RELATIVE EFFICIENCY OF MONOFILAMENT AND MULTIFILAMENT TRAMMEL NETS IN SOUTHERN PORTION OF LAKE KAINJI, NIGERIA.

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Absract

The relative efficiency and selectivity of monofilament and multifilament trammel nets in southern basin of Lake Kainji were studied. The nets were set and inspected daily for 30 consecutive fishing days. Monofilaments trammel nets had the highest relative species diversity index of 0.52 while multifilament had 0.48. A total of 204 fish were caught, 64.7% was caught by monofilament nets and multifilament net 35.3%. This suggests, that there was significant ($P < 0.05$) variation in catching efficiency of the trammel nets with regard to *Citharinus citharus* with the monofilament net having the highest 79 fishes, but was not significant ($P > 0.05$) in overall number of difference species caught. However, trammel nets showed better efficiency for catching *C. citharus*, *S. membranaceous*, *C. laticeps*, *O. nitoticus*, <u>Sarotherodon</u>, than other species caught. There is no significant difference ($P > 0.05$) in the minimum and maximum sizes of fish caught, and this indicates the efficiency of the trammel nets in avoiding juveniles of commercial species, due to the mesh sizes used (3" and 5").

This implies that rational exploitation could lead to proper management of fish stocks in the lake, which is now lacking. It is concluded that monofilament net is more efficient than multifilament trammel net

Keywords: Trammel nets, Catch efficiency, Mode of capture, Lake Kainji

Introduction

In Nigeria, as in many African countries, various types of traditional fishing gears are widely used by the artisanal fishers. Abiodun and Niworu (2004) recordrd 7,290 gillnets, 623 drift nets, 786 cast nets, and 2,776 longlines in the Kainji Lake.

There are two main types of gillnet and tangle nets: single wall nets and multi walled trammel nets. Trammel nets and one walled gillnets differ in their construction. Between the two wide meshed and stretched outer walls, a rather loose interior netting with smaller meshes are inserted. This smaller inner sheet of netting (named the lint or linnet) has plenty of slack because it is two to three times as deep as the rigged gear. When a fish swims through the large outer meshes it encounters and pushes against the loose interior net so that a pocket is formed around the fish in which it becomes entangled. Gill and trammel nets are highly selective. To be successful, the large meshes of the two outer walls must be exactly opposite to each other so that pockets will not be prevented from developing (Hamley, 1975).

In Nigeria, documented knowledge on these gear is restricted largely to multifilament trammel nets. Information on the monofilaments with respect to the efficiency, effect on the fish resources and comparative advantages vis-à-vis the socio-economics of the artisanal fishers are not available. This study therefore set out to assess the catch efficiency of monofilament and multifilament trammel nets in Kainji Lake, Northern Nigeria. It focused on species composition, size of fish caught, and mode of capture with the ultimate aim of assessing the efficiency, negative and positive effect of the trammel nets on the fish resources.

Materials and Methods

Study Location

This study was conducted in Kainji Lake Area of Niger State, Nigeria (Fig.1). The lake has a surface area of 1,270km^2, volume of 1,397km^3, maximum length 136m, maximum depth of 60m; and mean depth of 11m. The lake has an annual fluctuation in level of 10m and a ratio of capacity to discharge of 1:4. The dam was constructed mainly for electricity generation but it sustains important fisheries (Ita, 1972).

The Trammel nets

The trammel nets were constructed at the Fishing gear Net Loft Workshop of the Federal College of Freshwater Fisheries Technology, New Bussa. Both nets were set in Lake Kainji completely immersed in water and held in position. A four litre empty gallon was used as marker. The nets were set in three selected sites for seven days per station. The setting was done at 6.30 p.m. to 7.00p.m daily for 21 days (3 weeks).

The nets were inspected in the morning, between 7.30 am and 8.00a.m. daily. This was done by raising the head rope from the water surface starting from one end of the net to the other. Fish caught were counted and species identified based on Reed *et al.* (1967) and Olaosebikan and Raji (1998). The total length was measured to the nearest centimeter on a graduated measuring board, while the total weight (g) was obtained using a weighing balance of 10kg maximum capacity and sensitive weighing balance of 200g capacity (model Ohaus L.S 2000). Various catching methods of the nets were observed and recorded.

Data were processed using means and percentages. Analysis of variance (unpaired test) was carried out using a software (MS Excel). Relative species diversity index was calculated as described by Ahmed *et al.* (2006, In Press).

Results

The different types of fish caught in monofilament and multifilament trammel nets in Kainji Lake are presented in Table 1. A total of twelve (12) species belonging to nine (9) fish families were recorded . Except the family Mormyridae, Cichlidae and Bagridae that were represented by two species each, the other families had one species each. Of the 21 species caught, twelve (12) were caught by monofilament trammel net. Multifilament trammel net caught only ten species in Lake Kainji with relative species diversity index of 0.52 for the former and 0.48 for the later.

The number and percentage of the different species caught in the monofilament and multifilament trammel nets in Kainji Lake are presented in Table 2. A total of 204 fish was caught, of which 132 (64.7%) was caught in monofilament while multifilament trammel net-recorded 72 (35.3%) respectively. *Citharinus citharus* accounted for the greatest proportion of fish caught by both trammel nets. Monofilament net (59.85%) and multifilament (61.11%). Similarly, it accounted for 123 or 60.29% of the total number of fish recorded in this lake. Analysis of variance for all the species showed that the number of *Citharinus citharus* in the two trammel nets, was not significantly (P>0.05) different.

The composition of the fish weight in the catch is shown in Table 3. The total weight of fish caught in the monofilament net was 25.77kg while multifilament net-recorded 12.43kg. However, out of the total weight of fish caught in the monofilament net, *Citharinus* and *Oreochromis* species accounted for 39.2 and 26.6% by weight, respectively followed by *Clarotes* and *Synodontis* each of which accounted for 9.6 and 6.7% by weight. In multifilament net also, *Citharinus* accounted for higher proportion (45.6%), and *Bagrus* species accounted for 13.5%. *Hydrocynus, Distichodus, Tilapia, Mormyrops*, and *Labeo* species accounted for low percentages of 1.3, 1.6, 1.7, 2.8 and 3.9, respectively. Analysis of variance showed that the weight of fish species caught in both trammel nets were not significantly different (P<0.05).

Table 4 contains a summary of the lengths and weights of the different fish species caught in both trammel nets. Among the minimum length of fish caught were 13 and 18.5cm total length of *Citharinus citharus* and *Synoodontis* sp. respectively in monofilament net and 13, 17.5 and 19.8cm of *Citharinus citharus, Synodontis*, and *Tilapia* species respectively in multifilament net. The maximum length of the various species caught included 35.6 and 32.2cm of *Mormyrops* and *Clarias* respectively in monofilament and 33.2 and 32.1cm of *Hydrocynus* and *Distichodus* species respectively in multifilament net. The weights of the various species (Table 4) indicate values of 415.3gm for *Bagrus*, 500gm for *Oreochromis*, 402.3gm for *Distichodus,* and 423.2gm for *Clarotes*in monofilament net while multifilament net recorded a maximum weight of 423.5gm of *Bagrus,* 413.6gm for *Distichodus* and 321.7gm for *Clarias* species. Analysis of variance of length of the different fish species caught by the two trammel nets revealed that there wereno significant differences (P>0.05) in length and weight of the different fish species caught.

The mode of capture of the fish species in trammel nets is shown in Table 5.
Entangling was the commonest mode of capture recorded in all the trammel nets. The highest entangling method was recorded in *Citharinus citharus* with total number of 48 (,71.64%), 31, (68.89%) in (monofilament and multifilament trammel nets respectively, followed by enmeshing with 22, (64.70%) in monofilament. Overall the mode of capture reveals that entangling is the highest with 54.90% followed by enmeshing with 23.04 and wedging is the least with 22.06%.

Discussion

The species composition of the fish caught shows the effectiveness of monofilament and multifilament trammel nets in catching different fishes that are known to exhibit different behavioral characteristics and feeding ecology (Reed et al; 1967) in the lake. The numbers of species caught in each type of trammel net were almost the same. This probably suggests equal efficiency in catching various fish species. The number of fish species recorded in Kainji Lake is only indicative of the fish biodiversity, and not true representation, due to extrinsic and intrinsic factors that affect selectivity of fishing gear (Lagler, 1978). Thus, an array of trammel nets of various sizes both monofilament and multifilament would have to be employed before the true fish biodiversity of Kainji Lake can be obtained. Machiels *et al.* (1994) found monofilaments nets more efficient for *Pikeperch* (*Stizostedion lucioperca*), but multifilament more efficient for bream *(Abramis-brama)*.

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The significantly (P<0.05) higher numbers of *Citharinus* species than other species in the catches of the two trammel nets appeared to indicate higher abundance of the species than the others; as well as good efficiency of the trammel nets for the species. The biomas of the different species indicated higher individual weight for *Oreochromis, Distichordus, Clarotes* and *Mormyrops* sp. than those of *Synodontis membranaceus, Citharinus and Tilapia zillii*. The length and weight of the fishes caught show that both trammel nets are capable of catching large size commercial fishes like *Bagrus, Synodontis, Clarias* and *Citharinus* species.

The inconsistency in the length of the various fish species also indicate that both nets are capable of catching large sizes of individuals of a particular species or different species, though, this could be attributed to the mesh sizes (3" and 5") of the net used, with bigger mesh size net for bigger fish (Nomura, 1959). Generally, the size range of the individual fishes caught in both trammel nets did not contravene section II (fifth schedule) of the Kebbi State Fisheries Edict of 1997 which prohibits the catching of individuals of *Bagrus* species of less than 25cm and *Citharinus sp., Clarias* sp., *Labeo* sp. and *Synodontis membranaceus* of less than 20cm. It is also to be noted that the mesh sizes of the two trammel nets in this study were larger than those of gillnets used by the artisanal fishers in the study area, and this equally does not contravene section 4 No 1 (a) of the State Edict, which prohibits the use of net less than 8cm (3 inches) mesh size. The size of the fishes caught by both trammel nets appear conducive to good sustainability of the fish resources that could reduce irrational exploitation of the fish stocks by the artsianal fishers within the Lake, especially as fisheries management fails to enforce the provisions of fisheries edicts as in both Kebbi and Niger States.

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Table 1: Types of fish caught in Monofilament and Multifilament trammel nets in Lake Kainji

Family	**Species**	**Trammel nets**	
		Monofilament	**Multifilament**
Bagridae	*Bagrus bayad*	+	+
	Clarotes laticep	+	+
Characidae	*Hyrocynus forskali*	-	+
Cichlidae	*Oreochromis niloticus*	+	-
	Tilapia zilli	+	+
Citharinidae	*Citharinus citharus*	+	+
Claridae	*Clarias anguillaris*	+	+
Cyprinidae	*Labeo coubie*	+	+
Distichodontidae	*Distichodus brevipinnis*	+	+
Mochokidae	*Synodontis membranaceus*	+	+
Mormyridae	*Mormyrops deliciousus*	+	+
	Mormyrops senegalensis	+	-
Total Number of fish caught		11	10
Relative Species Diversity Index (RSDI)		0.52	0.48

Table 2: Number and percentage of different fish species caught in Monofilament and Multifilament trammel nets in Lake Kainji.

Species	**Number**	**Percentage**
A. Monofilament trammel net		
Citharinus citharus	79	59.85
Labeo coubie	5	3.79
Synodontis membranaceus	13	9.85
Clarotes laticep	7	5.3
Mormyrops deliciousus	3	2.27
Bagrus bayad	3	2.27
Oreochromis niloticus	14	10.61
Tilapia zilli	3	2.27
Mormyrops senegalensis	2	1.52
Clarias anguillaris	2	1.52
Duistichodus brevipinnis	1	0.75
Total	132	100
B. Multifilament Trammel Nets		
Citharinus citharus	44	61.11
Labeo coubie	3	4.17
Synodontis membranaceus	9	12.5
Clarotes laticep	4	5.56
Mormyrops deliciousus	1	1.39
Bagrus bayad	4	5.56
Tilapia zilli	2	2.77
Hydrocynus forskali	1	1.4
Clarias anguillaris	2	2.77
Distichodus brevipinnis	2	2.77
Total	72	100

Table 3: Weight and percentage of various species caught by Trammel nets during experimental period

Species	Total wt (gm)	Mean wt (gm)	Percentage
A. Monofilament trammel net			
Citharinus citharus	10101.1	127.86	39.22
Labeo coubie	993.3	198.66	3.85
Synodontis membranaceus	1716.9	132.07	6.66
Clarotes laticep	2469.6	352.8	9.58
Mormyrops deliciousus	708.1	236.03	2.75
Bagrus bayad	1193.6	297.87	4.63
Oreochromis niloticus	6856.9	489.78	36.61
Tilapia zilli	395.2	131.73	1.53
Mormyrops senegalensis	428.5	214.25	1.66
Clarias anguillaris	501.2	250.6	1.95
Distichodus brevipinnis	402.3	402.3	1.56
Total	25766.7	2833.95	100
B. Multifilament Trammel Nets			
Citharinus citharus	5663.1	128.71	45.58
Labeo coubie	436.8	145.6	3.55
Synodontis membranaceus	1128.9	125.43	9.05
Clarotes laticep	1427.8	356.95	11.58
Mormyrops deliciousus	227.4	227.4	1.86
Bagrus bayad	1682.6	420.65	13.54
Tilapia zilli	302.5	151.25	2.48
Hydrocynus forskali	152.4	152.4	1.25
Clarias anguillaris	582.7	291.35	4.49
Distichodus brevipinnis	821.4	410.7	6.62
Total	12425.6	2410.44	100

Table 4: Summary of sizes of fish species caught with trammel nets during experimental period in Kainji Lake.

Species	LENGTH (CM)		WEIGHT (GM)	
	Min	Max	Min	Max
A. Monofilament trammel net				
Citharinus citharus	13	24.2	120	136.8
Labeo coubie	20	22.5	109.2	163.8
Synodontis membranaceus	18.5	22.8	113.4	135.5
Clarotes laticep	21.5	25.4	353.5	377.7
Mormyrops deliciousus	27.8	31.5	250.2	350.2
Bagrus bayad	25.2	28.5	397.9	415.3
Oreochromis niloticus	19.3	22.5	484.1	500
Tilapia zilli	20.3	24.2	121	153.2
Mormyrops senegalensis	29	35.6	214.3	223.5
Clarias anguillaris	29.4	32.2	250.6	276.4
B. Multifilament Trammel Nets				
Citharinus citharus	13	25.2	120	136.8
Labeo coubie	21.2	23.1	109.2	163.8
Synodontis membranaceus	17.5	20.4	113.4	135.5
Clarotes laticep	20.5	26.3	322.4	350

Mormyrops deliciousus	25.6	28.9	227.4	227.4
Bagrus bayad	27.3	31.2	420.7	423.2
Tilapia zilli	19.8	22.2	151.3	154.2
Clarias anguillaris	25.9	31.2	86.2	321.5
Distichodus brevipinnis	26.5	32.1	410.7	413.5

Table 5: Mode of capture of the sampled fish species from the two experimental nets (Monofilament and Multifilament trammel nets)

		MODE OF CAPTURE		
Species	**No**	**Wedging**	**Entangling**	**Enmeshing**
A. Monofilament trammel net				
Citharinus citharus	79	9	48	22
Labeo coubie	5	0	0	5
Synodontis membranaceus	13	10	1	2
Clarotes laticep	7	1	5	1
Mormyrops deliciousus	3	0	2	1
Bagrus bayad	3	1	2	0
Oreochromis niloticus	14	8	3	3
Tilapia zilli	3	2	1	0
Mormyrops senegalensis	2	0	2	0
Clarias anguillaris	2	0	2	0
Distichodus brevipinnis	1	0	1	0
Total	132	31	67	34
A. Multifilament Trammel Nets				
Citharinus citharus	44	4	31	9
Labeo coubie	3	0	0	3
Synodontis membranaceus	9	7	2	0
Clarotes laticep	4	0	3	1
Mormyrops deliciousus	1	0	1	0
Bagrus bayad	4	1	3	0
Tilapia zilli	2	2	0	0
Hydrocynus forskali	1	0	1	0
Clarias anguillaris	2	0	2	0
Distichodus brevipinnis	2	0	2	0
Total	72	14	45	13