Fish resources of lagoon waters of Ogun waterside Local Government Area, Ogun State, Nigeria

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Abstract
A study was conducted to determine distribution and abundance of fish over two years (dry and wet seasons) in lagoon systems of Ogun waterside Local Government Area, Ogun State, Nigeria. Fish sampling was carried out in four selected stations based on catch. Physical and chemical characteristics of the lagoon systems and fish distribution was also carried out. The study revealed that Bagridae represented by *Chrysichthys nigrodigitatus* contributed the highest number of fish in the two seasons. Fish species were evenly distributed in the wet seasons than dry seasons. Simpson index (D) computed for the 4 sites are 0.29, 0.14, 0.14 and 0.29 respectively for Ode-Omi, Awodikora, Eba and Ebute-Okun in the dry seasons and 0.09, 0.10, 0.07 and 0.09 for dry seasons. There are positive correlations between fish number and some physico-chemical parameters, phosphate (r= 0.74), Ammonia (r= 0.4*). There are variations among physico-chemical parameters of water samples. Information revealed by this study will be useful in fisheries resource management for the study locations.

Key words: Fish resources, lagoon, seasons, Ogun waterside

INTRODUCTION

Nigeria with an estimated population of over 140 million people is blessed with a vast expanse of inland and marine ecosystems (Ita, 1993). The estimated surface area of marine and brackish water cover 233,000 km^2 with estimated fishery potential of 273,500 metric tonnes per annum (Ita, 1993 and Amadi, 1990). Lagoon systems of Ogun waterside in Nigeria is an important ecosystem that provide fish and other aquatic resources for the people. Lagoons are also known to play major ecological roles of transporting nutrients and organic materials to marine system through circulation (FAO, 2002).

Fish are appropriate indicators of trends in aquatic environment because of impact they have on the distribution and abundance of other organisms in the water they inhabit (Olopade, 2001). Dublin-Green and Tobor (1992) classified the resources in the marine environment into two: renewable and non-renewable. They include the algae, some plants and finfish, marine mammals, reptiles shell fishes, etc.

Arabatzis and Kokkinakis (2005) observed that lagoon systems are places of great biological importance where fishery is the main economic activity in these ecosystems but intensive agriculture, industry and tourisms have degraded their sensitive environmental structure.

In line with the foregoing, there is need to assess the fish distribution and abundance of lagoon systems of Ogun Waterside Local Government Area to provide information on the state of fish resources.

MATERIALS AND METHODS

Description of study site

The study was conducted along the lagoon stretch of Ogun waterside Local Government Area. The lagoon stretch is located between longitude 4^o 12N – 4^o 34N and latitude 6^o 18 SE – 6^o 40 SE on the map of Ogun waterside LGA, Ogun state, Nigeria. The lagoon borders the forest belt and receives a number of important rivers draining their waters into it (Fig 1).

Experimental Procedures

(a) Fish sampling procedure

Four sampling sites, Ode-omi, Awodikora, Eba and Ebute-okun were selected due to intensive human activities. Fish abundance was determined by monitoring and recording the fish catch data from various locations in the lagoon. The fish sample data were collected from each of the selected villages and landing sites for two years on seasonal basis (dry and wet). The number of fish species caught per species were recorded and identified to the lowest taxonomic level. Assessment of the quantities and types of fish species caught from the selected sites was done twice a week to have monthly data on types of available fish (FAO, 1990; Olaosebikan and Raji, 1998).

(b) Determination of fish diversity

The diversity indices used were:

i Species richness (S), which is the total number of different fish species present.

Where S = Σ n1 + n2 + n3 +………ni

ii Simpson index (D), which is the measurement that account for the percent of each species from a biodiversity sample within a local aquatic community. The index assumes that the proportion of individuals in an area indicates their importance to diversity.

Simpson index (D) = Sum $(Pi)^2$ where Pi = the number of given species divided by the total number of fishes observed. The probability computed for each species is given in decimal percent.

iii Shannon – Weiner index (H) = - Sum (Pi ln (Pi)) (natural log). This index measures the order or disorder observed with a particular system. This order is characterized by the number of individuals observed for each species in the sample site (Simpson, 1949).

(c) Determination of physical and chemical parameters of water samples

Water level was determined using a calibrated rope line (in cm) attached with a lead sinker. The rope was lowered from the boat into the water until it touched the floor of the water. The depth was then read off a calibrated rope. This process was repeated at every site and done on seasonal basis (dry and wet) (Arowomole, 2000). Temperature was determined using the ordinary mercury in glass thermometer calibrated in degree celcius (^{0}C) (Boyd, 1979). The thermometer was dipped into the surface water from the boat for a depth of 20cm and the value read off the mercury line on the thermometer after the level was stable. Water transparency was measured using the Secchi disc. The Secchi disc attached to calibrated rope was lowered from the boat slowly into the water until it disappeared and depth noted, it was then slowly pulled up and the depth at which the disc just reappeared was noted. The transparency value was taken as the mean values of the two readings and recorded for the study site. Dissolved oxygen was determined using dissolved oxygen meter model (Jenway DO 9071). The instrument was standardized by using saturated potassium chloride and zero solutions. The probe was then dipped from the boat into the water to record oxygen readings in situ for the various locations. Salinity of the collected water samples from the study sites was determined using Argentomeric method (APHA, 1998). pH of the water samples from the various locations was derived using a digital pH meter Suntex (model TS-2). This was first calibrated using 2 buffer solutions of 7 and 4. The nitrates level of the waters from the various locations was determined using Nitrate Electrode Method (APHA, 1998). The Ammonia level of the waters from the study sites was determined using Acidic method for Nitrogen (APHA, 1998). Phosphates level of the waters from the study sites was determined using Vanadomolybdophosphoric Acid Colorimetric method (APHA, 1998).

Statistical analysis

Data collected on fish and water samples from the study sites were analysed using the following statistical procedures: Correlation analysis and Analysis of variance (ANOVA) where appropriate.

RESULTS

The abundance and biodiversity indices composition of fish species in lagoon systems of the four sites, Ode-omi, Awodikora, Eba and Ebute-okun are presented in Tables 1 and 2. Thirty-nine fish species belonging to 30 families of which 37 were fin fishes and 2 shell fishes were identified during the dry season while thirty-nine fish species belonging to 31 families of which 37 were fin fishes and 2 shell fishes were identified in the wet season. Bagridae represented by *Chrysichthys nigrodigitatus* contributed the highest number of fish in the two seasons. The Simpson diversity index (D) computed for Ode-omi, Awodikora, Eba and Ebute-okun were 0.29, 0.14, 0.14 and 0.29 respectively in the dry seasons. Simpson diversity index (D) computed for wet season for the four sites were 0.09, 0.1, 0.07 and 0.09 respectively. Fish abundance was higher in the wet season than that of dry season.

The physico-chemical parameters of water samples in the 4 locations of the lagoon systems for both wet and dry seasons are presented in Tables 3 and 4. The highest mean temperature was recorded in Ode-omi (28.15 ± 2.3^{0}C) while the least was 26.90 ± 2.3^{0}C in Awodikora in the wet season. Eba recorded the highest mean value of 9.58 ± 0.7mg/l for dissolved oxygen while the lowest mean value was 6.88 ± 0.5mg/l at Awodikora in wet season. The peak record on salinity was recorded in Ebute-okun with 21.09 ± 0.7$^0/_{00}$ in wet season while the same study site recorded 21.19 ± 0.8$^o/_{oo}$ in the dry season. Ode-omi recorded the highest value of 86.40 ±

30.9cm for water transparency in the wet seasons while the lowest was 83.35 ± 32.3cm at Ebute-okun. The peak value of 96.10 ± 21.9cm was recorded in Awodikora in dry sesons. Phosphates values across the locations show significant difference ($p<0.05$) in the two seasons. There are positive correlations between fish numbers and some physico-chemical parameters such as phosphates ($r = 0.74$) and Ammonia ($r = 0.4$) in the two seasons.

DISCUSSION

Thirty-nine fish species belonging to 30 families of which 37 were fin fishes and 2 shell fishes recorded during the dry period and 39 fish species belonging to 31 families of which 37 were fish species and 2 shell fishes identified in wet season. This finding agrees with the number of families by Ajani (2001) who recorded thirty-two families of which 52 were fin fishes. The number of fish species observed was not in agreement with the number discovered at the study sites. In both seasons Bagridae represented by *Chrysichthys nigrodigitatus* contributed the largest number and are more distributed across the 4 sites.

The high numbers of fish species of marine origin in both seasons agree with the observations of Fagade and Olaniyan (1974) who recorded higher fish species of marine origin in dry season. This observation was in line with the fact young stages of many marine base fish species live in water of reduced salinity. Families such as Mugilidae, Bagridae, Clupeidae, Sphraenidae and Elopidae which were more common in the dry season is in congruent with findings of Fagade and Olaniyan (1974) and Ajani (2001). The water depth of the study sites which range from 4.02m – 4.49m in wet season and 2.89m - 3.84m in dry season agrees with the observation of Ajani (2001) who recorded highest depth value of 5.5m in wet season but the 0.5m value recorded for dry season was too low compare to the one recorded for the study sites. This variation is probably due to short break that exist between the wet and dry season period. There was a positive correlation with rainfall which means that the water level rises with rain intensity. The water surface temperature values of the study sites were generally uniform across the sites in both seasons. The variation was less than 2^0C. This observation conforms to other previous workers (Oyewo, 1998; Ajani, 2001; Chukwu and Nwakwo, 2003; and Ajibola *et al*, 2005). Ajibola *et al* (2005) recorded temperature range values of 27^0C – 29^0C in the lagoon; they noted that at this temperature physical, chemical and biological properties in the waters are affected. The water temperature values also conform to the values recorded for tropical waters in which fishes thrive (Longhurst, 1968, Ceda, 1997). Boyd (1979) also noted that warm water fishes grow best at temperature between 25^0C and 32^0C. The dissolved oxygen levels were higher in wet season than dry season this is probably due to the influx of adjoining rivers that flow into the lagoon. There was a negative correlation between the dissolved oxygen and temperature. This observation disagrees with the findings of Ajani (2001) who recorded positive correlations between dissolved oxygen and temperature. The high levels of D.O observed from the study sites agrees with Boyd and Lichtkoppler (1985) who reported that the oxygen concentration level above 5.00mg/l as the desirable level for most fish species. The salinity values recorded for the sites were generally higher especially during the dry season; the salinity is typical of lagoon that is closer to marine locations. The high salinity value is probably due to low discharge of water and the slightly low value of salinity in wet season may be due to dilution rate of the rainfall and discharge of fresh water from adjoining rivers. This observation agrees with Olaniyan (1969), Dublin-Gren (1990) and Oyewo, (1998).

CONCLUSION

The study found 39 fish species to show some level of richness in the fish diversity of the study sites. *Chrysichthys nigrodigitatus* was the most dominant fish species caught in the dry and wet season in the study sites. The physical and chemical parameter values recorded for the study area supported the biological life in the lagoon systems and thus enhance the fish abundance and distribution. The information and observation of the study will be useful in formulating the rational exploitation of fish species especially *Chrysichthys nigrodigitatus* and conservation of less abundant fish species.

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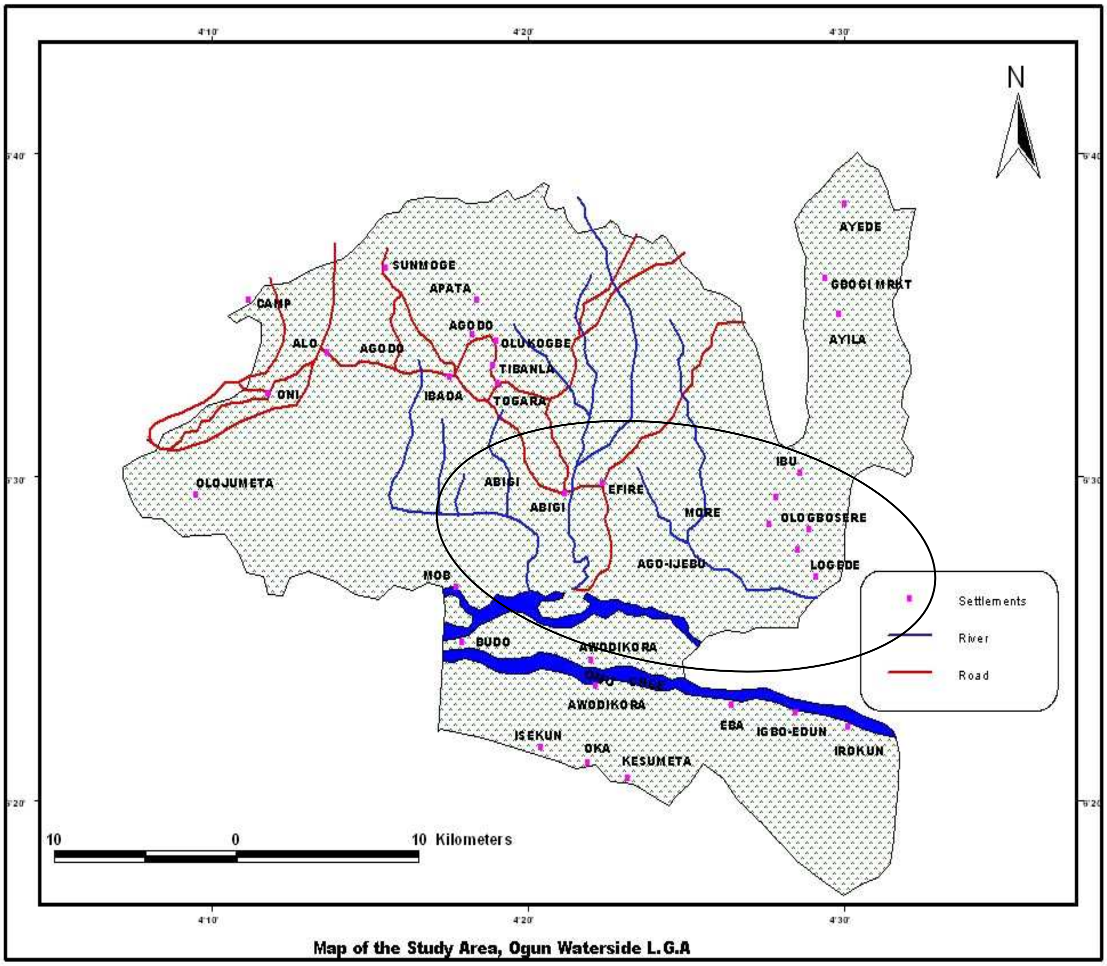

Figure1: Map of Ogun waterside LGA showing the lagoon systems of the study area

Table 1: Abundance of fish species sampled during the dry season in lagoon systems of the study area.

Family	Species	Location				
		Ode-omi	Awodikora	Eba	Ebute-Okun	Abundance
Cichlidae	*Oreochromiis niloticus*	1122	455	156	215	1948
	Oreochromis aureus	0	0	0	31	31
	Sarotherodon galilaleaus	0	0	0	4	4
	Hemichromis farsciatus	0	o	3	0	0
Channidae	*Parachanna Obscura*	60	124	0	39	223
Bagdridae	*Chrysichthys nigrodigitatus*	5307	274	120	1484	7185
	Chrysichthys auratus	0	0	110	110	220
Gymnarchidae	*Gymnarchus niloticus*	160	62	37	29	288
Mugilidae	*Mugil cephalus*	736	1634	158	198	2726
Hepsetidae	*Hepsetus odoe*	11	64	0	4	78
Elopidae	*Elops lacerta*	807	352	132	161	1452
Notopteridae	*Papyrocranus afer*	101	24	45	47	217
Clariidae	*Clarias gariepenus*	75	24	8	7	114
	Clarias angularis	0	430	0	8	438
Carangidae	*Caranx carangus*	22	0	126	13	161
Trachinidae	*Trachinotus ovatus*	0	13	27	7	47
Osteoglossidae	*Heterotis niloticus*	22	7	8	0	37
Polypteridae	*Polyterus senegalensis*	16	88	0	50	154
Morniyridae	*Mormyrops deliciosus*	0	1	0	4	5
	Gnathonemus abadii	33	0	0	0	33
	Mormyrus rume	23	0	0	0	23
Mochokidae	*Synodontis clarias*	38	81	0	96	215
Sphraenidae	*Sphraena piscartorum*	12	42	34	10	98
Schilbeidae	*Schilbe senegalensis*	201	335	15	47	598
	Physalia pellucida	0	215	951	5	1171
Polynemidae	*Galeiodes decadactylus*	0	20	17	9	46
Lutjanidae	*Latjanus dentatus*	0	0	20	0	20
Trachinidae	*Trachinus apmatus*	0	13	0	42	55
Clupidae	*Pellonula afzeluisi*	1553	1377	525	182	3637
	Ethmalosa fimbriata	318	1977	670	0	2985
Monodactylidae	*Psettias sebae*	41	12	177	13	243
Characide	*Brycinus nurse*	15	20	10	34	79
Pomadasyidae	*Pomadasys jubelini*	32	172	99	9	312
Anabantidae	*Ctenopoma kingslea*	o	150	0	0	150
Cyprinidae	*Barbus lagoensis*	0	7	0	2	9
Hemirgmphidae	*Hemiramphus balao*	0	0	0	3	3
Cynoglossidae	*Cynoglossus senegalensis*	0	0	0	5	5
Cynoglossidae	*Callinectes pallidus*	39	90	39	15	183
Penaedae	*Peneaus duorarum*	0	30	71	0	101

Table 2: Abundance of fish species sampled during the wet season in lagoon systems of the study area.

Family	Species	Location Ode-Omi	Awodikora	Eba	Ebute-Okun	Abundance
Cichlidae	*Oreochromiis niloticus*	945	1758	701	280	3684
	Oreochromis aureus	-	-	-	-	-
	Sarotherodou galilaleaus	56	0	0	0	56
	Hemichromis farsciatus	0	0	8	0	8
Channidae	*Parachanna Obscura*	236	167	42	55	500
Bagdridae	*Chrysichthys nigrodigitatus*	1916	1547	157	884	4504
	Chrysichthys auratus	1029	177	743	62	2011
Gymnarchidae	*Gymnarchus niloticus*	110	47	72	29	258
Mugilidae	*Mugil cephalus*	763	1426	445	164	2798
Hepsetidae	*Hepsetus odoe*	114	162	174	78	528
Elopidae	*Elops lacerta*	818	915	656	363	2752
Notopteridae	*Papurocranus afer*	158	75	127	84	444
Clariidae	*Clarias gariepenus*	111	73	128	89	401
	Clarias angularis	0	0	0	60	60
Carangidae	*Caranx carangus*	39	99	78	30	246
Trachinidae	*Trachinotus ovatus*	0	26	46	29	101
Osteoglossidae	*Heterotis niloticus*	101	91	62	16	270
Polypteridae	*Polypterus senegalensis*	26	21	18	18	83
Morniyridae	*Mormyrops deliciosus*	9	16	30	18	83
	Gnathonemus abadii	154	10	23	45	232
	Mormyrus rume	58	16	0	128	202
Mochokidae	*Synodontis clarias*	840	233	425	247	1745
Sphraenidae	*Sphraena piscartorum*	71	30	73	25	199
Schilbeidae	*Schilbe senegalensis*	201	437	112	47	797
	Physalia pellucida	152	0	453	0	605
Polynemidae	*Galeiodes decadactylus*	42	11	35	28	116
Lutjanidae	*Lutjanus dentatus*	0	0	20	0	20
Trachinidae	*Trachinus apmatus*	50	10	14	17	91
Clupidae	*Pellonula afzeluisi*	1203	1392	802	291	3688
	Ethmalosa fimbriata	202	867	859	458	2386
Monodactylidae	*Psettias sebae*	103	172	130	35	440
Characide	*Brycinus nurse*	173	97	47	67	384
Pomadasyidae	*Pomadasys jubelini*	62	38	125	42	267
Anabantidae	*Ctenopoma kingslea*	370	569	438	309	1686
Cyprinidae	*Barbus lagoensis*	26	22	50	5	103
Hemirgmphidae	*Hemiramphus balao*	3	0	0	0	3
Cynoglossidae	*Cynoglossus senegalensis*	0	0	0	15	15
Cynoglossidae	*Callinectes pallidus*	55	59	69	29	212
Penaedae	*Peneaus duorarum*	76	155	141	20	392
Phractolelamidae	*Phractolaemus ansorgii*	0	5	84	18	107

Table 3: Physical and Chemical Parameters for wet seasons

	1	2	3	4
Water Depth (m)	4.02 ± 0.9	4.27 ± 0.9	4.29 ± 1.2	4.49 ± 1.2
Temperature (^{0}C)	28.15 ± 2.3	26.90 ± 2.3	27.40 ± 2.0	27.60 ± 1.6
Dissolved oxygen (mg/l)	7.92 ± 0.5	6.88 ± 1.1	9.58 ± 0.7	9.10 ± 1.0
Water temperature (cm)	86.40 ± 30.9	84.85 ± 32.6	85.05 ± 32.6	83.35 ± 32.3
Salinity ($^0/_{00}$)	16.99 ± 0.6	18.14 ± 0.7	19.79 ± 0.5	21.09 ± 0.7
pH	7.50 ± 0.7	7.90 ± 0.6	7.80 ± 0.7	8.10 ± 0.8
Nitrate (mg/l)	-	-	0.04 ± 0.001	0.03 ± 0.001
Phosphate (mg/l)	2.40 ± 0.2	1.81 ± 0.1	2.46 ± 0.2	2.14 ± 0.1

Table 4: Physical and Chemical Parameters for dry seasons

	Ode-omi	Awodikora	Eba	Ebute-Okun
Water Depth (m)	2.89 ± 0.5	2.96 ± 0.6	3.20 ± 0.6	3.38 ± 0.3
Temperature (^{0}C)	28.85 ± 1.5	27.40 ± 1.4	27.7 ± 1.9	27.20 ± 1.9
Dissolved oxygen (mg/l)	7.74 ± 0.6	8.48 ± 0.9	8.96 ± 0.7	7.45 ± 2.0
Water temperature (cm)	91.90 ± 22.2	96.10 ± 21.9	89.45 ± 13.6	94.20 ± 19.2
Salinity ($^0/_{00}$)	17.13 ± 0.4	18.21 ± 0.6	19.52 ± 0.4	21.19 ± 0.8
pH	7.30 ± 0.8	7.85 ± 0.5	7.75 ± 0.3	7.90 ± 0.4
Nitrate (mg/l)	-	-	0.03 ± 0.001	-
Phosphate (mg/l)	2.38	1.73 ± 0.2	2.65 ± 0.1	2.22 ± 0.2