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Species Composition and Abundance of the Cichlid Fishes in Owalla Reservoir, Osun State, Nigeria

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Abstract

Fish production plays crucial roles in enhancing food security and alleviating poverty of many people in Nigeria. As demand for fish increases steadily over the years, production becomes inadequate. One of the ways in which adequate fish production could be met is adequate conservation efforts. This study was conducted with a view of providing a more recent catalogue and update of species composition and abundance of cichlid fishes in Owalla reservoir. Sampling for cichlids fishes in the reservoir was done monthly for 24 weeks with the use of dugout canoe. Four experimental gillnets, each measuring 2 by 30 m, with various stretched mesh sizes (25.4, 38.1, 50.8 and 63.5 mm) were designed to sample various sizes of the fishes. Other sampling techniques adopted include the use of cast net, fish traps and hook and line. The six species of cichlid fishes identified during study are Hemichromis fasciatus (SL=7.35±0.12 cm; mean weight=15.58±9.01g), Sarotherodon galilaeus (SL=11.77±3.12 cm; mean weight=89.48±14.17 g), Oreochromis niloticus (SL=8.35±1.90 cm; mean weight=36.11±10.02 g), Tilapia zilli (SL=9.95±1.09 cm; mean weight=88.03±16.04 g), Tilapia mariae (SL=9.83±1.07 cm; mean weight=57.81±14.01 g) and Tilapia dageti (SL=11.12.±2.01 cm; mean weight=85.30±20.01 g). The fish species were adequately represented, well distributed and occurred frequently in both wet and dry seasons, though the occurrence was higher in the wet season. The mean values of length and weight recorded for the fishes were small when compared with the values of cichlids from similar Nigerian inland waters and was attributed to the indiscriminate use of gillnets with unregulated mesh sizes. Overfishing by the artisanal fishermen could not be ruled out due to lack of regulations on the reservoir. Therefore, regular qualitative and quantitative information on cichlid fishes in the reservoir is necessary for enhancement of management and appraisal of the fisheries potential of the reservoir becomes essential.

Keywords: Abundance, Cichlid, Owalla, Gillnet and Seasonal variation

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INTRODUCTION

In Nigeria, inland fisheries greatly add to the fish and fish resources supply to the society, especially at the grassroot level where the common people could not afford to buy imported fish due to its high cost. However, the activities of man on the aquatic ecosystem have contributed immensely to the ecological challenging and crisis in fisheries and aquatic managements (Mustapha and Kolawole, 2019). The need for proper and effective monitoring of the fishes and other aquatic organisms in the fresh water ecosystems in Nigeria has become pertinent with the records of fall in fish production though unsustainable developments and exploitations (Iyiola *et al.,* 2022). The need and effort to set up the mechanism that regulates the fish and other aquatic organisms in order to ascertain adequate conservation and sustainable management of the aquatic resources becomes highly necessary. Komolafe and Arawomo (2008) observed that the downward trend in fish intake in a highly populated country like Nigeria might be due to poor management practices and over-exploitation of inland water. Arlinghaue e*t al.,* (2002) had earlier noted the amongst the greatest problems facing the sustainable developments is the need for concerted effort for controlling environmental degradation. Abban *et al.,* (2000) equally observed that among the challenges are largely due to rapid changes in the aquatic environment due to uncontrolled fishing and environmental degradation. The above expression by these researchers shed light on the possibility of losing some important fish species, fish diversity and other aquatic biota before they are well known.

Population dynamic studies can be used to establish the relative wellbeing of a fish population, differentiate taxonomic unit, conduct fish stock size assessment and discrimination, rational utilization of stocks, enable protection of new recruit and prediction of recruitment viability (Offem *et al*., 2007). Cichlid fishes are highly valued food resources and probable the most economically important resources of tropical African freshwaters making up about 43% aquaculture production (Fagbenro, 2007). Cichlid fishes are often favored for culture due to their availability, easy handling and production, fast growth rate, feeding malleability and tolerance to poor water quality conditions and most species are omnivore and the fish can be reared on a low-quality feed based on agricultural by products (Mustapha, 2018). Strassny (1991) noted that about 80% of all cichlid fishes found in African freshwaters are still yet to be described.

Owalla reservoir is utilized for domestic, industrial and agricultural usages. The reservoir was designed for the primary purpose to supply water to major towns in the state (Oladejo, 2021), but also for fishery development and agriculture in the state (Aduwo and Adeniyi, 2019). The reservoir is said to contribute significantly to fish production in Osun State, Nigeria and it is known to contain many freshwater fishes (Taiwo, 2010). However, baseline data on reservoir fisheries enhancement are still rudimentary for most reservoirs in Osun state, Nigeria. Despite the importance of cichlid fishes in lakes; few studies have been undertaken on the biology and dynamics of these fishes. Obtaining qualitative and quantitative information on cichlids fishes in the reservoir is necessary in enhancing management and appraising the fisheries potential of the reservoir. Therefore, this study was conducted with a view to assessing the composition and abundance of the cichlid species in Owalla reservoir.

MATERIALS AND METHODS

Study Area

Owalla reservoir lies between Latitude 7^{o} 54′ 30.44″ N and 7^{o} 57′ 00.79″ N and Longitudes 4^{o} 32′ 21.71″ E and 4^{o} 34′23.48″ E of the Greenwich Meridian (Mustapha and Olaleye, 2021; Iyiola

et al., 2022). Figure 1 shows the Map of Owalla reservoir together with the catchment area. The reservoir covers an area of about 14 km^2 at the normal water level and about 15 km^2 at maximum water level (Adedeji and Ajibade, 2008).

Sampling Procedure and Morphometric Measurements

Sampling for cichlid fishes in the reservoir was done monthly and lasted for a period of 24 months. Collection of fishes was facilitated by the use of a locally constructed dugout canoe with the assistance of the artisanal fishermen that fish on the reservoir. Four mixed batteries of multifilament gillnets with various lateral stretched mesh sizes (25.4, 38.1, 50.80 and 63.50 mm) were used for sampling. Each net measured 2 by 30 m. The experimental nets for the study were designed to sample various sizes of cichlid fish and to minimize species and size selectivity of the sampling gear. Other sampling techniques adopted include the use of cast net, fish traps and hook and line. Additional fish samples were obtained from fishermen that fish on the reservoir at the designated fishing sites along the reservoir. For the purpose of sampling and sample collection, the reservoir was demarcated into four zones based on the accessibility to the reservoir during the period of study. The specimens were identified individually using identification key prepared by Leveque *et al*. (1992), and Adesulu and Syndehem (2007). The sex of the sampled fishes was identified and determined according to Offem *et al*., (2007) methodology by examining the genital papilla located immediately behind the anus. In the male fishes the genital papilla has only one opening (the urinary pore of the ureter) through which both milt and urine pass. In the female fishes, the eggs exit through a separate oviduct and only urine passes urinary the pore. Placing a drop of dye (methylene blue) on the genital region helps to highlight papilla and its opening (Offem *et al*., (2007). The identified fishes were appropriately labelled for further morphometric analysis. The standard length (SL) of the sampled fishes was determined using the conventional measuring board (graduated in millimeters) and the fishes were weighed using electronic kitchen scale EK5055 calibrated in gramme. Data were subjected to descriptive and inferential analysis such as the means and the standard deviation which gave the depiction of cichlid fishes' composition and abundance.

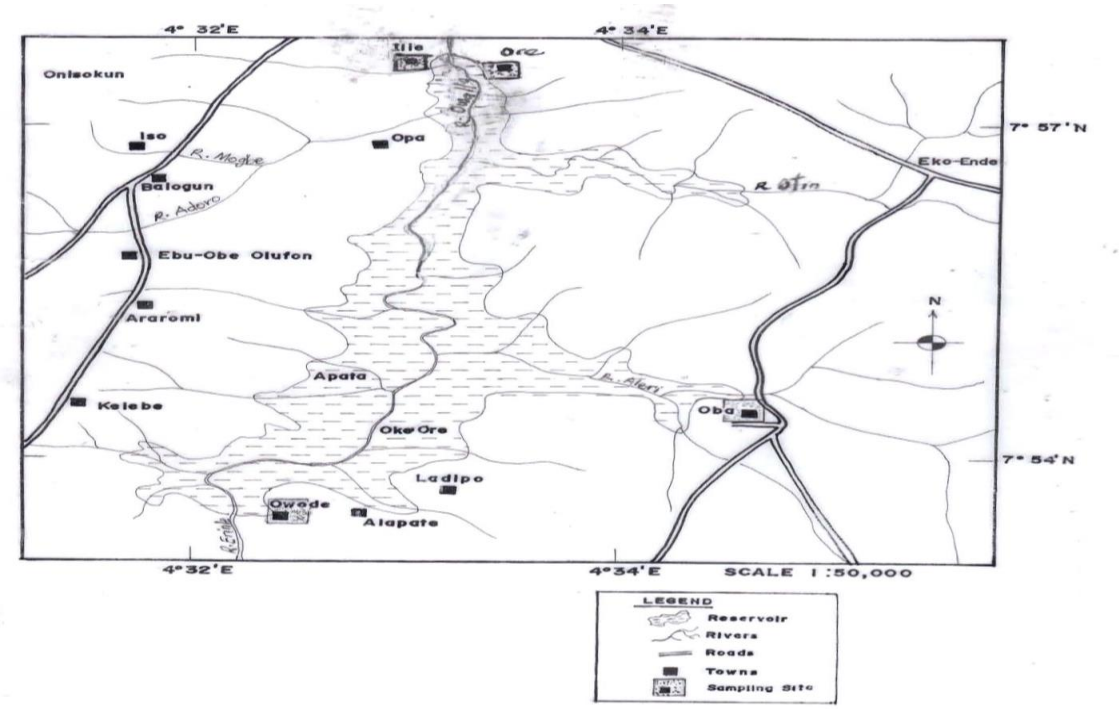

Figure 1: Map of Owalla reservoir showing the catchment area (Mustapha and Olaleye, 2021).

RESULTS

Six species of cichlid fish; *Hemichromis fasciatus, Sarotherodon. galilaeus, Oreochromis niloticus, Tilapia zillii, Tilapia mariae and Tilapia dageti* were collected throughout the period of study. Abundance of fish caught with different gears from the reservoir sampling survey is shown in Table 1. Gill-nets catch was 75.17% of the sampled specimens, followed by local trap (13.45%), cast nets (7.94%) while the least number of specimens were caught by hook and line (3.41%). Figure 2 shows the abundance of cichlid fishes caught from the reservoir during the sampling period and Figure 3 describes the monthly distribution of the fishes caught during the period of study. Seasonal variation in the occurrence of cichlid fishes in Owalla reservoir during the study period and sexual variation in the occurrence of the fishes in the reservoir are shown in Figures 4 and 5 respectively. The occurrence of the cichlid fishes in the wet season was generally higher than the cichlid fishes in the dry season except for *S. galilaeus* where its occurrence was found to be higher (52.26%) in the dry season than during the wet season (47.7%). No obvious pattern was detected in the seasonal variation by sampling sites, however on the whole the occurrence tends to be slightly higher in wet season than the occurrence in the dry season (Figure 2). There was relatively low population occurrence of *Tilapia zilli* and *Oreochromis niloticus* in comparison with the other four species.

The number of both male and female in the six species of cichlid fishes is almost the same (Figure 5) indicating that the sex ratio in cichlid fishes during this study was generally one to one (1:1).

Table 1: Population of cichlid fishes caught with the different gears

Fish species	Gillnet	Cast net	Hook and line	Local trap	Overall number
H. fasciatus	443	56	21	95	615
S. galilaeus	452	43	19	83	597
O. niloticus	237	2	11	15	284
T. zillii	214	18	09	51	292
T. mariae	414	44	22	64	544
T. dageti	396	46	16	78	536
Total	2156 (75.17%)	228 (7.94%)	98 (3.41%)	386 (13.45%)	2868

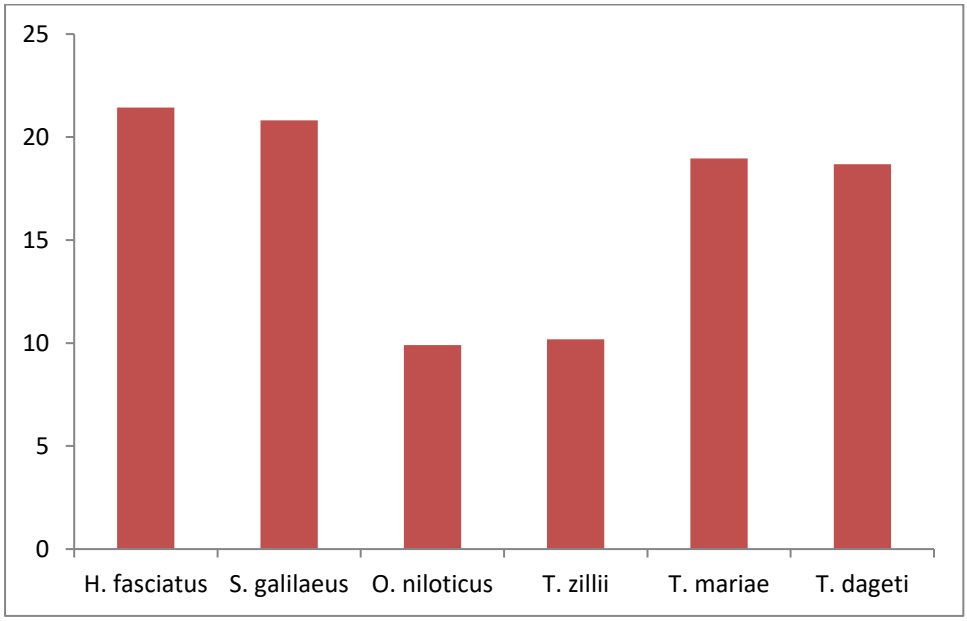

Figure 2: Abundance of cichlid fishes caught from the reservoir during sampling period

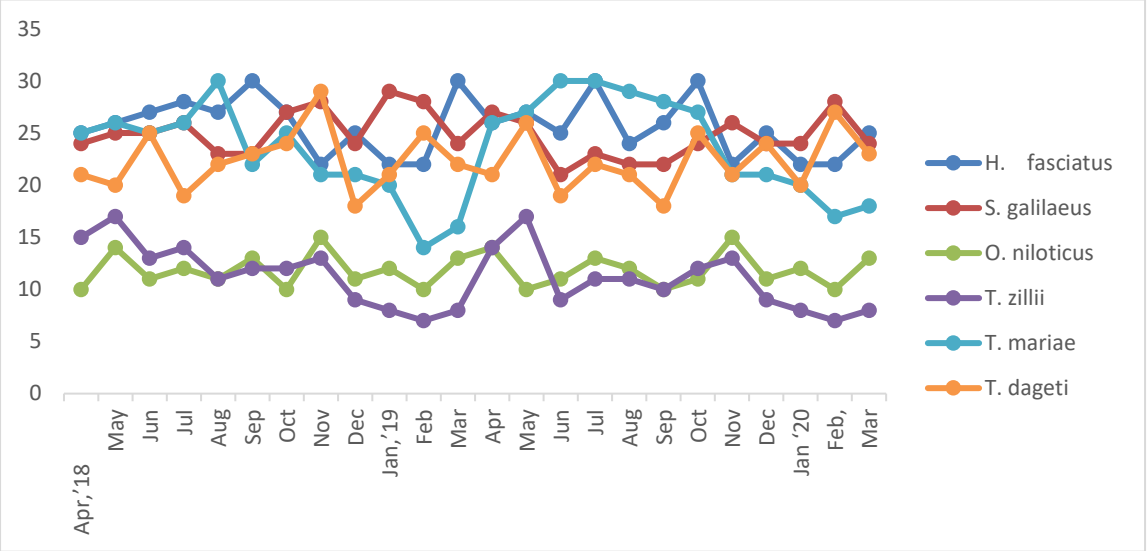

Figure 3: Monthly distribution of cichlid fishes caught during the period of study

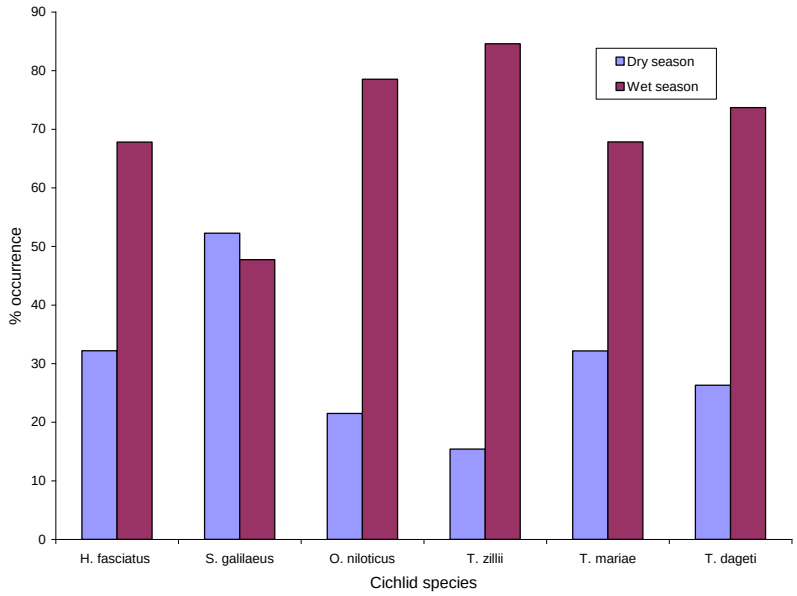

Figure 4: Seasonal variation in the occurrence of cichlid fishes in Owalla reservoir during the study period

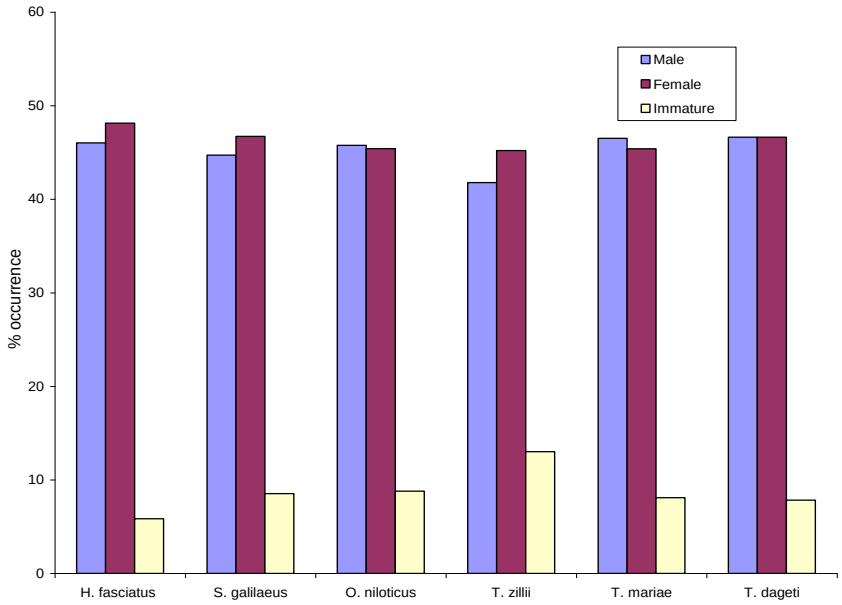

Figure 5: Sexual variation in the occurrence of cichlid fishes in Owalla reservoir during the study period.

Length and weight variation of cichlid fishes in the reservoir during the study period is shown in Table II. For *H. fasciatus*, the standard length of the fish ranged from 5.20 to 10.40 cm with a mean with a mean value of 7.35±0.12 cm, while the weight ranged between 5.50 and 45.80 g with a mean value of 15.58 ±9.01 g. In *S. galilaeus,* the standard length of the fish ranged from 5.50 to 26.30 cm with a mean value of 11.77±3.12 cm, while the weight ranged between 9.80 and 359.10 g with a mean value of 89.48 ±14.17 g. In *O. niloticus,* the standard length ranged from 4.60 to 13.70 cm with a mean value of 8.35±1.90 cm, with the weight ranging between 7.40 to 78.60 g with a mean value of 36.11 ±10.02 g. In *T. Zilli*, the standard length ranged between 5.40 and 18.60 cm with a mean value of 9.95±1.09 cm. The weight in the fish ranged between 11.60 to 262.10 g with a mean value of 88.03 ±16.04 g. In *T. mariae*, the standard length ranged from 5.40 to 15.90 cm with a mean value of 9.83±1.07 cm, while the weight ranged between 7.60 to 161.80 g with a mean value of 57.81±14.01 g. In In *T. dageti,* the standard length varied between 5.50 and 19.30 cm with a mean value of 11.12±2.01 cm, while weight ranged between 10.10 and 236.30 g with a mean value of 86.30 ±20.01 g

Table II: Length and weight variation of cichlid fishes caught in Owalla reservoir during the study period

Fish species	Total Number caught	% (total Number)	Standard length (cm) Range	Mean x ±SE	Body weight (g) Range	Mean x ±SE
H. fasciatus	615	21.44	5.20- 10.40	7.35 ± 1.08	5.50-45.80	15.58 ± 9.01
S. galilaeus	597	20.82	5.50-26.30	11.77 ± 3.12	9.80-359.10	89.48 ± 14.17
O. niloticus	284	9.90	4.60-13.70	8.35 ± 4.90	7.40-78.60	36.11 ± 10.02
T. zillii	292	10.18	5.40-18.60	9.95 ± 3.09	11.60-262.10	88.03 ± 16.04
T. mariae	544	18.97	5.40-15.90	9.83 ± 1. 87	7.60-161.80	57.81 ± 14.01
T. dageti	536	18.69	5.50-19.30	11.12 ± 2.51	8.10-236.3	86.3 ± 20.01
	2868	100				

A number of fishes which were not cichlids were commonly encountered during the period of study in the reservoir. Utmost among them are *Chrysichthys nigrodigitatus* (family Bagridae), *Clarias anguillaris* (family Clariidae), *Barbus leonensis* (family Cyprinidae), *Schilbe intermedius* (family Schilbeidae), *Parachanna obscura* (family Channidae), *Mormyrus rume* (family Mormyridae), *Hepsetus odoe* (family Hepsetidae), *Marcusenius senegalensis* (family Mormyridae) and *Brycinus logopinnis* (family Alestiidae).

DISCUSSION

Six species of cichlid fishes identified during the period of study were found in all the four sampling sites where they occurred frequently in both dry and wet seasons, though their occurrence was generally higher in the wet than in the dry season. The total number of 2868 fishes caught at different sampling sites was an indication that cichlid fish species were adequately present and well distributed in the reservoir, during the period of study. The finding is similar to the results of Komolafe and Arawomo (2008) where it was reported that cichlid fishes constituted more than half of the fish population of Osinmo reservoir and about 98% of Opa reservoir fish population. The abundance of cichlid fishes in the reservoir also confirmed the report of many researchers g Fagbenro (2007) and Komolafe and Arawomo (2008), on the dominance of cichlid species in several East African lakes. The high percentage of cichlid fishes dominating these African reservoirs and other waterbodies was attributed to good parental care exhibited by most of the species which confers a considerable advantage in the colonization of their chosen habitat (Adesulu and **S**ydenham,2007). Taiwo (2010) also reported that Owalla and Eko–Ende reservoirs were dominated by the family cichlidae. The relatively low population of *Tilapia zilli* and *Oreochromis niloticus* in the catch could be attributed to the reproductive behavior of the fishes, Tilapia *zilli* being substrate brooder and *Oreochromis niloticus* a mouth brooder.

Generally, the mean values of length and weight recorded for the cichlid fishes were small when compared with the cichlids from other Nigerian water bodies. The standard-length range obtained in this study was also considered relatively small when compared with the result of Offem *et al.,* (2007) who reported a standard-length range of 12.4 to 35.6 cm, 14.8 to 24.8 cm, 12.6 to 22.4 cm, 13.9 to 28.4 cm, and 9.4 to 12.2 cm for *O. niloticus, T. mariae, T. zilli, S galilaeus and H. fasciatus* respectively from Cross river.

The major reason for the relatively small size of the cichlid fishes can be attributed to the fact that most of the fishes were caught by static gill-net with mesh sizes that were not size selective. According to Soyinka and Ayo-Olalusi (2009), non-selectivity of the fishing nets will most likely decimate the population of certain size groups. Also, over- fishing by the artisanal fishermen could not be ruled out because of lack of regulation on the reservoir (Taiwo, 2010). Over-fishing will likely affect the breeding adults and recruitment into the population (Olaosebikan and Raji, 1998).

CONCLUSION

The study revealed that the six species of cichlid fishes encountered were adequately represented and occurred frequently in both wet and dry season sin the reservoir. But the sizes recorded were lower than the sizes of cichlids obtained from similar inland waters. These reduced sizes could be attributed to the high level of exploitation due to uncontrol use of fishing nets with unregulated mesh sizes and possibly unrestricted fishing due to lack of regulation on the reservoir.

Based on the findings of this study it could also be established that the water quality of the reservoir provides a good environment for cichlid fishes to thrive. Therefore, management strategies including fish gear restriction and selective cropping need to be applied so as to guarantee and protect the breeding population for the maintenance of sufficient spawning biomass and bigger size fish. There should be proper regulation and monitoring of the fishing activities of the fishermen in the reservoir. The effort for maximum production and provision of further information on the scope of the fishing potentials in the reservoir becomes essential.

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