Fish Species Distribution in a Domestic Water Supply Reservoir: A Case Study of Lower Usuma Reservoir, Bwari, Nigeria

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Abstract: Study on the fish species distribution of Lower Usuma Reservoir, Bwari, FCT-Nigeria was conducted from July, 2009 to June, 2010 using a fleet of gill-nets consisting of nine multifilament nets of 25.4, 38.1, 50.8, 63.5, 76.2, 88.9, 101.6, 127.0 and 177.8mm stretched meshes to sample the shore, surface and bottom water habitats. Each net measured 30m long and 3m deep, with 210/3 twine used for the first eight meshes and 210/6 for the 177.8 mm mesh. A total of 1573 fishes were sampled. Eleven fish species were identified belonging to five families. There were more fishes at the surface (38.78%), followed by the shore with 31.09% while, the bottom was the least representing 30.13% of the total catch. The fish family Cichlidae was the most dominant with 75.40%. With respect to habitat distribution, the fish families Cichlidae and Cyprinidae dominated the reservoir surface by number representing 38.45% and 43.43% respectively of the total catch of each family. The fish families Clariidae, Bagridae and Mormyridae dominated the Reservoir bottom. In terms of abundance, *O. niloticus* and *Barbus occidentalis* were the most abundant species while, *T.zilli* dominated all the catches (43.67%). There was significant difference in the composition by number of the different families ($f=138.15$; $df=14$; $P<0.05$) but, there was no significant difference ($P>0.05$) in terms of distribution of fishes and the various habitats.
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Key words: Fish, Distribution, Gillnets, Habitats, Reservoir.

1. Introduction

Reservoirs are created by man through construction of barriers across river channels. The original purpose may be to generate electricity, irrigation or domestic water supply. Irrespective of what may be the main objective, they also produce fish and the yield from such Reservoirs may constitute a substantial contribution to a country's total domestic fish production. Throughout Africa and Nigeria in particular, the occurrence of a large number of inland or freshwater Reservoirs, Lakes, Rivers and other aquatic habitats such as swamps and flood plains, of different sizes and forms, and containing a wide variety of fish populations, have provided mankind with the opportunity to exploit fish for food, income and livelihoods in general for many centuries (Neiland, 2005). Most studies on fish population dynamics in Nigeria have been concentrated on Lake Kainji (Ita, 1984; Balogun, 1986). Other works on fish population dynamics in different Reservoirs in Nigeria include those of Kontagora, Oyun, Osinmo, Owena, Kangimi (Ibrahim *et al*., 2009; Mustapha, 2009; Komolafe and Arawomo, 2008; Fapohunda and Godstates, 2007; Balogun, 2005). However, little similar work has been carried out in Lower Usuma Reservoir. Distribution and abundance are important variables of fish population dynamics studies that will help in evaluating the effect of fishing on a fishery as a basis of fishery management decisions (Sissenwine *et al.,* 1979). For sustainability of fisheries resources in the reservoir, a crucial management tool is a comprehensive understanding of the ichthyofaunal composition as well as there distributional pattern. In the light of the above constraints, this research intends to conduct ichthyofauna surveys in this Reservoir in order to ascertain the fish distribution as well as the potentiality of the Reservoir for effective fisheries management.

2. Materials and methods

2.1 Study area

Lower Usuma Reservoir is located in Bwari Area Council of FCT, Abuja. Abuja is located in the centre of Nigeria with a land area of 8,000 Square Kilometers. It lies between the Latitude of $8^0$25 and $9^0$25N and Longitude $6^0$45 and $7^0$45E. The Reservoir was constructed in 1987 and since then it has been the main source of drinking water for the city. The reservoir has

a maximum capacity of 100 million $m^{3.}$ The main Dam is 1,300 meters long with a saddle dam of 350 meters long. The maximum depth of the Reservoir and saddle is 45 meters and 10 meters respectively (F.C.D.A.2006).

Sampling Gears

A fleet of gill - nets consisting of nine multifilament nets of 25.4, 38.1, 50.8, 63.5, 76.2, 88.9, 101.6, 127.0 and 177.8mm stretched meshes was used to sample the shore, surface and bottom waters at the Reservoir. Each net measured 30m long and 3m deep, with 210/3 twine used for the first eight meshes and 210/6 for the 177.8 mm mesh (Olatunde, 1977; Balogun, 1986; 2001; 2005).

2.3 Fish Sampling

Fish were sampled once in every month throughout the sampling periods. The fish caught in each net were removed and transferred into labeled plastic bags. There was a separate bag for each net.

2.4 Sampling Time

The gill nets were usually set in the evening between 5pm and 6pm and lifted the following morning between 7am and 9am. Previous experience (Ajayi, 1972) had shown that setting the nets in the mornings and lifting them in the afternoons or evening had always yielded very poor catches.

2.5 Distribution and Abundance

Sampling was done at the Shore, Surface and Bottom to determine the distribution and abundance of fishes in the study area. The number in each species was ascertained to determine species abundance. Abundance score of the species were estimated following the criteria of Allison *et al.* (1997), as follows: 1-50 Rare; 51-100 Few; 101-200 Common; 201-400 Abundant and >400 Dominant.

2.6 Laboratory Analysis

All the fish caught during the night by the gill nets were removed from the nets the following morning and kept in polythene bags which had been labeled according to the mesh sizes of the nets. In the laboratory, the fishes were brought out of the bags and sorted According to species, the net type and mesh sizes

The family Cichlidae was the most dominant in terms of number (75.40%). This was followed by the Cyprinidae (18.88%).The of the nets. The number of each species caught was recorded. Fishes were identified using the key by Olaosebikan and Raji (2004); the key of West African Fresh Water Fishes (Holden and Reed, 1972) and Fish and Fisheries of Northern Nigeria (Reed, *et al.,* 1967).

2.7 Data Analysis

Analysis of variance (ANOVA) was used to test for significant differences within and among various treatments using Statistical Package for Social Scientists (SPSS) 15.0. Differences were considered significant if $P< 0.05$. Analyses were carried out through the computer enhanced Microsoft Excel Programs version 2007.

3. Results

A total of 1,573 fishes were caught throughout the sampling period (July 2009 – June 2010) in the study area as shown in Table 1. There were more fishes at the surface (610) representing 38.78%, followed by the shore with 489 (31.09%) while, the bottom was the least with 474 fishes representing 30.13% of the total catch. Eleven fish species were identified to belong to five families (Cichlidae, Cyprinidae, Bagridae, Clariidae and Mormyridae). The species are *Tilapia zilli, T. guineensis, T. mariae, Oreochromis niloticus, Barbus occidentalis, Barilius loati, B. niloticus, Auchenoglanis occidentalis, Clarias gariepinus, Heterobronchus bidorsalis* and *Mormyrus macropthalamus.*

T. zilli was the most dominant species in terms of number with 43.67%. This was followed by *O. niloticus* (19.45%), *Barbus occidentalis* (13.10%). While, *T. mariae, C. gariepinus, B. loati,*and *B. niloticus,* had 11.95, 4.26, 3.50 and 2.29% respectively. *Auchenoglanis occidentalis* had 1.21% while, *T. guineensis* had 0.32%, *H. bidorsalis* and *M. macropthalamus* each was represented by 0.13% respectively.

Within each of the family, Cichlidae were the most diversified represented by four (4) species and dominated by *T. zilli*. The family Cyprinidae was represented by three species dominated by *Barbus occidentalis*. While, Clariidae had two species dominated by *C. gariepinus.* The fish families Bagridae and Mormyridae were represented by a species each. families Clariidae, Bagridae and Mormyridae had 4.39%, 1.21% and 0.13% respectively.

Table 1: Percentage composition of fish by number in Lower Usuma Reservoir gill net catches from July, 2009-April, 2011 and the relative distribution of each species within the habitats (shore, surface and bottom).

Family/Species	Number	Abundance score	Distribution (%)		
			Shore	**Surface**	**Bottom**
Cichlidae					
1. *Tilapia zilli*	687(43.67)	D	232(47.44)	272(44.59)	183(38.61)
2.*O.niloticus*	306(19.45)	A	107(21.88)	111(18.20)	88(18.57)
3. *Tilapia mariae*	188(11.95)	C	63(12.88)	69(11.31)	56(11.81)
4.*Tilapia guineensis*	5(0.32)	R	1(0.20)	4(0.66)	0
Sub total	**1186(75.40)**		**403(82.41)**	**456(74.75)**	**327(68.99)**
Cyprinidae					
5.Barbus occidentalis	206(13.10)	A	64(13.09)	79(12.95)	63(13.29)
6.Barilius loati	55(3.50)	F	12(2.45)	30(4.92)	13(2.74)
7. *Barilius niloticus*	36(2.29)	R	3(0.61)	20(3.28)	13(2.74)
Sub total	**297(18.88)**		**79(16.16)**	**129(21.15)**	89(18.78)
Bagridae					
8.*Auchenoglanis occidentalis*	**19(1.21)**	R	**2(0.41)**	**6(0.98)**	11(2.32)
Claridae					
9.*Clarias gariepinus*	67(4.26)	F	5(1.02)	19(3.11)	43(9.07)
10.*Heterobranchus bidorsalis*	2(0.13)	R	0	0	2(0.42)
Sub total	**69(4.39)**		**5(1.02)**	**19(3.11)**	**45(9.49)**
Mormyridae					
11.*Mormyrus macropthalamus*	**2(0.13)**	R	**0**	**0**	**2(0.42)**
GRAND TOTAL	**1,573**		**489**	**610**	**474**

R-Rare, F-Few, C-Common, A-Abundant, D-Dominant

Table 2: Percentage composition of fish families by number among the habitats of Lower Usuma Reservoir from 2009-2011

Families	% Distribution				
	Shore	**Surface**	**Bottom**	**Total**	**Abundance score**
Cichlidae	403(33.98)	456(38.45)	327(27.57)	1,186	D
Cyprinidae	79(26.60)	129(43.43)	89(29.97)	297	A
Clariidae	5(7.25)	19(27.54)	45(65.22)	69	F
Bagridae	2(10.53)	6(31.58)	11(57.89)	19	R
Mormyridae	0	0	2(100.00)	2	R

*Figures in parenthesis represent percentage.

The distribution pattern of each family among the three major habitats is as shown in Table 2. The family Cichlidae dominated the catches in terms of number. One thousand one hundred and eighty six (1,186) Cichlids were caught of which 38.45% were caught at the surface while, the catches from shore and the bottom were 33.98% and 27.57% respectively. This was followed by the family Cyprinidae with 297 fishes having the highest catches from the surface (43.43%) followed by the shore (26.60%) while, the catch from the bottom was 29.97%. Sixty nine (69) fishes caught belong to the family Clariidae with the highest catches from the bottom (65.22%) followed by the surface and the shore with 27.54% and 7.25% respectively.

The highest catch of members of the family Bagridae were from the bottom (57.89%) followed by the surface and shore with 31.58% and 10.53% respectively. All the Mormyrids were caught only at the bottom habitat.

4. Discussion

At the end of the study period, 11 fish species belonging to 5 families were identified from the experimental gillnets. The diversity of species in the present study compared favorably with other findings of some reservoirs in Nigeria. Mustapha (2009) identified 18 species belonging

to 14 genera and 9 families in Oyun Reservoir with a surface area of $6.9x10^5m^2$ in Offa, Kwara State. Komolafe and Arawomo (2008) identified 4 families comprising of 7 species in Osinmo Reservoir, Osun State. Fapohunda and Godstates (2007) recorded 14 species belonging to 7 families in Owena Reservoir, Ondo State.

The family Cichlidae was the most dominant family (75.40%) in the present study. The dominancy of members of the family Cichlidae in the present study could be attributed to the high prolific breeding nature of members of the family Cichlidae with good parental care and this compares favourably with that of Opa, Osinmo and other African Reservoirs were cichlids are known to dominate (Komolafe and Arawomo, 2003; 2008 and Balogun, 1986; 2001; 2005). The study of Olaniran (2000) and Mustapha (2009) all confirmed the dominance of Cichlidae in Nigerian waters.

In terms of diversity of species, the family Cichlidae was the most diversified in the present study with 4-species representations (*T. zilli, O. niloticus, T. Mariae and T. guineensis*) and dominated by *T. zilli* . This was attributed to good parental care of members of the family cichlidae which gives a considerable advantage in the colonization of their chosen habitat. The Cichlids ware the most diversify (4-species) and dominated by *T.zilli* in Osinmo Reservoir, Osun State (Komolafe and Arawomo, 2008). The fish family Cichlidae was the most diversified in Kangimi Lake with 5-species representation but dominated by *Hemichromis fasciatus* (Balogun, 2001 and 2005). The study by Mustapha (2009) also confirmed the dominance of *T. zilli* in some Nigerian reservoirs such as Eleiyele, (Olaniran, 2003), Osinmo (Komolafe and Arawomo, 2008).

The distributional pattern among the families showed all the major families (Cichlidae and Cyprinidae) not having habitat preference as they are caught in all the habitats (Shore, Surface and Bottom) except the Mormyridae which were caught only at the bottom. Even though Cichlids are littorals inhabit, Greenwood (1981) noted that Cichlids can be bottom-feeding omnivores or benthic/ pelagic insectivores showing various degrees of specialization for feeding on particular life stages on different kinds of food items. The pattern of Cichlids distribution in the present study was attributed to trophic as well as related anatomical and functional specialization. The dominance of the Cyprinids at the surface habitat compared favorably with the situation in Kangimi reservoir (Balogun, 2005).

5. Conclusion

The present research reveals that Lower Usuma Reservoir is behaving like other Nigerian reservoirs/lakes where the cichlids are known to dominate the entire catches. Also the common phytoplankton cichlids feeders which are dominant in African water bodies dominated the catch composition of Lower Usuma Resrvoir with high fish production potential under adequate management.

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