FISH AND FISHERIES OF BAKOLORI RESERVOIR

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ABSTRACT

This report is an exposition of fisheries activities carried out in Bakolori Reservoir within the context of many and varied functions of Sokoto Rima River Basin Development Authority.

In order to study the fish fauna and its trend, experimental fishing was conducted for 55 days in 1979 when the reservoir was only one year old and the exercise continued in 1980 and 1981 also for 85 and 52 days respectively. During the three years exercise only bottom set gill-nets of 5-10cm mesh size were operated at various depths and the catch per unit effort showed an increasing trend with increasing efforts by four times to that of the initial.

The fish harvest was 1.205 kg per day when 3.8 nets were operated in 1979, this went up to 3.2 kg when the number of nets were increased to 8.37 per day in 1980. This increasing trend continued in 1981 season also when 16.15 nets caught 5.756 kg fish per day. A direct relationship has been observed in the fishing efforts and catch. The catch per 1000 m^2 net operated also showed a positive trend, as it was recorded 4980.4, 5865.3 and 5567.9 gms for three years respectively. Tilapia, Clarias, Labeo, Schilbe and Synodontis spp, were the most predominant fish species in the catch and contributed more than 97 per cent of the total fish harvest.

Due to high turbidity and resultant low transparency, the production potentials of the lake are likely to remain lower than many man made lakes of Africa. Large number of trees and forest areas left uncleared prior to inundation are now partially or fully submerged and pose serious problems and threat to fishing operations. If the proper benefits are to be realised from the fisheries potentials of the reservoir, it should be stocked adequately with fast growing fish seed. The potential fishing grounds should be improved and the under-water trees and bushes should be cleared for smooth, economic and efficient fishing. Use of all kinds of nets having less than 8cm mesh size should be stopped to prevent over exploitation of juvenile fishes for a period of at least two years after the reservoir is stocked.

INTRODUCTION

Bakolori Reservoir is located between latitudes 12.25 N and 12.35 N and longitudes 6.10 E tp 6.17 E. The reservoir comes under the administrative boundry of Talata Mafara Local Government near Bakolori Village (now submerged) in Sokoto State of Nigeria. The project was first identified by the F.A.O. in 1969 as the first phase of Sokoto and Rima River Basin Development Plan. The feasibility study of this project was completed in 1974 and the contract for its construction was awarded to Messrs Impresit Bakolori (Nigeria) Limited an indiginised Italian company, while the review of detailed design and supervision was entrusted to Messrs M.R.T. Consultants Limited, also an indiginised British Firm. The dam was completed in 1978.

This reservoir has approximately 8000 ha water area at maximum reservoir level with a dendric shore line. Approximately 4000 families (14000 people) were affected by the creation of this water body. They have been resettled in three new villages namely New Maradun - 2700 household units, Gidan Dan Kano - 1200 household units and Kuka Mai Rafu - 100 household unit.

Bakolori reservoir like most other reservoirs in the world was also constructed for well defined purposes such as irrigation. Development of 23,000 ha farm land, water supply, hydro-electric and flood control etc.

Salient Features of Bakolori Reservoir

Reservoir area at maximum flood level	8,000 ha
Gross storage capacity	450 mill m^3
Normal pool elevation	334. m.a.s.l.
Maximum pool elevation	320 m.a.s.l.
Maximum flood elevation	338 m.a.s.l.
Length - concret dam	353 meters
Length - earth fil dam	5135 meters
Length of shore line approximately	107 km.
Annual rainfall	689 - 760 m.m.
Air temperature	12.0 - 39.9 C
Hydropower turbines and generation	2 Nos. 1.6 MV each

Irrigation canals

Supply canal	15 km 35 m^3/Sec.
Main canals IL & IR	2 Nos. 45 km Total
Secondary canals	200 km
Tertiary canals	300 km
Field channels	800 km.

Pumping Station

Irrigation lift	2 Nos.
Sprinklers	25 Nos.
Drainage	2 Nos.
Pumps	160 Nos.
Burried pipe line	500 km.
Mobile Alluminium pipes	800 km.

It is envisaged from the project that in addition to 147,821 tonnes of various rood grains, approximately 450 tonnes of fish would also be produced annually from various types of fisheries resources created by the lake formation and irrigation network.

MATERIALS AND METHOD

The data collected and analysed in this paper are of a fishing unit consisting of two fishermen, a boat and varying number of shore set nylon gill nets of 32 meter length and 2 meter depth. The most common and effective mesh sizes, were 5-10cm. The head.rope was provided with floats and foot rope with lead sinkers to keep the net in standing position. To have a comparative idea of catching efficiency at times surface gill nets of the same mesh sizes were also operated but found quite ineffective as these nets used to get rolled up due to high speed hermattan winds and wave action. All the data if otherwise not mentioned are refered to shore set gill nets only.

In starting, usually the nets were operated in mid day and collection of fish catch was done in the following morning. In

order to minimise the damage in nets they were allowed to remain set on the same fishing ground until the fishing site was changed. The per day catch thus could be refered as catch per 24 hours.

RESULTS

Fishing Operation

During 1979 fishing season, fishing was conducted for 55 days in the month of July, September, October and December and the number of fishing days in each month varied considerably. In July, 79 fishing was conducted for 17 days while in September, October and December it was conducted for 14, 16 and 8 days respectively Table 3. The overall mean catch per fishing day was 1.20 kg; but it varied considerably from first two months to that of last two months i.e. 1.0 kg to 1.5 kg per fishing day respectively.

Like the number of fishing days, the number of nets operated in each fishing month also differed. However when the number of nets were increased to 8.3 nets per fishing day in 1980 from 3.8 nets of 1979, the catch went up by 2.6 times i.e. from 1205 gms in 1979 to 3144.3 gms in 1980. It gave an indication that the efforts could still be increased without endangering the fish population, when the number of nets per day were again doubled in 1981 to 16.15 nets, the catch also followed the same trend with average fish landing of 5756 gms per day. The steady increase in catch per unit effort and stabilised catch rate per 1000 m^2 net i.e. 4980.4, 5865.3 and 5567.9 gms for 1979, 1980 and 1981 fishing seasons repectively. Table 1, indicated that marginal profit could be derived if the fishing efforts are further intensified. The catch per 1000 m^2 net area was quite different from what was observed by Ita et al. 1982, (261 gms per night for the same net area). Inspite of the fact that the number and area of the nets operated daily were almost doubled in previous years, the catch rate also increased accordingly without adversely affecting the catch per unit net area. It was an indication that fishing efforts could be intensified to start commercial fish exploitation.

Table 1 Various fishing parameters for the three fishing years

I T E M	1979	1980	1981
No. of fishing days	55	85	52
No. of the nets operated	208	712	840
Fish harvested in kg	66.3	271.8	299.4
Av. No. of fishing days per month	4.6	7.1	4.3
Av. No. of nets operated per fishing day	3.8	8.37	16.15
Av. net area operated daily in m^2	242	535.6	1033.6
Av. catch per 1000 m^2 net gm	4980.4	5865.3	5567.9
Av. catch per fishing day in kg	1.205	3.144	5.756

As fishing months are different in different years, it is difficult to compare the catch per unit effort of a particular month to the corresponding month of the following year. However, it has been observed during the examination of commercial fish catches of 1982 that catches were generally higher in rainy season, it may be due to up-stream migration of most fishes in this season for spawning and there they are usually fished with one gear type or the other.

Species Composition

Ita et. al.(1982) identified 17 species in Bakolori Reservoir. During the catch analysis of experimental fishing, five species were found contributing 97 per cent of total catch. In order of predominance Tilapia, Labeo, Schilbe, Synodontis and Clarias spp, are the important fish species, while the remaining 12 species contributed around 3 per cent of the catch.

When the catch composition of 1980 and 1981 experimental fishing seasons are compared with the commercial catch of 1982, interesting trend in the species composition could be observed. Labeo spp. contributd 22 per cent of total catch in 1980, but went down to 20.6 and 14.1 per cent of the catch in 1981 and 1982 respectively. Tilapia spp. showed an increasing trend from 12.0 per cent in 1980 to 45.2 per cent in 1981 and 1982 fishing seasons. Synodontis spp. appeared to be most affected as it recorded 38 per cent in 1980 but sharply decreased to 9.2 and 8.9 per cent in 1981 and 1982 fishing seasons. Clarias spp. made up 11.0 per cent of the catch in 1980, but came down to 7.9 per cent in 1981 and again went up to 19.5 per cent in 1982, while there has been a mixed trend in Schilbe spp. Table 2. Though the experimental fishing was conducted with a single gear type i.e. shore set gill nets, the catch composition cannot be said to be a good representative sample of the fish population of the reservoir. Nevertheless it gives an idea as to how the gill net fishery is shapping in the reservoir.

Most species caught during the experimental fishing were less than 100 gm average weight except Labeo and Clarias spp whose average weight varied between 200 - 300 gms. Though at times some specimen of Clarias had been caught weighing 5 to 6 kg by private fishermen, their frequency was low. Most of the important species which could attain a good size are yet to be recorded such as Lates niloticus (Giwan ruwa), Gymnarchus niloticus etc. Probably they do not exist in the reservoir and need to be introduced.

DISCUSSION

It is observed from the last three years study that there is a general paucity of fish species in the lake and the position is not likely to change remarkable until the economically important fish species are stocked intensively in the reservoir. As there is no perennial river emptying into the reservoir there is hardly any chance of natural recruitment of new species other than what already exists in the lake. Table 2 shows the pattern of the fishery. It appears that Tilapia is increasing in number while its average size and weight in decreasing year after year. This species contributed approximately 45 per cent of the total landings within the last two years. However, the average size and weight has decreased from 19.6cm to 17.0cm and weight from 93.9gms to 69.4gms. It shows that more fish have been caught per unit weight.

The same trend has been observed in the case of Labeo spp also which appears to be the most affected one. The average size of Labeo has reduced considerably from 31.4cm in 1980 to 22.5cm in 1981 and every specimen has gone down by 100.3 gm in weight. Not only the average size is affected but its percentage contribution has also gone down to 14.1 per cent in 1982 from 22.0 per cent of 1980. Synodontis species although they did not reduce in average size its contribution in the total landings has significantly gone down from 38.3 per cent to 9.2 and 8.9 per cent in 1980, 1981 and 1982 respectively. Most Synodontis caught from the reservoir were of the uniform size i.e. 19.0cm. The decreasing trend in average size of the important species is probably the direct result of inadequate natural food in the reservoir. Bakolori reservoir has very high turbidity round the year which has normally been observed to be about 360ppm. The high turbidity causes low transparency and low light availability to

Table 2 Morphometric Data and catch composition including commercial fishing of 1982

Species	Av. Length in (cm)		Av. Wt. in (gm)		Catch Composition per cent by Wt.		
	80	81	80	81	80	81	82
Labeo spp.	31.4	22.5	297.3	197.0	22.0	20.6	14.1
Tilapia spp	19.6	17.0	93.1	89.4	12.0	45.8	45.2
Clarias spp.	34.2	29.9	318.5	279.6	11.0	7.9	19.5
Schilbe spp.	22.0	21.4	87.2	92.7	12.9	14.4	9.5
Synodontis spp.	19.0	19.1	128.0	83.3	38.3	9.2	8.9
Others	18.7	18.9	85.8	75.5	3.8	2.1	2.8

Table 3 Details of Fishing efforts

Month	1979 Number of			Catch per Net in gms	1980 Number of			Catch per Net in gms	1981 Number of			Catch per Net in gms
	Fishing Days	Nets Used	Fish Caught kg		Fishing Days	Nets Used	Fish Caught kg		Fishing Days	Nets Used	Fish Caught kg	
January	-	-	-	-	-	-	-	-	19	208	62.5	300.4
February	-	-	-	-	-	-	-	-	7	120	51.5	429.1
March	-	-	-	-	13	88	18.7	212.5	6	120	32.8	273.3
April	-	-	-	-	6	32	6.6	206.2	-	-	-	-
May	-	-	-	-	12	107	44.0	412.2	20	392	152.6	389.2
June	-	-	-	-	19	177	94.5	533.8	-	-	-	-
July	17	51	16.0	313.7	18	164	60.3	367.0	-	-	-	-
August	-	-	-	-	6	48	8.0	166.6	-	-	-	-
September	14	62	15.8	245.8	-	-	-	-	-	-	-	-
October	16	63	231.4	731.2	-	-	-	-	-	-	-	-
November	-	-	-	-	-	-	-	-	-	-	-	-
December	8	32	11.1	346.8	11	96	39.7	413.5	-	-	-	-
Total	55	208	66.3	318.7	85	712	271.7	381.6	52	840	299.4	356.4

subsurface water layers and subsequently it leads to low photo-synthesis and primary productivity in Bakolori than other Nigerian reservoirs, such as Tiga and Kainji Lakes. The low primary productivity results probably in tough competition for food among different plankton and phyto-phagous fish species and thus the average size of fishes is adversely affected.

Large scale destruction of fully gravid fishes have been noticed in rainy season when mature males and females are migrating upstreams for spawning. The fishermen normally catch these fishes by crude fishing methods and in times to come it may adversely affect the natural recruitment. It is therefore necessary that a complete close fishing season from 15th of May to 15 of July, is observed every year, and catching of all kind of fishes declared illegal. For this purpose a suitable legislation should be enacted at National level to provide protection to the natural fisheries resources, which are now being exploited indiscriminately. The law should be supported by vigorous extension exercise among the fishermen community to enlighten them about benefits of not catching any fish during this period. Though it would be difficult to enforce the law at the beginning the fishermen might cooperate with the law enforcement agency after seeing the results.

Commercial Fish Exploitation

When the reservoir was first filled the fishermen living around the reservoir started operating different kinds of fishing gears and their catch varied from a few grams to a few kilograms/day. A systematic approach was adopted during 1982 commercial fishing season to collect the various statistical data of fishing operations. Out of 80 fishermen living around the reservoir (Ita 1982) only 43 fishermen on an average were engaged in daily fishing and caught approximately 98.8 kg of fish per day and 2.3 kg fish per fisherman. Approximately 36.068 metric tonnes of fish were harvested at an average production rate of 4.5 kg of fish per ha per year.

There are three main fish landing centres around the reservoir namely Dam site, New Maradun and Kuka Mai Rafu. The data were recorded normally once a week at every centre. The catches were comparatively lower in the reservoir and the average size of individual fish species was smaller in comparison to other African reservoir. The low catch per unit effort probably does not encourage the fishermen to intensify the fishing efforts.

CONCLUSION

The individual size of different fish species caught from the reservoir is comperatively smaller and it has been observed that it is decreasing year after year.

The average catch per unit effort is rather low. Probably there are more fishes around submerged trees and bushes because fishermen prefer to operate their nets around bushy areas. The under water trees and bushes pose serious problem in fishing and navigation. At times it has been found that the new nets operated once are damaged badly and thus making them unservicable. Fishes attaining large sizes such as Lates niloticus and Gymnarchus niloticus are absent in the lake.

The fishermen generally fish with old and traditional fishing gears. The catch is usually sold in fresh condition to the middle men operating around the landing centres who transport it to the local markets in unpreserved and uniced condition.

RECOMMENDATION

The reservoir should be stocked heavily with the fast growing fish species. Plankton feeders should be preferred for stocking. Fishing in the reservoir with less than 8cm mesh size should be prohibited in

order to prevent over-exploitation of juvenile fishes. Submerged trees and stumps should be cleared off from the potential fishing grounds as and when such areas are exposed due to the draw down of the water.

Proper and modern fishing gears such as, gill nets, cast nets, drag nets and hook and lines should be provided to fishermen for smooth and efficient fishing operations.

A close fishing season should be observed from 15th of May to 15th of July every year in order to increase the natural recruitment of fishes through breeding and protection.

ACKNOWLEDGEMENT

The author wishes to thank his professional colleagues for all possible help and assistance. Special mention should be made for the generosity, kind consideration and encouragement given by the management for the cause of fisheries development. Special thanks also go to Mr. H.M. Emecheta, Chief Agriculture Officer - Sokoto Rima River Basin Development Authority for going through the manuscript and guidance.

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