylepis	21.0	16.5	18.1	0.3	13	
			Xenochromis hecqui	28.0	16.0	20.1	1.7	6	

Gear	Mesh size	Hauls	Species	Lmax	Lmin	Mean L	SE	N
Gill net	76.2	7	Acapoeta tanganyicae	24.5	21.2	23.0	0.6	5
			Auchenoglanis occidentalis	67.0	62.0	64.5	2.5	2
			Bathybates spp	34.0	6.0	23.2	1.2	38
			Boulengerochromis microlepis	40.0	19.5	28.4	2.5	9
			Chrysichthys sianenna	33.0	25.0	28.7	2.3	3
			Clarias spp	57.0	29.0	40.8	2.0	13
			Crabs	14.0	12.0	13.0	1.0	2
			Hydrocynus goliath	30.0	20.0	25.5	0.8	17
			Lates mariae	46.0	17.0	25.1	2.0	15
			Limnotilapia dardennei	24.0	20.0	21.8	0.6	6
			Neolamprologus meeli	25.0	20.2	23.0	0.6	7
			Oreochromis tanganyicae	26.0	14.0	19.2	1.4	10
			Polypterus ornatipinnis	72.0	35.0	47.9	2.8	13
			Synodontis spp	29.0	24.0	26.3	1.3	4
			Xenochromis hecqui	33.5	33.5	33.5	0.0	1
Gill net	152.4	4	Auchenoglanis occidentalis	59.0	45.0	50.0	1.6	9
			Boulengerochromis microlepis	41.0	32.0	35.8	1.7	7
			Chrysichthys graueri	61.0	56.0	58.3	1.5	4
			Dinotopterus cunningtoni	109.0	109.0	109.0		3
			Hydrocynus goliath	55.0	47.0	51.0	4.0	2
			Lates mariae	84.0	23.0	54.3	8.0	1
Gill net	177.8	3	Auchenoglanis occidentalis	64.0	43.0	53.3	1.4	19
			Chrysichthys sianenna	66.0	66.0	66.0		1
			Dinotopterus cunningtoni	97.0	62.0	79.5	17.5	2
			Lates mariae	83.0	47.0	70.5	3.4	12
Gill net	202.2	2	Dinotopterus cunningtoni	129.0	61.0	96.4	8.5	7
Floating gill net	50.8	1	Oreochromis tanganyicae	18.5	15.5	16.5	0.7	4
Encircling gill net	38.1	3	Auchenoglanis occidentalis	42.0	26.0	33.4	2.9	5
			Bathybates spp	25.0	25.0	25.0		1
			Boulengerochromis microlepis	52.5	25.6	33.5	6.4	4
			Chrysichthys sianenna	20.5	17.5	18.6	0.7	4
			Ctenochromis horei	16.6	16.6	16.6		1
			Lates mariae	27.0	17.0	19.9	0.6	15
			Lates stappersii	23.0	12.0	20.2	1.4	7
			Limnotilapia dardennei	25.0	14.0	19.4	0.4	30
			Oreochromis tanganyicae	29.0	11.0	17.4	2.0	9
			Tylochromis polylepis	23.0	15.5	19.0	0.4	23

Gear	Mesh size	Hauls	Species	Lmax	Lmin	Mean L	SE	N
Encircling gill net	50.8	6	Auchenoglanis occidentalis	35.0	19.0	26.4	1.4	1
			Bathybates spp	25.0	21.5	23.2	1.0	1
			Boulengerochromis microlepis	44.0	20.0	24.5	0.9	1
			Dinotopterus cunningtoni	89.0	89.0	89.0		1
			Lamprologus callipterus	18.0	18.0	18.0		3
			Lates mariae	35.0	12.0	23.1	0.9	6
			Limnotilapia dardennei	20.0	15.0	17.5	0.3	15
			Mormyrus longirostris	33.0	25.0	28.3	1.3	23
			Oreochromis tanganicae	20.5	13.0	15.7	0.5	24
			Synodontis multipunctatus	13.0	13.0	13.0		29
			Tylochromis polylepis	21.0	15.0	18.2	0.2	44
			Xenochromis hecqui	12.0	12.0	12.0	0.0	32
Encircling gill net	63.5	22	Acapoeta tanganicae	22.0	22.0	22.0		1
			Auchenoglanis occidentalis	55.0	17.0	29.7	1.0	85
			Bathybates spp	24.5	6.0	16.1	1.1	22
			Boulengerochromis microlepis	57.0	14.0	27.9	1.2	62
			Chrysichthys sianenna	18.0	15.0	16.7	0.9	3
			Citharinus gibbosus	25.0	22.0	23.3	0.6	6
			Clarias spp	45.0	40.0	42.3	1.5	3
			Ctenochromis horei	15.5	12.5	14.0	0.9	3
			Cyathopharynx furcifer	18.5	13.5	16.4	0.2	50
			Cyphotilapia frontosa	34.0	34.0	34.0		1
			Grammatotria lemarii	25.0	12.8	15.1	0.6	25
			Hydrocynus alestes	33.0	13.0	24.6	4.2	4
			Labeo spp	32.2	23.5	25.5	1.4	6
			Lates mariae	86.0	8.0	23.2	1.8	42
			Limnothrissa miodon	12.0	10.6	11.3	0.1	16
			Limnotilapia dardennei	25.0	6.0	17.1	0.3	109
			Lobochilotes labiatus	27.0	24.5	25.8	1.3	2
			Mormyrus longirostris	35.0	35.0	35.0	0.0	2
			Neolamprologus meeli	20.0	8.0	12.0	1.5	7
			Oreochromis tanganicae	28.0	11.0	18.3	0.4	85
			Oreochromis tanganicae	16.0	12.0	13.5	0.4	11
			Tylochromis polylepis	27.0	2.7	17.9	0.3	117
			Xenotilapia ornatipinnis	12.0	11.0	11.4	0.2	5
			Xenotilapia spp	15.0	9.9	12.7	0.5	13

Gear	Mesh size	Hauls	Species	Lmax	Lmin	Mean L	SE	N
Beach seine		29	Acapoeta tanganicae	16.0	16.0	16.0		1
			Astatotilapia burtoni	10.0	10.0	10.0		1
			Auchenoglanis occidentalis	55.0	12.5	27.9	1.5	44
			Bathybates graueri	18.0	18.0	18.0		1
			Bathybates spp	24.0	9.0	14.4	0.6	30
			Boulengerochromis microlepis	59.0	6.8	23.1	1.3	90
			Brycinus rhodopleura	36.0	23.0	29.0	3.8	3
			Callochromis spp	9.9	6.9	8.1	0.2	20
			Chrysichthys graueri	15.0	10.0	12.0	0.7	7
			Chrysichthys sianenna	13.6	8.0	9.9	0.4	14
			Ctenochromis horei	19.0	5.7	11.4	0.4	49
			Cyathopharynx furcifer	14.0	8.0	11.4	0.7	10
			Dinotopterus cunningtoni	106.0	97.0	101.0	2.6	3
			Grammatotria lemarii	24.0	8.0	14.3	0.4	89
			Hippopotamyrus discorhynchus	10.0	9.1	9.6	0.4	2
			Hydrocynus alestes	30.0	15.9	22.6	3.0	5
			Hydrocynus goliath	55.0	55.0	55.0		1
			Hydrocynus spp	57.5	34.0	46.0	2.6	9
			Lamprichthys tanganicanus	11.1	11.0	11.1	0.0	2
			Lamprologus callipterus	17.2	7.0	9.9	1.1	9
			Lamprologus lemarii	7.5	4.5	6.5	0.3	12
			Lates mariae	121.0	11.5	29.3	4.4	34
			Lepidolamprologus attenuatus	10.0	9.0	9.7	0.3	3
			Limnothrissa miodon	13.0	2.0	5.6	0.5	77
			Limnotilapia dardennei	23.0	6.0	16.1	0.4	108
			Mastacembelus ophidium	51.0	44.0	47.5	3.5	2
			Mastacembelus spp	46.0	37.5	41.8	4.3	2
			Mormyrus longirostris	45.0	28.0	34.1	5.4	3
			Neolamprologus meeli	19.4	6.0	12.1	0.8	30
			Oreochromis tanganicae	26.6	9.0	15.4	0.3	191
			Perissodus microlepis	18.2	17.5	17.9	0.3	2
			Petrochromis spp	8.5	6.0	7.3	1.3	2
			Polypterus ornatipinnis	66.0	66.0	66.0		1
			Pseudosimochromis curvifrons	10.2	5.5	7.7	0.9	5
			Tetradon mbu	55.0	55.0	55.0		1
			Tylochromis polylepis	18.0	10.0	16.2	1.6	5
			Xenochromis hecqui	13.5	6.0	9.1	0.4	22
			Xenotilapia boulengeri	21.0	8.3	11.1	0.3	48
			Xenotilapia dardennei	12.0	10.0	11.0	0.3	10
			Xenotilapia ornatipinnis	13.0	6.0	9.4	0.5	20
Xenotilapia sima	13.0	8.0	10.0	0.4	18			
Xenotilapia spp	22.0	6.0	12.5	0.3	88			

6.4 Appendix 4. Notes of Village Visits

Village name **Kalalangabo**
Date 24/11/99 Time of day: 10.30am

Description: Small village in bay north of Kigoma

Habitat: Sandy bay. Rocky headlands

Merely a brief stop to allow one of the staff to visit.

Gears observed in Use.

5 x beach seine for use at night with lights on floats targeting Kapenta (*Limnothrissa miodon*). Others reported to be in the village houses but no fishing going on due to full moon.

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

Description:

A village in a bay on the northern end of Gombe National Park. Population probably in excess of 2000. Many permanent buildings, two markets, two restaurants. Bar selling beer and local fermented drinks.

Habitat: Shingle shore with shallow drop off.

Boats: A very large number of boats of all sizes. Dugouts, small planked, large planked and transport. Many adapted for O/B. Towing boats for the Lift Net fishery specially developed.

Gears in Use.

4 x beach seine for use at night with lights on boats targeting Kapenta (*Stolothrissa miodon*). All of these nests were out in the open being mended. They were on Dagaa drying fields as it was full moon and there was no dagaa to dry. These seines target sardines and, reportedly, young *L. stappersii*. Lights on floats are not used. The seines do not have a bag in the net and use 8mm Raschel 210d/4 red knotless netting throughout apart from some panels in the wings and on the footrope. (25.4mm knotted PE ~ R600tex)

Pole and Lines

Many children were using pole and lines. The catch of one was investigated:-

Four species found :-

Pseudosimochromis curvifrons

Xenotilapia sp

Lobochilotes labiatus

Cyathopharynx furcifer

All juveniles.

The use of Termites (flying ants in their immediate post winged phase) as bait, as well as worms was noted.

The catch of three children using pole and lines from a boat anchored slightly offshore, with exactly the same gear as the children using pole and line on the shore was examined. This consisted of 5 x *Oreochromis tanganicae* of about 150gm each, a total of 750gms. *O. Tanganicae* is a very saleable fish at this size.

Handlines

Vertical hand line for jigging for *Lates stappersii* (x 26 in the village (two in each boat using). Possibly 200 boats using this method along the coast between Gombe stream and Burundi Border

75 boats were observed sailing home from the fishing grounds, though more were coming into view all the time, and given the distances involved many would be out of view. About 13 were expected (by the FPSS facilitator) to arrive in this village. The sail powered boats had left during the early night (1-2am) and paddled/sailed into the lake towards the South West, returning between 12 noon and 4.00pm. A trip length of 10-15 hours. It takes 2-3 hours to reach the fishing grounds by sail, which is faster than paddling. The fishing grounds are actually in Congolese waters, in the very deepest parts of the lake – more than 1000m deep.

Fish retail at 8 for 500/= TZ, and an average fisherman was reported to expect to earn up to 40,000/=TZ per day. This is equivalent to 640 fish per boat per day, though the observed average catches seemed to be smaller, 20 – 40 kg, rather than the 80 kilos that this earnings estimate would imply. Despite this 200 boats catching a conservative 30 kilos a day is 6,000kg per day. Even allowing for seasonal variations and variations in effort this is a significant fishery of significantly more than 1000 tonnes/year. The beginning of the wet season is reported as the best time for fishing *L. stappersii* in this manner.

The gear is not new, and has been used for about 30 years. Who discovered that the *L. stappersii* lived at such great depth, in the relatively distant parts of the lake, is unknown.

The gear used is a hand line of 150m length PA white mono Ø 0.70mm. The weight is a piece of iron reinforcing bar, 20 cm long x Ø20mm, whipped with nylon PA white mono Ø 0.70mm with one whipping used as a loop. To this the mainline of mono is attached. On the mainline 60 x size 12 Mustad Kirby ringed and blued hooks are attached on droppers of 6 cm at a spacing of 60cm. The line is kept on a soft wood line holder into which the hooks are stuck to avoid their tangling up. In some examples of the gear the shanks of the hooks are covered with strips of toothpaste (Colgate™) tube metal, metallic side out, rolled round the hook, to improve its visibility. (See Figure attached)

The boats have a sail to use whenever there is wind. In the morning there may (or may not be) a land breeze, which helps the boats out to the depths of the lake. In the afternoon the sea (lake ?) breeze brings them home.

The boats used are small, 5 – 6m, planked without frames. Three seats, one at the stern, one in the bows and one in the beam of the boat, provide stiffening for the boat. In the forward seat is a hole for the sail with a wooden step nailed onto the bottom of the boat. The lateen sail is made from PE sacking stitched together. It is only because Lake Tanganyika is relatively benign that there are not large losses of life in the use of such rudimentary craft so far from land.

Lift nets

No lift nets were operating as the moon was nearly full and the fish would not concentrate. One lift net was undergoing major reconstruction on a dagaa drying field. During a suitable period it is obvious that large numbers of lift nets would be in use and this is further evidenced by the large areas of dagaa drying fields in the village

Bottom Set gill

This was not a very well used method in this village; and the FPSS team omitted to ascertain the number of gill nets in the village.

Fish smokers

For *Stolothrissa tanganicae* and *Lates stappersii*

A smoker was measured. Built of mud bricks mortared with mud. Floor mud, covered with white ash. Rectangular. 160 cm wide x 413 cm long x 50cm high internal dimensions. Three sides solid. Second long side with two gaps in the wall of 65cm. This wall therefore 70 cm of brick, gap of 65 cm, 140 cm of brick, gap of 65 cm, 70 cm of brick.

Onto this mud brick surround a rectangular frame of timber (40mm x 25mm), of 122cm x 250 cm covered by steel mesh (of mesh height 3cm and 1.5cm width, more normally seen in windows as a protective screen against prospective burglars). This rack placed on the smoker, one end placed on the short wall of the smoker and the other end held in place with a bamboo pole to stop it falling into the flames of the fire below. The rack only covered two thirds of the mud walled enclosure.

On the mesh was laid partially dried *Stolothrissa tanganyicae* to be smoked for 12 hours under a very low smoke and heat intensity. The fish covered with steel sheets of roofing iron. This operation to salvage something from the *S tanganyicae* which had suffered damage in the recent rains.

Variation on this was a similar smoker with *Lates stappersii* curled up with their tails through their cheeks and threaded on poles, through the circle made by their bodies. Many poles. These fish bought fresh the previous day from vertical hand line fishermen, and smoked for 20 hours on a high flame with lots of smoke and heat. Perhaps this explains in some way the denuded hills behind the village.

Village name	Zashe		
Date	25/11/99	Time of day:	8.00am

Description:

A long village, from Zashe river to the Burundi border. Several Kilometers long (4.5 ?). strip development along the lake with agriculture on the completely deforested hills behind. Evidence of severe erosion on these hills.

Habitat: A long beach with alternate pebble and sand, pebble & rocks predominating, leading along gentle slope to sand and weed offshore with steep drop off about 50m offshore.

Boats: Very large number of canoes, though the beach appeared half deserted at time of visit due to the large numbers of canoes out on the lake persecuting the *Lates stappersii* stocks offshore with vertical jigging gear.

Gears in Use.

Two beach seine targeting dagaa (*Stolothrissa miodon*).

Only one beach seine was seen though another reported in the village. These were night beach seines using light boats.

Numerous Pole and Lines

Very many children were observed fishing in the lake using pole and line. Termites and worms used as bait. Many hooks home made without barb. One child noted using reed pole like in Burundi and also using one strand of PE twine taken from PE 218d/15 – thus using a monofilament of PE R24.2tex. Commercial hooks when used were No 20 Mustad Kirby blued and ringed.

Handlines

Extensive use of handlines for jigging for *Lates stappersii*. Informant claimed 200 in this village alone, but this seems unlikely, despite the length of the village. In any event some of these boats would have to act as light boats for the lift nets and beach seines, when the moon is suitable for attracting sardines, thus reducing the effort in the handline/jigging fishery. The people involved in this fishery are supposed to be Tanzanians, and have not come from Burundi.

Bottom Set gill nets

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

Lift nets

An indeterminate number of lift nets were in the village.

At the north end of Zashe

Beach seines.

8 reported in the village. For sardines

Bottom set Gill nets.

3 reported in the village

Mousquitaire. Dragged bag net.

A net made of mosquito netting was observed. The catch was about 200 grammes and was being taken home in an old saucepan (so presumably was the trips total catch). Species were:-

Fry of *Limnothrissa tanganicae*
Juvenile *Limnotilapia dardennii*
Juvenile *Ctenochromis horei*
Juvenile *Petrochromis* spp
Juvenile *Lamprologus* spp

Unfortunately the child carrying the net ran off into the village and could not be enticed, even with the offer of 100/=, to return with the net so that it could be measured. However another net was located and it was measured. It is made of a mosquito net (of the sort commonly bought in stores and stalls at the market). This is attached to two pieces of wood which make a support at the sides, and form the net into a rectangular opening with a bag. It can be concluded that at least two such nets exist in the village.

Trolled surface handline

A gear new to the FPSS was found in this village. 19 hooks, spaced at 670cm apart on 16cm droppers of Ø0.8mm white nylon monofilament, attached to mainline of Ø0.9mm nylon white monofilament. PP foam doughnut shaped float attached at far end of line, 296cm behind last hook. Line trolled behind the boat with the first hook 15m behind stern. No 9 Mustad Kirby Ringed and Blued hooks used. Sardine used as bait. Target species *Lates angustifrons* only. Used by trolling at night round the area of the light boats of the lift net fishery. Hooks and line stored on a H shaped piece of wood, with the hooks embedded in the soft wood to stop tangles. Two man paddling canoe. This used by 3 people in the village. (See diagram).

Village name	Kiziba		
Date	27/11/99	Time of day:	Forenoon

Description:

A long village, six kilometers, between the Mulowa River and the Zashe River. Permanent buildings. Denuded hills behind

Habitat: . Gravel and pebble bays with rocky headlands, bays sloping gently towards sand and then to a steep drop off.

Boats: Many planked canoes. Many larger lift net boats. Many designed for engines.

No census taken due to length of village. Many boats absent on the lake.

Gears in Use.

3 x beach seine for use at night with lights on boats targeting Dagaa (*Stolothrissa tanganicae*). None fishing as the state of the moon was not suitable. Gear not used on the local beaches, but moved about and the fish landed in Mwamgongo as that is where the market is.

Vertical handline (jigging) for *L. stappersii*

Informant claimed 100 of these boats in the village, indicating 200 hand lines. These said to use size 12 Kirby blued & ringed Mustad hooks.

Pelagic Vertical Handline (baited) from lift net boats

A new method for the FPSS. Used by lift net fishermen to catch fish whilst lift netting. Target is *Lates angustifrons* and *Lates mariae*. 20 to 30 hooks are used on a vertical line. White Nylon Mono Ø0.65mm mainline and droppers. 20 – 30 hooks depending on the individual fisherman's preference. On 8cm droppers and spaced about 65cm apart. *Stolothrissa tanganicae* used as bait. Weight Ø 25mm reinforcing rod cut to 20cm lengths. The line is threaded through a loop on the end of one of the spreaders for the lift net and then lowered into the water to the required depth, which was said to be 100m, though that is the depth of the deepest hook, the shallowest hook would be 70m or less. The spreader of the lift net acts as a bite indicator, in that it "nods" when a fish is caught.

Demersal vertical handlines
Several baited handlines for littoral fishes were reported.

Pole and line
Very many children observed with pole and lines. Both at the stop made and cruising along the beaches.

Bottom set Gill nets
Three nets of 2 inch stretched mesh x 10 pieces of 50 yards (resultant = 300 meters length) reported in the village.

Visit to Gombe National Park Headquarters

Interviewed Dattomax Sellanyika. The senior park warden.

The Park is not a lake reserve. It is solely a terrestrial park, unlike Mahale, which has a 1.5km zone lake reserve reaching into the lake where fishing is not allowed at all.

Mr Dattomax explained that Gombe Park had a 100m buffer zone, extending out to the lake and inland. This had been established at the setting up of the park. Up to 1000 people could use this zone according to the agreement.

Prior to 1998, when Beach Seining had been allowed, the people from the adjoining villages had camped in the 100m land zone and beach seined during the night. They had cut down bush to make dagaa drying fields. Trees had been cut down for firewood. The fishermen had targeted sardine at night.

[The damage to the 100m barrier inside the park seemed to be the main reason that the Park had objected so strongly to the presence of the fishermen in the park].

In 1998 beach seining had been banned by the Government, and the National Park had enforced this in the parks boundaries. Nowhere else is this ban enforced in the Kigoma District, as Fisheries Department is not enforcing this ban. In the village immediately North of the National Park are 5 beach seines, openly laid out on the beach.

The enforcement of the ban has had a dramatic effect. The dagaa drying fields have grassed over (in only 18 months); temporary pole and grass shelters for fishermen, which line the beaches of the National Park, are now lying derelict, visited only occasionally by the odd baboon or chimpanzee.

Mr Dattomax stated that the nearby villages had reported an increase in the catch of littoral species. There was apparently a feeling that the Park now acted as a reserve and nursery ground, where fish were free to breed and grow.

The Park authorities are trying to negotiate a local by-law with the local villages that no fishing in the 100m lake zone or use of the 100m terrestrial barrier zone is permitted in the future. This has been blocked by one individual councillor, but Mr Dettomax was confident of success in the future with this initiative.

Offshore people continue to use liftnets, and 3 people are licensed to fish with gill nets in the Park 100m barrier zone.

Village Visits Luiche & Ujiji

Village name	Kangamoja		
Date	22/11/99	Time of day:	Forenoon

Description:
Beach. No dwellings permanent or temporary. About 5 km south of Ujiji. Used solely by fishermen who move about from their base, fishing on beaches between Luiche delta and Ujiji. 18 people and three boats on the beach. One seine not presently in use as owner away.

Habitat: Small sandy beach with reed beds on each side and extending extensively North and South of the site

Boats: 3 planked canoes of about 7m.
No O/B engines in evidence.

Gears in Use.

2 x beach seine for use at night without lights targeting mixed littoral species.
One of these beach seines was not being used, it was being mended; the owner was away.

The two beach seines were of dramatically different sizes, although the owner of the smaller was not there to advise as to its dimensions.

The larger seine was reported as having a net 200m long, with draw lines of 1100m each. A variety of mesh sizes were utilised in the wings of the net, in many different panels. In principle the wing mesh was 1" knotted (~210d/36 ?) with the central area of the net 12m 210d/4 Raschel knotless and the bag of the net (a very definite shaped bag) 10mm Raschel knotless 210d/4. Stone weights whipped with inner tube were countered by a variety of plastic, doughnut and cylindrical center bored floats with some wooden home made floats interspersed amongst them. Two wooden spreaders were attached at each end of the netting. No net shaping in the wings was evident. The draw lines were Ø10 – 12mm of mixed materials.

This seine is used in the night without lights. At night a better catch with more species is expected. The period of the new moon is also preferred due to enhanced catches.

It would seem that 10-12 people operate this seine, fishing at night and resting during the day in canvas shelters put up specially for the purpose. The fishermen come from Ujiji.

Offshore – 2 x vertical hand lines

2 x dugout canoes with one fisherman. Targeting mixed demersal fish. 4 hooks ~ size 12, blued. Lead conical weight. Blue mono Ø ~ 0.40mm. Depth no more than 6 m.

Village name	Luiche delta mouth		
Date	22/11/99	Time of day:	Noon.
Continuous rain			

Description:

A swamp. Reeds and papyrus clumps. Crocodile infested. Water lilies and thick weeds. Ducks, geese and a miscellany of birds. A twitchers paradise.

Fishing gears

One floating gill net (2" x 26md, length indeterminate) was observed in the swamp, threaded between the weed clumps. One *Tilapia sp* was observed in the net.

Village name	No name		
Date	22/11/99	Time of day:	Lunchtime

Description:

Small "temporary" village, a couple of miles North of Luiche Delta, though showing signs of being a permanent dwelling area and agricultural outpost. Bananas, palm oil, maize and other mixed agriculture (palm oil seeming predominant as an agricultural activity), with sheep, chickens, ducks.

Habitat: Small sandy beaches interspersed with reed beds. Reed beds extending extensively North and South (towards Luiche) of the site

Boats: 2 planked canoes of about 5m.
No O/B engines in evidence.

Fishing Gears

One child with pole & line, operating with another in a joint effort. Bait worms. Hook size Mustad No 19. Two hooks on line. Line Ø~0.80. Catch *Oreochromis tanganicae* & *Neolamprologus meeli*

Village name Fisherman by reed bed, north of Luiche delta
Date 22/11/99 Time of day: Early afternoon

Description:

Habitat: Shallow water of less than 60cm near reed beds. Reed beds extending extensively North and South (towards Luiche) of the site

Boats: 1planked canoe of about 5m. One paddle, but pole used for propulsion

Fishing Gears

One drive in gill net. 2½" 210d/2 26md. Reeds used as floats. About 90m long. 60cm reed attached to headline of 210d/6 every 1.2m. Each reed float counterpoised with a D size torch/radio battery, attached to the 210d/6 footrope with rubber inner tube bindings.

The method involves setting the net parallel with the reed bed edge, approximately 1 metro from the reeds. The boat is then paddled along the line of the net about 10m into the lake, and the paddle beaten on the water to frighten the fish into the net. The net is then retrieved, and the gilled fish removed. The net is deep enough to cover the whole water column from bottom to surface.

Catch observed, one small *Oreotilapia tanganicae*

Village name Ujji
Date 22/11/99 Time of day: Early afternoon

Description:

Large village. Many permanent houses and famous for reasons other than its fishery.

Habitat: Large & long sandy

Boats:

15 planked canoes of about 5m.
No O/B engines in evidence.
Many large trading canoes.
Construction of canoes and trading canoes

Fishing Gears

Fishing without gears

On the road approaching the beach village (below the main village/town) a group of boys and young men were capturing *Clarius sp* by hand and with the use of large stones and sticks. The fish ranged up to 0.5m. Total catch was not less than 5 kilos. This was in the middle of a rainstorm and after a night of continuous rain. The fish were swimming from one rice paddy to another across the road where they were being captured.

Gill nets. 15 nets counted.

FPSS team returned 23/11/99 to investigate further.

No	Mesh size	Mesh size (mm)	No pieces	Length Stretched (yds)	Length in (Yds)	Length hung (M)	Length hung in	Comment
1	5	127	30	1500	990	900.9		
2	6	152.4	15	750	495	450.45		
3	5	127	20	1000	660	600.6		
4	3	76.2	15	750	495	450.45		
5	4	101.6	15	750	495	450.45		
6	3	76.2	15	750	495	450.45		
7	1	25.4	20	1000	660	600.6		
8	2	50.8	10	500	330	300.3		
9	3	76.2	20	1000	660	600.6		
10	6	152.4	20	1000	660	600.6		
11	2.5	63.5	13	650	429	390.39		
12	2	50.8	15	750	495	450.45		
13	3	76.2	20	1000	660	600.6		
14	3	76.2	20	1000	660	600.6		
15	3	76.2	20	1000	660	600.6		
16	2.5	63.5	20	1000	660	600.6		
1	Not surveyed but present in village				594	540.54		Estimate
2					594	540.54		Estimate
3					594	540.54		Estimate
4					594	540.54		Estimate
5					594	540.54		Estimate
Total length in Yards					12474			
Total length in metres					11351.34	11351.34		

Long Line. 200 hooks. Hooks locally made in Ujiji. Droppers 16cm spaced 218cm. Polystyrene float to 100m PA mono Ø0.08mm. Then connected with loop to nylon braided Ø0.60mm recovered twine from tyres. Weights = an old brass tap and a piece of iron bar, threaded. Both about 200 gms. Hook spread 10mm, crook 6.5mm, shank 55mm. Flat end, no barb. Fished in less than 100m using *Stolothrissa tanganicae* as bait. Fished in day only.

Target species:-

Bathybates sp

Boulengerochromis microlepis

Mastacembelus sp

Lates sp

Dinotopterus sp

Limnotilapia sp

Synodontus sp

Trolled line. Commercial spinner, with one kirbed hook (No 6 ?) attached to 0.7mmØ mono PA - 9m. Then to round stone of approx 150gms bound in mesh of nylon inner tube. Then to 90m of Ø0.7mm mono PA to holder of wood in shape of H. Paid out behind one man paddling canoe whilst on his way to set long line. Stone runs along bottom, which must be sand. Target *Lates spp* and *Boulengerochromis microlepis*

Village name

Lugunga

Date

30/11/99

Time of day:

10.30am

Description:

"Temporary" camp though shows signs of being permanent. Ducks, chickens, agriculture and lots of fishing. Many Congolese refugees. Dominant fishing is with the use of drive in gill nets.

Habitat:

Sandy beach, bordered by reed beds and clumps of reeds. Northern area reedy and interspersed with sandy beaches. Towards South more reeds leading to marshes & swamp at Malagarasi delta.

Gears observed in Use.

12 encircling gill nets. (locally known as "Mtimbo", or "splashing water") Used with a Tam Tam.

Encircling gill nets in this village are divided into two sorts

For use by day. With a mesh size of 1½"

For use by night. With a mesh size of 2 – 2½"

They are all made of standard netting such as that available in Kigoma. 210d/3 or 210d/4, 26 mesh deep and 50 yards in length. Double selvege top and bottom. Typically 5 panels long and 4 panels deep. Hence 104 mesh deep and 150m long. With draw lines of ~100 meters and 130 meters. Draw lines are net sennet which is easy on the hands. Floats a variety of broken PP and PE doughnut and cylindrical commercial floats or bark.

Used in water of or below the depth of the net.

These nets have been illegal for many years.

1 x offshore seine

The offshore seine has a bag and the fish are caught in the bag rather than the net (hence a seine not a gill net). Used during the day. This is known also as a "mtimbo" by the local fishermen though it is not the same and uses a different principle. For a full description see attached diagram.

Pole and line

Not as many pole and line fishermen as would be expected were found in this village. There were some though.

Traps

One individual had 37 fish traps set in the reed beds. One of these was acquired for posterity.

Village name	Mwakizega Village.	Landing site Kabeba	
Date	30/11/99	Time of day:	Late afternoon

Description:

A large scattered village extending far into the hinterland. Many permanent buildings.

Habitat: Reedy with sandy beaches

Boats: Numerous planked canoes observed but more probably dispersed in reed beds.
No outboards observed

Gears in Use.

Beach seines (Night and day)

One beach seine, used both in the night and the day, was sitting on the beach.

Pole and Lines

Children with pole and lines were observed fishing the margins

Bottom Set gill nets

Two 2" gill nets were reported in the landing site.

Scoop Net (Lusenga).

Five scoop nets are in evidence. Not presently operating as the fish had moved offshore and this method only works in shallow water. They used floating lamps on ropes to float out another lamp, which was bought close to the boat to assist in concentrating fish on the one lamp at the bows of the boat. In the net were many panels of netting of 6mm, 8mm and 12mm stretched mesh 210d/4 nylon Raschel knotless. The net was attached to the frame with PE 3 strand 210d/15. This being looped round the frame through another strand of PE210d/15 which was stitched in to the net at 15cm intervals.

Longline

A longline was measured. This had 560 hooks of local manufacture on a mainline line of PE 3 strand 210d/15, each hook on a 15mm dropper of 210d/24 PA 3 strand multifilament, at 350cm intervals. Placed in 50 to 75 meters of water depth on a floatline of PE 210d/60. A small weight of iron bar was placed at each end of the mainline and each end of the mainline had a weight and a float. The species targeted were reported to be:-

Bathybates sp

Boulengerochromis microlepis

Chrysichthys graueri

Lates mariae

Lates angustifrons

Lates microlepis

Xenochromis hecqui

Village name	On the way to Malagarasi Delta		
Date	1/12/99	Time of day:	10.00am

Description: A canoe. 2 man paddling.

Habitat: Offshore shallow near reeds.

Gears in Use.

1 x reed floated gill net with battery weights.

Trolled Bottom line

This was similar to one seen in Ujiji earlier, except with far less line and for use in shallower water. The spinner was home made of brass with a No 8 Kirby Tinned hook.

Village name	On the way to Malagarasi Delta		
Date	1/12/99	Time of day:	10.20am

Description:
A canoe. 2 man paddling.

Habitat: Offshore shallow near reeds.

Gears in Use.

Bottom set long line

Home made hooks. 250 hooks. Catch of *Clarius sp* only. 5~7kg total catch. Not weighed. Soap, the cheapest, white with blue colouring used as bait.

Village name	On the way to Malagarasi Delta		
Date	1/12/99	Time of day:	10.20am

Description: wo canoes. 3 man paddling.

Habitat: Offshore shallow near reeds.

Gears in Use.

Encircling gill nets

The operation of two vessels utilising encircling gill nets was observed.

Village name	Mwambani Fishing Camp.		
Date	01/12/99	Time of day:	Early Afternoon

Description:

A fishing camp in the Malagarasi delta swamp. Up a branch of the delta and then up a channel cut into the reeds. Not really a camp, more a landing site for a camp. At the site 17 adults, one woman and 10 children

Habitat: Reedy. In a swamp. Shallow weedy waters.

Boats: 4 planked canoes. 3 dugouts.
No outboards observed

Gears in Use.

Gill nets.

7" and 8" gillnets. The catch observed were 6 very large *Lates angustifrons* and 8 *Barbus* sp. Up to 15kg.

Gill nets for Tilapia nests.

One fisherman had (reportedly x 100) small nets for fishing tilapia nests. These were unweighted made of a piece of 210d/2 white PA nylon 3" gill net, 15 meshes by 26 meshes. The 15 mesh sides (top and bottom) being double selvedged. A piece of commercial netting. On the headline were 5 reeds as floats/spikes, the outer two being used as spikes to hold the net in place and the inner three as floats to keep the top of the net at the surface. Reed Ø = 7mm. See diagram.

The use of the net was that it is placed next to tilapia nests. The end reeds are spiked into clumps of vegetation or the muddy bottom substrate, and the mesh stretched between them, with the three inner floats holding the net from sinking. The bottom, unweighted edge of the net is pushed into the mud/vegetation substrate using another reed so that it reaches the bottom.

A description of this method is given by Townsley in a previous FPSS/SE report, though his description of the method employed is at variance with the account given here.

The method is called "Matela".

Beach Seine

Further round the swamp, at the mouth of the Malagarasi, but still originating from (Great) Mwambani Fishing Village a beach seine. Operated by one boat and 8 people.

Catch consisted of:-

Oreochromis tanganyicae (the bulk of the catch)

Limnothrissa miodon

Mormyrids (Very small Juveniles)

Tylochromis polylepis

Bathybates sp

Boulengerochromis microlepis (juveniles)

Cyathopharynx furcifer (Juveniles)

Raimus mourei

Ctenochromis horei

Tilapia rendalli

Lates mariae (juveniles)

Xenotilapia sp

Village name

Bililani Fishing Camp. Ilagala Village.

Date

1/12/99

Time of day:

12.30pm

Description:

Half a mile up the Malagarasi delta. A small hamlet of 3 houses. A lot of agriculture including taro, sweet potato, pawpaw, sugar cane, sweet corn, tobacco, cassava and hashish. Two smokehouses, one in use drying exclusively *Oreochromis tanganyicae*

Habitat: River bank

Boats: One dugout

Gears in Use.

Pole and line.

3 x poles of ~247cm with line. Line 3 x the pole length. 210d/15 nylon multifilament used as line. Hook ringed tinned size 25 (?) ~ Mustad No 8. A large hook. Thick line. A more substantial gear than used by children. Pole 6mmØ at thin end where line attached, and Ø17mm at hand end.

Gill nets

3" mesh size. 3 in village. All in the river. *Tilapia tanganyicae* and *T rendalli* the targets.

Village name **In the Malagarasi River**
Date 1/12/99 Time of day: 12.45

Description:

Canoe passing by.

Habitat: River

Boats: One dugout

Gears in Use.

Floating midwater set line

A line of 210d/15 nylon multifilament of 60cm attached with a Ringed Tinned Kirby Mustad size 9 hook, to a balsa like (green & freshly cut) float. Baited with bits of *Tilapia sp* and *Clarius sp*. Set in the swamp in waters of 1m – 1.20m. See diagram attached.

Fish targeted:-

Polypterus aethiopicus

Polypterus ornatipinnis

Oreochromis tanganyicae

2 x *Clarius sp*

Village name **Matanuruni Fishing Camp**
Date 1/12/99 Time of day: 1.00pm

Description:

One family hamlet of 3 buildings 1½ miles up the Malagarasi River. Bee hive, chickens, ducks. Master of the house away; so information not easily collected.

Habitat: River

Boats: One dugout

Gears in Use.

Gill nets

1 on shore and 2"

1 in nearby creek and not accessible.

Traps

Conical trap. Entrance end Ø78mm. 150cm long round the curve. Made of 87 pieces of Ø8mm – Ø15mm split bamboo pieces whipped on to two circular Ø3cm wooden circular hoops. Entrance end made up of 32 pieces of split bamboo pieces of varying lengths, 20 of which are shaped round a loop of Ø3cm wood frame to form the entrance to the trap. The whole bound together with one strand of 210d/36 PE multifilament (Resultant 210d/12) to form a mesh.

Village name **In the middle of the swamp somewhere**
Date 1/12/99 Time of day: 2.00pm

Description: One hut on the side of the river. Whether associated with the fisherman unknown.

Habitat: Small tributary to river

Boats: One dugout

Gears in Use.

Cast nets

1 being used by a man in the canoe.

The net was home made, 33 meshes deep (1m64cm deep). The mesh varies from the top to the bottom (23mm to 55mm, though not very regular) and this is how the shape is achieved. 270 lead weights in a continuous string make up the footrope. Three leads home made. Approx 30 x 8 x 6mm. 12 drawstrings, trifurcating 18cm from the footrope pass through a steel hoop Ø6cm internal at the headrope. See diagram.

The hand line was 4.60m 2 x PVA green 2mmØ multifilament.

The target species were *Labeo sp* and *Oreochromis tanganyicae*, which were observed in the canoe.