Journal of
Fisheries and Aquatic Science

ISSN 1816-4927

Academic
Journals Inc.

www.academicjournals.com

Journal of Fisheries and Aquatic Science 7 (6): 392-401, 2012
ISSN 1816-4927 / DOI: 10.3923/jfas.2012.392.401

Species Diversity and Growth Pattern of the Fish Fauna of Epe Lagoon, Nigeria

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ABSTRACT

Thirty-two fish species belonging to 27 families were collected from Epe Lagoon between December 2010 and July 2011. The physico-chemical parameters, air temperature ranged from 27-30.1°C; water temperature ranged from 28.7-31.5°C; pH ranged from 7.4-7.5 while salinity was 0‰, throughout the sampling period. The most occurring fish species were the elephant fish, *Monodactylus sebae* (100%); the sole, *Cynoglossus senegalensis* (87.5%), the schilbid catfish, *Schilbe mystus* (87.5%) and *Tilapia guineensis* (87.5%), respectively. From the biometric description, using fin count of each species, mouth type, no new species not occurring on the electronic database were discovered in the samples collected. The seasonal occurrence of fish species in this lagoon was not salinity influenced but probably from influences of adjacent water bodies. From length-weight relationship, b values obtained ranged from 0.28-4.37, where 40.6% exhibited negative allometric growth 36.9% showed isometric growth while 12.5% showed positive allometric growth. Condition factor (K) of species ranged from 0.20 to 5.92 with 78.12% of species having condition factors greater or equal to one, which suggested that the lagoon was suitable for most species. The lagoon is rich in fish species resource which can be properly exploited for maximum sustainable yield.

Key words: Lagoon, fish species, season, salinity

INTRODUCTION

Several pubhcations are available on the fish fauna and fisheries of the south-western lagoons of Nigeria. The united nations food and agricultural organization report (FAO, 1969) gave a survey of the fisheries of the Badagry Lagoon. Ezenwa and Kusemiju (1985) studied the reproductive biology of the catfish, *Chrysichthys nigrodigitatus*, from the Badagry Lagoon. Solarin and Kusemiju (1991), Agboola *et al.* (2008) documented the day and night variations in the fish and shellfish caught in the Badagry creeks. Fagade and Olaniyan (1974) reported a seasonal distribution of the fish fauna of the Lagos Lagoon. Kumolu-Johnson *et al.* (2010) reported 20 families and 34 species, 94.53% fish, 4.87% shrimps and 0.69 crabs from Ologe Lagoon. Also, Olukolajo and Oluwaseun (2008) reported the seasonal variation in fish species of Ologe Lagoon. Oribhabor and Ogbeibu (2012) highlighted the fish species assemblages in a Niger-delta mangrove creek, Nigeria, while Mondal and Kaviraj (2009) and Shareet *et al.* (2009) reported the fish assemblages in two floodplain lakes in India and Camaronera Lagoon, Veracruz, respectively.

Most of these works on the fish fauna in south-western Nigerian lagoons concentrated on aspects of the biology of some of the species and ecological conditions of the lagoons. But works on the fish species diversity of Epe Lagoon, the length-weight relationship and condition factor of the fish fauna are scarce. However, the increasing population in the Lagos metropolitan area has led

to an increased demand for protein by the human populace. In order to meet the increased demand for protein by the masses, the artisanal fishermen have resorted to overfishing which involved the capture of the different size grades of particular species available in a water body irrespective of age or size range, or season i.e. juveniles, adults and irrespective of breeding season (Lawson *et al.*, 2010). The length-weight relationship is very important for proper exploitation and management of the population of fish species (Anene, 2005). Nieto-Navarro *et al.* (2010) determined the growth pattern of demersal fish from eastern coast of the Gulf of California. Other works on length-weight relationship include (Ayoade, 2011; Kamaruddin *et al.*, 2011).

Although, Fafioye and Oluajo (2005) studied the length-weight relationships of five fish species (*Clarias gariepinus*, *Ilisha africana*, *Chrysichthys nigrodigitatus*, *Chrysichthys walkeri* and *Ethmalosa fimbriata*) in Epe Lagoon, Lagos, Nigeria, the objectives of this present study were to investigate the fish species composition of Epe Lagoon, their seasonal occurrence and the growth pattern of all fish species recorded.

MATERIALS AND METHODS

Description of study site: Epe lagoon (Fig. 1) lies between latitudes 03050'-04010'N and longitudes 005030' –005040'E is fed by River Oshun, it has a surface area of more than 243 km^2 (about 225 km2) and a maximum depth of 6 m though a large area of the lagoon is relatively shallow with a minimum depth of 1 m, and the vegetation surrounding the Lagoon is of the mangrove swampy type (Balogun, 1987).

Epe lagoon is sandwiched between two other lagoons, the Lekki lagoon (freshwater) in the east and Lagos lagoon (brackish water) in the west. The lagoon opens into the Gulf of Guinea (the sea) via the Lagos Harbour.

Physico-chemical parameters: Water samples were collected and measurement of physico-chemical parameters was accurately carried out. Temperature was determined in °C using a mercury in-glass thermometer. Salinity was measured using a salinometer and was determined in parts per thousand (‰). pH was measured using a pH-Jenway meter.

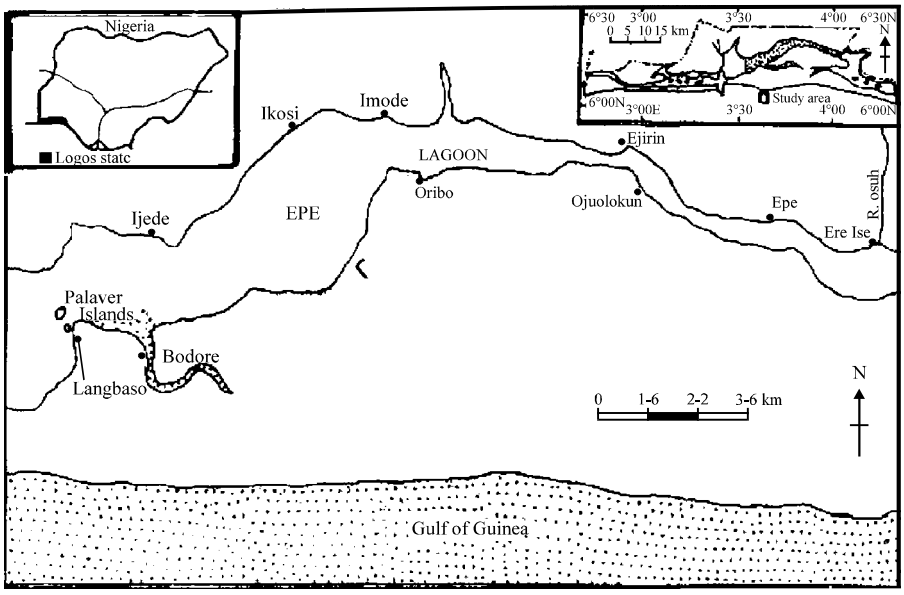

Fig. 1: Map of Epe lagoon with maps of Lagos and Nigeria inserted

Collection of fish: A total of 354 fish were obtained from the catches of local fishermen at Chief market fish landing station located at Epe Lagoon. The collection was done for 8 months from December 2010 to July 2011. The samples were placed in ice-chest from the landing point and transferred into deep freezer (temperature -20°C) at the Marine Research Laboratory, University of Lagos, Nigeria.

Laboratory procedures: Excess moisture was removed from fish immediately after thawing, the biometric data such as Body Weight (BW) using an electronic weighing balance to the nearest 0.01 g and Total Length (TL) Fork Length (FL) Standard Length (SL) were recorded using a measuring board, to the nearest 0.1 cm for each of the specimens. The total length was taken as the distance from the snout with the mouth closed to the tip of the caudal fin; the fork length from the snout to the forked tip of the caudal fin and the standard length from the snout to the caudal peduncle.

Fish identification and biometric features: The fish samples were sorted into families after the species name had been identified after using appropriate field guides, information on Fishbase.org and personal communication with researchers. Biometric features such as the type of mouth; position of the mouth, shape of tail fin, fin count; spine count, barbell counts and position, kind of teeth, etc. were examined on the fish species for purpose of taxonomy, in case new species or strains were observed.

Seasonal occurrence: The fish species were grouped into season (dry and rainy seasons) of occurrence or collection. The relative abundance of the species is noted. Deductions were made as to whether the seasonal differences affected the occurrence of fish species in the lagoon.

Growth pattern

Length- weight relationship: For the growth pattern of the species, the length-weight relationship was determined using the equation:

$$\text{Log } W = \log a + b \log L$$

where, W = weight in grams (g); L = standard length of fish in centimetres (cm), a = regression constant ; b = regression coefficient.

Condition factor (K): The condition factor is the state of general well-being of a fish studied in relation to size and is denoted by the equation;

$$K = 100\ W/L^3$$

where, K = condition factor; L = standard length in centimeters (cm); W = weight in grams (g).

RESULTS

Physico-chemical parameters

Temperature (°C): The air temperature ranged from 27-30.1°C (mean: 28.7°C) and water temperature between 28.7-31.5°C (mean: 29.9°C). The period with the lowest air temperatures recorded occurring between December and March; such a pattern was not seen in water temperature range (Fig. 2).

Salinity (‰): The monthly variation in salinity value recorded was 0‰ (Fig. 2).

pH: The monthly variation in pH values ranged from 7.4-7.5 with a mean value of 7.46 (Fig. 2).

Fish species composition: A total of 32 species belonging to 27 families were recorded. This is indicated in Table 1.

Seasonal occurrence of fish species: The fish species collected were grouped into three groups based on the season of occurrence and the result is presented as follows:

Dry Season (Dec-May): There were 32 species recorded during the dry season and are as follows:

No.	Species	No.	Species
1	*Alestes baremoze*	17	*Heterotis niloticus*
2	*Chromidotilapia guntheri*	18	*Malapterurus electricus*
3	*Ethmalosa fimbriata*	19	*Parachanna obscura*
4	*Bathygobius soporator*	20	*Pomadasys jubelini*
5	*Cynoglossus senegalensis*	21	*Sphyraena barracuda*
6	*Gymnarchus niloticus*	22	*Caranx hippos*
7	*Liza falcipinnis*	23	*Ctenopoma petherici*
8	*Mormyrus rume*	24	*Pseudotolithus elongatus*
9	*Polypterus senegalus*	25	*Clarias isheriensis*
10	*Schilbe mystus*	26	*Erpetoichthys calabaricus*
11	*Brienomyrus longianalis*	27	*Hepsetus odoe*
12	*Chrysichthys walker*	28	*Marcusenius cyprinoides*
13	*Pollimyrus adspersus*	29	*Polydactylus quadrifilis*
14	*Chrysichthys nigrodigitatus*	30	*Monodactylus sebae*
15	*Elops lacerta*	31	*Synodontis eupterus*
16	*Tilapia guineensis*	32	*Xenomystus nigri*

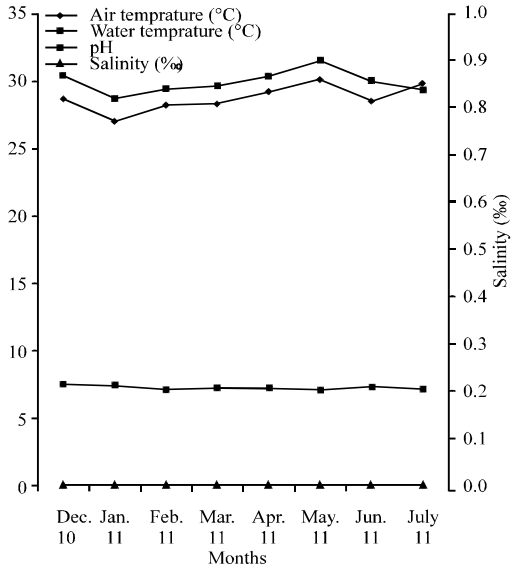

Fig. 2: Physico-chemical parameters of Epe lagoon (Dec. 2010-July 2011)

Table 1: Length - weight relationship of fish species collected from Epe Lagoon

Family and scientific name	No. of species	Mean weight	Mean standard length	a	b	r	K (Mean)
Alestidae	7	54.21	14.27	-1.69	2.929	0.96	1.69
Alestes baremoze (Joannis, 1835)							
Gobiidae	10	67.43	13.71	-2.09	3.383	0.93	1.74
Bathygobius soporator							
Mormyridae	1	25.01	16.60	1.04	0.178	1	0.55
Brienomyrus longianalis							
Carangidae	2	100.69	15.50	-0.08	1.039	1	2.72
Caranx hippos (Linnaeus, 1766)							
Cichlidae	6	62.57	12.42	-0.44	2.046	0.64	3.20
Chromidotilapia guntheri							
(Sauvage, 1882)							
Claroteidae	9	72.62	16.34	-0.80	2.167	0.97	1.60
Chrysichthys walkeri							
(Gnnther, 1899)							
Chrysichthys nigrodigitatus	13	47.33	13.88	-0.68	2.052	0.90	1.76
(Lacepède, 1803)							
Clariidae	21	27.49	13.42	-0.22	1.476	0.79	4.36
Clarias isheriensis							
(Sydenham, 1980)							
Anabantidae	3	65.48	11.63	-2.16	3.708	1.0	3.89
Ctenopoma petherici							
(Gïnther, 1864)							
Cynoglossidae	32	54.20	20.07	0.64	0.819	0.76	1.03
Cynoglossus senegalensis							
(Kaup, 1858)							
Elopidae	17	27.23	14.54	-1.59	2.591	0.91	1.41
Elops lacerta (Valenciennes, 1847)							
Polypteridae	14	25.40	26.92	-3.28	3.252	0.94	0.12
Erpetoichthys calabaricus							
(Smith, 1865)							
Clupeidae	5	17.42	9.54	-3.18	4.37	0.99	1.46
Ethmalosa fimbriata							
(Bowdich, 1825)							
Gymnarchidae	10	143.19	39.64	-1.28	2.11	0.95	0.20
Gymnarchus niloticus							
(Cuvier, 1829)							
Arapaimidae	1	223.82	27.5	0.40	1.04	1	1.45
Heterotis niloticus (Cuvier, 1829)							
Hepsetidae	10	86.33	18.54	-1.67	2.83	0.78	1.34
Hepsetus odoe (Bloch, 1794)							
Mugilidae	15	56.48	14.54	-1.91	3.10	0.94	1.66
Liza falcipinnis							
(Valenciennes, 1836)							
Malapteruridae	11	62.91	13.91	-1.76	3.08	0.77	2.27
Malapterurus electricus							
(Gmelin, 1789)							
Mormyridae	17	25.45235	12.30588	-2.19	3.28	0.97	1.29
Marcusenius cyprinoides							
(Linnaeus, 1758)							
Mormyrus rume	3	65.51	18.67	-0.45	1.75	1.0	1.11
(Valenciennes, 1847)							

Table 1: Continued

Family and scientific name	No. of species	Mean weight	Mean standard length	a	b	r	K (Mean)
Pollimyrus adspersus (Gunther 1866)	1	21.84	11.4	0.77	0.28	1.00	1.47
Channidae *Parachanna obscura* (Günther, 1861)	16	57.12	16.87	-2.58	3.49	0.99	1.04
Polynemidae *Polydactylus quadrifilis* (Cuvier, 1829)	7	37.02	14.94	1.17	0.33	0.44	1.44
Polypteridae *Polypterus senegalus* (Cuvier, 1829)	4	133.07	28.65	-3.02	3.48	0.74	0.52
Haemulidae *Pomadasys jubelini* (Cuvier, 1830)	10	45.22	12.14	0.19	1.68	0.76	2.69
Monodactylus sebae	22	30.68	7.9	-0.78	2.50	0.95	5.92
Sciaenidae *Pseudotolithus elongatus* (Bowdich, 1825)	1	38.98	16.2	0.70	0.43	1.00	0.92
Schilbeidae *Schilbe mystus* (Linnaeus, 1758)	26	14.66	10.49	-2.35	3.31	0.99	0.95
Sphyraenidae *Sphyraena barracuda* (Edwards, 1771)	5	136.76	26.78	0.53	1.13	0.76	0.72
Mochokidae *Synodontis eupterus* (Boulenger, 1901)	19	24.23	10.04	-0.89	2.26	0.76	2.39
Pseudocrenilabrinae *Tilapia guineensis* (Günther, 1862)	22	70.22	11.30	-1.44	3.02	0.99	3.83
Notopteridae *Xenomystus nigri* (Günther, 1868)	9	80.85	21.42	-1.75	2.67	0.92	0.69

Rainy season (June-July): There were 23 species recorded in the rainy season and are as follows

No.	Species	No.	Species
1	*Bathygobius soporator*	13	*Elops lacerta*
2	*Xenomystus nigri*	14	*Erpetoichthys calabaricus*
3	*Synodontis eupterus*	15	*Heterotis niloticus*
4	*Chrysichthys nigrodigitatus*	16	*Hepsetus odoe*
5	*Clarias isheriensis*	17	*Malapterurus electricus*
6	*Cynoglossus senegalensis*	18	*Marcusenius cyprinoides*
7	*Gymnarchus niloticus*	19	*Parachanna obscura*
8	*Liza falcipinnis*	20	*Polydactylus quadrifilis*
9	*Mormyrus rume*	21	*Pomadasys jubelini*
10	*Polypterus senegalus*	22	*Monodactylus sebae*
11	*Schilbe mystus*	23	*Sphyraena barracuda*
12	*Tilapia guineensis*		

Both seasons (Dec.-July): There were 23 species found occurring both in the dry and rainy seasons These are listed below.

No.	Species	No.	Species
1	*Bathygobius soporator*	13	*Clarias isheriensis*
2	*Chrysichthys nigrodigitatus*	14	*Erpetoichthys calabaricus*
3	*Elops lacerta*	15	*Parachanna obscura*
4	*Cynoglossus senegalensis*	16	*Polydactylus quadrifilis*
5	*Gymnarchus niloticus*	17	*Pomadasys jubelini*
6	*Heterotis niloticus*	18	*Monodactylus sebae*
7	*Hepsetus odoe*	19	*Schilbe mystus*
8	*Liza falcipinnis*	20	*Sphyraena barracuda*
9	*Mormyrus rume*	21	*Synodontis eupterus*
10	*Polypterus senegalus*	22	*Tilapia guineensis*
11	*Malapterurus electricus*	23	*Xenomystus nigri*
12	*Marcusenius cyprinoides*		

when the species were separated into known habitats at adult stage using the electronic database (www.fishbase.org), the following were obtained: fresh (62.5%), fresh and brackish (9.4%) marine brackish (12.5%), marine brackish and fresh (12.5%), and those with habitats unreported (3.1%).

Growth pattern

Length-weight relationship and condition factor: From length-weight relationship, b values obtained ranged from 0.28 to 4.37, where 40.6% of the species exhibited negative allometric growth, 36.9% showed isometric growth while 12.5% showed positive allometric growth. Condition factor (K) of species ranged from 0.20 to 5.92 with 78.12% of species having condition factors greater or equal to one, which suggested that the lagoon was suitable for most species. The results are presented in Table 1.

DISCUSSION

The physico-chemical parameters obtained during this period of study; Temperature (°C) (air and water), salinity and pH, was similar to the physico-chemical parameters reported by Jimoh *et al.* (2011) where salinity ranged between 0.24±0.19, pH 7.56±0.05 and temperature 30.35±0.17 in Epe Lagoon. This confirmed that the lagoon is relatively fresh and stable from season to season. This freshness could be due to the closer connection of two fresh water bodies: Lekki Lagoon and River Oshun, which over-ride the effect of further distant brackish water, Lagos Lagoon, and also coupled with an irregular pattern of heavy rainfall between December 2010 and July 2011. The physico-chemical parameters were relatively stable.

Thirty-two species of fish belonging to 27 families were identified in this lagoon, which showed the species richness in the lagoons of tropical climate as that of Nigeria. However, when this is compared to reports on other lagoons of south-western Nigeria such as Fagade and Olaniyan (1974) on the fish fauna of Lagos Lagoon, Olukolajo and Oluwaseun (2008) on the seasonal variation in the distribution and fish species diversity in Soyinka *et al.* (2010) on the fish fauna of Badagry Lagoon in which 72 species (34 families), 25 species (16 families) and 37 species (21 families) were collected respectively, there is probably a high level of species richness in Epe Lagoon than in Badagry and Ologe lagoons. Although, Badagry Lagoon had greater number of species than Epe

Lagoon, yet the numbers of families were lesser. The higher number of fish families in Epe Lagoon could have resulted from exchange of species from Lagos and Lekki Lagoons, River Oshun emptying into it, and resident species. However, there was relatively little or no seasonal variation in species composition in Epe Lagoon as compared with these other lagoons. Of note is that one specimen of eagle ray was seen at the Epe Lagoon fish landing point during the sampling period but was not collected.

The importance of tracking records of new species in aquatic ecosystem is emphasised by Palacios-Salgado and Ramirez-Valdez (2011). From the taxonomical description of fish species using biometric features, there was no strain or new species discovered among the fishes from Epe Lagoon. Fresh water species were predominant in the lagoon. However, species known to be found in marine and brackish water bodies, *Pseudotolithus elongatus* and *Caranx hippos* numbered 1 and 2, respectively from population of fish collected from Epe Lagoon and this suggested that the species were predominantly marine. Also, *Cynoglossus senegalensis* and *Polydactylus quadrifilis* which are marine in adult, had 9.2% and 2% occurrence respectively and this suggested that the species are euryhaline and can adapt to fresh water environment.

The seasonal occurrence showed that nine species which occurred in the dry season (Dec 2010 to May 2011) alone did not probably occur during the rainy season. All species that were collected during the rainy season (June to July 2011) were found to occur during the dry season. However, though the lagoon is not influenced by salinity, this variation in species present may be due to migrating fishes from the adjacent water bodies.

From the length-weight relationship, when compared with b values 2.790-3.210 reported by Fafioye and Oluajo (2005), which studied the length-weight relationships of five fish species in Epe Lagoon; 2.607-3.254 recorded by Agboola and Anetekhai (2008), which studied the length-weight relationships of 35 fish species from Badagry Creek, Lagos and 2.012-2.991 recorded by Kumolu-Johnson *et al.* (2010) on length-weight relationship of 21 species in Ologe lagoon, the lagoon could be said to support a wide range of species exhibiting different growth patterns.

From the condition factor for the thirty-two fish species collected, it was observed that 87.5% (24 out of 32 species) of the fish species had their K values below the range 2.9-4.8 recommended as suitable for matured fresh water fish by Bagenal and Tesch (1978). A total of 78.12% of species had condition factors greater than or equal to 1. According to Lagler (1956), it has been found that the value of K is not constant for individuals, species or populations but is subject to wide variations for fish of average natural condition; the K-factor should be equal to 1, while < 1 and > 1 indicate below and above average conditions respectively. Wade (1992) stated that condition factor greater or equal to one is good. This suggests that the condition of Epe Lagoon in comparison to lagoons affected by season and salinity was favourable to most of these fishes in the lagoon.

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