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ENVIRONMENTAL CHANGES ON THE FISH FAUNA OF OLD AND NEW OWENA RESERVOIRS, NIGERIA

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ABSTRACT

The finfish and shellfish of the Old and New Owena reservoirs were assessed from 2008 to 2009. Population indices such as index of dominance (C), index of similarity (S), species richness (D), Shannon index (H'). Frequency of Occurrence (FOC) and Number of Occurrence Index (NOI) were used to determine diversity variation. The species composition of the two reservoirs were similar (S = 0.7272) while the values of C were 0.0743 and 0.229 in old and new reservoir respectively. The old reservoir was richer (D = 2.7390) and more diverse (H= -2.8900) than the new reservoir (D = 0.9257, H = -1.6184). The total catch recorded in old reservoir comprising of eleven families; cyprinidae, Polypteridae, Mormyridae, Chacacidae, Gynarchidae, Clariidae, Malapteruridae, Bagridae, Tilapia, Osteoglossidae and Channidae, while the new reservoir comprising of four families; cyprinidae, Chacacidae, Clariidae, Tilapia. Two species of freshwater crabs (*Sudanonautes africanus* and *Potamonemus asyles*) and two freshwater mussels (*Aspatharia pfeifferiana* and *Etheria elliptica*) were identified only in the old reservoir. The number of licensed fishermen (100) and unregulated mesh sizes (25.5mm – 51.5mm) are beyond what the ecosystem can support; hence future sustainability of stock is a problem if not properly managed

Keywords: Fish species, Owena reservoir, population indices, *Etheria elliptica*

INTRODUCTION

The fresh water fish species of Nigeria is the richest in West Africa, with more than 268 species known presently (Olaisebikan and Aminu 1998). The fishes are remarkable for their diversity of habitat, form and colour and also have a high food value; because of this, they have special appeal for all groups of people. Since early time, man has caught fish for food and today the introduction of highly efficient fishing techniques has led to over exploitation of some of the commercial fish stocks. Nigeria's domestic fish production hovers around 400,000 metric tons (MT). This is far less than what is required to support the annual fish consumption of her populace estimated at 120 million. For instance, in 1997, the fish demand figure was 1.27 million MT. In order to fill the demand – production gap, Nigeria expended over 200 million US dollars annually on the importation of frozen fish to augment the under production (Dublin – Green and Tobor, 1992). Also, Nigerian waters are over-exploited, thus reducing the volume of fish catch and enhancing the catch of undersized fish; the waters are polluted by oil and run-off of chemicals and fertilizers, the nutrient enrichment leads to algal blooms and mats of water hyacinth impedes navigation, thereby minimizing social and economic activities in the riverine areas. In addition, the supposed fishery stakeholders, namely, the government, the fishermen - fishers (artisanal & trawling) and fish farmers, fish traders (Processors and Marketers) and consumers have either directly or remotely jeopardized the objective of sustainable fishery resources by their actions and counter- actions in time past. In order to achieve sustainable fishery development, management strategies need to be enhanced beyond the present level. Survey of resources should be regularly carried out. This will provide ready information on the state and identity of stock, which is used for quick intervention in cases of excessive drop in yield. There is a need for an extensive and quantitative study of the artisanal fishery for further development. This is as a result of overexploitation of stock occasioned by excessive fishing and the use of small mesh size net, which results in mortality of young fishes which ought to grow and replenish the stock. Sampling of catches of artisanal and industrial fleets 'should be improved and reliable statistics made available on species caught, size, yield, etc Moreover, measures should be taken to reduce conflicts in artisanal fishery which is caused by the open access phenomenon of the resources hence competition and consequent conflict among fishermen. Measures to enhance inland fisheries management include aquaculture, adequate

Legislation, environmental engineering and more importantly partnership of various stakeholders in order to cope with the changing environment. Fish production in Nigerian inshore waters is relative to the width of the continental shelf, which ranges from 8 to 25nautical miles; and this is one of the reasons why her fish production is not as high as that of some tiles neighboring countries. Secondly pelagic fish production is closely related to the level of upwelling, which is not substantial in Nigeria inshore waters. Such pelagic species include *Ethmalosa fimbriata*, *llisha africana, Sardinelia maderensis, Scomberomeros tritor* to mention a few. Nutrient deposits from inland into the coastal waters are another factor that influences the level of fish production in Nigerian coastal waters. Another reason for low fish productivity in Nigeria is non - adherence to fishing laws/regulations. It is also very difficult to give an accurate estimation of Nigeria's fishery production and resource potentials. This is because over 80% of fish production is from the artisanal fishery sector. These numerous small-scale fishermen are scattered in remote villages along the coastline and the extensive brackish-water system. In addition to this, Nigeria has an extensive freshwater system and fishermen settle in remote villages around rivers, streams, lakes and flood plains (Aina, 1992).

In addition, shellfish remain an understudied, yet critically imperiled, fauna. Although knowledge of the shell fish diversity in Nigeria is poor, it is known that Nigeria hosts more than 250 species of endemic coastal water shellfish comprising of shrimps, prawns, crabs, snails, periwinkles, bivalves etc (Bello-Olusoji 1997, 2004). These species are greatly threatened by habitat fragmentation and degradation, as well as by pesticide used in nearby plantation areas. Four specific areas of concern regarding freshwater shellfish were highlighted as concerns in the context of conservation. Areas of concern include freshwater shellfish conservation strategies, taxonomy and systematic, ecological research, and conservation challenges.

Human activities' effects on the fish profile and status, emergence of new species due to mutation, cross-breeding and genetic manipulation should be researched. Therefore, this study assesses the effects human activities have had on the diversity, population density and distribution of fish in the old and new owena reservoirs.

MATERIALS AND METHODS

THE STUDY AREA

Fish samples were collected from old and new Owena reservoir (Figure 1) located on River Owena between latitude 7º15'N, longitude 5º 5'E and latitude 7º 4'N, longitude 4º47'E in Western Nigeria. The new reservoir is about 300m long and 9m in its deepest part, with the capacity of approximately 600,000m^3 and the catchments area controlled by the reservoir is 790km^2. Old Owena reservoir was established over 46 years ago along Ondo-Akure road, domestic purposes within Akure and Ondo metropolis together with their neighbouring villages. The new reservoir was established on the upper part of the same river along Ilesa-Akure road and commissioned in 2006. The river flows over rock, muddy and sandy beds from upland in the state through the thick forest, and many plantations such as cocoa and plantain. The river is shallow and fast flowing into the coastal waters in the southern part of Ondo State. The river is generally clear most of the time except during rainy season that is muddy within the catchment areas due to run offs and upstreams that flow into it.

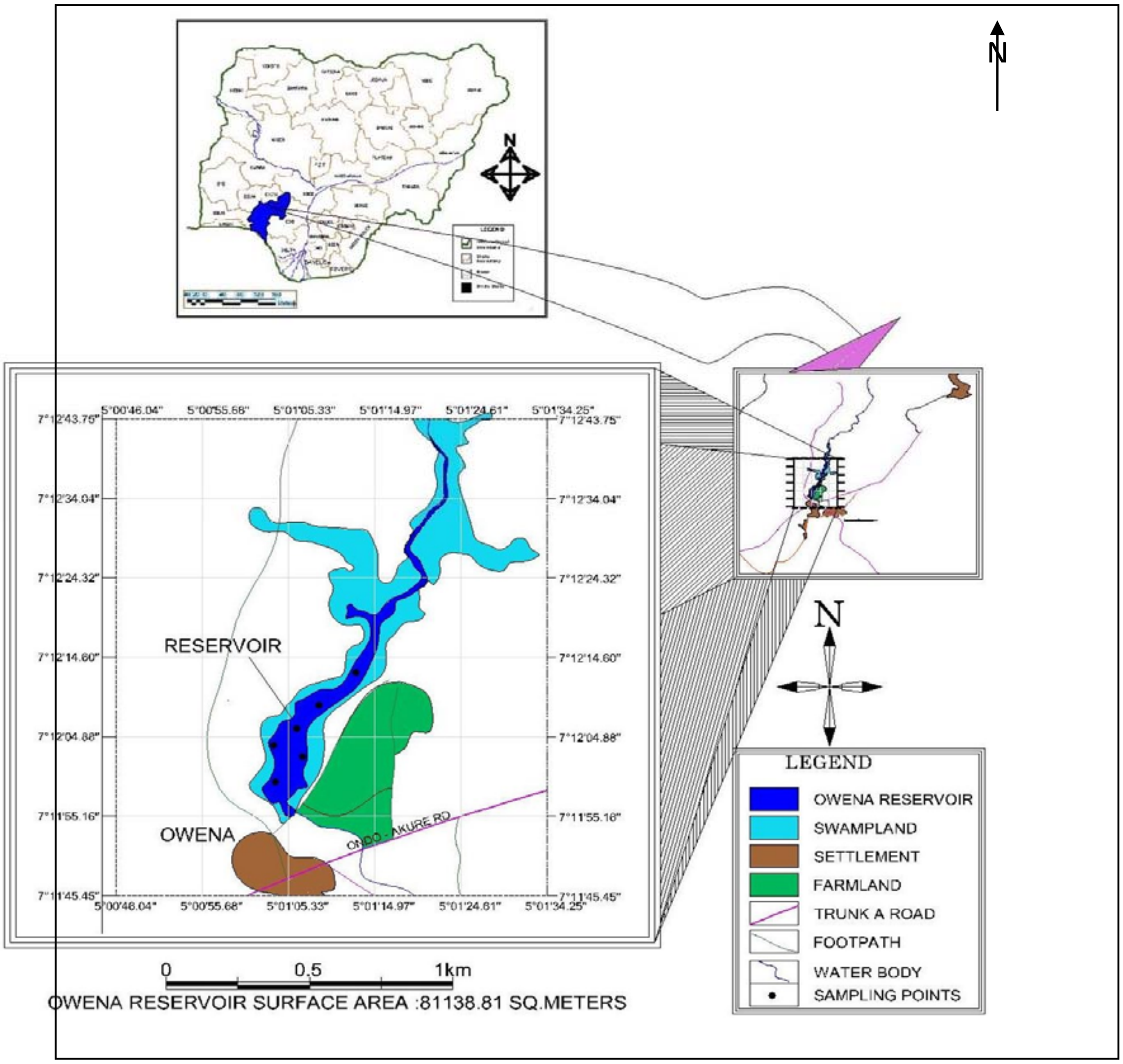

Fig. 1: Map showing Owena River

FISH SAMPLE COLLECTION

Variety of sampling methods was employed at each site to collect all the available fish species. The following fish gears; cast nets (25.5mm mesh size), baited traps, monofilament nylon, gill nets (51.5mm mesh size) and hook and line were all employed with the assistance of the local fishermen. Fish samples were stored in thermo flask vacuum (25liter box) and transported to Limnology laboratory in the Department of Fisheries and Aquaculture Technology, Federal University of Technology, Akure. All specimens collected were examined in the Laboratory, preserved in 15% formalin and stored for later examination. In the laboratory fish were identified by taxa to species level after Babatunde and Aminu, (1998) and Adesulu and Syndeharn (2008). They were classified to the lowest possible taxonomic level. Fish species, abundance, frequency of occurrence and other population parameters were determined per catch. The following indices were used;

(i) **Frequency of Occurrence (FOC):** This is the number of catches with a specific fish species item expressed as a percentage of the total number of catches containing the fish species (Cortez *et al,* 1995)

FOC = A/B x 100

Where A = number of time the specific fish species/catch occurred throughout the fishing period.

B = total number of catches.

(ii) **Number of Occurrence Index (NOI):** This is total number of individual species counted in each catch express as a percentage of the total number of fish species in all catches.

NOI = C/D x 100

Where C = number of individual species counted in each catch

D = total number of fish species in all catches

The fish diversity analysis was done using index of dominance (C), index of similarity (S), species richness (D) and Shannon index (H).

Index of dominance (C) - Is useful in determining whether or not a particular fish species dominate old and new Owena reservoir. Water with an index close to 1.0 are said to be dominated by a few fish species. When values for water are low, the implication is "that dominance is shared by all species in the community" (Cummins, 2002).

It is calculated using the formular; ∑ **(ni/N)ˆ2**

Where c = Index of dominance

ni = number of individuals of each species

N = total number of individuals

Index of Similarity (S) - This show similarity among species obtained in each reservoir (Cummins, 2002). It is calculated using the formular : **2C / (A+B)**

Where S = Index of similarity

C = Number of species common to both Reservoir

A = Number of species in New Reservoir

B = Number of species in Old Reservoir

Species Richness Value (D) = (S – 1) / (ln N)

D = Species Richness Value

S = number of species found in each reservoir

N = total number of individuals

Shannon Index of diversity (H) = -∑[(ni/N) log (ni/N)]

H = Shannon index of diversity

ni = number of individuals of each species

N = total number of individuals

Plastic containers (7.5litres) were used for specimen collection, kept in thick plastic bags with leak proof closures. A knife, scalpel, and long-handed net, were taken along to dislodge mussels attached to the rocks for collection. Collected specimens were transported in medium-sized thermos jugs (cooler) to the Limnology laboratory in the Department of Fisheries Aquaculture Technology, Federal University of Technology, Akure and preserved immediately with 15% alcohol, together with a field label after collection. Crabs were collected with baited traps, while some were dislodged out of their nests, and kept in 12% formalin.

Identification of freshwater molluscs was carried out using Brown (2004). Small- or medium-sized snails were identified with the aid of a binocular dissecting microscope equipped with an ocular micrometer calibrated to 0.1 mm accuracy so that precise measurements can be made.

RESULT AND DISCUSSION

FIN FISHES

A total of 8310 specimens were caught by the fishermen from the two sampling sites as shown in Table 1. From the survey, 77% (6388) of the total catch was recorded for Old reservoir, comprising of eleven families; cyprinidae (2), Polypteridae (1), Mormyridae (4), Chacacidae (4), Gynarchidae (1), Clariidae (3), Malapteruridae (1), Bagridae (2), Tilapia (5), Osteoglossidae (1) and Channidae (2). Collection from the new reservoir was 1922, which was dominated by tilapia (64.7 %,). Each collection site gave different sample sizes. In the old reservoir, the highest number of individuals was collected from the middle part of the reservoir, 4436 individuals, followed by 1506 individuals from the upper part of the reservoir and only 446 individuals from lower part of the reservoir. Collections from the new reservoir also gave the same distribution pattern. The middle part of the reservoir gave 1279 individuals while 438 were collected at the upper part and 205 from lower part. The ideal free distribution model predicts that fish will occupy the highest and best rich natural food production habitat, until the density of individual reduces the benefit per individual. The species then spill over into the next highest quality area, as reported by Matthews, (1998). The middle part of the reservoir gave the highest quantity of fish in both reservoirs, indicating that the mostly populated area has the highest quality living areas for fish. Tilapia population dominated in the two reservoirs. The fish population has reduced in size due to the obnoxious fishing activities. More than 100 fishermen were registered for fishing in the new reservoir, while the registered number for Old reservoir could not be determined. This could be seen affecting the total catch of each fisherman and the fish population. Hence, proper management practices (such as reduction in the number of licensed fishermen, use of right fishing gears etc) are required for sustainability of fish in the reservoir.

Fishing gear and methods used included hook and lines, gillnet, castnet, seines, traps and pots adapted from Mali fishermen. Mesh sizes used by fishermen ranged from 12.7mm for castnets and traps to 25-76mm for gillnets. According to Solarin and Kusemiju (2003) gillnets with mesh size between 30 mm – 45 mm caught relatively small juvenile fish species thereby inflicted a great toil on the population of the commercially important fish. They further stated that a minimum of 50mm stretched mesh size is recommended. Factors responsible for poor catches by fishermen include an increased population of fishermen, persistent and upstream development, leading to the desiccation of most of the floodplain areas. These factors have also given rise to size reduction in the catch and the disappearance of some species especially the larger predators such as *Lates*. The existing management system is poor and if not controlled will affect fish sustainability in the reservoir.

FISH DIVERSITY

Index of dominance (C)

Using index of dominance to determine whether or not a particular fish species dominate the old and new reservoirs, it was observed that in the two reservoirs dominance is shared by all species in the communities since the values obtained from both reservoirs are far from 1.0 (as represented in Table 2). Nevertheless, the new reservoir has values (0.229) that are higher than old reservoir (0.0743) probably because of less species found within the reservoir as at the time of survey.

Index of Similarity (S)

The index of similarity shows that the old and new reservoir can be considered relatively similar (i.e. S = 0.7272) in species composition, as the calculated index of similarity is close to 1.0

Species Richness Value (D)

The old reservoir is far richer (2.7390) in fish species than the new reservoir (0.9257). This can be attributed to more fishing activities that take place in the new reservoir; about 100 fishermen are licensed to fish on the new reservoir while fewer fishermen fished on the old reservoir. Also these observed differences may be related to increased flora cover in the well established old reservoir, while the new reservoir has tilapia as the predominant fish without established aquatic plants. Unlike the new reservoir, the old reservoir was once been stocked with some fish species.

Shannon Index of diversity

Old reservoir is more diverse in fish species (2.8900) than the new reservoir (1.6184), even though it has been affected by human activities for a longer period of time. The low diversity observed in new reservoir may be because the fish species found in it is represented by one species i.e. Tilapia spp.

SHELLFISHES

Two species of freshwater crabs; *Sudanonautes africanus* and *Potamonemus asyles* were present in large quantities in the two sites. Freshwater mussels (Bivalves) *Aspatharia pfeifferiana* and *Etheria elliptica* were present in small quantities at the old Reservoir. There was no trace of their occurrence at the new site. The *A. pfeifferiana* was more in abundance and dominated the benthic zone at the littoral zone of the reservoir. *E. elliptica* was firmly attached to the rocks at the lower part of reservoir where the water current was high. However, most of the shellfish species are being threatened due to the chemicals residues from the surrounding plantations coupled with chemicals and other obnoxious fishing activities by the villagers. Freshwater molluscs, especially gastropods are important from the medical and veterinary public health point of view. About 100 species of freshwater gastropods are reported to act as intermediate hosts for the diagnostic trematode by some Scientists (Subba Rao 1993, Thompson 1984; Harasewych, 1998; Dundee and Paine, 1999). The crabs and the water snails are delicacies among the rural dwellers. The existence of these shellfish are threatened, while some that were collected by the fishermen over twenty years ago are now extinct, e.g. freshwater prawn. Many of these species have adapted to much specialised habitats that are currently been rapidly destroyed or irreparably damaged by mankind. More studies are needed to establish the importance of various environmental factors that produce a collective effect on the nature and distribution of freshwater molluscs

CONCLUSION

Industrialization, urbanization, deforestation, mining, and agricultural land and water use often caused degradation of aquatic environments, which is the greatest threat to inland fish production in Nigeria. Fishery resources are being affected by excessive fishing and use of small mesh size net, destruction and fragmentation of aquatic habitat by aquatic pollution due to the release of urban and industrial effluents and run-off of agro-chemicals, impoundment, channelization of water bodies, excessive water abstraction or diversion, soil erosion and manipulation of hydrological characteristics of rivers, lakes and flood plains.' In order to achieve sustainable fishery development, management strategies need to be enhanced beyond the present level.

Survey of resources should be regularly carried out. This will provide ready information on the state and identity of stock, which is used for quick intervention in cases of excessive drop in yield. Hence, human activities' effects on the fish profile and status in relation to diversity, population density and distribution of fish in the old and new Owena reservoirs were observed. Generally, ecosystems lack the capacity to adapt to these human imposed stresses and still maintain normal functions and structures. Stress results in a process of degradation which is commonly marked by such signs as loss of biodiversity, lowered resilience to natural disturbance, and reduced primary and secondary productivity. The effect of overfishing and use of small sized mesh net was more prominent in the new reservoir where more fishermen were licensed, fishing gear regulation was absent and management practices were poor.

Due to high and prohibitive cost of fishing inputs in Nigeria, these fishermen tend to use obnoxious fishing methods which have detrimental effects on the aquatic ecosystem; a contributing factor to the low level of species richness observed in the new reservoir. Since living organisms cannot live as isolated units rather their activities are dependent and closely controlled by their external environment, the old reservoir having more fish species and diversity may be attributed to the increased flora cover; a pointer to a less disturbed ecosystem and better water quality. Therefore, for proper management purposes, information on the environment is useful as a basis for the planning and formulation of management policies towards the rational utilization of the resources for different end-use.

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TABLE 1: FISH SPECIES FOUND IN OLD AND NEW OWENA RESERVOIR

Family/*Species name*	Common name	Old Reservoir			New Reservoir		
		FOC (%)	Abundance	NOI	FOC (%)	Abundance	NOI
Family Cyprinidae *Barbus chlorotaenia*	Barb	72	412	6.45	20	48	2.50
B. ablabes	Barb	52	252	3.94	NC	NC	
Polypteridae *Polypterus species*	Bichir	12	24	0.37	NC	NC	
Mormyridae *Hyperopsis bebe*	Trunk fish	20	72	1.13	NC	NC	
Mormuyrus rume	Elephant snout fish	76	392	6.14	NC	NC	
M. macrophthalmus	Elephant snout fish	52	156	2.44	NC	NC	
M.hasseiquisti	Snout fish	32	72	1.13	NC	NC	
Chacacidae *Alestes macrophthalmus*	Silversides	48	154	2.41	NC	NC	
Alestes dentex	Silversides	56	210	3.29	NC	NC	
Hydrocynus brevis	Tiger fish	64	252	3.94	4	6	0.31
H. lineatus	African Tiger fish	48	201	3.15	8	22	1.15
Gymnarchidae- *Gymnachus niloticus*	Trunk fish	4	9	0.14	NC	NC	
Clariidae – *Clarias gariepinus*	Catfish	90	452	7.07	32	180	9.36
C. isheriensis	Catfish	22	121	1.89	NC	NC	
Heterobranchus bidorsalis	Catfish	12	39	0.64	NC	NC	
Malapteruridae- *Malapterurus electricus*	Electric Fish	56	221	3.46	NC	NC	
Bagridae – *Chrysichthys auratus*	Silver Catfish	10	220	3.44	NC	NC	
C. nigrodigitatus	Silver catfish	24	144	2.25	NC	NC	
Tilapia –*Oreochromis niloticus*	Tilapia	100	1006	15.75	100	621	32.31
Oreochromis aureus	Tilapia	100	778	12.18	100	482	25.08
Tilapia zilli	Tilapia	82	644	9.42	92	422	21.95
Tilapia dageti	Tilapia	50	150	2.35	32	141	7.34
Hemichromis fasciatus	Tilapia	42	120	1.88	NC	NC	
Osteoglossidae – *Heterotis niloticus*	Bony Tongue	A/NS	A/NS		NA	NA	
Channidae *Channa obscura*	Snake head	48	281	4.39	NA	NA	
Hepsetus spp	African pike	50	106	1.65	NA	NA	
SUB TOTAL For Finfish			**6388**			**1922**	
***Shellfish:* Potamonautidae** *Sudanonautes africanus*	W/African Fresh water crabs	NA	NA	NA	NA	NA	
Potamonemus asyles	W/African Fresh water crabs	NA	NA	NA	NA	NA	
Iridinidae*-Aspatharia pfeifferiana*	Freshwater mussel	NA	NA	NA	NA	NA	
Etheriidae *Etheria elliptica*	Freshwater mussel	NA	NA	NA	NA	NA	

Key: NA- Not available; A/NS- Available/not sighted; NC – Not caught.

TABLE 2: INDEX OF DOMINANCE

Key: NA- Not available; A/NS- Available/not sighted; NC – Not caught.

	Old Reservoir			New Reservoir		
Family/*Species name*	Ni	ni/N	(ni/N)ˆ2	ni	ni/N	(ni/N)ˆ2
Family Cyprinidae *Barbus chlorotaenia*	412	0.0644	0.0041	48	0.0249	0.0006
B. ablabes	252	0.0394	0.0015	NC	-	-
Polypteridae *Polypterus species*	24	0.0037	0.0000	NC	-	-
Mormyridae *Hyperopsis bebe*	72	0.0112	0.0001	NC	-	-
Mormuyrus rume	392	0.0613	0.0037	NC	-	-
M. macrophthalmus	156	0.0244	0.0005	NC	-	-
M.hasseiquisti	72	0.0112	0.0001	NC	-	-
Chacacidae *Alestes macrophthalmus*	154	0.0241	0.0005	NC	-	-
Alestes dentex	210	0.0328	0.0010	NC	-	-
Hydrocynus brevis	252	0.0394	0.0015	6	0.0031	0.0000
H. lineatus	201	0.0314	0.0009	22	0.0114	0.0001
Gymnarchidae- *Gymnachus niloticus*	9	0.0014	0.0000	NC	-	-
Clariidae **–** *Clarias gariepinus*	452	0.0707	0.0049	180	0.0936	0.0087
C. isheriensis	121	0.0189	0.0003	NC	-	-
Heterobranchus bidorsalis	39	0.0061	0.0000	NC	-	-
Malapteruridae- *Malapterurus electricus*	221	0.0345	0.0011	NC	-	-
Bagridae **–** *Chrysichthys auratus*	220	0.0344	0.0011	NC	-	-
C. nigrodigitatus	144	0.0225	0.0005	NC	-	-
Tilapia **–** *Oreochromis niloticus*	1006	0.1574	0.0247	621	0.3231	0.1043
Oreochromis aureus	778	0.1217	0.0148	482	0.2502	0.0626
Tilapia zilli	644	0.1008	0.0101	422	0.2195	0.0481
Tilapia dageti	150	0.0234	0.0005	141	0.0733	0.0053
Hemichromis fasciatus	120	0.0187	0.0003	NC		
Osteoglossidae – *Heterotis niloticus*	A/NS	-	-	NA	-	-
Channidae *Channa obscura*	281	0.0439	0.0019	NA	-	-
Hepsetus spp	106	0.0165	0.0002	NA	-	-
TOTAL	**6388**		**0.0743**	**1922**		**0.2297**
Shellfish**-Potamonautidae**						
Sudanonautes africanus	NA	-	-	NA	-	-
Potamonemus asyles	NA	-	-	NA	-	-
Iridinidae-*Aspatharia pfeifferiana*	NA	-	-	NA	-	-
Etheriidae *Etheria elliptica*	NA	-	-	NA	-	-

TABLE 3: SHANNON-WIENER INDEX OF DIVERSITY FOR THE FINFISH

Fauna	Old Reservoir					New Reservoir		
Family/*Species name*	**No**	**Pi**	**ln pi**	**Pi ln pi**	**No**	**pi**	**ln pi**	**Pi ln pi**
Family Cyprinidae								
Barbus chlorotaenia	412	0.0644	-2.7426	-0.1766	48	0.0249	-3.6928	-0.0919
B. ablabes	252	0.0394	-3.2339	-0.1274	NC	-	-	-
Polypteridae								
Polypterus species	24	0.0037	-5.5994	-0.0207	NC	-	-	-
Mormyridae								
Hyperopsis bebe	72	0.0112	-4.4918	-0.0503	NC	-	-	-
Mormuyrus rume	392	0.0613	-2.7919	-0.1711	NC	-	-	-
M. macrophthalmus	156	0.0244	-3.7131	-0.0905	NC	-	-	-
M.hasseiquisti	72	0.0112	-4.4918	-0.0503	NC	-	-	-
Chacacidae								
Alestes macrophthalmus	154	0.0241	-3.7255	-0.0897	NC	-	-	-
Alestes dentex	210	0.0328	-3.4173	-0.112	NC	-	-	-
Hydrocynus brevis	252	0.0394	-3.2339	-0.1274	6	0.0031	-5.7763	-0.0179
H. lineatus	201	0.0314	-3.4609	-0.1086	22	0.0114	-4.4741	-0.051
Gymnarchidae-								
Gymnachus niloticus	9	0.0014	-6.5712	-0.0091	NC	-	-	-
Clariidae –								
Clarias gariepinus	452	0.0707	-2.6493	-0.1873	180	0.0936	-2.3687	-0.2217
C. isheriensis	121	0.0189	-3.9685	-0.075	NC	-	-	-
Heterobranchus bidorsalis	39	0.0061	-5.0994	-0.0311	NC	-	-	-
Malapteruridae-								
Malapterurus electricus	221	0.0345	-3.3667	-0.1161	NC	-	-	-
Bagridae –								
Chrysichthys auratus	220	0.0344	-3.3696	-0.1159	NC	-	-	-
C. nigrodigitatus	144	0.0225	-3.7942	-0.0853	NC	-	-	-
Tilapia –								
Oreochromis niloticus	1006	0.1574	-1.8489	-0.291	621	0.3231	-1.1297	-0.365
Oreochromis aureus	778	0.1217	-2.1061	-0.2563	482	0.2502	-1.3854	-0.3466
Tilapia zilli	644	0.1008	-2.2946	-0.2312	422	0.2195	-1.5164	-0.3328
Tilapia dageti	150	0.0234	-3.755	-0.0878	141	-2.6113	-2.6131	-0.1915
Hemichromis fasciatus	120	0.0187	-3.9792	-0.0744	NC	-	-	-
***Osteoglossidae** –H. niloticus*	A/NS				NA	-	-	-
***Channidae** Channa obscura*	281	0.0439	-3.1258	-0.1372	NA	-	-	-
Hepsetus spp	106	0.0165	-4.1043	-0.0677	NA	-	-	-
TOTAL	**6388**	**1.0142**	**-90.9349**	**-2.89**	**1922**	**-1.6855**	**-22.9565**	**-1.6184**

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