

## Analysis of Ichthyofaunal Diversity and Peculiarities of Some Lakes in Nigeria

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**Abstract:** Fish species richness and peculiarities of seven lakes from different zones of the country were analyzed. A total of ninety species from twenty-five families were reported for these lakes. Asejire had the highest number of species (41) while the lowest was recorded from Opi (13). Oguta had highest number of families (17) and lowest being Tiga (8). Similarities and peculiarities of fish fauna of these lakes showed that *Tilapia zillii* was common to all the lakes. Asejire had the highest restricted species (6) and Tiga with the lowest species (2). The family Polypteridae is restricted to Dadin Kowa, Osteoglossidae and Palaemonidae to Oyan while Notopteridae to Oguta lake. Diversity index was highest in Oguta (0.5) and lowest in Opi (0.1) which was not significantly different ( $p>0.05$ ). Size of water body, physiochemical parameters and geographical location amongst other factors influenced species richness and peculiarities of these lakes.

**Key words:** Fish fauna, richness, similarities, peculiarities, lakes, diversity index, Nigeria

### INTRODUCTION

Nigeria (latitudes  $4^{\circ}16'$  and  $13^{\circ}52'N$ , longitudes  $2^{\circ}49'$  and  $14^{\circ}37'E$ ) is blessed with vast stretch of inland freshwater and brackish ecosystems from the coastal region to the arid zone. Thirteen lakes and reservoirs with a total surface area of 953,600 ha representing about 1% of the country have been reported (Ita *et al.*, 1985). They are of significant importance because they hold populations of diverse fish species. Species that are of great commercial value and importance vary in their composition depending on the water body. Belsare reported that these species of fish serve as source of protein and food in the face of the ever increasing population in developing countries. In addition, the lakes' fisheries had served as a source of livelihood to the riparian communities and biodiversity of tremendous conservation values. Fish fauna of lakes in different part of the country have been explored by numerous researchers (Ita *et al.*, 1985; Akinyemi, 1985; Bankole, 1988; Yem and Sami, 2005). However, much of the research done was to assess diversity, abundance and distribution, stock assessment and so on. This study tends to examine, fish species diversity of these lakes and also to ascertain factors that influences their presence or absence in these water bodies.

**Characteristics of the lakes:** Tiga lake, man-made lake in the Northern part of Nigeria with approximate surface area of 17,800 ha (Ita *et al.*, 1985). It is situated on the Kano river and located on latitudes  $11^{\circ}15'-11^{\circ}29'$  North and

longitude  $8^{\circ}16'-8^{\circ}38'$  East. The lake has maximum length, width and depth of 40.42, 24.42 km and 40.0 m, respectively. The mean depth is 13.0 m, surface area of 17,806 ha with total and active storage capacity of  $1.978.49 \times 10^6$  and  $1.845 \times 10^6$  m<sup>3</sup> with annual draw down of about 3 m. Opi lake is a combination of small natural lakes with source from Uhere river. It is located between  $6^{\circ}45'0'' - 6^{\circ}45'28''N$  and  $7^{\circ}29'28'' - 7^{\circ}29'35''$  in the valley of River Uhere in Eastern part of the country. It has no permanent but overflows through a small channel at the Southern end during flood period. The lake has a gentle sloppy shoreline with thick marginal vegetation. Surface area and maximum depth fluctuate seasonally and range between 0.6 and 2.0 ha and 2.0 and 4.5 m, respectively. The bottom deposit is a mixture of mud, humus and acidic (pH 5.5-6.5). Oguta lake is located between latitude  $5^{\circ}41'$  and  $5^{\circ}44'$  North of equator and longitude  $6^{\circ}56'$  and  $6^{\circ}45'$  East of Greenwich. It is a natural lake with surface area of 1.80 km<sup>2</sup> at peak flood and maximum depth of 7.00 m during dry season, mean depth of 5.50 m. The lake is fed mainly by the Njaba and Obana rivers and empties itself into the River Niger drainage system through River Orashi. It has a minimum and maximum surface areas of 1.80 and 2.48 km<sup>2</sup>, respectively. Surface temperature of the lake is 24.31°C, transparency 0.61-4.00 m, monthly evaporation 297-470 mm, conductivity 8.8-16.5  $\mu$  Scm<sup>-1</sup>, total phosphate-phosphorus 0.01-0.68 mg L<sup>-1</sup>, nitrate-nitrogen 0.17-2.24 mg L<sup>-1</sup>, silica 2.76-26.76 mg L<sup>-1</sup>, conductivity 8.6-16.6  $\mu$ cm L<sup>-1</sup>, surface dissolved oxygen 3.40-6.95 mg L<sup>-1</sup>, BOD 0.11-2.60 mg L<sup>-1</sup>, pH 5.1-6.4 and total alkalinity of 150-500 mg L<sup>-1</sup>. Dadin kowa is a

man-made lake lies between latitude 10°15' and 11° North and longitude 11°15' and 11°45' East and is approximately 65 km long. It has maximum flood level and depth of 249 m above sea level and 35 m, respectively, a surface area 300 km<sup>2</sup>. Asejire lake (07°21'N, 04°07'E) is located in the Southwestern Nigeria, a man-made lake constructed over River Oshun in 1972. The lake is Y-shaped with two unequal arms of the Y. Catchment area above the dam is 7,800 km<sup>2</sup> and the impounded area is 2,342 ha. The lake has gross storage of 7,403 million L with an elevation of 137 m. The lake has relative humidity of 73.4-79.1%, transparency range between 0.7-1.72 m, surface water temperature of 24-31.5°C, dissolved oxygen 5.1-8.9 mg L<sup>-1</sup>, pH 6.2-8.5 (Ayoade *et al.*, 2006). Oyan lake is also located in the Southern Nigeria, latitude 7°15'N and longitude 3°16'E. It is a man-made lake is constructed over Oyan river with catchment area of approximately 9,000 km<sup>2</sup>

and covers an area of 4,000 ha. The average annual flow at the dam site is estimated at 1,770 million m<sup>3</sup>. The relative humidity of the lake range 53.4, transparency between 0.7-1.72 m, surface water temperature of 24-31.5°C, dissolved oxygen 5.1-8.9 mg L<sup>-1</sup>, pH 6.2-8.5 (Ayoade *et al.*, 2006). The lake is underlain by metamorphic and sedimentary rocks, the soil are coarse to medium-grained size. Asa lake is located Southern of Ilorin, the capital of Kwara state (08°26' and 04°29'E) with a surface area of 302 ha (Ita *et al.*, 1985).

**Fish species of the lakes:** Comprehensive study of the fish fauna of these water bodies included those of Akinyemi (1985), Ita *et al.* (1985), Bankole (1988), Omotosho (1998), Ufodike and Zakari (1992), Inyang (1995) and Ikenweije *et al.* (2006). These lakes are located in different geographical zones in the country. Table 1

Table 1: Fish species composition of the lakes

| Family/species                     | Oguta | Dadin Kowa | Asejire | Oyan | Asa | Tiga | Opi |
|------------------------------------|-------|------------|---------|------|-----|------|-----|
| <b>Polypteridae</b>                |       |            |         |      |     |      |     |
| <i>Polypterus senegalus</i>        | -     | X          | -       | -    | -   | -    | -   |
| <b>Cichlidae</b>                   |       |            |         |      |     |      |     |
| <i>Tilapia dagetti</i>             | -     | -          | X       | -    | -   | -    | -   |
| <i>Tilapia mariae</i>              | X     | -          | X       | X    | -   | -    | -   |
| <i>Tilapia melanopleura</i>        | X     | -          | -       | X    | -   | -    | -   |
| <i>Tilapia macrocephala</i>        | -     | -          | -       | X    | -   | -    | -   |
| <i>Tilapia zillii</i>              | X     | X          | X       | X    | X   | X    | X   |
| <i>Tilapia monody</i>              | X     | -          | -       | X    | -   | -    | -   |
| <i>Sarotherodon galilaeus</i>      | X     | X          | X       | X    | X   | X    | -   |
| <i>Oreochromis niloticus</i>       | X     | X          | X       | X    | X   | X    | -   |
| <i>Hemichromis fasciatus</i>       | X     | -          | X       | X    | X   | -    | X   |
| <i>Pelmatochromis guentheri</i>    | -     | -          | X       | -    | -   | X    | -   |
| <i>Chromidotilapia guentheri</i>   | -     | -          | X       | -    | -   | -    | -   |
| <i>Tylochromis sudanensis</i>      | X     | -          | -       | -    | -   | -    | -   |
| <b>Alestidae</b>                   |       |            |         |      |     |      |     |
| <i>Brycinus leuciscus</i>          | -     | -          | X       | -    | -   | -    | -   |
| <i>Brycinus nurse</i>              | X     | X          | X       | X    | X   | X    | -   |
| <i>Alestes macrolepidotus</i>      | -     | -          | X       | X    | -   | -    | -   |
| <i>Alestes baremose</i>            | X     | X          | -       | X    | -   | X    | -   |
| <i>Alestes longipinnis</i>         | -     | -          | -       | -    | -   | -    | -   |
| <i>Alestes dentex</i>              | -     | -          | -       | -    | -   | X    | -   |
| <i>Alestes imberi</i>              | -     | -          | X       | X    | -   | -    | -   |
| <i>Alestes brevis</i>              | X     | -          | -       | -    | -   | -    | -   |
| <i>Micralestes acutidens</i>       | -     | X          | -       | -    | -   | -    | -   |
| <i>Hydrocynus forskalli</i>        | -     | X          | X       | X    | -   | X    | -   |
| <i>Hydrocynus lineatus</i>         | X     | X          | X       | -    | -   | -    | -   |
| <b>Bagridae</b>                    |       |            |         |      |     |      |     |
| <i>Bagrus bajad</i>                | -     | X          | X       | X    | -   | X    | -   |
| <b>Claroteidae</b>                 |       |            |         |      |     |      |     |
| <i>Chrysichthys nigrodigitatus</i> | X     | -          | X       | X    | X   | -    | -   |
| <i>Chrysichthys auratus</i>        | -     | -          | X       | -    | -   | X    | X   |
| <i>Auchenoglanis occidentalis</i>  | -     | X          | -       | -    | X   | X    | -   |
| <i>Auchenoglanis bisculatus</i>    | -     | X          | -       | -    | -   | -    | -   |
| <b>Clariidae</b>                   |       |            |         |      |     |      |     |
| <i>Clarias anguillaris</i>         | -     | -          | X       | -    | X   | -    | X   |
| <i>Clarias gariepinus</i>          | X     | X          | -       | X    | -   | X    | X   |
| <i>Clarias submarginatus</i>       | -     | -          | -       | X    | -   | -    | -   |
| <i>Clarias angolensis</i>          | -     | -          | -       | -    | X   | -    | -   |
| <i>Clarias senegalensis</i>        | -     | -          | -       | -    | X   | -    | -   |
| <i>Heterobranchius longifilis</i>  | -     | -          | -       | X    | -   | -    | X   |
| <b>Mormyridae</b>                  |       |            |         |      |     |      |     |
| <i>Mormyrus rume</i>               | X     | X          | X       | X    | X   | -    | -   |
| <i>Gnathonemus abadii</i>          | X     | X          | X       | -    | -   | -    | -   |
| <i>Gnathonemus pictus</i>          | -     | -          | X       | -    | -   | -    | -   |

Table 1: Continued

| Family/species                      | Oguta | Dadin Kowa | Asejire | Oyan | Asa | Tiga | Opi |
|-------------------------------------|-------|------------|---------|------|-----|------|-----|
| <i>Gnathonemus cyprinoids</i>       | -     | -          | -       | -    | X   | -    | -   |
| <i>Gnathonemus senegalensis</i>     | X     | X          | X       | -    | -   | X    | -   |
| <i>Petrocephalus bane</i>           | -     | X          | X       | X    | -   | -    | -   |
| <i>Petrocephalus bovei</i>          | -     | -          | -       | -    | X   | -    | -   |
| <i>Marcusenius psittacus</i>        | -     | X          | X       | X    | -   | -    | -   |
| <i>Marcusenius isidori</i>          | -     | X          | -       | X    | -   | -    | -   |
| <i>Mormyrops deliciosus</i>         | -     | X          | X       | X    | X   | X    | -   |
| <i>Mormrops hasselquistii</i>       | -     | -          | -       | -    | -   | -    | X   |
| <i>Mormrops engystoma</i>           | -     | -          | -       | -    | -   | -    | X   |
| <i>Hyperopisus bebe</i>             | -     | X          | -       | X    | -   | -    | -   |
| <i>Hippopotamyrus psittacus</i>     | -     | -          | -       | X    | -   | -    | -   |
| <b>Schilbeidae</b>                  |       |            |         |      |     |      |     |
| <i>Schilbe intermedius</i>          | X     | X          | -       | X    | X   | X    | -   |
| <i>Eutropius niloticus</i>          | -     | X          | X       | X    | -   | -    | -   |
| <i>Siluranodon auritus</i>          | X     | -          | X       | -    | -   | -    | -   |
| <i>Parailia pellucida</i>           | -     | X          | X       | X    | -   | -    | -   |
| <b>Hepsetidae</b>                   |       |            |         |      |     |      |     |
| <i>Hepsetus odoe</i>                | X     | -          | X       | -    | -   | -    | -   |
| <b>Ichthyoridae</b>                 |       |            |         |      |     |      |     |
| <i>Phago loricatus</i>              | -     | -          | X       | X    | -   | -    | -   |
| <b>Centropomidae</b>                |       |            |         |      |     |      |     |
| <i>Lates niloticus</i>              | X     | X          | X       | X    | -   | -    | -   |
| <b>Mochokidae</b>                   |       |            |         |      |     |      |     |
| <i>Synodontis clarias</i>           | X     | X          | X       | -    | -   | -    | -   |
| <i>Synodontis gambensis</i>         | -     | -          | X       | -    | X   | -    | -   |
| <i>Synodontis nigrita</i>           | -     | X          | X       | -    | -   | -    | -   |
| <i>Synodontis sorex</i>             | -     | -          | X       | -    | -   | -    | -   |
| <i>Synodontis schall</i>            | X     | -          | -       | -    | X   | -    | -   |
| <i>Synodontis filamentosus</i>      | -     | -          | X       | -    | -   | -    | -   |
| <i>Synodontis resupinatus</i>       | X     | -          | -       | -    | -   | -    | -   |
| <i>Synodontis batensoda</i>         | -     | X          | -       | X    | -   | -    | -   |
| <i>Syndontis eupterus</i>           | -     | -          | -       | -    | -   | -    | -   |
| <i>Synodontis ocellifer</i>         | X     | -          | -       | -    | -   | -    | -   |
| <i>Synodontis gobroni</i>           | -     | X          | -       | -    | -   | -    | -   |
| <b>Channidae</b>                    |       |            |         |      |     |      |     |
| <i>Parachanna obscura</i>           | X     | -          | X       | X    | X   | -    | X   |
| <b>Anabantidae</b>                  |       |            |         |      |     |      |     |
| <i>Ctenopoma kingslayae</i>         | -     | -          | X       | -    | X   | -    | -   |
| <b>Distichodontidae</b>             |       |            |         |      |     |      |     |
| <i>Distichodus rostratus</i>        | X     | -          | X       | -    | -   | -    | -   |
| <i>Distichodus brevipinis</i>       | X     | -          | X       | -    | -   | -    | -   |
| <i>Distichodus engecephalus</i>     | X     | -          | -       | -    | -   | -    | -   |
| <i>Nanaethiops unitaenicatus</i>    | -     | -          | -       | -    | -   | -    | X   |
| <b>Citharinidae</b>                 |       |            |         |      |     |      |     |
| <i>Citharinus citharus citharus</i> | X     | X          | -       | -    | -   | -    | -   |
| <i>Citharinus lotus</i>             | X     | -          | -       | -    | -   | -    | -   |
| <i>Citharinus distichodoides</i>    | X     | -          | -       | -    | -   | -    | -   |
| <b>Cyprinidae</b>                   |       |            |         |      |     |      |     |
| <i>Barbus occidentalis</i>          | -     | -          | X       | X    | -   | X    | -   |
| <i>Labeo senegalensis</i>           | X     | X          | -       | -    | -   | X    | X   |
| <i>Labeo coubie</i>                 | -     | X          | -       | X    | -   | -    | -   |
| <i>Labeo brachypoma</i>             | X     | -          | -       | -    | -   | -    | -   |
| <i>Barilius senegalensis</i>        | -     | -          | -       | -    | -   | -    | X   |
| <b>Protopteridae</b>                |       |            |         |      |     |      |     |
| <i>Protopterus annectens</i>        | -     | X          | -       | -    | -   | -    | -   |
| <b>Malapteruridae</b>               |       |            |         |      |     |      |     |
| <i>Malapterurus electricus</i>      | X     | X          | -       | -    | -   | -    | -   |
| <b>Gymnarchidae</b>                 |       |            |         |      |     |      |     |
| <i>Gymnarchus niloticus</i>         | X     | -          | -       | -    | -   | -    | -   |
| <b>Tetraodontidae</b>               |       |            |         |      |     |      |     |
| <i>Tetraodon lineatus</i>           | X     | -          | -       | -    | -   | -    | -   |
| <b>Cyprinodontidae</b>              |       |            |         |      |     |      |     |
| <i>Epiplatys sexfasciatus</i>       | -     | -          | -       | -    | -   | -    | -   |
| <b>Osteoglossidae</b>               |       |            |         |      |     |      |     |
| <i>Heterotis niloticus</i>          | -     | -          | -       | X    | -   | -    | -   |
| <b>Palaemonidae</b>                 |       |            |         |      |     |      |     |
| <i>Macrobrachium</i> sp.            | -     | -          | -       | X    | -   | -    | -   |
| <b>Notopteridae</b>                 |       |            |         |      |     |      |     |
| <i>Papyrocranus afer</i>            | X     | -          | -       | -    | -   | -    | -   |
| <i>Xenomystus nigri</i>             | X     | -          | -       | -    | -   | -    | -   |

X = Present; - = Absent

Table 2: Showing fish species peculiarities of the various lakess

| Lakes      | Fish species  |
|------------|---|
| Asejire    | <i>Tilapia dagetti</i><br><i>Brycinus leuciscus</i><br><i>Chromidotilapia guentheri</i><br><i>Gnathonemus pictus</i>  |
| Oyan       | <i>Tilapia macrocephala</i><br><i>Clarias submarginatus</i><br><i>Hippopotamyrus psittacus</i><br><i>Macrobrachium</i> sp.<br><i>Heterotis niloticus</i>  |
| Oguta      | <i>Tylochromis sudanensis</i><br><i>Alestes brevis</i><br><i>Synodontis resupinatus</i><br><i>Pappyrocranus afer</i><br><i>Xenomystus nigri</i><br><i>Gymnarchus niloticus</i><br><i>Labeo brachypoma</i><br><i>Citharinus distichodoides</i><br><i>Citharinus latus</i><br><i>Distochodus engycephalus</i><br><i>Synodontis eupterus</i> |
| Tiga       | <i>Alestes dentex</i>   |
| Dadin Kowa | <i>Barilius senegalensis</i><br><i>Micralestes acutidens</i><br><i>Protopterus annectens</i><br><i>Synodontis gobroni</i>   |
| Asa        | <i>Clarias senegalensis</i><br><i>Clarias angolensis</i><br><i>Gnathonemus cyprinoids</i><br><i>Petrocephalus bovei</i>   |
| Opi        | <i>Mormyrops hasselquistii</i><br><i>Mormyrops engystoma</i><br><i>Epiplatys sexfasciatus</i><br><i>Namaethiops unitaeniatus</i>  |

shows fish species and the various families recorded from the seven lakes. A total of ninety species from twenty-five families were recorded for the lakes. Out of the seven lakes, Asejire had the highest number of fish species (41) followed by Oguta (39), Oyan (36), Dadin kowa (28), Asa (21), Tiga (19) while Opi lake recorded the lowest number of species (13). Akinyemi *et al.* (1985) reported that Asejire lake is rich in terms of fish species diversity.

Nwadiaro (1989) reported that Oguta lake is one of the largest natural lakes in the South Eastern Nigeria and attributed the high diversity of the ichthyofauna in the lake to its intimate contact with three rivers, one of which (the River Orashi) joins the River Niger known to be rich in fish fauna while Inyang (1995) did report that the diversity of fish fauna in Opi lake is relatively poor. This could be due to the small size/surface area of the lake. Nautiyal and Rizvi (2005) reported that as per species richness-area relationship, the number of species increased with corresponding increase in surface area.

Asa dam could be said to be a body of tropical man-made lake that is fairly rich in both variety and abundance of fish species compared with Tiga and Opi lakes. However, Omotosho (1998) reported that more investigations would reveal more species in this water

body. In terms of families, Oguta lake recorded the highest (17) followed by Asejire (15), Dadin kowa and Oyan (14), Asa (10), Opi (9) and the lowest being Tiga (8). The distribution of some families reflected the effects of habitat alteration (Inyang, 1995). Many migratory fish are also affected in terms of their distribution as a result of impoundment (Welcomme, 1979).

In the same vein, Obeng asserted that dam construction alters fish communities both up and down stream of the barrier while Cross and Braasch (1968) also reported that changes in water quality as a result of human activities are also known to affect fish communities. Opi lake according to Inyang (1995) has acidic oligotrophic condition which favours some fish species over the others. This is could be the reason why the lake recorded low fish families.

Similarities and peculiarities of fish fauna elucidate to some extent geographical location because great significance is attached to the occurrence of some species in distinct locations. Dadin kowa, Tiga and Asa lakes are located in the North while Asejire, Opi and Oguta are located in the Southern part of the country. *Tilapia zillii* is the only species common to all the lakes (Table 1).

Bonetto *et al.* (1969) in his study of Parana river valley reported that lakes had their own peculiar species composition. Table 2 shows that Oguta lake is highest with twelve species that is peculiar to that water body followed by Asejire (6), Dadin Kowa and Oyan with (5) each, Asa and Opi with (4) each while Tiga recorded the lowest (2).

*Tilapia dagetti*, *Brycinus leuciscus*, *Chromidotilapia guentheri* and *Gnathonemus pictus* were only recorded in Asejire alone while *Alestes dentex* and *Barilius senegalensis* were restricted to Tiga lake. This could be due to geographical location and nature of the water body. Fish communities according to Benech *et al.* (1983) cannot be equivalent to ichthyocoenoses due to sampling of a group of fish in a particular environment at a given time. Table 1 shows fish families that are common while others are restricted to some of these lakes.

The family Polypteridae only found in Dadin Kowa, Osteoglossidae and Palaemonidae in Oyan while Notopteridae is restricted to Oguta lake. This could be due to the nature of the habitat in terms of size, plant and animal compositions which can accommodate these families. Diversity indices gives an idea of how rich a water body is in terms of fish species. From analysis Asejire has the highest (0.5) followed by Oguta and Oyan with 0.4, Dadin Kowa 0.3, Tiga 0.2 and Asa with 0.2 then Opi lake with 0.1 which were not significantly different ( $p > 0.05$ ).

## CONCLUSION

Twenty-five families were recorded for the seven lakes analyzed. While Asejire had the highest in terms of different species, Opi lake recorded the lowest. Oguta lake recorded the highest number of families while Tiga had lowest number of fish families. There was no significant difference ( $p > 0.05$ ) between the diversity indices of these lakes. Locations and sizes of these water bodies have influence on fish species richness, diversity, similarities and peculiarities.

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