

# ASSESSMENT OF INLAND WATERS FISHERIES IN NIGERIA WITH IMPLICATIONS FOR IMPROVED FRESHWATER FISH PRODUCTION, POVERTY ALLEVIATION AND FOOD SECURITY.

By

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## ABSTRACT

Rapid Appraisals of the current fisheries situations of some selected inland water bodies in Nigeria were carried out within the framework of Aquaculture and Inland Fisheries Project (AIFP)-Annex II of the National Special Programme for Food Security (NSPFS). This paper presents the results of the fishery assessment of one of the selected inland water bodies (Sabke Lake) in Nigeria with a view to optimizing the fish yield through the adoption of improved culture-based fishery techniques and community-based fisheries management. The Lake is unmanaged and the fishing pressure was found to be very high. Also a number of fishermen were found using small mesh size nets to crop the juveniles of highly valued fish species. For an optimum catch, about 14 Fishermen ought to have been engaged in full time fishing activities if, the fisheries of this lake is to be managed on a sustainable basis. However, a surplus of over 100 Fishermen was recorded actively fishing during the period of the study. The results further revealed that Fisheries Rules and Regulations were not established for the rational exploitation and proper management of the fisheries of many inland water bodies including Sabke Lake. All these have a depletory effect on the abundance and sizes of fish harvested from the Nigerian inland water bodies especially Sabke Lake. A community based management system that establishes a participatory involvement of fishermen in the conservation and rational exploitation of fisheries resources for their own well being is recommended for Sabke lake and other inland water bodies in Nigeria.

## INTRODUCTION

Nigerian inland water bodies are primarily utilized for fishing by fishers. The greater part of inland fisheries is artisanal in nature, supplying families with food and income. Artisanal fishing usually is not a full-time activity, but rather it is integrated with farming and other activities. In many cases, fishing is vital to the livelihoods of those who engage in it and provides high quality food and employment to others through the market system. Nigerian inland fisheries produce about 200,000 tons from the 14 million hectares of inland waters (Aquaculture and Inland Fisheries Project Newsletter, April 2004). With 14 million hectares of inland water bodies, Nigeria could be self-sufficient in fish production and in fact be a major exporter of fish if these water bodies are properly managed. Improved management of the country's inland waters must, therefore, start with increased knowledge of the water bodies, information on the current status of the fisheries and the socio-economic characteristics in the fishing communities so that people can be effectively integrated into co-management programme. The objectives of this work are to determine the size and distribution of fishing localities, fishermen, fishing craft and fishing gears around the Sabke lake and also to assess the catch composition, abundance, estimating catch per unit effort (cpue) and the current fish yields. These are aimed at formulating a

management plan, which will enhance sustainable fish yield on the Lake, thus improving the living standard of the fishermen and the protein in take of fish consumers. This paper therefore presents the results of the fishery assessment of Sabke Lake as one of the selected inland water bodies in Nigeria.

## BACKGROUND

Sabke Lake was impounded about seven years ago by damming of the Sabke River primarily for irrigation and water supply. The Federal Republic of Nigeria under the scrapped Petroleum Trust Fund (PTF) financed the construction of the dam. The Sabke Lake is situated between latitudes  $9^{\circ} 50'$  -  $10^{\circ} 02'$  North and longitudes  $8^{\circ} 10'$  -  $8^{\circ} 22'$  East. It is located close to Niger's boarder and is about 78 km East of Katsina State capital. The lake is about 700 hectares in size with a tremendous economic impact on the villages around the lake, as an intensive irrigation farming, which produces peppers, tomatoes, onions and other vegetables is being carried out virtually by the communities around the lake. An important small-scale fishery has also developed within the lake, which calls for the development of the fishery at community level.

Before the impoundment of the water, no fisherman resided in the area. However, migrant fishermen from other states (Kano and Kebbi) started fishing and taught the local people around the lake about fishing. Today, one can find many fishermen around the lake, although, most of these are part-time fishermen who are also farmers. A survey embracing both frame and catch assessment was conducted to appraise the current fishery situation in the lake. The results of the survey are inputs needed for the management of the fisheries of the Lake. From the preliminary limnological studies of the lake, the lake can be described as a natural eutrophic lake of very green, nutrient-rich water. Aquatic vegetation around the lake consisted of *Chara*, *Liverworts*, and emergent *Typha* (cattail). Water analysis indicated a pH of 7.5, dissolved oxygen ( $DO_2$ ), 4.8, transparency 32 cm and hardness of 39 ppm. For an optimum catch and viable economic return, 2 full-time fishermen/ $km^2$  was recommended for most African Inland waters by Henderson and Welcome (1974). Based on this recommendation, about 14 full-time fishermen would have been ideal in number for the lake. However, a surplus of over 100 fishermen was recorded actively fishing during the survey period. From the Rapid Appraisal Analysis (RAA), the total fish yield estimate was 118 tons per annum. This is far below 2,100 tons potential yield estimate if the lake is properly managed.

## METHODOLOGY

Fishery assessment information on Sabke Lake was collected using Catch Assessment and Frame surveys, which were conducted for five consecutive days in April, 2004. Also a Socio-Economic survey was carried out within the same period. The Frame survey involved going round the entire lake to identify and count every fishing localities within the lake, the total number of fishermen, the crafts and fishing gears employed for fishing. Catch Assessment Sampling (CAS) involved a detailed examination and recording of the content of a canoe that had just landed on returned from fishing trip using properly trained ADP enumerators. As a fisherman landed his canoe on the beach, the enumerators examined the fish caught, sorted them according to species and the gear type used, record the weights, number and beach prices of all the species of fish landed. Fishing time and the number of canoes were also recorded to establish the catch per unit effort (CPUE). The CPUE is expressed as kg fish caught/canoe/day. Catch Assessment Sampling was carried out in Tsbu landing site where fishermen from four other fishing villages around the lake were instructed to land their catches for assessment. For the CAS, all active fishing canoes and gourds were counted to provide estimate of total fishing effort for each day sampled. Canoes' and gourds' catches were pooled to give an estimate of catch per unit effort (kg per canoe) for the landing for each craft, which was taken as

being representative of the entire Sabke Lake. Then the number of canoes at this fish landing was multiplied by catch per unit effort to give an estimate of the total fish landed for that day. Also informal interviews and discussions were conducted to obtain information on the fishermen's knowledge of the fish species available in Sabke Lake and proportion of fish consumed by fishermen from their catch.

## RESULTS AND DISCUSSION

**Frame Survey** - A total of 5 fishing localities were identified. Localities could be Permanent Fishing Village (PFV) - a village that has permanent buildings including markets, mosque, etc and it is always in the same place; Permanent Fishing Camp (PFC) - a place inhabited all year round for the sole purpose of fishing, it does not have brick buildings and there is little farming activity around the place and Temporary Fishing Camp (TFC) - similar to permanent fishing camp but, the camp is moved throughout the year and thatched tents are dismantled when the camp is vacated. Therefore, the identified localities around the lake were therefore 3 permanent fishing camps and 2 permanent fishing villages. Table 1 shows the distribution of fishermen, their fishing crafts and gears in relation to the villages around the lake. A total of 50 crafts were counted out of which 17 were canoes and 33 were gourds (these are large calabashes with holes in the top and little water in the bottom) majorly used in place of canoes on Sabke lake. A total of 126 fishermen were also counted out of which only 13 were full-time fishermen. The remaining 113 were part-time fishermen who also farmed. A full-time fisherman is one that has fishing canoe(s) and fishes at least 15 days per month whereas, a part-time fisherman fishes less than 15 days per month with or without fishing canoe. A total of 84 shoreline fishermen (a shoreline fisherman is one who does not have canoe but wades in the water to fish), 73 fishing assistants were also recorded. The fishermen used mostly gill nets, cast nets, longlines (hooks) and fish traps for fishing. During the 5 days survey, a total of 122 gill nets, 55 cast nets, 350 longlines and 2,936 fish traps were recorded (see Table 1).

**Catch Assessment** - The species composition of the fishermen catch remained relatively stable through out the period of assessment. Table 2 gives the species composition of the catch by number and weight. The species most consistently represented in the catch on the Sabke Lake were Nile perch (*Lates niloticus*), *Tilapia zilli*, *Oreochromis niloticus*, *Sarotherodon galilaeus*, *Clarias spp.*, *Schilbe spp.*, and *Mormyridae*. The cichlids dominated the catch by number and contributed 94.5% to the total number of fish caught on the lake during the survey. This was followed by Nile perch (*Lates niloticus*), which constituted 8.5% by number and 75% by weight of fish harvested on the lake. Although, this is not surprising as it was gathered from the fishermen at Tsabu that four years ago fishermen from nearby Dannakola fishing village introduced 80 fingerlings of Nile perch (*Lates niloticus*); this was followed by a second introduction of 200 fingerlings of *Lates niloticus* by the Chairman of Mai'adua Local Government Area. This aggressive predator appears to be well established in the lake with many large specimens found in the fishermen's catches, weighing between 4 and 12 kg each. A number of juveniles and small sized *Lates niloticus* were also registered in fishermen's landings confirming their successful reproduction. Fishermen interviewed indicated they would like to see the introduction of other species such as *Heterobranchus*, *Synodontis* and *Mormyridae* into the lake. Figure 1 shows relative fish species abundance by number and biomass on Sabke Lake. *Lates niloticus* tops the list by percentage weight followed by *Oreochromis niloticus*, *Tilapia zilli*, *Sarotherodon galilaeus*, *Schilbe spp.*, *Clarias spp.*, and *Mormyrus spp.* in that order. The order in terms of numerical abundance is *Tilapia zilli*, *Oreochromis niloticus*, *Lates niloticus*, *Schilbe spp.*, *Clarias spp.*, and *Mormyrus spp.*.

**Fishing Gear-** A number of fishermen were found using small mesh nylon monofilament gill nets and Malian fish traps of less than 1 inch mesh sizes. Many of the fishermen know that it is a bad method to fish with such type of nets but they believe small mesh nets have higher catch rate than bigger mesh sizes. This has a negative impact on *Clarias*, *Tilapia* and *Schilbe species* as many immature individuals were found in the catches. The disappearance of *Bagrus* species (fishermen indicated the availability of this species in the early stage) from the lake and scanty number of *Clarias* species in the catch might also be due to the effect of these small sized nets and the heavy predation by the *Lates niloticus*. Very few fishermen used gillnets of 4 inches mesh size, longlines of various hook sizes as well as cast nets. Many part-time fishermen used gourds for "floating fishing" and a large number of fishermen fish from the shore with traps, longlines and cast nets (Table 1).

### **Catch Per Unit Effort**

Catch per unit effort (CPUE) is expressed as average weight of fish caught per day per unit of fishing effort of gear type. The estimation procedure is different from gear to gear, particularly for active as opposed to passive gears. Landings of passive gears are divided by the number of fishing units (bundles for gillnets, number of traps and number of long lines). For an active gear such as cast nets, the calculation is, total catch sampled multiplied by total number of hours fished per day divided by total number of hour(s) for fish sampled. Therefore for the 5 days catch assessment of Sabke Lake, the catch per unit effort of the gillnets was 2.0 kg while that of longlines was 2.8 kg and traps 1.1 kg. Longlines contributed 73% to the total fish yields, gillnets 23% and traps 4%. The daily catch per unit effort per canoe is a measure of fishing success for the average canoe and is influenced primarily by the catchability of gears and abundance of fish. Based on the survey data, the fishing success or cpue was 4.1 kg per canoe per day. This is good for the fisheries if it can be sustained. To obtain an accurate CPUE for determining fishing success and fish abundance in Sabke Lake, a long time series of catch data is required.

### **Approximate Estimate of Current Fish Yields-Analysis of 12 months catch**

assessment samplings is required before the current yields can be determined accurately. In the meantime, we obtain an approximate estimate through the rapid appraisal of the 5 days catch assessment conducted. From the frame survey carried out within the same period, 50 fishing craft were recorded (17 canoes and 33 gourds). Within the period, catches from several gillnets, longlines and fish traps were examined. Most of the catches were between 18 and 61 kg per fishing day. No catch data is available for cast net fishing through out the assessment period although 55 cast nets were recorded in the frame, so it will be assumed that catches are about the same. Based on the informal interview with the fishermen, the activity level can be put at 150-200 fishing days in a year, 175 days on average. An approximate yield could therefore be calculated as shown below:

$$17 \text{ fishing craft} \times 175 \text{ (150-200) fishing days} \times 39.5 \text{ kg/day (18-61)} \\ = 117.5\text{t (Range: 46-207)}$$

Thus, the total yield can be estimated at about 118 tonnes per annum, with minimum and maximum values of 46 and 207 tonnes respectively. The total yield estimate is likely to be more because, the yields from shoreline and gourds fishermen were not included in the calculation.

### **CONCLUSION AND RECOMMENDATIONS**

It is important here to emphasize key considerations relative to development of a management system for the Sabke Lake fishery in Katsina State. A number of fishermen were found using small mesh size gillnets and Malian traps to crop the juveniles of highly

valued fish species. Therefore, fishing pressure, both in terms of the number of fishermen and the kinds of fishing gear in use, has a depletative effect on the abundance and sizes of commercially exploited species. Based on survey data, a CPUE of 4.1 kg of fish per canoe per day was estimated. However, a long time series of catch data is required for better estimate of CPUE for the fisheries of the lake. Also an approximate estimate of current fish yields of Sabke Lake is put at 118 tones per annum. However, analysis of 12 months catch assessment is required before the current yields can be determined accurately. Fishermen requested for the introduction of fingerlings of new fish species into the lake.

It is recommended that, the ADP Fisheries Staff should focus on carrying out a general enlightenment campaign to educate the fishermen and the fishing community on the need for responsible fisheries. In effect, the fishing community must be aware that the lake and its fish belong to them for use, exploitation and conservation. However, the community must also understand that this is a big responsibility, which requires selfless service and management to ensure sustainability of the fishery. Fishing rules and regulations need to be established and enforced by fishermen, following a training workshop conducted by the Aquaculture and Inland Fisheries Project (AIFP) on fisheries management. Also an effective community based management system, should be established, which must:

- Control the number of fishermen and access to resources exploitation.
- Protect the small sized and commercially valuable species;
- Encourage the availability of fish to households for consumption.

The protection of small sized fish cannot be achieved without placing limitations on the kinds of gears used for harvesting and possibly also on when and where those gears can be used. Cast nets can be overly effective during low water when fish are concentrated and vulnerable. This gear should be totally prohibited during low flow periods. However, it could be acceptable during normal flow periods when effectiveness is reduced. Furthermore, the minimum mesh size for this gear should not be less than 2 inches in line with Federal Inland Fisheries decree 1992. Gill nets should be of a large mesh size to protect the spawning stock of commercially valued species. The minimum mesh size should probably not be less than 3 inches. In an effort to maintain the availability of fish to the households, it would be reasonable to allow children to use "noncommercial" gears such as traps, clap nets and hook and lines in shoreline areas. It is assumed that this kind of fishing pressure would not be detrimental to the stocks of commercially valuable species, though immature individuals of these species will surely be captured. It is certainly feasible that household members engaging in this kind of fishing can be taught to recognize small individuals of valuable species, which could be put back to the water when caught. Introduction of fingerlings into this lake is expected to increase the species diversity of lake and reduce the pressure on the very few available species. However, the introduction of new fish species is recommended provided the species are carefully chosen in order to maintain a balance population. Swingle (1950) defined a balanced population as one in which the ratio of forage to carnivorous (F/C) ranges from 1: 4 - 10. Six to twelve months catch assessment data will be required to be able to determine the true ratio accurately. Typically, management has been approached in a top-bottom fashion with an emphasis on strong government authority. But, it has been shown repeatedly that top – down management of these fisheries cannot work in Nigeria and thus should be abandoned (Ita 1982). We therefore suggest bottom-up community based management of fisheries in Sabke and other inland water bodies in Nigeria

Table 1. Summary of Frame Survey data showing Village names, distribution of Fishermen and assistants, number of canoes and fishing craft on Sabke Lake.

Village name	Village type	Fishermen	Full-time	Part-time	Shoreline fishermen	Asst	Can	Gou	Gn	Cn	LL	Tr
Tsabu	PFV	60	9	51	51	20	11	-	22	24	157	1751
Wazobia	PFC	17	3	14	8	18	3	6	58	3	141	465
Tuduyel	PFC	8	1	7	7	5	-	3	7	3	8	210
Unguwa Mata	PFC	15	-	15	15	2	-	-	1	-	-	180
Be'el	PFV	26	-	26	3	28	3	24	24	15	44	330
Total		126	13	113	84	73	17	33	122	55	350	2936

Note: PFV = Permanent fishing village; PFC = Permanent fishing camp; Ass = Assistant; Can = Canoe; Gou = Gourd; Gn = Gillnet; Cn = Castnet; LL = Longlines; Tr = Traps

Table 2. Total Catch by Species during the 5 days Catch Assessment Survey at Tsabu fishing Village.

Type of species	Number	Weight (kg)	% Number	% Weight
<u>Oreochromis niloticus</u>	226	21.60	40.0	12.0
<u>Sarotherodon galilae</u>	7	0.91	1.0	0.5
<u>Tilapia zilli</u>	357	21.20	53.5	11.8
<u>Schilbe spp.</u>	15	0.80	2.2	0.4
<u>Clarias spp.</u>	3	0.50	0.5	0.3
<u>Mormyrus spp.</u>	2	0.10	0.3	0.0
<u>Lates niloticus</u>	57	135.10	8.5	75.0
<b>Total for 5 days</b>	<b>667</b>	<b>180.21</b>		
Number of canoe sampled	18			
Catch/canoe (kg)	37	10.1		

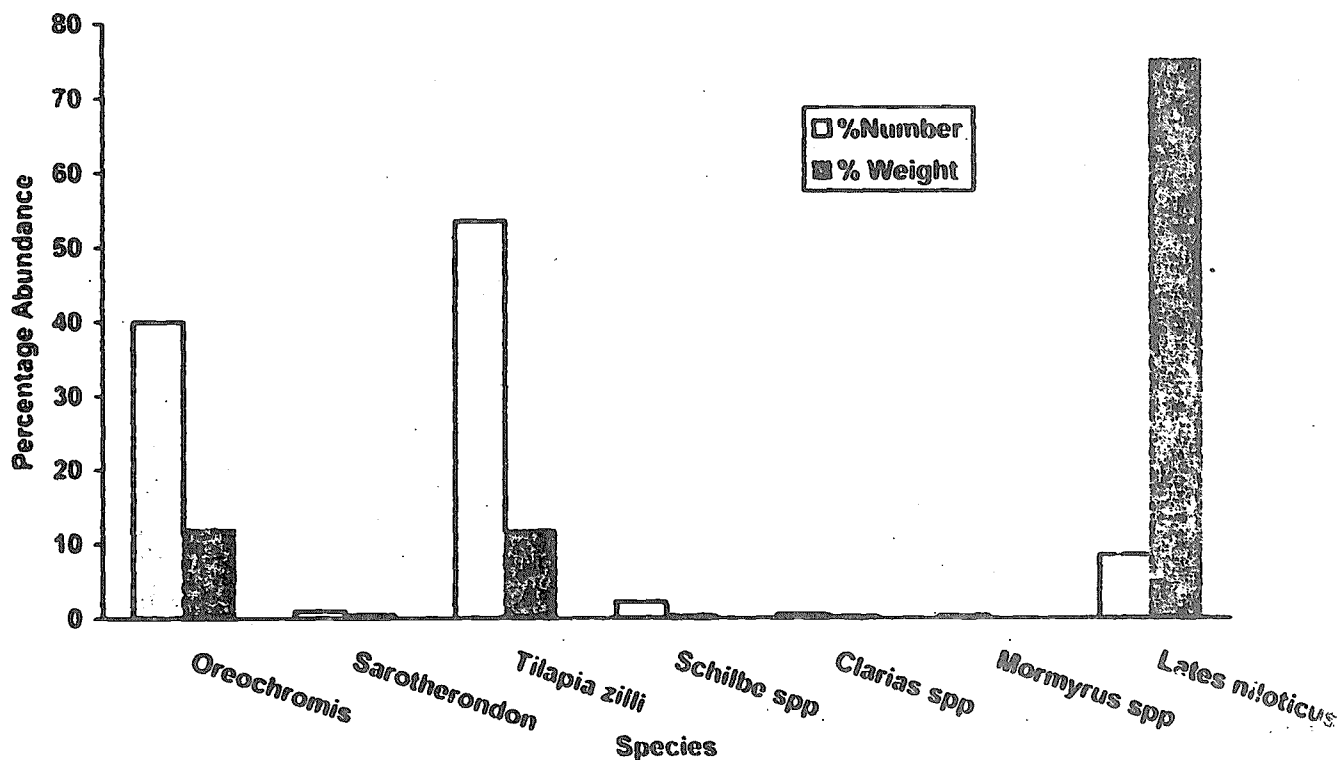


Fig. 1 Relative Fish Species abundance by Number and Biomass on Sabke Lake.

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