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Evaluation of Fisheries Catch Trend on Lake Kainji, in Nigeria, 1995-2001

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ABSTRACT: The highlights of the analysis of fisheries data collected between 1995 and 2001 for the purpose of monitoring and evaluating the Kainji Lake fishery in Nigeria was presented. There was a downward trend in the total number of Fishermen, gear recorded for all fishing methods and annual fish yield between 1995 and 2001. The annual fish yield reached 32,474 metric tones in 1995 and declined to 13,361 metric tones in 2001. For an optimum catch, only 1,905 Fishermen ought to have been engaged in full time fishing activities if, Kainji Lake fisheries is to be managed on a sustainable basis. However, the results further revealed that a surplus of over 2,200 Fishermen were still recorded actively fishing in 2001 despite the interjected management measures of licensing and banning the use of beach seine on the Lake. This has led to a decline in daily catches of Fishermen, which invariably caused a reduction in the total annual fish yield by 58% during the seven years sampling period. @JASEM

Monitoring and evaluation of the Kainji Lake fishery were not carried out for over a decade. As a result, there existed a gap in knowledge with respect to the number of fishermen, fishing methods and other lake fisheries statistics. This study was undertaken to bridge the gap. Lake Kainji in the Northern Guinea Savanna vegetation zone of central western Nigeria was impounded in 1968 by damming of River Niger. Although the Lake's primary function was for hydroelectric generation, an important small- scale fishery developed within the lake, which attracted a lot of scientific research that concentrated mainly on the changes in the abundance of fish species and other investigations rather than the development of the fishery at the community level. Early yields after impoundment reached 28,639 t in 1970 (Bazigos, 1972) after which the yields declined to 4,500 t in 1978 (Ekwemalor, 1978). After this period, regular monitoring of the fishery ceased. Presumed increase in fishing pressure and use of undersized gears led to further declines in daily catch (Balogun, 1985).

Reports of declining fishermen's catches prompted the start of a 9-year technical cooperation project "The Nigerian-German (GTZ) Kainji Lake Fisheries Promotion Project" in 1993. The project overall goal was that the standard of living of fishing communities around Lake Kainji is improved through the sustainable management of the fisheries and other aquatic resources of Lake Kainji. This was to be achieved through the implementation of a community based fisheries management plan. But, fisheries data from the lake only existed from 1969 to 1978. After this period, regular data collection ceased. There was therefore, a lack of current information, which any one could draw upon to formulate an appropriate management plan for the lake fishery. This problem was addressed by initiating fisheries surveys designed both for the development of the fisheries management plan and for long term evaluation and monitoring of the fisheries. Between 1995 and 2001 these activities had generated a large volume of data.

The objective of this paper is to present the highlights of the results of data obtained from 1995 to 2001 frame and catches assessment surveys in order to determine the fisheries catch trend of the Lake.

MATERIALS AND METHODS

Study Area: The study area is Lake Kainji (Fig 1) showing the 15 landing sites where monthly catch and effort samplings took place. Lake Kainji is situated between latitudes 9° 50' – 10° 57' North and longitudes 4° 25' – 4° 45' East. The lake was impounded on 2nd August 1968 and it is 136.8 km in length and 24.1 km maximum width. Its surface area has been variously quoted as approximately 1,300 km^2 (Vanden Bossche, J.P. & Bermacsek, G.M, 1969). At full volume, the water is at the altitude 142 m and at low volume the water is at the 133 m level. The distance from Lagos is about 1014.3 km by river from the sea along River Niger and about 563.5 km by road. Niger and Kebbi States comprising 5 Local Government Areas border the lake.

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The annual frame surveys took place in November each year when the water level was high, thus making accessibility to each fishing village easier. The data collectors visited and catalogued all the fishing villages, fisherfolk, gears and crafts. The results of frame surveys were used to implement a gear-based catch and effort sampling program from which monthly and annual estimates of fishing effort and fish yield by species and gear type were derived. Catches and fishing activity levels for each of the existing fishing methods were sampled for 2 days every month in each of the 15 sites in Figure 1. Activity data was derived from 20 sampled fishermen in each station who were selected annually as being representative of the total gears present for that village. The number of gears recorded as having fished on each day is divided by the total for the village to give an estimate of activity by gear type. Catch per unit effort (CpUE) data is derived by recording any fisherman's catch landed at the recording station. For each gear type the catch is sorted into 20 fish groups with the numbers and weights of fish in each being taken. Fishing time and the numbers of gears were recorded to establish the CpUE that is expressed as kg fish caught/unit gear/24hrs. Also informal interview and discussion were conducted in area of fishing input purchase and other domestic needs of the fisherfolk to ascertain low their day to day life affect fishing. All the fisheries data generated were compiled and analysed on the computer using Microsoft® Access programme.

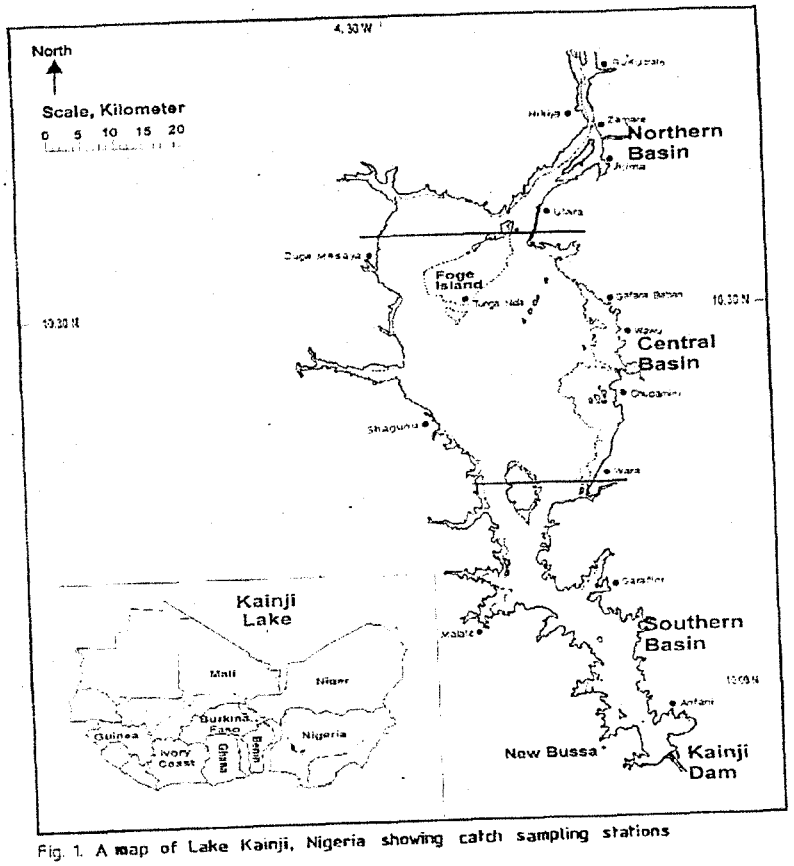

Fig. 1. A map of Lake Kainji, Nigeria showing catch sampling stations

RESULTS AND DISCUSSION

Fishing Localities: Two types of fishing locality were identified around Lake Kainji area. These include permanent fishing villages and temporary fishing camps. The number of permanent fishing villages rose from 228 in 1995 to 276 in 2001, an increase of 21% while the temporary fishing camps also increased by 46% from 26 in 1995 to 38 in 2001. In general, the number of fishing localities increased steadily from 273 in 1995 to 309 in 1999. However, in 2001, the number stabilized with a total of 314 fishing localities recorded. The highest number of fishing localities occurred at the eastern side of the lake, especially in the southern and northern basins where conditions are more congenial for settlement and farming and the area is the most productive of the lake for fishing (du Feu and Abiodun 1998).

Fisherfolk: A total of 4,973 fishermen with 12,218 fishing assistants were counted in 1995 during the frame survey. The number rose in 1995 and 1996 until it reached 5,817 fishermen and reduced to 7,126 fishing assistants in 1997. There existed a progressive decline from 5,564 fishermen and 6,140 fishing assistants in 1998 to 4,499 and 3,009 fishermen and fishing assistants respectively in 2000. There was a decrease by 17% in the number of fishermen and 79% fishing assistants over the seven-year sampling period, while the number in 2001 showed a further reduction since the peak in 1997. A total of 4,105 fishermen and 2,508 fishing assistants were recorded during the 2001 frame survey (Table 1).

Table 1. Frame survey data for the Kainji Lake Fishery, 1993-2001

Year	Ent	Ass	Can	Eng	GN	CN	BS	DN	LL	TR
1993	4,285	11,626	8,259	1,167	22,387	4,890	560	1,035	13,051	27,177
1994	3,915	9,434	7,353	1,128	19,582	5,079	617	942	12,549	32,332
1995	4,973	12,218	8,755	1,303	17,680	5,760	810	1,576	7,762	38,817
1996	5,499	12,449	9,278	1,292	18,655	5,548	753	1,560	7,390	36,979
1997	5,817	7,126	7,610	998	12,147	3,661	582	1,001	7,996	32,691
1998	5,564	6,140	7,127	585	10,163	2,740	486	967	3,450	23,628
1999	5,201	4,301	6,204	541	8,706	2,074	122	1,002	5,364	22,565
2000	4,499	3,009	5,407	402	6,977	1,638	N/A	909	5,003	19,106
2001	4,105	2,508	4,820	429	6,704	1,314	17	762	4,162	16,848

Note: Ent = Entrepreneur, Ass = Assistant, Can = Canoe, Eng = Engine, GN = Gill netCN = Cast net, BS = Beach seine, DN = Drift net, LL = Longlines, TR = Traps N/A= Not available

Table 2. Monthly Fish Yield (t) for Kainji Lake, 1995-2001

Mth/Yr.	1995	1996	1997	1998	1999	2000	2001
Jan.	4,267	2,659	3,209	2,066	1,976	1,173	1,049
Feb.	4,618	2,867	2,144	3,093	1,769	927	1,714
Mar.	3,876	3,151	2,924	3,026	1,544	1,012	1,432
Apr.	2,586	3,830	2,515	2,669	1,468	1,207	1,003
May	3,127	3,894	2,643	2,524	1,447	1,309	1,110
Jun.	2,387	4,446	2,435	3,402	1,379	1,178	1,049
Jul.	2,330	2,979	2,684	1,978	1,255	1,002	1,144
Aug.	2,519	2,502	1,747	2,062	1,200	1,182	971
Sep.	2,193	2,317	2,384	1,655	1,099	1,065	965
Oct.	1,427	3,288	2,140	2,119	946	1,050	979
Nov.	1,333	3,072	1,934	2,209	1,126	1,355	983
Dec.	1,811	3,241	1,994	2,048	1,144	915	962
Total	32,474	38,246	28,753	28,851	16,351	13,375	13,361

The decline is partly due to the exodus of fishermen from the fishery due to falling ownership of gears because of high cost of gear materials and the ban on fishing with beach seines (in 2000 about 6.4% of fishermen stopped fishing, whilst 7% migrated with other gears), as well as the introduction of a systematic licensing program. This made some fishermen not to disclose themselves during the frame to evade paying for the license. There has been a large reduction in the number of assistants due to the lower ownership of fishing gears (effectively making them redundant), the decline in the seine fishery that engaged in large number of assistants and more especially the effect of including them in licensing. Although, for an optimum catch, 2 fishermen/km^2 was recommended for Lake Kainji (Henderson and Welcome, 1974) and therefore only about 1,905 fishermen ought to have been engaged in full-time fishing activities if Kainji Lake is properly managed. A surplus of over 2,200 fishermen were therefore still recorded in 2001 in spite of the implementation of management measures of licensing and banning of beach seine. It is expected that as the management measures get better implemented, this surplus will reduce if not phased out to the level recommended by Henderson and Welcome.

Fig 2 shows the changes in commercial landings and number of fishing boats in Kainji Lake between 1995-2001. There was a sharp increase between 1995 and 1996. The peak landing was in 1996 and the decline has continued from then till 2001.

Fishing Canoes and Engines: The total number of fishing canoes decreased from 8,755 in 1995 to 4,820 in 2001. This showed a decrease of 44%. Like the localities and fishermen, the highest concentration occurred at the eastern side of the central lake basin. The average number of canoes per fisherman has consistently decreased from 1.9 to 1.2 during the past seven years and, like the fishing assistants, is as a result of the declining numbers of gears owned by fishermen. There was a decrease in the number of transport canoes. The number of outboard engines has also declined drastically to less than half the level recoded in 1995. This is evident from Table 1, which shows that only 7% of the canoes used for fishing were motorized. The decline in transport canoes and outboard engines was due to high cost of these materials and low income resulted from declined daily catch. Fishing Gears: During the 1995 frame survey, a total of 17,680-gill nets, 1,576 drift nets, 5,760 cast nets, 7,762 longlines and 38,817 fishing traps were recorded. But during the 2001 frame survey, a total of 6, 704 gill nets, 762 drift nets, 1,314

cast nets, 4,167 longlines and 16,848 traps were recorded (Table 1).

The percentage reductions in that order were: 62%, 51%, 77%, 46% and 56%. The consequences of the downward trend in the total number of gears recorded for all fishing methods from 1995 till 2001 are among others, the following: One of such consequences is that each fisherman owns fewer gears than before. The reduction is critical when calculating yield estimates from the catch assessment survey, since lower gear ownership will result in lower yield estimates. For sustainable exploitation, however, the reduction in the number of fishing gears and ultimately fishing effort is welcome given the present level of growth over fishing of some commercially important species.

The lower number in all the fishing gear types is due to decline in daily catch and the high price of fishing gears causing the fisherfolk to purchase less of the fishing materials in spite of gain accruing from the higher fish price. Gears such as gill nets and longlines are increasingly being stolen as claimed by fisherfolk, when set on the lake and fishermen are discouraged from investing in them. The beach seine fishery is the most controversial of all the fishing methods on Lake Kainji and has an associated high by-catch of juvenile and undersized fish that comprised of 25% of the total seine yield.

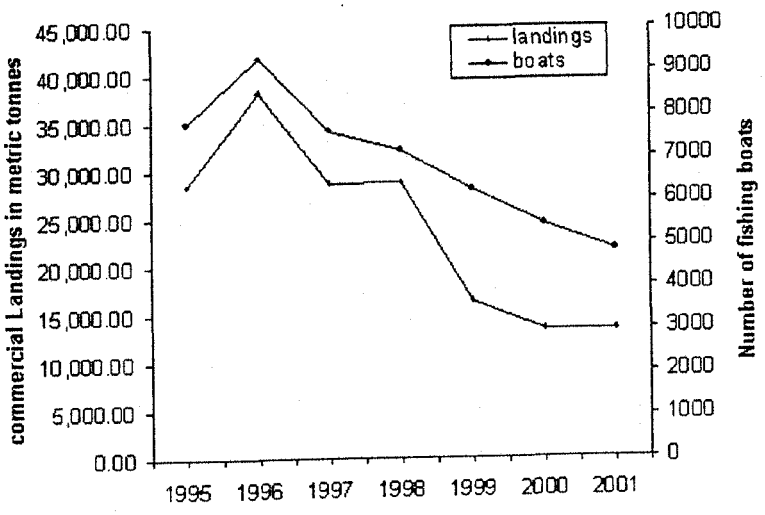

Fig. 2. The changes in commercial landings and number of fishing boats in Kainji Lake between 1995-2001

Despite the ban placed on the gear in 1999, the rate at which the gear came up in 2001 on the lake was alarming. This probably meant not enough enforcement; policing and strict penalty was placed on the ban. Perhaps buyers of undersized fish caught by the gear should also be prosecuted. By so doing, the fisherfolk would stop fishing undersized fish once they know there would be no market for it.

Fishing Net Characteristics: The mean mesh sizes recorded every month during the catch assessment sampling remained stable. The average mesh size of 50 mm for drift nets was lower than the 63 mm minimum allowable size, whilst it was above for gill nets and cast nets. According to Niger and Kebbi State Fisheries Edict 1997, minimum allowable mesh sizes are; gill net: 75 mm, drift net: 63 mm, cast net: 50 mm. All mesh sizes measured as stretched mesh size in mm.

According to Niger and Kebbi State Fisheries Edict 1997, minimum allowable mesh sizes are; gill net: 75 mm, drift net: 63 mm, cast net: 50 mm. All mesh sizes measured as stretched mesh size in mm. A recent development was that fishermen changed from multi-ply 52 and 63 mm gill nets to nylon monofilament because it is highly effective in catching juveniles especially for *Citharinus citharus* and *Tilapia* species. This may constitute another management problem soon. However, evidence abound that some fisherfolk were using increased mesh sizes greater than 125 mm. This is an encouraging development on the efforts taken towards sustainable management of fisheries of the Lake.

Annual Fish Yield: The estimated total yield for the lake fishery was 13,361 mt. during 2001. This has not shown any significant reduction from 13,375 mt. ($P < 0.05$) recorded in 2000 but showed a reduction of 65% since the peak in 1996 (Table 2). The total yield was more likely higher since the yields from the seine nets were not taken into consideration in 2001 because of the ban on it. The reason for this high decline from 1996 can be attributed mainly to the absence of the yield from beach seine fishery, which targets the small pelagic clupeids and contributed 53% to the 1996 yield (du Feu and Abiodun, 1998). Figure 3 shows the trend in the monthly total yield and catch value excluding the yield from beach seine fishery from 1996 to 2001. There was a sharp decrease between 1996 and 1997. The peak was in

1996 and the decline has continued from then till Annual Yield By Species: The annual yield of 13 of the sampled species groups declined by more than 40% from 1998-2001. Small sized species such as Schilbeids, *Auchenoglanis*, *Chrysichthys* and small *Synodontis* showed the largest reduction. These were all species commonly caught by the trap fishery and their decline was probably due to the lower effort. The top three commercial species Citharinidae

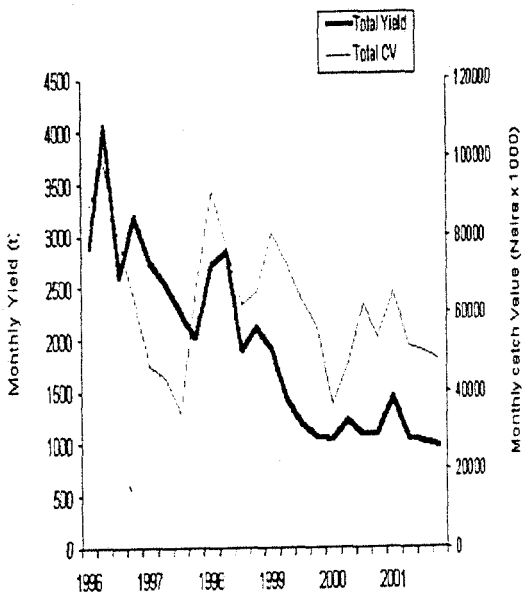

Fig. 3. Total Yield (t) and total catch value (N, 000) excluding the Beach seine fishery, 1996-2001

This increased to about 38, 246 metric tones in 1996. The fish landings declined to 28, 753 metric tones in 1997 and 13,361 metric tones in 2001. The decline followed a steady downward trend. The decline was initially due to the effect of the high yielding, but destructive, beach seine fishery and over-fishing of fish stocks by effort levels that were 40% higher than

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2001.
(notably *Citharinus citharus*), tilapiines (mainly *Sarotherdon galilaeus*) and *Synodontis membranaceus* have all declined by about one third since 1998. The only species that increased were *Lates niloticus* with others from families like *Mormyridae, Gymnarchidae, Tetradontidae, Polypteridae , Malapteruridae.*

that required for the maximum sustainable yield. But, the implementation of the ban on beach seines using co-management strategies in early 1999 resulted in a much-reduced fishing pressure from the beach seine fishery. This has led to an increase in mean size of those fish species previously caught as by-catch by the beach seines. In order to transform the increased fish abundance into higher catches, however, it is vital that the ban placed on beach seines be sustained. The upsurge of beach seines fishing would affect the over all catch of the majority of fisherfolk using other fishing methods. It is also important to ban the use of small mesh size nets to crop juveniles as this would continue to have adverse effects on fish population, recruitment and yield. Finally, the continuous reduction in the number of fisherfolk and consequent reduction in total effort is an appropriate management measure if fish production and total biomass is to be sustained.

Conclusion: Previous reports (Bazigos, 1972) revealed that soon after the impoundment of the lake, annual commercial landing of fish reached about 28,639 metric tones between 1969 and 1970. By 1978, the commercial landing dropped drastically to about 4,500 metric tones (Ekwemalor, 1978). Between 1978 and 1995 a gap in knowledge was created with respect to the total annual fish landings from the Lake. In Table 2, the annual fish landing was established at 32, 474 metric tones in 1995.

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