



Preliminary investigation of the fish fauna composition and abundance of this brackish open lagoon

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Abstract

The fish fauna of Lekki lagoon in south-western part of Nigeria was studied from March 2006 to February 2008. Sampling was carried out once a month using different fishing gears and the market was visited to confirm the fish species diversity from the lagoon. A total of 16,960 specimens made up of juveniles and adults caught were identified and classified. They comprised of eighty-one species belonging to 40 families, 56 genera and 14 orders. Variation in the mesh of fishing gears used greatly influenced fish catch in the lagoon. The fish species encountered were of three ecological origin and seasonal occurrence in the Lekki Lagoon. There were eleven fishes of euryhaline origin which occurred mostly throughout the year, fifty-six fishes of freshwater origin and ten fishes of marine origin. The dominant fish species in the catches of the fisher folks between March 2006 and February 2008 were *Chrysichthys nigrodigitatus*, *Chrysichthys filamentosus*, *Tilapia guineensis*, *Tilapia zillii*, *Gymnarchus niloticus*, *Mormyrus rume*, *Elops lacerta*, *Liza falapinnis*, *Clarias agboyiensis*, *Polydactylus quadrifilis*, *Synodontis clarias* and *Cynolossus senegalensis*. The high number of species (81) recorded for Lekkilagoon in this study confirms the fact that the lagoon is a transition zone between brackish and freshwater systems.

Keywords: Ichthyofauna, low brackish, fishing gears, Lekki lagoon.

INTRODUCTION

Lekki lagoon is in the eastern part of Lagos State, Nigeria. This lagoon impacts significantly on the lives of Lagosians. It is one of the four major lagoons in the Nigerian coastal system. It is used primarily for fishing, aquaculture, sand mining and recreation activities. The lagoon is also important in conservation terms because of the great diversity of endemic species. Fish and fishing related activities are among the main occupation of the majority of the people in the surrounding communities. The fishery productivity of the Lekki lagoon is put above 42.1 kg/ha/yr (Emmanuel, 2009). The fishery is diverse with about 35 landing sites and more than 6000 fishers. According to Olaosebikan and Raji (1998) the freshwater

food fishes found in Nigeria are about 268 different species. They inhabit over 34 well-known freshwater bodies (rivers, lakes, reservoirs and lagoons), which constitute about 12% of Nigeria's total surface area which is put at 94,185,000 ha (Ita, 1993). Oguzie (1997) produced a key to some of the freshwater fishes of Nigeria as adopted from Boulenger (1916) and Olaosebikan and Raji (1998). The key agreed with the identification method published by Leveque et al. (1991) on the freshwater fishes of the NILO-Sudan river basin in Africa. Welman (1948) produced a list of 181 species of fishes that could be found in Nigeria inland waters. It was further reported that there are about 145 species of fish

in the areas of the Kainji Lake basin. The report also revealed that Anambra, Kaduna and Sokoto/Rima Rivers have 23, 28 and 22 species respectively. Cross River, Ogun and Osun Rivers have 39, 23 and 23 fish species respectively. Olaosebikan and Raji (1998) published a list of African freshwater fishes to include 976 species, referable to 185 genera and 43 families. Ita (1993) reported that an estimated 230 species of fish have been recorded from the rivers of Nigeria, but no record is available on the species present in Rivers like Benin and Calabar which all empty directly into the ocean.

Knowledge of fish biology and species composition of different water bodies is necessary to enhance the management of water resources. Until now, published information on the fishes and fisheries of the lagoons of the south-western Nigeria has been mainly on Lagos lagoon (FAO, 1969; Fagade, 1969; Fagade and Olaniyan, 1974; Solarin, 1998; Emmanuel et al., 2008a, b). Recently, fishing pressure on the Lekki lagoon is high and there have been clearance on the landward side for agriculture. The swamp forests and rain forests of the area have been largely destroyed. All these have impacted greatly on the lagoon ecosystem in terms of the physical structure and physico-chemical parameters, which invariably result in changes in the fishery resources and making the conservation status of the area to be unprotected. Apart from the work of Kusemiju (1973) on catfish's biology and fishery over three decades ago, no major work has been done on the fishes and fisheries of the Lekki lagoon. Most recent investigations on the lagoon have focused on condition factors, fat and protein content of five fish species (Saliu et al., 2007) and population parameter of *Macrobrachium vollenhoevenii* (Abohweyere and Falaye, 2008). There is no literature record of the ichthyofauna composition of the Lekki lagoon. There is however, a need for studies on the abundance and diversity of the ichthyofauna of the Lekki lagoon, to serve as database information of the composition of the various fish species in the lagoon. Therefore, the present study is a preliminary investigation of the fish fauna composition and abundance of this major lagoon, with the view to appraising the economic importance of this lagoon in the area of fish protein supply in the area.

MATERIALS AND METHODS

Description of the study site

The Lekki lagoon is one of the largest lagoons in West Africa and it supports a major fishery. The lagoon is located between Lagos and Ogun States of Nigeria and lies between longitude 4° 00' and 4° 15' E and between latitude 6° 25' and 6° 37' N (Figure 1). The lagoon has a surface area of about 247 km² and it is mostly shallow (less than 3.0 m deep), the maximum depth being 12.25 m. Lekki lagoon is a freshwater environment fed by River Oni in the north eastern part and by Rivers Osun and Saga in the north western parts of the lagoon. It opens into the sea via the Lagos lagoon and harbour. The lagoon is transitional in that it connects three south western states

(Ondo, Ogun and Lagos). The lagoon is part of an intricate system of waterways made up of lagoons and creeks that are found along the coast of South-western Nigeria from the Dahomey border to the Niger Delta.

The two distinct seasons (dry and rainy) are observable in the lagoon which is typical of the southern part of Nigeria.

The vegetation around the Lekki lagoon consists mainly of stilt rooted trees, a dense undergrowth of shrub and raphia palms (*Raphia sudanica*) and oil palms (*Elaeis guineensis*). The floating grass (*Saccarum* sp) occurred on the periphery of the lagoon while coconut palms (*Cocos nucifera*) are widely distributed in the surrounding villages. Some parts of the lagoon are covered by floating plant like the water lettuce, *Pistia stratiotes*, duck weed, *Lemna* sp and the water hyacinth, *Eichhornia crassipes* are always found in the periphery and are distributed all over the lagoon during the dry season especially December, January, February and early March of the year.

Fish sampling procedure

Fish collections were made through the assistance of local fishermen using gillnets, castnets, longlines, basket and bamboo traps. The fishing gears were set overnight (that is, they were set a day prior to the sampling) and were retrieved on the sampling day for data collection. Sampling was done once a month for two years (March, 2006 to February, 2008). Fish were identified to species level using the available literature on the coastal waters of Nigeria (Schneider, 1990; Holden and Reed, 1991; Olaosebikan and Raji, 1998).

Fish species analysis

All fish species collected were counted to determine species abundance. Numerical abundance of the fish species was observed and noted. The abundance of each species was estimated according to the following criteria as described by Benech et al. (1983):

- ≥ 10% = dominant
- 1 to 9% = subdominant
- < 1% (but caught more than once) = occasional
- < 1% (and caught only once) = rare.

In the market, the catch abundance was recorded using these keys: 1 (very abundant), 2 (abundant), 3 (few) and 4 (rare) as described by Emmanuel (2009).

RESULTS

General survey of the fish fauna in Lekki lagoon

A total of 16,960 specimens made up of juveniles and adults caught with different fishing gears types in the Lekki lagoon, were identified and classified. They comprised eighty-one species belonging to 40 families, 56 genera and 14 orders. Decapod crustaceans comprised the freshwater prawns (*M. vollenhoevenii* (Herklots) and *Macrobrachium macrobrachion* (Herklots) and the swimming crab *Callinectes amnicola* (De Rocheburne). Table 1 shows a list of fish order, family and species, the size and weight ranges of the fish specimens. Anabantidae was represented by species

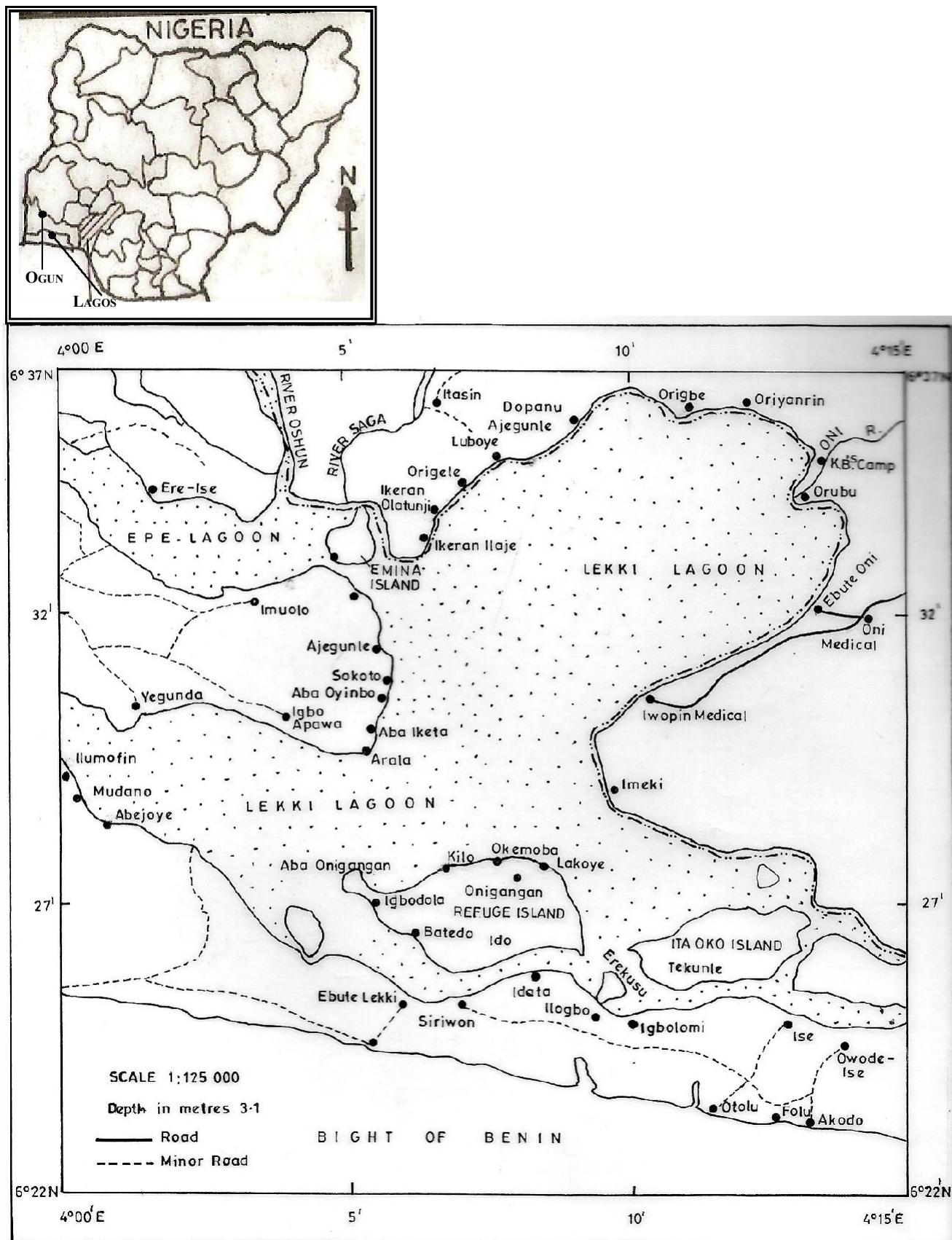


Figure 1. Map of Lekki Lagoon and its environs.

Table 1. Fish species composition in Lekki Lagoon, their weight and length.

Order/Family/Species	Total length range (cm)	Standard length (cm)	Weight (g)
Perciformes			
Anabantidae			
<i>Ctenopoma petherici</i> (Gunther, 1864)	6.0- 13.5	4.5 - 11.0	20.0 - 95
Centropomidae			
<i>Lates niloticus</i> (Linne, 1762)	10.5 - 60.0	8.2 - 55.0	40.0 - 4000
Carangidae			
<i>Caranx hippos</i> (Linnaeus, 1766)	5.5- 59.5	4.0 - 53.5	9.0 - 3900
<i>Trachinotus teraia</i> (Cuvier, 1832)	9.5- 45.0	7.0 - 40.5	20.0 - 3600
Cichlidae			
<i>Tilapia guineensis</i> (Bleeker, 1862)	4.0- 21.0	3.0 - 19.5	2.81 - 700
<i>Tilapia zilli</i> (Gervais, 1848)	5.5- 24.0	3.5 - 18.40	5.94 - 530
<i>Tilapia mariae</i> (Boulenger, 1899)	5.7- 16.0	3.5 - 14.5	3.0 - 410
<i>Chromidotilapia guntheriguntheri</i> (Sauvage, 1882)	5.0- 12.0	3.0- 9.5	4.0 - 200
<i>Sarotherodon melanotheron</i> (Rupell, 1852)	4.4- 16.0	3.0 - 14.0	3.70 - 375
<i>Oreochromis niloticus</i> (Linne, 1758)	6.8- 26.0	4.5 - 23.0	13.0 - 857
<i>Hemichromis fasciatus</i> (Peters, 1852)	4.4- 12.0	3.2 - 10.0	4.16 - 120
<i>Hemichromis bimaculatus</i> (Gill, 1862)	3.9- 10.0	2.5- 8.5	3.39 - 30.0
Eleotridae			
<i>Eleotris vittata</i> (Dumeril, 1858)	7.8- 14.5	5.5 - 10.5	7.95 - 150.0
<i>Kribia nana</i> (Boulenger, 1961)	3.4 - 4.5	2.5- 3.5	3.40 - 10.0
Channidae			
<i>Parachanna obscura</i> (Gunther, 1861)	14.1 - 30.8	11.5- 28.5	89.5 - 400
<i>Parachanna africana</i> (Steindachner, 1879)	13.0 - 29.5	10.2- 27.0	79.8 - 390
Pomadasysidae			
<i>Pomadasys jubelini</i> (Cuvier, 1830)	9.3- 22.0	7.0 – 19.5	19.75 - 309
Lutjanidae			
<i>Lutjanus dentatus</i> (Dumeril, 1860)	9.3- 22.0	7.0 - 18.0	20.20 - 311
Polynemidae			
<i>Polydactylus quadrifilis</i> (Cuvier, 1829)	18.0- 105.0	16.0- 85.0	20.70 - 6000
Gobiidae			
<i>Bathygobius soporator</i> (Valenciennes, 1873)	12.90 - 14.60	10.90 - 12.5	24.8 - 40.0
<i>Goboides ansorgii</i> (Boulenger, 1909)	15.40 - 32.50	13.00- 30.10	25.0 - 65.0
Sphyraenidae			
<i>Sphyraena barracuda</i> (Walbaum, 1792)	30.9- 103.0	27.5- 87.0	98.5 - 4000
Monodactylidae			
<i>Psettias sebae</i> (Cuvier, 1931)	5.5- 10.5	3.5- 8.2	10.5 - 65.0
Distichodontidae			
<i>Ichthyborus monodi</i> (Pellegrin, 1929)	6.0- 16.5	4.0 - 14.0	16.9 - 66.5
Rajiformes			
Dasyatidae			
<i>Dasyatis garouaensis</i> (Stauch and Blanc, 1962)	35.0		600
Polypteriformes			
Polypteridae			
<i>Polypterus senegalus senegalus</i> (Cuvier, 1829)	9.0- 30.0	7.0 - 28.0	20.5 - 150.0
<i>Erpetoichthys calabaricus</i> (Smith, 1866)	20.2 - 35.5	18.0- 33.5	19.5 - 50.2
Elopiformes			
Elopidae			
<i>Elops lacerta</i> (Valenciennes, 1846)	11.0 - 27.0	9.2 - 25.0	9.5 - 241

Table 1. Contd.

Osteoglossiformes			
Pantodontidae			
<i>Pantodon buchholzi</i> (Peters, 1876)	5.6 - 10.0	3.0 - 7.0	10.0 - 20.0
Notopteridae			
<i>Papyrocranus afer</i> (Gunther, 1868)	12.2 - 55.5	10.5 - 52.0	12.5 - 1069
<i>Xenomystus nigri</i> (Gunther, 1868)	12.0 - 45.0	10.0 - 42.0	13.0 - 1050
Osteoglossidae			
<i>Heterotis niloticus</i> (Cuvier, 1829)	14.5 - 54.5	12.0 - 50.5	20.0 - 2000
Mormyriiformes			
Mormyridae			
<i>Mormyrus rume</i> (Valenciennes, 1846)	12.5 - 48.0	9.5 - 46.5	15.6 - 868
<i>Mormyrus macrophthalmus</i> (Gunther, 1866)	12.2 - 30.1	9.2 - 46.5	20.0 - 600
<i>Hippopotamyrus pictus</i> (Marcusen, 1864)	5.5 - 15.5	4.0 - 12.5	15.0 - 50.5
<i>Hippopotamyrus psittacus</i>	6.5 - 25.0	5.0 - 23.0	18.0 - 75.9
<i>Hyperopisus bebe</i> (Lacepede, 1803)	15.6 - 50.0	12.5 - 48.0	20.5 - 850
<i>Mormyrops anguilloides</i> (Linnaeus, 1758)	9.1 - 63.3	7.0 - 60.0	5.8 - 2453
<i>Marcusenius senegalensis</i> (Steindachner, 1870)	9.6 - 27.3	7.0 - 25.3	10.0 - 248
<i>Pollimyrus adspersus</i> (Gunther, 1866)	5.2 - 9.6	3.5 - 7.2	17.0 - 50.0
<i>Marcusenius brucii</i> (Boulenger, 1910)	6.3 - 30.8	5.0 - 28.5	12.1 - 515
<i>Brienomyrus longianalis</i> (Boulenger, 1901)	16.0 - 30.8	14.0 - 28.5	50 - 610
<i>Gnathonemus petersii</i> (Gunther, 1862)	15.0 - 35.0	13.5 - 33.0	48.5 - 590
<i>Mormyrops caballus</i> (Pellérdin, 1927)	9.1 - 46.0	7.1 - 44.2	15.8 - 850
Gymnarchidae			
<i>Gymmarchus niloticus</i> (Cuvier, 1829)	35.0 - 120.0	32.5 - 117	89.0 - 3000
Clupeiformes			
Clupeidae			
<i>Pellonula afzeliusi</i> (Johnels, 1954)	4.0 - 10.1	3.0 - 8.0	5.0 - 26.0
<i>Ethmalosa fimbriata</i> (Bowdich, 1825)	8.70-14.70	6.80-11.40	5.35-32.26
Characiformes			
Citharinidae			
<i>Citharinus latus</i> (Muller and Troschal, 1845)	7.0 - 46.0	5.0 - 43.5	25.5 - 1065
<i>Cithranus citharus</i> (Goeffrey Saint Hilane, 1809)	10.0 - 50.0	8.0 - 47.5	45.0 - 2010
Hepsetidae			
<i>Hepsetus odoe</i> (Bloch, 1794)	7.5 - 30.5	5.6 - 28.8	9.26 - 856
Characidae			
<i>Alestes macrophthalmus</i> (Gunther, 1867)	20.5 - 30.6	18.2 - 29.0	45.0 - 150.0
<i>Alestes baremose</i> (de Joannis, 1835)	10.5 - 40.5	8.5 - 38.2	20.2 - 300
<i>Brycinus nurse</i> (Ruppell, 1832)	5.3 - 20.5	3.8 - 18.2	5.2 - 212
<i>Brycinus longipinnus</i> (Gunther, 1864)	4.8 - 10.7	3.0 - 8.8	3.6 - 41.6
Siluriformes			
Bagridae			
<i>Chrysichthys Walkeri</i>	5.5 - 36.5	3.5 - 33.6	4.36 - 724
<i>Chrysichthys nigrodigitatus</i> (Lacepede, 1803)	5.8 - 42.5	4.0 - 40.5	5.0 - 1500
<i>Chrysichthys filamentosus</i> (Boulenger, 1912)	5.6 - 38.5	3.8 - 36.8	4.0 - 798
<i>Parauchenoglanis akiri</i> (Risch, 1987)	10.0 - 12.5	8.0 - 10.0	15.9 - 45.6
<i>Auchenoglanis occidentalis</i> (Valenciennes, 1840)	15.0 - 20.0	13.0 - 18.0	24.0 - 50.1

Table 1. Contd.

Schilbeidae			
<i>Schilbe mystus</i> (Linne, 1758)	7.0 - 21.0	5.8 - 19.0	4.15 - 119.5
<i>Schilbe uranoscopus</i> (Ruppell, 1832)	6.2 - 28.5	5.0 - 26.5	7.61 - 360
Clariidae			
<i>Clarias gariepinus</i> (Burchell, 1822)	20.0 - 50.5	17.0 - 46.8	78.00 - 1920
<i>Clarias agboyiensis</i> (Boulenger, 1909)	10.2 - 20.0	7.5 - 17.9	22.8 - 64.25
<i>Clarias anguillaries</i> (Line, Sydenham, 1980)	11.2 - 21.0	8.5 - 18.7	21.9 - 72.96
<i>Heterobranchus longifilis</i> (Valenciennes, 1840)	9.0 - 34.5	7.2 - 31.5	17.0 - 65.0
Malapteruridae			
<i>Malapterurus electricus</i> (Gmelin, 1789)	13.0 - 16.5	11.5 - 14.0	60.6 - 89.8
<i>Malapterurus minjiraya</i> (Sagua, 1987)	14.0 - 17.5	12.2 - 15.0	64.7 - 92.0
Mochokidae			
<i>Synodontis eupterus</i>	4.5 - 22.0	3.0 - 20.0	9.2 - 218
<i>Synodontis clarias</i> (Linne, 1758)	5.5 - 22.5	3.8 - 21.0	10.2 - 316
<i>Synodontis couterti</i> (Pellergin, 1906)	6.5 - 20.6	4.2 - 18.0	10.5 - 212
<i>Synodontis filamentosus</i> (Boulenger, 1901)	5.5 - 18.6	3.0 - 16.2	8.9 - 200
Mugiliformes			
Mugilidae			
<i>Liza falcipinnis</i> (Valenciennes, 1836)	13.0 - 26.5	10.5 - 19.2	41.6 - 200
<i>Mugil cephalus</i> (Linnaeus, 1758)	12.5 - 20.5	10.0 - 18.0	41.2 - 360
Synbranchiformes			
Mastacembelidae			
<i>Caecomastacembelus decorsei</i> (Pellegrin, 1919)	14.2 - 36.5	12.5 - 35.0	20.0 - 96.0
Pleuronectiformes			
Citharidae			
<i>Citharus linguatula</i> (Linnaeus, 1758)	10.30 - 15.0	8.0 - 13.2	9.0 - 15.9
Cynoglossidae			
<i>Cynoglossus senegalensis</i> (Kaup, 1858)	15.6 - 54.0	13.8 - 49.2	20.0 - 460.0
Gonorychiformes			
Phractolaemidae			
<i>Phractolaemus ansorgii</i> (Boulenger, 1901)	10.5 - 19.0	8.0 - 17.0	17.0 - 56.0
Decapoda			
Palaemonidae			
<i>Macrobrachium vollenhoveni</i>	6.4 - 13.0	3.00 - 600*	6.06 - 32.4
<i>Macrobrachium macrobrachion</i>	6.4 - 12.00	3.00 - 5.50*	6.04 - 28.29
Portunidae			
<i>Callinectes amnicola</i>	3.4 - 15.5**		19.5 - 115.5

*Carapace length, **Carapace width.

(*Ctenopoma petherici*)). Currently the species was caught mainly with double funnel traps in and around the River Saga's mouth. Dasyatidae was represented by only one species *Dasyatis garouaensis* (Stanch & Blanc) and

being listed in the Lekki Lagoon for the first time. The species was caught with boat seine in the sandy area of the Agan in the centre of the lagoon. The length of 65.0 cm and a weight of 400 g were recorded for the species.

The family mormyridae was represented with twelve species. This family had the highest species diversity in the lagoon. Only two specimens of *H. longifilis* were recorded throughout this study. The fish species and the target fishing gear are shown in Table 2.

Fish species and their ecological origin

The fish species were of three ecological origin and seasonal occurrence in the Lekki Lagoon. There were eleven fishes of euryhaline origin which occurred mostly throughout the year, fifty-six fishes of freshwater origin and ten fishes of marine origin occurred in Lekki Lagoon during this study (Table 3).

Fish species dominance in Lekki lagoon

The dominant fish species in the catches of the fisher folks during the year between March 2006 and February 2008 were *Chrysichthys nigrodigitatus*, *Chrysichthysfilamentosus*, *Tilapia guineensis*, *T. zilli*, *Gymnarchus niloticus*, *Mormyrus rume*, *Elops lacerta*, *Liza falapinnis*, *Clarias agboyiensis*, *Polydactylus quadrifilis*, *Synodontis clarias* and *Cynolossus senegalensis*. Other fish species observed in the fisher-folks catches during the rainy season period were *Ethmalosa fimbriata*, *Lates niloticus*, *Tilapia marie*, *Sarotherodon melanotheron*, *Chromidotilapia guntheri guntheri*, *Oreochromis niloticus*, *Pomadasys jubelini*, *Lutjanus agenes*, *Eleotris vitata*, *Caranx hippos*, *Hemichromis bimaculatus*, *Bathgobius soporator*, *Pantodon buchholzi*, *Papyrocranus afer*, *Sphyreana barracuda*, *Xenomystus nigri*, *Mormyrops anguilloides*, *Marcusenius bruci*, *Pellonula afzeluisi*, *Citharinus latus*, *Trachinotus teraia*, *Citharus citharus*, *Alestes macrophthalmus*, *Brycinus nurse*, *Schilbe uranoscopus*, *Citharus linguatula*, *Citharus linguatula*, *M. vollenhoevenii* and *M. macrobrachion*. Few of the lagoonspecies were recorded for dry season; there were *Parachanna africana*, *Xenomystus nigri*, *Hippopotamyrus pictus*, *Hyperopisus bebe*, *Marcusenius senegalensis*, *Polymus adspersus*, *Brienomyrus longuanalis*, *Alestes baremose*, *Parauchenoglanis akiri*, *Hepsetus odoe*, *Clarias anguillaries*, *Malapterurus minijiraya*, *Synodontis filamentosus* and *Phractolaenus ansorgii*. Fish speciesdominance and seasonal variation is shown in Table 4.

DISCUSSION

This study provides general information on the fish species composition and assemblages of Lekki lagoon. However, the wet season is typically the period of the highest fish abundance and species richness in the area as well as the period of highest population densities of juvenile species and a single attempt to examine year-

to-year variation in this area did not find significant differences in fish assemblage structure (Emmanuel, 2009). Due to the relationship between the sea and inland waters, the lagoon is characterized by environmental unpredictability. The high number of species recorded in wet season shows that Lekki lagoon is an important spawning and nursery area. The nursery function of lagoons has been documented throughout the world (Blaber and Blaber, 1980; Lenanton, 1982; Robertson and Duke, 1987; Blaber and Milton, 1990; Emmanuel and Kusemiju, 2005; Emmanuel et al., 2008a, b). The lagoon supported a high diversity of fish species of fresh, brackish and marine water origins. They must have had ability to adapt and cope with the variable conditions (salinity and temperature) of the lagoon. Many fishes have evolved specialized physiological and behavioral adaptation (Zander et al., 1999). Increasing the specialization of these adaptations to cope with localized conditions may be a strategy to exist as a permanent lagoon resident. More fish species were recorded in this study compared to Kusemiju (1973) report over 3 decades ago in the lagoon where 28 species were recorded.

The interaction between fish and its habitat (physical, as well as biological characteristics) may be factors in predicting changes in overall abundance, breeding population size and other aspects of population structure (Koutrakis et al., 2000; Caldeira et al., 2001; Emmanuel and Onyema, 2007; Emmanuel, 2009). In addition to this, Beneech et al. (1983) reported that fish communities studied are not generally equivalent to ichthyocoenoses because the description of any fish community is a biased image arising from the sampling of a group of fishes in a particular environment at a given period. This may be so of the report of Kusemiju (1973) where a trawl was used as against diverse gears used in this study. The ichthyofauna of Lekki lagoon with 81 species belonging to 40 families, 56 genera and 15 orders appear richer than 60 species from 34 families of Lagos Lagoon (Solarin, 1998). The occurrence of fishes of both marine and euryhaline origins gave a sign of environmental alteration (salt water intrusion). Several workers have recognized the phenomena of an optimum salinity level would cause variation in the number of species available (Hesse et al., 1951; Hedgepeth, 1957).

Macan (1963) cited by Kusemiju (1973) observed that where masses of fresh water and seawater adjoined, species from each invaded the brackish region between them, but few penetrated far and the number of species at a midway between the two was small. Motwani and Kanwai (1970) worked in the completely freshwater environment and recorded 82 species of fish belonging to eighteen families at Kainji Lake, Nigeria. The high number of 81 species recorded for Lekki Lagoon in this study confirms the fact that the lagoon is a transitional zone between brackish and freshwater systems (Emmanuel, 2009).

Table 2. Fish species and the fishing gear used to catch them.

Species	Fishing gear types						
	GN	LL	CN	BS	BT	BAT	LN
<i>Ctenopoma petherici</i> (Gunther, 1864)	X				X		
<i>Lates niloticus</i> (Linne, 1762)	X	X		X			
<i>Caranx hippos</i> (Linnaeus, 1766)	X	X		X			
<i>Trachinotus teraia</i> (Cuvier, 1832)	X	X		X			
<i>Tilapia guineensis</i> (Bleeker, 1862)	X	X	X	X	X		
<i>Tilapia zilli</i> (Gervais, 1848)	X		X	X	X		
<i>Tilapia mariae</i> (Boulenger, 1899)	X		X	X	X		
<i>Chromidotilapia guntheriguntheri</i> (Sauvage, 1882)	X		X	X	X		
<i>Sarotherodon melanotheron</i> (Rupell, 1852)	X		X	X			
<i>Oreochromis niloticus</i> (Linne, 1758)	X		X	X			
<i>Hemichromis fasciatus</i> (Peters, 1852)	X		X	X	X		
<i>Hemichromis bimaculatus</i> (Gill, 1862)	X		X	X	X		
<i>Eleotris vittata</i> (Dumeril, 1858)				X	X		
<i>Kribia nana</i> (Boulenger, 1961)					X		
<i>Parachanna obscura</i> (Gunther, 1861)	X			X	X		
<i>Parachanna africana</i> (Steindachner, 1879)	X			X	X		
<i>Pomadasys jubelini</i> (Cuvier, 1830)	X			X			
<i>Lutjanus dentatus</i> (Dumeril, 1860)	X		X	X			
<i>Polydactylus quadrifilis</i> (Cuvier, 1829)	X	X		X			
<i>Bathygobius soporator</i> (Valenciennes, 1873)	X			X			
<i>Goboides ansorgii</i> (Boulenger, 1909)	X			X			
<i>Sphyræna barracuda</i> (Walbaum, 1792)	X	X	X	X			
<i>Psettias sebae</i> (Cuvier, 1931)	X	X	X	X			
<i>Ichthyborus monodi</i> (Pellegrin, 1929)	X		X	X			
<i>Dasyatis garouaensis</i> (Stauch & Blanc, 1962)	X	X		X			
<i>Polypterus senegalus senegalus</i> (Cuvier, 1829)					X		
<i>Erpetoichthys calabaricus</i> (Smith, 1866)					X		
<i>Elops lacerta</i> (Valenciennes, 1846)	X		X	X			
<i>Pantodon buchholzi</i> (Peters, 1876)					X		
<i>Papyrocranus afer</i> (Gunther, 1868)	X		X	X			
<i>Xenomystus nigri</i> (Gunther, 1868)	X		X	X			
<i>Heterotis niloticus</i> (Cuvier, 1829)	X		X	X			
<i>Mormyrus rume</i> (Valenciennes, 1846)	X		X	X	X		
<i>Mormyrus macrophthalmus</i> (Gunther, 1866)	X		X	X	X		
<i>Hippopotamyrus pictus</i> (Marcusen, 1864)	X		X	X	X		
<i>Hippopotamyrus psittacus</i> (Boulenger, 1897)	X		X	X	X		
<i>Hyperopisus bebe</i> (Lacepede, 1803)	X		X	X	X		
<i>Mormyrops anguilloides</i> (Linnaeus, 1758)	X		X	X	X		
<i>Marcusenius senegalensis</i> (Steindachner, 1870)	X		X	X	X		
<i>Pollimyrus adspersus</i> (Gunther, 1866)	X		X	X	X		
<i>Marcusenius brucii</i> (Boulenger, 1910)	X		X	X	X		
<i>Brienomyrus longianalis</i> (Boulenger, 1901)	X		X	X	X		
<i>Gnathonemus petersii</i> (Gunther, 1862)	X		X	X	X		
<i>Mormyrops caballus</i> (Pellegrin, 1927)	X		X	X	X		
<i>Gymmarchus niloticus</i> (Cuvier, 1829)	X	X	X	X			
<i>Pellonula afzeliusi</i> (Johnels, 1954)					X		X
<i>Ethmalosa fimbriata</i> (Bowdich, 1825)	X		X	X	X		
<i>Citharinus latus</i> (Muller & Troschal, 1845)	X			X			
<i>Citharinus citharus</i> (Goefrey Saint Hilane, 1809)	X			X			
<i>Hepsetus odoe</i> (Bloch, 1794)	X	X	X	X	X		

Table 2. Contd.

<i>Alestes macrophthalmus</i> (Gunther, 1867)	X		X	X	X	
<i>Alestes baremose</i> (de Joannis, 1835)	X		X	X	X	
<i>Brycinus nurse</i> (Ruppell, 1832)	X		X	X	X	
<i>Brycinus longipinnus</i> (Gunther, 1864)	X		X	X	X	
<i>Chrysichthys walkeri</i>	X	X	X	X	X	X
<i>Chrysichthys nigrodigitatus</i> (Lacepede, 1803)	X	X	X	X	X	X
<i>Chrysichthys filamentosus</i> (Boulenger, 1912)	X	X	X	X	X	X
<i>Parauchenoglanis akiri</i> (Risch, 1987)	X			X	X	
<i>Auchenoglanis occidentalis</i> (Valenciennes, 1840)	X	X	X	X	X	
<i>Schilbe mystus</i> (Linne, 1758)	X		X	X		
<i>Schilbe uranoscopus</i> (Ruppell, 1832)	X		X	X		
<i>Clarias gariepinus</i> (Burchell, 1822)	X	X	X	X	X	
<i>Clarias jaensis</i> (Boulenger, 1909)	X	X	X	X	X	
<i>Clarias agboyiensis</i> (Sydenham, 1980)	X	X	X	X	X	
<i>Clarias anguillaries</i> (Line, 1758)	X	X	X	X	X	
<i>Heterobranchus longifilis</i> (Valenciennes, 1840)	X	X	X	X	X	
<i>Malapterurus electricus</i> (Gmelin, 1789)	X			X		
<i>Malapterurus minjiraya</i> (Sagua, 1987)	X			X		
<i>Synodontis eupterus</i>	X	X	X	X		
<i>Synodontis clarias</i> (Linne, 1758)	X	X	X	X		
<i>Synodontis couterti</i> (Pellergrin, 1906)	X	X	X	X	X	
<i>Synodontis filamentosus</i> (Boulenger, 1901)	X	X	X	X	X	
<i>Liza falcipinnis</i> (Valenciennes, 1836)	X		X	X	X	
<i>Mugil cephalus</i> (Linnaeus, 1758)	X		X	X	X	
<i>Caecomastacembelus decorsei</i> (Pellegrin, 1919)						
<i>Citharus linguatula</i> (Linnaeus, 1758)	X		X	X	X	
<i>Cynoglossus senegalensis</i> (Kaup, 1858)	X		X	X		
<i>Phractolaemus ansorgii</i> (Boulenger, 1901)	X		X	X	X	
<i>Macrobrachium vollenhoveni</i>	X		X	X	X	
<i>Macrobrachium macrobrachion</i>	X		X	X	X	
<i>Callinectes amnicola</i>	X		X	X	X	

GN= gillnet; CN = cast net; LL = long line; BT = basket trap; BAT = Bamboo trap; LN = lift net.

Table 3. Fishes and their ecological origin in Lekki lagoon.

Freshwater origin	Euryhaline origin	Marine origin
<i>Ctenopoma petherici</i>	<i>Chrysichthys nigrodigitatus</i>	<i>Caranx hippos</i>
<i>Lates niloticus</i>	<i>Ethmalosa fimbriata</i>	<i>Trachinotus teraia</i>
<i>Tilapia zillii</i>	<i>Tilapia guineensis</i>	<i>Pomadasys jubelini</i>
<i>Tilapia marie</i>	<i>Pellonula afzeluizi</i>	<i>Lutjanus dentatus</i>
<i>Chromidotilapia guntheri guntheri</i>	<i>Elops lacerta</i>	<i>Sphyaena barracuda</i>
<i>Oreochromis niloticus</i>	<i>Liza falcipinnis</i>	<i>Ethmalosa fimbriata,</i>
<i>Hemichromis bimaculatus</i>	<i>Sarotherodon melanotheron</i>	<i>Liza falcipinnis</i>
<i>Eleotris vittata</i>	<i>Polydactylus quadrifilis</i>	<i>Mugil cephalus</i>
<i>Kribia nana</i>	<i>Bathygobius soporator</i>	<i>Citharus linguatula</i>
<i>Parachanna obscura</i>	<i>Cynoglossus senegalensis</i>	<i>Cynoglossus senegalensis</i>
<i>Parachanna africana</i>	<i>Psettias sebae</i>	
<i>Ichthyborus monodi</i>		
<i>Dasyatis garouaensis</i>		
<i>Polypterus senegalus senegalus</i>		

Table 3. Contd.

<i>Erpetoichthys calabaricus</i>
<i>Pantodon buchholzi</i>
<i>Papyrocranus afer</i>
<i>Hippopotamyrus pictus</i>
<i>Hyperopisus bebe</i>
<i>Mormyrops anguilloides</i>
<i>Marcusenius senegalensis</i>
<i>Pollimyrus adspersus</i>
<i>Marcusenius brucii</i>
<i>Brienomyrus longianalis</i>
<i>Gnathonemus petersii</i>
<i>Mormyrops caballus</i>
<i>Gymnarchus niloticus</i>
<i>Citharinus latu</i>
<i>Auchenoglanis occidentalis</i>
<i>Hepsetus odoe</i>
<i>Citharinus citharus</i>
<i>Alestes macrophthalmus</i>
<i>Alestes baremose</i>
<i>Brycinus nurse</i>
<i>Brycinus longipinnus</i>
<i>Chrysichthys walker</i>
<i>Chrysichthys filamentosus</i>
<i>Parauchenoglanis akiri</i>
<i>Schilbe mystus</i>
<i>Schilbe uranoscopus</i>
<i>Clarias gariepinus</i>
<i>Clarias jaensis</i>
<i>Clarias agboyiensis</i>
<i>Clarias anguillaries</i>
<i>Heterobranchus longifilis</i>
<i>Malapterurus electricus</i>
<i>Malapterurus minjiraya</i>
<i>Synodontis eupterus</i>
<i>Synodontis clarias</i>
<i>Synodontis courteti</i>
<i>Synodontis filamentosus</i>
<i>Caecomastacembelus decorsei</i>
<i>Phractolaemus ansorgii</i>

Table 4. Fish dominance and abundance in Lekki Lagoon.

Order/Family/Species	Mar 2006	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb 2007
Perciformes												
Anabantidae												
<i>Ctenopoma petherici</i> (Gunther, 1864)	2	2	4	4	4	3	4	3	2	1	3	3
Centropomidae												
<i>Lates niloticus</i> (Linne, 1762)	4	4	4	4	4		3	3	3	4	4	3
Carangidae												
<i>Caranx hippos</i> (Linnaeus, 1766)	4	4	4	3	3	2	4	3	4	3	4	3

Table 4. Contd.

<i>Trachinotus teraia</i> (Cuvier, 1832)	3	3	3	3	3	2	2	3	2	2	2	3
Cichlidae												
<i>Tilapia guineensis</i> (Bleeker, 1862)	1	3	1	1	1		1	1	1	1	1	1
<i>Tilapia zillii</i> (Gervais, 1848)	2	3	2	3	1		1	1	4	1	4	2
<i>Tilapia mariae</i> (Boulenger, 1899)	4	2	3	4	4		4	3	2	3	1	3
<i>Chromidotilapia guntherguntheri</i> (Sauvage, 1882)	3	3	4	4	4		2	4	1	1	2	4
<i>Sarotherodon melanotheron</i> (Rupell, 1852)	3	3	4	4	4		2	4	4	2	4	4
<i>Oreochromis niloticus</i> (Linne, 1758)	4	4	4	4	4		3	2	4	2	3	4
<i>Hemichromis fasciatus</i> (Peters, 1852)	3	3	3	4	4		4	4	3	3	2	2
<i>Hemichromis bimaculatus</i> (Gill, 1862)	3	3	3	4	4		3	4	4	4	4	4
Eleotridae												
<i>Eleotris vittata</i> (Dumeril, 1858)	4	3	3	4	4		2	3	2	-	4	4
<i>Kribia nana</i> (Boulenger, 1961)	4	4	4	4	4		4	4	4	-	4	4
Channidae												
<i>Parachanna obscura</i> (Gunther, 1861)	2	3	2	4	4	2	3	3	2	1	2	4
<i>Parachanna africana</i> (Steindachner, 1879)	2	3	4	4	4	4	4	4	4	4	4	4
Pomadasysidae												
<i>Pomadasys jubelini</i> (Cuvier, 1830)	3	3	4	3	3	3	3	3	3	3	3	3
Lutjanidae												
<i>Lutjanus dentatus</i> (Dumeril, 1860)	4	4	4	3	4	4	4	4	3	4	4	4
Polynemidae												
<i>Polydactylus quadrifilis</i> (Cuvier, 1829)	3	3	3	3	4	3	3	3	3	3	3	3
Gobiidae												
<i>Bathygobius soporator</i> (Valenciennes, 1873)	4	3	3	4	4	3	4	4	4	4	4	4
<i>Goboides ansorgii</i> (Boulenger, 1909)	4	4	3	4	4	3	4	4	3	3	4	4
Spyraenidae												
<i>Sphyaena barracuda</i> (Walbaum, 1792)	2	4	3	3	4	3	3	3	3	3	3	2
Monodactylidae												
<i>Psettias sebae</i> (Cuvier, 1931)	3	3	4	3	4	3	3	4	3	3	3	4
Distichodontidae												
<i>Ichthyborus monodi</i> (Pellegrin, 1929)	4	4	3	3	4	4	4	4	3	3	4	4
Rajiformes												
Dasyatidae												
<i>Dasyatis garouaensis</i> (Stauch and Blanc, 1962)	4	4	4	4	4	4	4	4	3	4	4	4
Polypteriformes												
Polypteridae												
<i>Polypterus senegalus senegalus</i> (Cuvier, 1829)	3	3	3	4	4	2	3	4	2	2	3	3
<i>Erpetoichthys calabaricus</i> (Smith, 1866)	3	3	4	4	4	4	4	4	1	1	1	4
Elopiformes												
Elopidae												
<i>Elops lacerta</i> (Valenciennes, 1846)	3	2	2	3	3	2	3	3	1	4	2	1
Osteoglossiformes												
Osteoglossidae												
<i>Heterotis niloticus</i>	4	4	3	2	2	2	3	3	3	4	4	4
Pantodontidae												
<i>Pantodon buchholzi</i> (Peters, 1876)	4	4	3	3	3	3	3	3	3	4	4	4
Notopteridae												
<i>Papyrocranus afer</i> (Gunther, 1868)	3	2	3	2	4	3	3	3	3	1	3	3

Table 4. Contd.

<i>Xenomystus nigri</i> (Gunther, 1868)	2	3	3	3	4	4	4	4	2	3	4	3
Mormyriiformes												
Mormyridae												
<i>Mormyrus rume</i> (Valenciennes, 1846)	2	2	2	2	2	2	4	4	2	2	1	3
<i>Mormyrus macrophthalmus</i> (Gunther, 1866)	2	3	4	2	4	2	4	4	4	4	2	4
<i>Hippopotamyrus pictus</i> (Marcusen, 1864)	3	4	4	4	4	4	4	4	4	4	1	2
<i>Hyperopisus bebe</i> (Lacepede, 1803)	3	4	4	4	4	4	4	4	4	2	4	4
<i>Mormyrops anguilloides</i> (Linnaeus, 1758)	3	4	4	4	4	4	2	2	2	4	4	4
<i>Marcusenius senegalensis</i> (Steindachner, 1870)	3	4	4	4	4	4	4	4	4	4	4	4
<i>Pollymus adspersus</i> (Gunther, 1866)	3	4	4	4	4	4	4	4	4	4	4	4
<i>Marcusenius brucii</i> (Boulenger, 1910)	3	4	4	2	4	4	2	4	4	4	4	4
<i>Brienomyrus longianalis</i> (Boulenger, 1901)	3	4	4	4	4	4	4	4	4	3	3	3
<i>Gnathonemus petersii</i> (Gunther, 1862)	3	4	3	2	2	4	1	4	1	2	4	4
<i>Mormyrops caballus</i> (Pellegrin, 1927)	3	3	4	3	3	3	2	2	2	3	3	4
<i>Hippopotamyrus psittacus</i> (Boulenger, 1897)	3	4	3	3	3	3	3	3	3	3	3	4
Gymnarchidae												
<i>Gymnarchus niloticus</i> (Cuvier, 1829)	3	3	3	2	2	3	2	2	1	1	1	4
Clupeiformes												
Clupeidae												
<i>Pellonula afzeliusi</i> (Johnels, 1954)	3	3	4	3	2	1	3	4	4	4	1	4
<i>Ethmalosa fimbriata</i> (Bowdich, 1825)	3	3	3	3	1	1	1	3	1	4	3	3
Characiformes												
Citharinidae												
<i>Citharinus latus</i> (Muller and Troschal, 1845)	4	4	4	4	3	3	3	3	3	4	4	4
<i>Citharus citharus</i> (Goeffroy Saint Hilane, 1809)	4	4	4	4	4	4	4	4	3	3	4	4
Hepsetidae												
<i>Hepsetus odoe</i> (Bloch, 1794)	3	3	3	4	4	4	4	4	3	3	2	3
Characidae												
<i>Alestes macrophthalmus</i> (Gunther, 1867)	3	3	3	3	3	3	3	3	4	3	4	1
<i>Alestes baremose</i> (de Joannis, 1835)	3	3	3	4	4	2	4	4	4	3	3	1
<i>Brycinus nurse</i> (Ruppell, 1832)	3	3	4	4	4	3	3	3	2	3	4	2
<i>Brycinus longipinnus</i> (Gunther, 1864)	3	4	4	4	4	4	4	4	1	4	3	3
Siluriformes												
Bagridae												
<i>Chrysichthys Walkeri</i> (Gunther, 1899)	2	3	4	4	4	1	4	2	4	1	1	1
<i>Chrysichthys nigrodigitatus</i> (Lacepede, 1803)	1	1	1	1	1	1	1	1	1	1	1	1
<i>Chrysichthys filamentosus</i> (Boulenger, 1912)	1	1	1	1	1	2	1	4	2	2	2	2
<i>Parauchenoglanis akiri</i> (Risch, 1987)	4	4	4	4	4	4	4	4	3	2	4	3
<i>Auchenoglanis occidentalis</i> (Valenciennes, 1840)	4	4	4	4	4	3	4	4	3	2	3	3
Schilbeidae												
<i>Schilbe mystus</i> (Linne, 1758)	3	2	2	2	2	2	1	1	3	2	3	3
<i>Schilbe uranoscopus</i> (Ruppell, 1832)	3	3	4	4	4	4	4	4	4	-	4	3
Clariidae												
<i>Clarias gariepinus</i> (Burchell, 1822)	2	2	2	4	2	1	4	3	3	1	1	1
<i>Clarias jaensis</i> (Boulenger, 1909)	3	3	4	4	2	4	4	1	1	1	3	2
<i>Clarias agboyiensis</i> (Sydenham, 1980)	3	3	4	4	4	2	1	4	4	1	4	2
<i>Clarias anguillaris</i> (Line, 1758)	3	3	1	1	1	4	4	4	4	4	4	3

Table 4. Contd.

<i>Heterobranchus longifilis</i> (Valenciennes, 1840)	4	4	2	4	4	4	4	4	3	4	4	4
Malapteruridae												
<i>Malapterurus electricus</i> (Gmelin, 1789)	3	3	3	2	2	2	3	4	2	2	2	3
<i>Malapterurus minjiraya</i> (Sagua, 1987)	3	3	4	4	4	4	4	4	4	4	4	3
Mochokidae												
<i>Synodontis eupterus</i>	3	3	4	4	4	4	4	4	1	4	4	3
<i>Synodontis clarias</i> (Linne, 1758)	2	2	2	1	1	1	1	2	1	3	1	2
<i>Synodontis couterti</i> (Pellegrin, 1906)	3	3	4	4	4	4	4	4	4	4	4	3
<i>Synodontis filamentosus</i> (Boulenger, 1901)	3	3	4	4	4	1	4	4	4	4	1	3
Mugiliformes												
Mugilidae												
<i>Liza falcipinnis</i> (Valenciennes, 1836)	2	2	3	2	2	2	2	3	4	4	1	2
<i>Mugil cephalus</i> (Linnaeus, 1758)	3	4	4	4	4	4	4	4	4	4	3	3
Synbranchiiformes												
Mastacembelidae												
<i>Caecomastacembelus decorsei</i> (Pellegrin, 1919)	3	3	4	3	4	4	4	4	4	4	4	3
Pleuronectiformes												
Citharidae												
<i>Citharus lingualata</i> (Linnaeus, 1758)	3	4	4	4	3	3	2	4	3	4	4	3
Cynoglossidae												
<i>Cynoglossus senegalensis</i> (Kaup, 1858)	2	3	3	4	3	2	2	3	3	2	2	2
Gonorychiformes												
Phractolaemidae												
<i>Phractolaemus ansorgii</i> (Boulenger, 1901)	3	3	4	4	4	4	4	4	4	4	3	2
Decapoda												
Palaemonidae												
<i>Macrobrachium vollenhovenii</i> (Herklots,1857)	3	3	2	2	1	2	1	1	1	3	3	3
<i>Macrobrachium macrobrachion</i> (Herklots,1857)	1	1	2	2	2	2	2	2	2	4	4	4
Portunidae												
<i>Callinectes amnicola</i> (DeRocheburne, 1883)	3	3	2	1	1	2	1	1	1	3	3	3

1 = very abundant, 2 = abundant, 3 = few, and 4 = rare.

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