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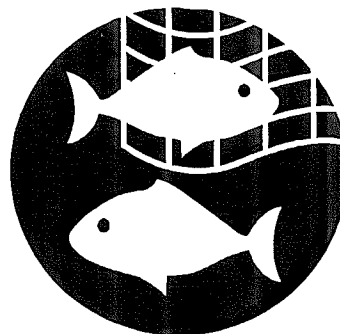
Nigerian-German Kainji Lake Fisheries Promotion Project

Technical Report Series 6.

FISHING GEAR SURVEY OF KAINJI LAKE, NORTHERN NIGERIA, 1996

by T.A. DU FEU, O.S. ABAYOMI AND M.D.B. SEISAY

**Nigerian-German (GTZ)
Kainji Lake Fisheries
Promotion Project**



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Summary

The survey was carried out in September 1996 alongside the annual frame survey. As in the previous surveys, there were six main fishing gear types in use on the lake. These included gill nets, drift nets, beach seines, cast nets, longlines (baited and foul hooking) and fishing traps.

A total of 813 canoes were sampled. The canoe lengths were similar to the previous gear surveys.

Altogether 466 gill nets were measured. They had an average length of 149 m., and were mostly bottom set. Of the gill nets measured 68% had a mesh size below 3 inches; the minimum mesh size allowable according to the Niger and Kebbi State Fisheries Edict, 1996. Of concern was the large increase in the number of 1 inch meshed nets recorded on the lake.

Drift nets had a mean length of 74 m. A total of 88% of all drift nets measured had a mesh size below 2.5 inches, the minimum mesh size stipulated in the State Edict.

A total number of 102 beach seines were sampled with a mean length of 110 m, the mesh size in use on the lake remained as 0.1 inches. Under the Edict beach seines are banned from fishing on Kainji Lake. The decline in the lengths of the beach seines (and therefore catch rates) recorded since 1995 was encouraging in light of the destructive nature of these nets.

A total of 30 cast nets were sampled, they had a mean diameter of 9.8 m. and a mean mesh size of 1.9 inches. All the nets had a hanging ratio of 0.5. Of the cast nets measured 40% had a mesh size below the minimum size of 2 inches recommended by the State Fisheries Edicts. Of concern was the continued rise in the number of gill nets with mesh sizes less than 2 inches.

There were two types of longlines in operation on the lake; the baited and the foul hooking longlines. They were mostly bottom set and the hook size nos. 12-14 (Kirby sea hook) were predominant.

Two types of fishing traps were identified, one was covered with a mesh of thin cane, one with netting material. The fishing traps had a mean height of 0.8 m. and a mean width at the base of 0.53 m. The mean mesh size used was 0.86 inches.

Citharinus was reported as the most targeted of all fish species on the lake. *Synodontis membranaceous* was also targeted by most gears especially the smaller meshed nets. *Labeo* and *Tilapia* were low on the list of targeted species but their incidence remains high in the catches.

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1. Introduction

The annual fishing gear survey of Kainji Lake was conducted in September, 1996 together with the annual frame survey .

There have been 3 gear surveys previously performed on the Lake by the Nigerian- German Kainji Lake Fisheries Promotion Project (du Feu, 1993; Yisa et al, 1994 and du Feu, 1995).

The purpose of the survey was to obtain and compare with previous surveys, the characteristics of the fishing gears in use on the lake. The survey also determined the targeted fish species for each gear type and the percentage of illegal gears operating on the lake.

Measurements of the gears will assist in the standardisation of units of fishing effort used during the frame survey and catch and effort monitoring. The information obtained from the analysis could assist in the formulation, and monitoring the effectiveness of, management measures so far introduced for the Kainji Lake fishery.

2. Methods

The methodology of the fishing gear survey was the same as the previous surveys described by du Feu, 1993, Yisa et. al., 1994, du Feu & Kasali, 1995.

Like the previous surveys the 1996 gear survey took place in September whilst the lake water was rising.

Alternate villages around the lake were visited and the following measurements were taken from fishing gears found in houses or on the beaches: canoe length, net headline length, net depth, stretched mesh size, twine size, net hanging ratio, distance between hooks, hook snood length, fishing trap height and width.

The data was entered into the fishing gear database (du Feu, 1996) for analysis. SPSS software was used to perform the statistical tests.

3. Results

3.1. Fishing Canoes

All the canoes sampled were made up of wood planks and locally built in Malale, Kokoli, Ulaira and Yauri.

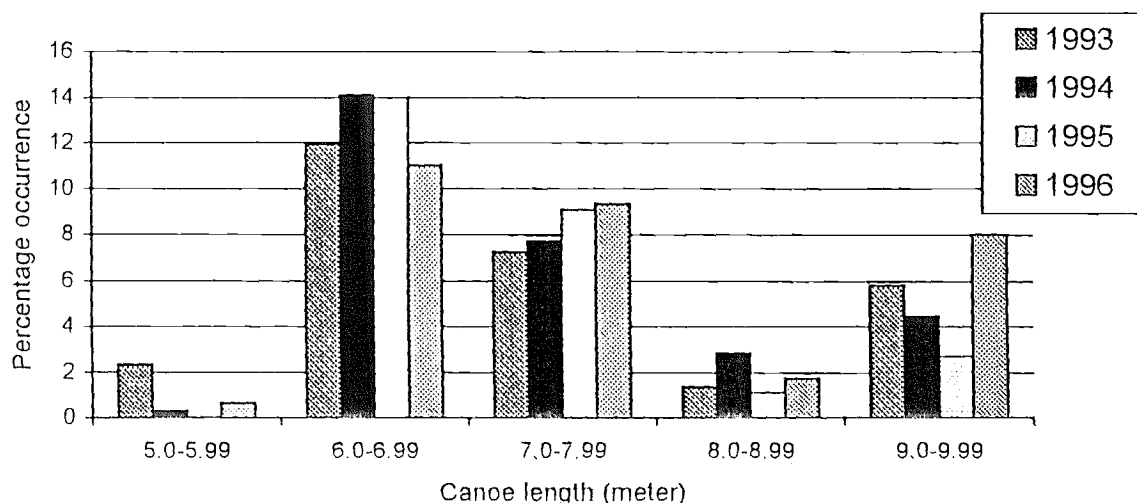
The number of canoes sampled was 813. The majority are designed to be paddled (87%) as opposed to motorised with an outboard engine (13%). Motorised canoes were mainly used by the beach seine fishery (66% of all canoes), whilst the gill net and fishing trap fisheries rarely used motorisation (7%). The cast net, longline and drift net fisheries hardly ever used engines (2%).

Paddled canoes had a length range of 5.0 -11.8 m. and mean length of 6.9 m. (95% C.I; 6.88-6.99). Motorised canoes were longer and had a mean length of 9.6 m. (95% C.I; 6.88-9.99). There was no evidence that the mean length of the motorised and the paddled canoes had significantly changed from 1993 to 1996¹.

The distribution of canoe lengths is shown in figure 1. Apart from the 7-7.99 meter size class which showed a rise in numbers no variation was seen within the other size classes.

The fishing canoes constructed locally are cheap to buy and have a long life span. The canoes are particularly robust and the small draft (depth in the water) allows the fisherman access to the shallow areas of the lake. At present the large width planks needed for construction are still available and unless this becomes a problem the NGKLFPP sees no justification to alter the type or the design of the canoes.

Figure 1. The Distribution of Canoe Length (meters) Recorded during the 1993-1996 Fishing Gear Surveys, Kainji Lake.



¹ Mann-Whitney U test; where groups of motorised and paddled are tested separately, P= 0.66 and P=0.39 res.

3.2. Fishing Gears

The main fishing methods used by the fishermen on the Lake included :

- Gill nets
- Drift nets
- Beach seines
- Cast nets
- Longlines
- Fishing traps.

3.2.1. Gill Nets

The gill net is a passive gear that captures fish by entanglement or gilling. It is especially effective for the fish species which are adorned with spines. The gear is usually set overnight with the catch collected in the morning.

During the 1996 gear survey, a total of 466 gill nets were measured. The nets had length range of 30- 500 m. with a mean length² of 149 m. (Std.= 91.6). The mean headline length of gill nets had increased by an average of 16% during every year from 1993 and was significantly longer in 1996 from all the previous surveys³. Figure 2 shows that the most frequently used net length was one bundle long. The mean depth of gill nets in 1996 was 2.34 m. A hanging ratio of 0.5 was used for the nets throughout the lake.

The mesh sizes recorded for gill nets varied between 0.5 to 10 inches with the most commonly used nets having a mesh size of 2.0- 2.5 inches (Figure 3). The mean mesh size was 2.4 inches (Std.= 1.36), this was significantly lower ($P=0.00$)⁴ than the mean mesh of 2.8 inches recorded in 1995 but not significantly lower ($P=0.09$)⁴ than 2.6 inches recorded in 1993.

There is no evidence that the number of large meshed nets to target large Citharimus and Lates is increasing. As outlined in previous reports (du Feu, 1997) these large fish are responsible for the high recruitment and sustaining the catches of the small meshed gears. Until further information about stock sizes is obtained it would be unwise to support a growth in the large meshed nets, which may lead to low recruitment due to overfishing of the parent stock.

Based on the State Fisheries Edicts which states that only gill nets with mesh sizes 3 inches or above should be used on the lake, 68% of this gear was illegal in 1996 (Table 1). This implies that the majority of nets in use target juveniles or immature fish which is dangerous for the sustained exploitation of the lake fishery. The number of legal and illegal nets sampled during the survey varied significantly during the years between 1993 to 1996⁵. Nets of different mesh sizes were occasionally joined together to make a fleet which was then set as one unit.

² 5% trimmed mean

³ Mann-Whitney U test. $P=0.00$ for the three tests 1996 to 1993, 1996 to 1994 & 1996 to 1995

⁴ Mann-Whitney U test

⁵ Chi square test. $P=0.00$

Of concern is the increased use of undersized meshed nets; particularly one inch mesh nets which increased from 6% to 21% from 1995 to 1996. The nets are especially destructive since they are all constructed with nylon twine which makes them very efficient in entangling juveniles. The NGKLFPP should highlight this area during enlightenment campaigns on the use of undersized meshed gill nets.

The twine size recorded for the netting material was 6 ply (27.7%), 9 ply (70.8%) and 12 ply (1.3%). The nets had widely spaced mountings of the sheet netting material to the head and foot ropes

The twine used for the construction of the nets is very thin. With the wide spaced mounting of the netting material along the head and foot ropes used any fish coming into contact with the net will be easily entangled by the thin twine and the loose 'pockets' of net. When formulating mesh size regulations for the gill net fishery this was into account since within Kainji Lake the fish are more likely to become tangled than gilled as in conventional gill nets.

As in the previous surveys 53% of all nets were bottom set whilst 46% were surface set, the remaining 1% were both surface and bottom set. The type of setting used varies with the season.

Table 1. The Percentage of Illegal Gill Nets on Kainji Lake, Fishing Gear Survey 1993- 1996.

<i>Year</i>	<i>Illegal nets (%)</i>
1993	66
1994	47
1995	54
1996	68

Figure 2. The Distribution of Gill Net Headline Length (meters) Recorded during the 1993-1996 Fishing Gear Surveys, Kainji Lake.

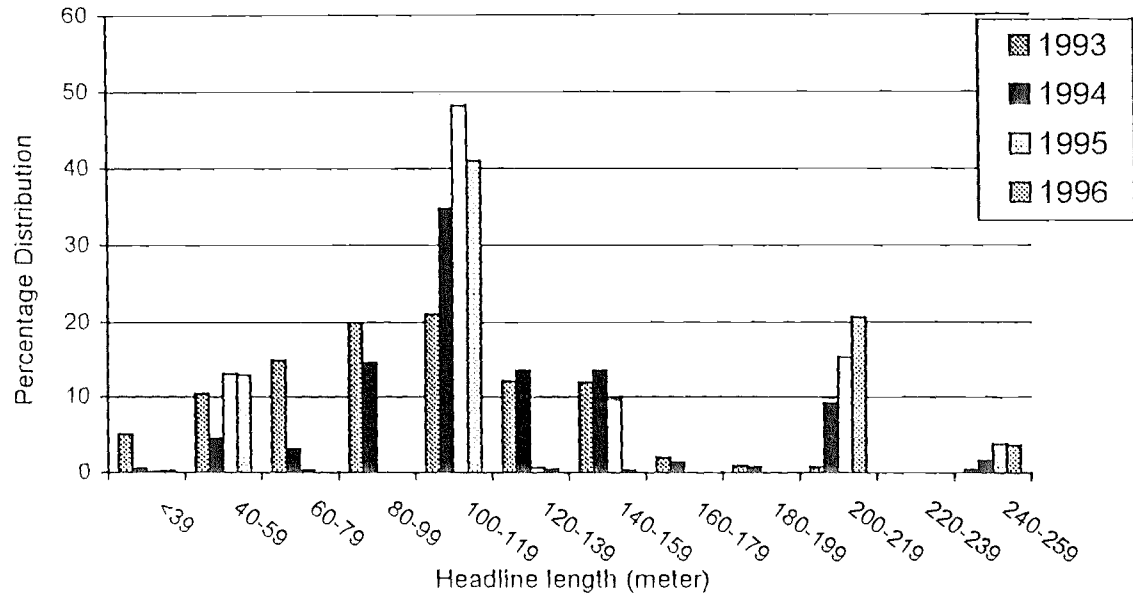
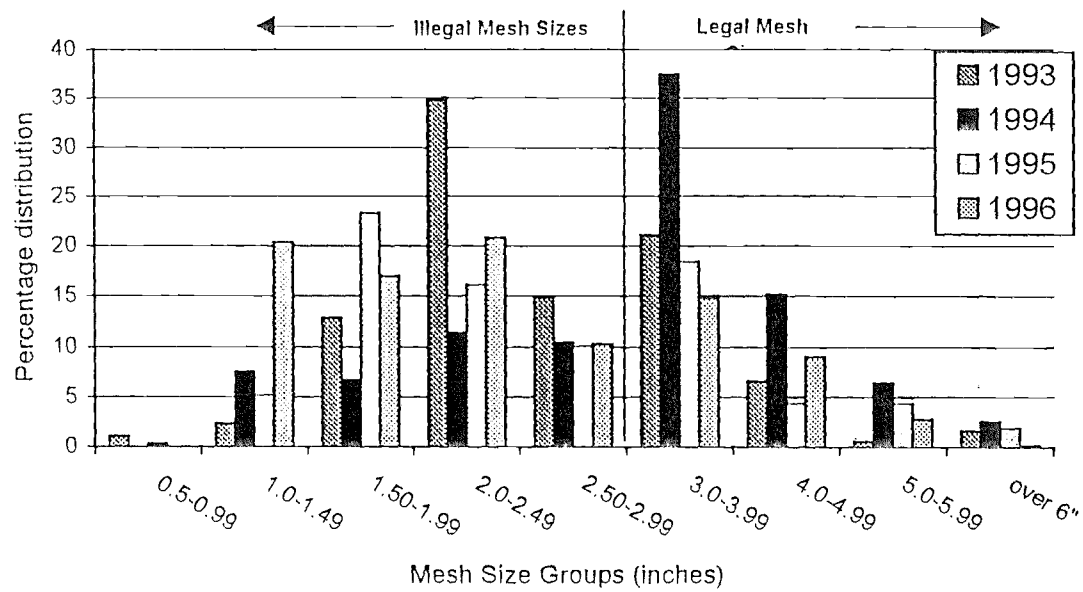


Figure 3. The Distribution of Gill Net Mesh Sizes (inch) Recorded during the 1993-1996 Fishing Gear Surveys, Kainji Lake.



3.2.2. Drift Nets

The drift net is an active gear that is used in the riverine section in the north of the lake. It's use is however becoming prominent in the still water lacustrine areas of the central and southern basins (Apeloko & du Feu, 1996).

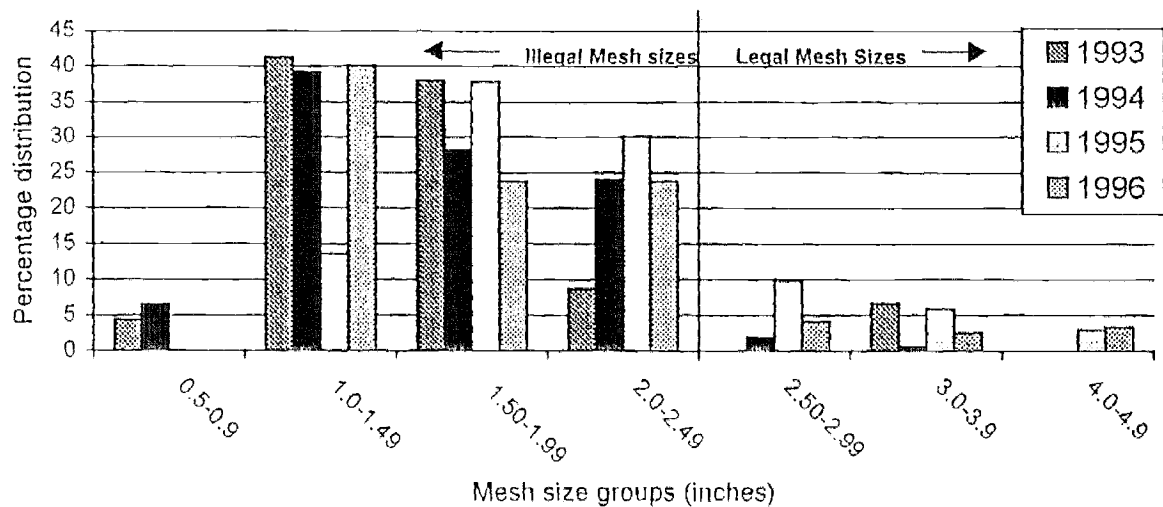
A total of 122 nets were measured. The length of the drift nets had a mean⁶ of 74.2 m. (Std. 38.9). The depth of the nets varied between 2.5 and 20.8 m. with a mean of 8.8 m. (Std.= 3.2).

The mesh sizes recorded varied between 0.5 and 6.0 inches with a mean of 1.68 inches (Std.= 0.88). The mean mesh size recorded was significantly smaller than 1995 ($P=0.00$)⁷ but not significantly different from the mean mesh size of 1993 ($P=0.07$)⁵ or 1995 ($P=0.20$)⁷. The drift net fishermen do not mix bundles of different meshes within the fleets as in the gill net fishery.

About 88% of drift nets operated on the lake were illegal (Table 2). There was strong evidence that the number of illegal drift nets varied between years⁸. The distribution of the mesh sizes recorded for the 1993-1996 gear surveys is shown in Figure 4.

The nets were commonly surface set and made of 6 ply, 9 ply and 12 ply twine with a hanging ratio of 0.5.

Figure 4. The Distribution of Drift Net Mesh Sizes (inch) Recorded during the 1993-1996 Fishing Gear Surveys, Kainji Lake.



⁶ 5% trimmed mean

⁷ Mann-Whitney U test

⁸ Chi square test, $P=0.00$

Table 2. The Percentage of Illegal Drift Nets on Kainji Lake, Fishing Gear Survey 1993-1996.

<i>Year</i>	<i>Illegal nets (%)</i>
1993	93
1994	98
1995	82
1996	88

3.2.3. Beach Seines

This fishing gear was specifically designed and introduced by the fishermen to catch the small pelagic clupeid fish species. However, during fishing the small meshed encircling net, which is pulled towards the shore, also captures the juveniles of other commercially important fish species e.g. *Citharus*, *Tilapia*, *Lates* etc.

The basic principle of operation of this gear has been described by du Feu, 1993. Fishing with beach seines usually starts by 6.00 a.m. and can extend into the night. Because of the nets bulk it requires a larger canoe to set it. Beach seine fishermen are highly mobile migrating around the lake. About 66% of the canoes were recorded as being motorised, higher than for any other gear.

A total number of 102 samples of beach seines were sampled with a length range of 30-200 m. and a mean length⁹ of 110 m. (Std. = 42) (Figure 5). Despite a significant increase in the length of the nets recorded from 1993 to 1996¹⁰, there is evidence that the beach seines became shorter from 1995 to 1996¹¹.

Catch rates, and hence by-catch increase as beach seines become longer. With the ban of beach seines it may be that fishermen are reluctant to 'add on' bundles of beach seine netting as they did in the past. Shortening of beach seine nets can therefore be viewed as beneficial to the fishery.

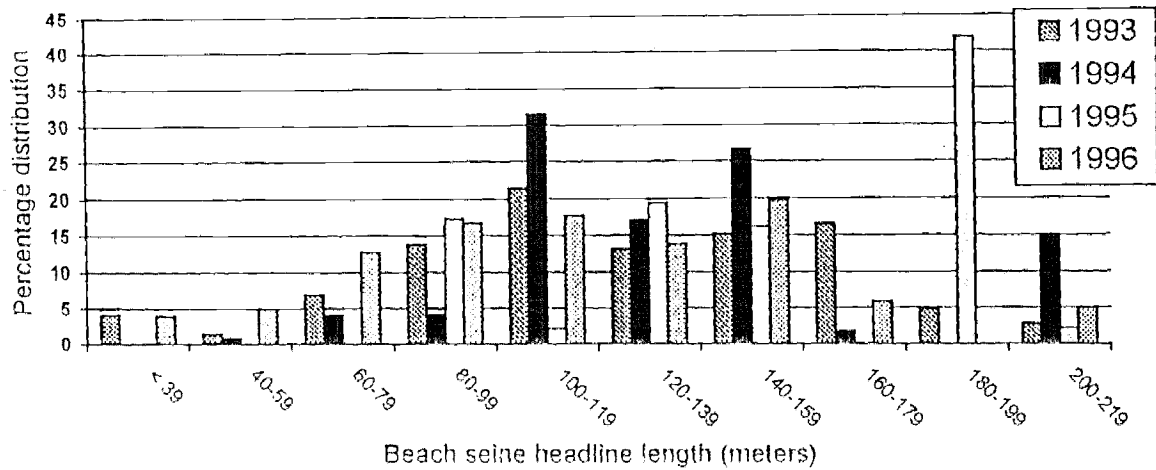
The net depth varied between 2.00-9.60 m. with a mean of 5.22 m. (Std.= 1.39). The mesh size remained as 0.1 inches. As stipulated in the Niger and Kebbi State Fisheries Edicts beach seines are banned on Kainji Lake.

⁹ 5% trimmed mean

¹⁰ Mann-Whitney U test, P=0.01

¹¹ Mann-Whitney U test, P=0.00

Figure 5. The Distribution of Beach Seine Headline Length (meters) Recorded during the 1993-1996 Fishing Gear Surveys, Kainji Lake.



3.2.4. Cast Nets

The nets are of small mesh and circular in shape with lead weights attached around the outer circumference. The net is either cast from the shore or from a canoe. As it sinks to the bottom the weighted edge sinks more rapidly than the centre with the net entrapping any fish beneath it. When hauled using the center rope the net closes, the pockets and lines around the outer edge help to ensure that the fish are trapped. Cast nets are usually fished for 2-8 hours per day.

A total number of 30 cast nets were sampled. Despite an increase recorded in the mean mesh size from 1993 it fell sharply from 1995 to 1996¹². In 1996 the mesh sizes ranged from 0.5-4.0 inches with a mean of 1.92 inches (Std.= 0.93).

The distribution of the cast net mesh sizes over the 4 years gear surveys is shown in Figure 6. The graph shows a sharp rise in the number of nets of 1 to 2 inch mesh in use from 1993 to 1996, whilst the number of nets above 2 inches fell. The most commonly used nets on the lake in 1996 were the ones with mesh sizes below 2 inches, unlike 1995 when the majority of nets used had a mesh size higher than 2 inch.

The minimum allowable stretched mesh size is 2.0 inches (State Fisheries Edict, 1997), the percentage of illegal nets is shown in table 3. There is evidence that the number of illegal cast nets recorded on the lake were significantly different between the years¹³.

¹² Significant, P=0.02, Mann-Whitney U test

¹³ Chi square test, P=0.01

The most important fish species caught by cast nets are *Citharinus* and *Tilapia*. It has been estimated that 31% by number of each these species is caught every year by the gear on the lake and these are mainly undersized fish (du Feu, 1997). Like the beach seine, cast nets cause high mortality of juvenile fish.

Cast net efficiency can be increased by using larger diameter nets; there is however a limit to the size of net which can be effectively spread when thrown. The cast net diameter has increased since 1993 and the 1996 mean diameter (9.8 m.) was significantly higher than any preceding years records¹⁴.

The increased use of small meshed cast nets since 1993 which are used to target juveniles of the main commercial species, Citharinus and Tilapia, is of major concern and should be addressed by the enlightenment campaigns of the NGKLFPP.

Figure 6. The Distribution of Cast Net Mesh Sizes (inch) Recorded during the 1993-1996 Fishing Gear Surveys, Kainji Lake.

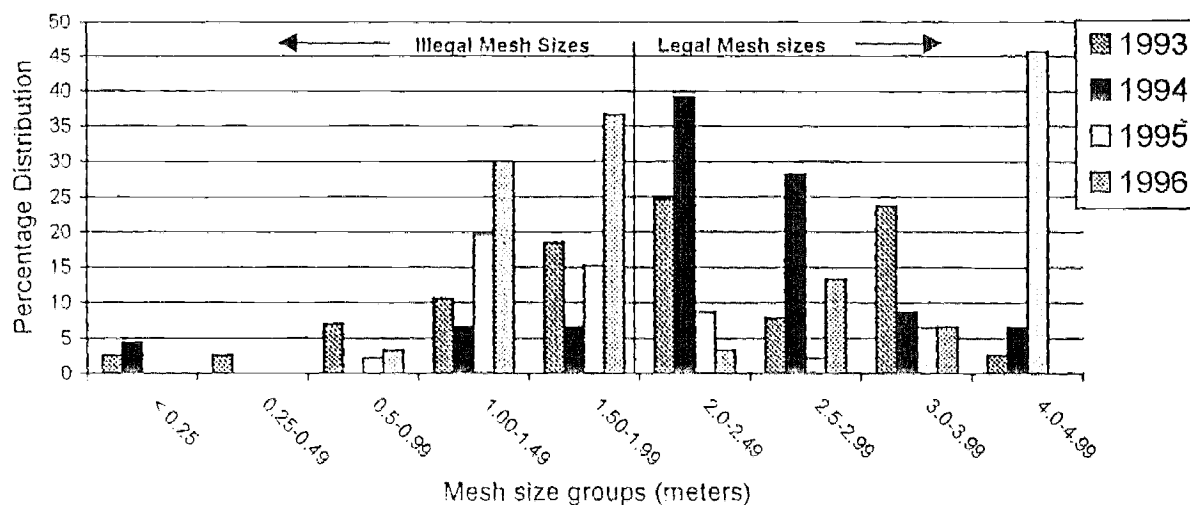


Table 3. The Percentage of Illegal Cast Nets on Kainji Lake, Fishing Gear Survey 1993-1996.

Year	Illegal nets (%)
1993	40
1994	13
1995	37
1996	40

¹⁴ Turkey's honestly significant test

3.2.5. Longlines

Longline are passive gears with the main line bearing many hooks on snoods. They are quite selective for species and to a considerable extent for fish size. The longlines may be baited or unbaited (foul hooking longline). They are normally set in the evening and lifted for checking in the morning.

A total number of 88 baited longlines were sampled. The hook size number ranged from 7-14 (Kirby sea hook) with a mean of 12.95. The distance between hooks varied between 1.6- 4.5 m., (mean 3.42 m.), the snood length varied from 0.1-0.3 m. (mean 0.20 m.).

Longlines with baited hooks were all bottom set. The number of hooks varied between 24-500 per line with a mean of 88.67 hooks. The hook size distribution for baited lines is shown in table 4. The most frequently used hooks on the lake were the smaller ones with sizes 12,13 and 14.

For the foul hooking longlines 78% were bottom set, 19% were surface set, while 3% were both bottom and surface set. The number of hooks ranged between 50- 612 per line. The distance between hooks was 0.2-4.8 m. The hook size varied between 7-14 (Kirby sea hook) with a mean of 12.7 (Table 5). The snood length varied between 0.1-0.3 m.

Table 4 The Distribution of Baited Longlines Used on Kainji Lake, 1993- 1996.

YEAR	No. & %	HOOK SIZE										
		6	7	8	9	10	11	12	13	14	15	
1993	No.	84	0	0	0	0	0	0	0	0	0	0
	%	100	0	0	0	0	0	0	0	0	0	0
1994	No.	113	3	0	0	0	0	0	0	0	0	0
	%	97.4	2.6	0	0	0	0	0	0	0	0	0
1995	No.	11	0	0	0	0	1	41	27	32	0	
	%	9.7	0	0	0	0	0.9	37.2	23.9	28.3	0	
1996	No.	0	0	3	0	2	1	11	10	31	0	
	%	0	0	5.2	0	3.4	1.7	19.0	17.2	53.4	0	

Table 5 The Distribution of Unbaited (foul hooking) Longlines in use on Kainji Lake, 1993-1996.

YEAR	No.& %	HOOK SIZE									
		6	7	8	9	10	11	12	13	14	15
1993	No.	4	3	0	0	3	8	16	7	3	4
	%	8.3	6.2	0	0	6.2	16.7	33.3	14.6	6.2	8.3
1994	No.	0	0	0	0	0	0	0	0	0	0
	%	0	0	0	0	0	0	0	0	0	0
1995	No.	0	0	0	0	0	0	0	0	0	0
	%	0	0	0	0	0	0	0	0	0	0
1996	No.	0	1	0	0	0	0	15	5	10	0
	%	0	3.1	0	0	0	0	50.0	15.6	31.2	0

3.2.6. Fishing Traps

The fish trap is a passive gear set on the bottom, fish are attracted by bait and enter through an opening which has a series of lines making escape difficult. Since the fish stay alive for long periods traps are usually checked less frequently than other fishing methods. There were two types of fishing traps in operation around the lake, one was covered with thin canes and one with netting material.

A total of 25 fishing traps were sampled during the 1996 gear survey. The fishing trap height ranged from 0.47-1.80m with a mean of 0.77m (Std.= 0.29). The width at the base varied between 0.36-1.50m with a mean of 0.53m (Std.= 0.24). Trap efficiency can be increased by using wider traps, especially if the traps are used also for fish fencing where they become full with fish.

Fishing traps are used to form an impenetrable wall to block the channel exits during fish fencing. Fish fencing occurs during the draw down period (March to June) and is most prominent in the flood plain areas of the lake. The practise is highly destructive catching juveniles of Tilapia and Citharinus. Stopping the incidence of fish fencing should be an urgent activity of the NGKLFPP

The mesh sizes of the fishing traps varied from 0.25 -1.0 inches with a mean of 0.86 inches (Std.= 0.20). The mesh size distribution of the fishing traps for the 4 years of the fishing gear surveys is shown in Figure 7, apparent was the increased use of traps with a mesh size 1-1.49 inches recorded in 1996. The most commonly used fishing traps were the ones with mesh sizes between 0.5-1.49 inches. The twine used was mostly of 9 ply. Almost all traps in use on the lake have a mesh size below 2 inches; the minimum allowable size according to the State Edicts (Table 6).

Figure 7. The Distribution of Mesh Sizes (inch) of Fishing Traps Recorded during 1993-1996 Fishing Gear Surveys, Kainji Lake.

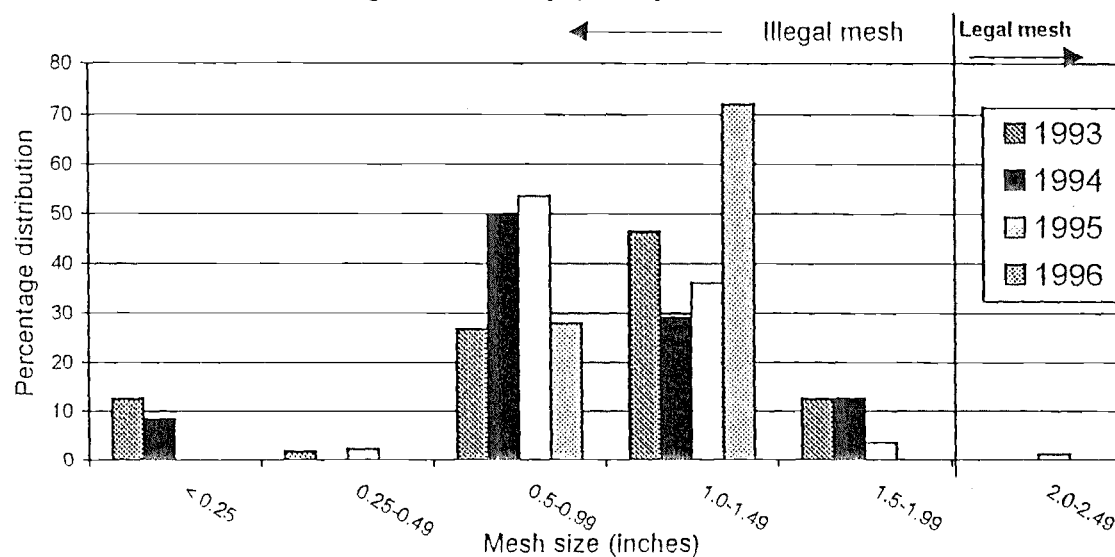


Table 6. The Percentage of Illegal Fishing Traps on Kainji Lake, Fishing Gear Survey 1993-1996.

Year	Illegal traps (%)
1993	100
1994	100
1995	95
1996	100

3.3. Target Species

For each gear measurement made during the survey the fisherman was asked which species he wished to target. The results of the combined data from the 1993 - 1996 surveys are given in table 7 which shows the totals for all gear types. Table 8 lists the six most important target species for each legal and illegal gear type.

Target species listing by the fishermen are important for management since they will not necessarily be the same as the major species caught. For example *Tilapia*, a fairly low value species on the lake, is the third most important commercial species caught but only appeared in fifth position on the choice of fish species targeted by the fishermen. It would be misleading perhaps to manage on the basis of *Tilapia* if it is not really a targeted species due to its low value.

Citharimus was the major fish species fishermen wished to target with 6 of the 10 gear types having it as first and all gear types having *Citharimus* either in first or second place. It is targeted especially by the larger cast net, drift net and gill net fisheries. There seems high fishing pressure on this species which appeared second place in the commercial species caught.

Synodontis membranaceous was another species which was targeted by all gear types especially the smaller gill and drift nets, the species is however only in sixth position in the commercial species caught. *Labeo* is the opposite, it is the fourth most important species caught on the lake but appeared fairly low on the fishermen's choice list and was only a target species for the larger drift and gill nets.

Bagrus, an important commercial species, was targeted by almost all gears on the lake especially the small meshed cast nets and to a lesser extent by the small meshed gill and drift nets.

Alestes feature surprisingly high in the targeted species being important for the larger meshed gill nets, they are only the twelfth most important commercial species caught on the lake.

The high value *Lates* appears surprisingly low on the fishermen's target species and was only targeted by the small meshed cast nets.

Clarias was only targeted by the longline fishery.

The detrimental nature of one inch gill nets, which catch mainly juveniles, is apparent from the target species list which displays all the major commercial species in the top six.

It is interesting to note that the major targeted species are similar in the illegal and legal meshed nets. The nets are therefore targeting the same species only at smaller sizes. This will assist in enlightenment campaigns suggesting that the same species can be left to grow before being caught at larger size by larger meshed gears.

Table 7. Target Species and Species Caught Listed in Order of Importance (summed for all gear types).

<i>Species</i>	<i>Target species Sum of percent</i>	<i>Ranking in commercial importance</i>
Citharinus	183	2
S. membranaceus	92	4
Bagrus	63	7
Alestes	60	12
Tilapia	59	3
Other synodontis	45	8
Lates	28	10
Clupeids	26	1
Labeo	18	6
Clarias	18	17
Auchenoglanis	15	13
Hydrocynus	13	15
Other catfish	6	17
Heterobranchus	6	18
Chysichthys	6	5

Table 8. The Target Species Listed in Order with Percentage Occurrence for Legal and Illegal Gear Types

Gear type	Mesh size	Target species listed in order (with % figure of occurrence)																					
		1	2	3	4	5	6	7	8	9	10	11											
Gill net	1 inch	S. membranac.	Citharinus	Alestes	Bagrus	Tilapia																	
	<3 inch	Citharinus	Alestes	S. membranac.	S. membranac.	Bagrus	Bagrus																
	>=3 inch	Citharinus	Alestes	S. membranac.	S. membranac.	Bagrus	Bagrus																
Drift net	<2.5 inch	S. membranac.	Citharinus	Bagrus	Bagrus	Bagrus	Labeo																
	>=2.5 inch	Citharinus	S. membranac.	Other synodontis	Other synodontis	Other synodontis	Alestes																
Cast Net	<2 inch	Bagrus	Citharinus	Lates	S. membranac.	Lates	S. membranac.																
	>=2 inch	Citharinus	Tilapia	Alestes	Other synodontis	Alestes	Other synodontis																
Beach seine		Clupeids	Alestes	Citharinus	Bagrus	Bagrus	Bagrus																
		Citharinus	Clarias	Tilapia	Bagrus	Bagrus	Bagrus																
Bait longline Foul longline		Citharinus	Bagrus	Clarias	Heterobranchus	Tilapia	Tilapia																
		Citharinus	Bagrus	Clarias	Tilapia	Tilapia	Tilapia																
Traps		Citharinus	Auchenoglanis	Tilapia	S. membranac.	Tilapia	S. membranac.																

Shaded areas indicate illegal fishing gears according to the State Fisheries Edicts

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Glossary

Hausa names

Fishing canoes	Jirgi
Gill net	Taru hako
Drift net	Taru duru
Beach seine	Dalla
Cast net	Birigi
Longline	Kugiya
Fishing trap	Gora or N'durutu

NGKLFPP: The Nigerian-German (GTZ) Kainji Lake Fisheries Promotion Project

- All mesh sizes are quoted in inches and refer to stretched mesh size.
- All means of gear lengths have been expressed as 5% trimmed means so as not to decrease the accuracy caused by extremely short or long gears.
- Gill net lengths are expressed by the fishermen as number of bundles. The length of a bundle varies but is taken to be 100 yards (91 meters) of unmounted netting material.
- Longlines on Kainji Lake all use Kirby Sea hooks. The size of hooks is therefore expressed for this hook. One box (100 hooks) forms one line.
- The targeted fish species quoted are the same taxonomic groupings used in the NGKLFPP CAS survey.

