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Seasonality and size variation of fish species in Nwaniba, Ikpa River southeast Nigeria

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ABSTRACT

Two thousand three hundred and seven fish specimens sampled from Nwaniba (Ikpa River) for 12 calendar months (March 2009 – February 2010) comprised 11 orders, 34 families, 59 genera and 136 species. There was temporal and seasonal significant differences ($P<0.05$) between number and species of fish caught. The mean annual Index of Preponderance (IP %) values ranged from 0.01 in *Brienomyrus brachyistus* and *Periophthalmus barbarus* to 4.24% in *Oreochromis niloticus*. Mean monthly occurrence shows highest in August (536; 23.23%) and lowest in June (47; 2.03%). The contributions of the fish orders in theirdescending order of abundance are as follow: Siluriformes (1072; 46.47%), Ophiocephaliformes (626; 27.13%), Characiformes (264; 11.44%), Mormyriformes (159; 6.89%), Clupeiformes (87; 3.77%), Cypriniformes (40; 1.73%), Gonorhynchiformes (33; 1.43%), Osteoglossiformes (13; 0.56%), Elopiformes (9; 0.39%), Pleuronectiformes (3; 0.13%) and Perciformes (1; 0.04%). The most abundant family and species in terms of number are Schilbeidae (646; 28.00%) and *Parailia pellucida* (577; 25.01%) while the least are Scaenidae, Soleidae and Sphyraenidae (1; 0.04%). The most abundant family in terms of species is Mormyridae (17) and the least are 9 families with only species. Relative abundance is higher during the wet season (105 species; 77.77%) than dry season (93 species; 68.88%). The largest fish size in terms of length is recorded in *Chrysichthys aluuensis* (45.60cmTLmax; 18.40±9.0cm) while the smallest individual is *Parailia pellucida* (1.10cmTLmin; 7.50±1.20cm). The overall weightiest fish is also *Mugil cephalus* with a total weight of 662.80gWTmax; 54.42±16.75 while the lightest individuals are *Parailia pellucida and Eutropius buffei* (1.00gTWmin). Previous results differ from these; which may be occasioned by the human anthropogenic perturbations which are on-going in the river system, thus leading to environmental degradation. Hence, recommendations are proffered.

Introduction

Tropical rivers have large heterogeneity across a continuum of a spatial scale that range from microhabitats to landscapes (Williamson *et al.*, 2008). Functional indicators are measures of the rates or relative importance of a particular process happening in an ecosystem, while structural indicators focus on patterns of a biotic resources or biological community composition (Matthew *et al.*, 1982 and Young and Huryn, 1998). In other words, functional indicators measure the services or functions provided by the ecosystem while structural indicators measure what lives in an ecosystem. Living organisms' responses including plants have been used in biodiversity studies as bioindicators to climatic variability and trends. Matthew *et al.*, (1982) and Vescovi *et al*., (2009) observed that since water level is often linked to important life-cycle stages, and any changes in the timing and amount of water may influence these stages, wetland organisms could be used as indicators of climate changes in hydrologic conditions over time. Also, monitoring changes in community composition and any shift within an ecoregion may be a good indicator.

Inland fishery resources of Nigeria comprise over 200 species (Udoidiong and King, 2000), with Lake Kainji having over 100 species while Lake Chad has 87 species (Natural Resources Conservation Council of Nigeria-NARESCON, 1992); Ogun River has 85 species (Sydenham, 1977); Cross River has 166 species (Teugels *et al*., 1992); Kubanni reservoir has 9 species (Annune and Bako, 1998); some Nigerian streams harbour 55 species (Udoidiong and King, 2000); Ntak Inyang stream (Ikpa River) has 26 species (Onuoha *et al*., 2010). A diversity of a fish community should reflect the qualities of a water body which allow the survival and adaptation of numerous species.

There is a neglected beach but very significant and popularly known as Nwaniba beach, Ikpa River. It is an important hydrographic component of Akwa Ibom State because of the number of streams and tributaries that drain into its main channels, its values to the inhabitants of the adjoining lands and numerous contributions to the regional life–systems. This important river also houses some important commercial and economic fish species, especially the popular "inaha"–catfish (*Chrysichthys* sp) fishery, "ecomog" (*Heterotis niloticus*), etc. for the various communities in Akwa Ibom State and its environs (Ekpo and Udoh, 2010). Udoidiong and King (2000) reported that many of the streams in the state form the headwaters of the major rivers that drain the state, of which Ikpa River is one. No comprehensive piscine species identification

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has yet been carried out in this river system, except Ekpo and Udoh (2010) where they were identified to the family level. Thus, this present study aims at investigating the multi-species pisces of Nwaniba to determine their seasonal and size variability, which will serve as baseline/benchmark data for environmental impact assessment, conservation, monitoring and management strategies for the river system.

Study area

The Ikpa River (Fig. 1) is situated in Akwa Ibom State within the rainforest zone of southeastern Nigeria. It is a small perennial rainforest tributary stream located west of the lower reaches of the Cross River system. It drains a catchment area of 516.5Km^2, 14.8% (76.5 Km^2) of which is prone to annual flooding. The stream has a main channel with total length of 53.5Km between its source in Ikono Local Government Area and where it discharges into the Cross River creek close to Nwaniba in Uruan Local Government Area. It is considered as the lower course of the river. Nwaniba is 394252.669mE and 558778.199mN and the study area has been widely discussed in King 1989.

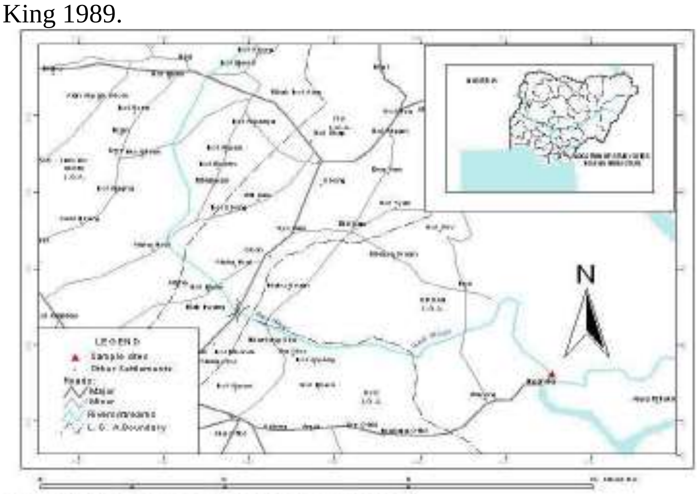

Fig. 1: Ikpa River showing sampling site at Nwaniba beach

Materials and methods

Sampling for this research work was carried out over a period of twelve calendar months from March 2009-February 2010 at Nwaniba beach along Ikpa River fortnightly. In order to exercise judgment to ensure that a sample was representative (Karr *et al*, 1986), gear capable of sampling all species in proportion to their relative abundance were chosen. Several fishing methods were used in a standardized manner to collect the maximum number of species and individuals in different sizes and microhabitats. Fishing equipment included gill nets (with stretched mesh size of 10-30mm), cast nets (with mesh size of 10-25mm) and traps during the day time in all the sampling sites. The unbaited gill nets and baited traps (using baits such as earthworms and palm fruits) were set at the vegetated marginal regions of the river while the cast nets were thrown in the open water in each sampling site.

Fish samples were preserved in 10% diluted formaldehyde solution in well-labelled containers to reduce microbial digestion to the minimum (Fagade, 1983). All preserved samples were removed from the formaldehyde solution, rinsed in clean water and placed slanting with the mouth down to drain out excess fluid for about 5-10 minutes prior to identification. Specimens were identified from family to species levels with the aid of identification keys such Olaosebikan and Raji (1988); Edwards *et al*, (2001); Idodo-Umeh (2005); Adesulu and Sydenham (2007). Each specimen was measured to the nearest 0.1cm total length (TL) as the length from the tip of the snout of the fish, when placed on the side, to the farthest tip of the caudal fin using a 1–100cm (range) measuring board. The fish sample was also weighed to the nearest 0.1g using a Sonex Spring (0.1–500g) and a top-loading Triple Beam (MB–2610) (0.1–610g) balances.

Statistical data analysis

Data generated were subjected to Analysis of Variance (ANOVA) at probability level of $p < 0.05$ to test for variations, Coefficient of Variation (CV) was calculated to determine seasonal variation and Statistical Analysis Systems (SAS, 2003) was used for mean separation. The monthly percentage occurrence of each family and species was computed as follows:

$$FO = n/N \times 100 \quad (1)$$

Where, FO = Frequency of occurrence, n = Number of individual fish species, N = Total number of all the fish species. The pooled data of catches in each sampling station was used in assessing the Index of Preponderance (IP) which was according to Watson and Balon, 1984$_a$ expressed as:

$$IP (\%) = \frac{\%N.\%W}{\Sigma (\%N.\%W)} \times 100 \quad (2)$$

Where, N = Number of fish species, W = Weight of fish species (g)

Fishes with IP values of less than (<) 0.50 were regarded as being of relative insignificant contributions while those with IP values greater than (>) 0.50 were considered as being of significant contributions (Moses, 1987). IP expressed the percentages of the total number and total weight of fish caught. Relative abundance of each fish species was computed as the percentage of the number of each individual fish over the total number of fish in each sampling station.

Results

Of the 2307 specimens of sampled from Nwaniba beach (Ikpa River), fish species composition revealed that it is made up of 11 orders, 33 families, 59 genera and 136 species. The various fish orders encountered in their descending order of abundance were as follow: Siluriformes (1072; 46.47%), Ophiocephaliformes (626; 27.13%), Characiformes (264; 11.44%), Mormyriformes (159; 6.89%), Clupeiformes (87; 3.77%), Cypriniformes (40; 1.73%), Gonorhynchiformes (33; 1.43%), Osteoglossiformes (13; 0.56%), Elopiformes (9; 0.39%), Pleuronectiformes (3; 0.13%) and Perciformes (1; 0.04%) (Fig. 2). The difference in species composition was statistically significant ($t = 0.09$; $df = 22$; $p< 0.05$).

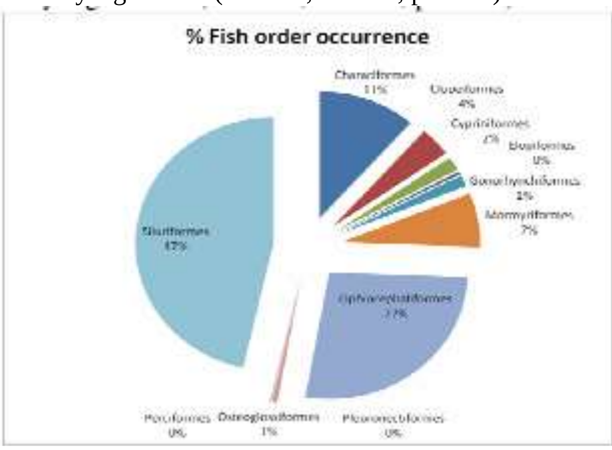

Fig. 2. Graphical representation of fish orders in Nwaniba, Ikpa River, Nigeria

Fish families' richness

Of the 33 fish families sampled most abundant by number was Schilbeidae (646; 28.00%) whereas least were those with one specimen, which were Scaenidae, Soleidae and

Sphyraenidae (0.04%). The family with the highest number of species was Mormyridae (17 species; 12.50%) while the least (1; 0.74%) was observed in Centropomidae, Cynoglossidae, Elopidae, Hepsetidae, Lutjanidae, Monodactylidae, Notopteridae, Scaenidae and Sphyraenidae. From the next highest to the least, the following families contributed to the total fish population (by number): Characidae (232), Cichlidae (224), Mormyridae (159), Eleotridae (130), Bagridae (126), Ariidae (117), Clariidae and Clupeidae (87), Mugilidae (83), Gobiidae (81), Mochokidae (77), Carangidae (43), Cyprinidae (40), Pomadasidae (34), Hepsetidae (33), Malapterinidae (19), Icthyboridae (13), Citharinidae and Monodactylidae (10), Distichodontidae and Elopidae (9), Osteoglossidae (8), Anabantidae (7), Channidae and Notopteridae (5), Lattidae, Polynemidae and Cynoglossidae and Lutjanidae (2). The most frequently occurred family was Cichlidae (54) and three families occurred only once (Lutjanidae, Sciaenidae and Soleidae).

Monthly occurrence and abundance

Table 1 shows that fish species varied in their monthly occurrence with the highest number of specimens occurring in August (536; 23.23%) and the lowest in June (47; 2.03%). In descending order, the following monthly occurrences were obtained: 341(14.76%) in September, 267(11.56%) in October, 198(8.57%) in February, 162(7.01%) in December, 160(6.93%) in January, 146(6.32%) in November, 142(6.15%) in July, 121(5.37%) in May, 118(5.11%) in April and 69(2.99%) in March. The following species had highest specimens occurrence in decreasing order: *P. pellucida* (233) in August with a total of 577 specimens, *P. schlegelli* (35) in September with a total of 59, *P. ansorgii* (26) in August with a total of 30, *A. latiscutatus* (22) in August with a total of 52, *E. senegalensis* (21) in September with a total of 61, etc and those with 1 specimen were *C. nuriei, C. nebulosum, C. macrocephalus, P. taeniatus, H. bidorsalis, P. barbarus, S. violaceus, M. delicious, M. mento, M. macrocephalus, G. decadactylus, P. macrocepis, P. rogeri, P, typus, S. micropogon, S. senegalensis, D. lakdoensis* and *S. afra*. Means separation by Least Square Mean (LSD) as depicted in Table 1 showed that monthly means were grouped into five categories and are as follow in their descending order: September; August; October; June, July, November, December, January and February; and March, April and May. The month with the highest mean was in August (18077.50±23172.60) whereas the least was in June (118.00±89.10); both during the wet season.

Seasonal variations

In terms of number, the wet season occurrence was higher (1839; 79.61%) than that of the dry season (471; 20.39%). During the dry season, a total of 697 fish specimens were sampled and 1550 fish specimens were sampled during the wet season (Table 2). The total number and relative abundance of the species was significantly higher during the wet season (105 species and 77.77%) than during the dry season (93 and 68.88%). Sixty-three species occurred in both seasons. The Coefficient of Variation (CV) and ANOVA performed for selected fish species with high condition factor £2.00) values at $p < 0.001$ probability level showed seasonal variation among the species. Two fish species had higher variability during the dry season than the wet season: *A. baremose* (27.50%; 22.60%) and *B. nurse* (15.57%; 4.72%). The fish species with higher variability during the wet season than the dry season were *B. leuciscus* (8.16%; 6.67%), *B. longipinnis* (15.91%; 6.83%), *T. mariae* (5.91%; 5.19%), *C. garienpinus* (5.13%; 2.73%), *M.electricus* (2.79%; 2.20%) and *P. pellucida* (40.18%; 23.75%). Also, some fish species were found to vary only in one season and absent in the other season. For instance, *O. aureus* (3.97%), *O. niloticus* (7.14%), *C. citharius* (12.93%), *I. africana* (7.47%) and *L. grandisquamis* (2.21%) were significant during the dry season while *B. macrolepidotus* (3.18%) and *H. fasciatus* (5.18%) were significant during the wet season.

Size variation

The largest fish size in terms of length was recorded in *C. aluuensis* (45.60cmTLmax; 18.40±9.0cm) while the smallest individual was *P. pellucida* (1.10cmTLmin; 7.50±1.20cm). The overall weightiest fish was also *M. cephalus* with a total weight of 662.80gWTmax; 54.42±16.75 while the lightest individuals were *P. pellucida and E. buffei* (1.00gTWmin).

Discussion

The natural fish fauna assemblage of a watershed is a valuable resource from ecological and economic viewpoints and the rational management and conservation of the fish resources based on the critical survey of the fish faunal composition (King 1992).

There is a high piscine endemics in the inland fishery resources of Nigeria which composed of over 200 species (Udoidiong and King, 2000), with Lake Kainji having over 100 species while Lake Chad has 87 species (NARESCON, 1992); Ogun River has 85 species (Sydenham, 1977); Cross River has 166 species (Teugels *et al*., 1992); Kubanni reservoir has 9 species (Annune and Bako, 1998); some Nigerian streams harbour 55 species and 40 species, 35 genera, 24 families (Udoidiong and King, 2000); 18 families, 32 genera and 48 species have been reported of the lower Benue River (Iorchor *et al*., 2007); 17 species, 15 genera and 11 families of fish from Onu-Iyi-stream (Sikoki *et al.*, 2008); Ntak Inyang stream (Ikpa River) has 4 orders, 7 families, 14 genera and 26 species (Onuoha *et al*., 2010); 32 fish families have been reported in lower Ikpa River (Ekpo and Udoh, 2010) and even those in other parts of the world: Brazillian tropical river had 51 species made up of 15 families (Pinto and Araujo, 2007); Mulgrave River composed of 36 species, 33 genera and 26 families (Rayner *et al*., 2008).

The freshwater fish species composition of Nwaniba (Ikpa River) composed of many euryhaline or marine intrusive species represented by such families as Mugilidae, Pomadasidae, Clupeidae, Carangidae, Eleotridae, Sphyraenidae, Monodactylidae, Polynemidae, Cynoglossidae, Scaenidae, Lutjanidae and Gobiidae.

They varied in shapes and sizes which showed that they occupied the whole length, width and depth of the river. The closeness of Ikpa River to the lower Cross River (which empties into the Atlantic Ocean at the Bight of Benin) must have permitted invasion of these marine migrants into Ikpa River as also reported by Welcomme (1985), Nwadiaro (1989), Udoidiong and King (2000), Sikoki *et al*., (2008), Onuoha *et al*., (2010) and Ekpo and Udoh (2010). In large rivers, Welcomme (1985) observed that the migration pattern tends to become more complex as migrations within the tributary rivers at the main river channel are mixed with movements between the various elements of the system. The presence of Carangidae, Lattidae, Lutjanidae, Mugilidae, Scaenidae, Soleidae and Sphyraenidae during the dry season only in this research agrees with the report of Welcomme (1985) that many marine or euryhaline species enter the lower reaches of rivers to feed during the dry season and return to the sea during the rains.

Table 1: Mean monthly variation in measures of disparity and LSD means of fish in Nwaniba beach, Ikpa River, Nigeria.

Months	N	%N	Mean ± Std	LSD mean
March	69	2.99	164.50±34.65	258.00_{c}
April	117	5.07	523.00±30547	245.00_{c}
May	124	5.37	273.00±76.37	207.00_{c}
June	47	2.03	118.00±89.10	353.00_{bc}
July	142	6.16	1668.00±2101.52	941.00_{bc}
August	536	23.23	15628.00±4750.34	5379.00_{ab}
September	341	14.76	18077.50±23172.60	6388.00_{a}
October	266	11.53	6105.00±76.84	2377.00_{abc}
November	146	6.32	553.00±29.70	474.00_{bc}
December	162	7.01	473.00±449.72	422.00_{bc}
January	160	6.93	904.50±573.46	542.00_{bc}
February	197	8.53	1607.00±1923.33	714.00_{bc}
TOTAL N	2307	100		

Means with the same letters are not significantly different.

Table 2: Species composition, size ranges, and seasonal occurrence of fish in Nwaniba, Ikpa River, Nigeria

Fish species	N	Size ranges						Seasonal occurrence	
		Total length (cm)			Total weight (g)				
		Min	Max	Mean	Min	Max	Mean	DS	WS
C. kingslayae	5	12.20	16.70	14.60±1.70	49.00	100.07	72.21±17.09	+	+
C. nebulosum	1	16.00	16.00	16.00	90.05	90.05	90.05	-	+
C. nuriei	1	13.40	13.40	13.40	10.80	10.80	10.80	-	+
A. gigas	39	8.80	25.00	14.00±3.90	5.20	79.20	2578±19.18	+	+
A. h eudelo ti	26	11.10	25.80	16.40±3.50	13.20	129.30	39.47±23.55	+	+
A. latiscutatus	52	8.50	20.20	12.90±2.60	6.70	56.60	21.10±12.12	+	+
A. fasciatu s	2	12.30	16.00	14.20±2.60	24.80	60.05	42.43±3.85	-	+
C. filamenteous	5	13.50	17.00	15.20±1.60	10.00	460.00	39.33±8.00	-	+
C. aluuensis	44	6.30	45.60	18.40±9.00	19.60	148.50	57.69±78.91	+	+
C. auratus	22	12.80	27.10	17.70±3.70	9.60	81.08	55.59±33.79	+	+
C. furcatus	24	10.00	32.10	16.90±4.40	70.06	126.30	44.17±19.73	-	+
C. nig rodigitatus	28	13.30	45.00	19.30±7.40	31.20	125.80	51.23±30.88	+	+
C. macrocephalu s	1	15.30	15.30	15.30	31.20	31.20	31.20	+	-
C. hippos	20	9.10	14.00	11.5±1.30	2.00	77.20	2179±759	+	-
C. sen egalensis	17	5.30	17.50	11.4±4.70	15.10	276.70	21.65±8.91	+	-
T. teraia	6	8.80	25.10	15.80±6.80	2.00	77.20	28.63±27.55	+	-
L. niloticus	4	22.60	27.50	25.10±3.50	13.80	276.70	100.95±103.68	-	+
P. Africana	2	11.80	27.60	21.80±8.70	103.30	183.50	143.40±40.10	+	+
P. obscura	3			22.60	13.80	183.80	76.20±76.41	+	-
A. dentex	3	10.60	20.50	20.00±0.50	18.20	81.30	35.10±1.35	+	+
B. brevis	4	9.40	18.20	11.00±0.02	18.20	42.50	20.30±1.85	+	-
B. intermediu s	10	12.20	15.30	13.50±1.40	21.40	80.00	30.13±19.71	+	-
B. leuciscus	13	11.50	19.60	13.40 ±2.40	2.80	20.35	1175±8.32	+	+
B. longipinnis	62	6.40	14.60	9.10±2.10	3.00	75.60	9.73±1158	+	+
B. macro lepidotus	19	3.80	16.70	8.80±2.90	5.90	220.07	19.28±47.35	+	+
B. nurse	48	7.30	25.60	9.00±4.10	5.50	110.04	31.49±25.41	+	+
B. quinquesquama e	6	7.10	19.00	12.30±3.00	1.70	83.00	31.94±32.29	+	+
H. forsakhlii	13	5.10	18.30	11.90±5.20	20.05	83.00	48.54±28.75	+	+
H. lineatus	4	11.00	18.30	14.90±3.00	6.30	37.20	36.05±1.15	+	+
M. humilis	24	8.20	15.50	12.20±3.70	6.30	57.40	17.04±13.99	+	+
M. elongates	16	7.00	15.60	10.00±3.10	2.30	30.00	11.51±8.21	+	+
M. occidentalis	10	5.50	14.50	9.70±3.00	8.80	18.00	12.97±3.45	+	+
C. guntheri	8	8.60	10.80	9.70±0.80	12.00	44.50	29.69±9.92	-	+
H. bimaculatu s	1	10.90	10.90	10.90	22.50	22.50	22.50	-	+
H. fasciatus	14	8.40	17.20	12.50±2.20	9.60	93.40	46.06±27.56	+	-
O. aureus	35	9.70	22.00	14.40±2.60	18.30	224.30	72.69±49.43	+	+
O. niloticus	31	9.80	29.60	15.20±4.10	20.20	476.10	86.48±8876	+	-
P. pulcher	5	8.30	14.40	12.30±2.60	9.80	66.20	38.68±19.19	+	+
P. taenia tus	1	8.80	8.80	8.80	10.06	10.06	10.06	+	+
S. galilaeus	10	12.80	22.30	15.50±2.60	70.00	210.05	83.95±45.77	+	-
S. macrocephala	19	8.00	17.70	14.30±2.30	10.00	108.20	60.91±24.18	+	+
S. melano theron	7	7.10	15.20	8.80±2.90	8.00	69.50	17.14±21.42	+	+
T. dageti	21	7.00	21.50	13.60±3.40	8.20	210.70	63.83±44.27	+	-
T. guineen sis	14	6.60	16.80	11.10±2.60	6.20	109.20	35.31±27.07	+	+
T. mariae	33	5.60	20.40	11.40±4.30	6.80	164.80	56.18±4536	+	+
T. zillii	25	6.00	18.00	9.90±3.20	6.30	150.55	31.33±32.94	+	+
C. citharius	2	11.40	23.40	16.80±4.20	16.40	80.10	47.66±28.88	+	+
C. latus	8	12.50	18.10	15.30±4.00	24.20	63.00	22.65±1.55	+	+
C. ag boyien sis	6	11.10	18.90	15.00±2.70	9.40	55.80	26.77±14.31	+	+
C. an guillaris	4	10.00	25.00	20.20±3.60	37.00	79.50	55.13±15.98	+	-
C. bu thupogon	6	16.30	22.70	19.80±2.20	32.00	76.20	56.80±13.80	+	+
C. camerunensis	5	19.70	22.40	20.90±1.10	62.30	82.10	74.80±1076	+	+
C. ga rienpinus	35	10.90	29.80	20.20±3.40	4.40	192.20	65.55±33.75	+	+
C. jaensis	4	17.20	23.50	21.50±3.00	38.00	120.03	87.25±28.00	+	+
C. macromystax	15	5.30	24.30	14.40±5.20	31.20	125.80	73.21±29.16	+	+
H. bidorsa lis	1	29.90	29.90	29.90	250.06	250.06	250.06	+	+
H. longifilis	11	9.10	34.70	18.30±6.90	5.80	364.20	69.25±96.91	+	-

E. fimbriata	32	9.60	13.10	10.90±0.80	9.20	25.10	13.12±3.43	+	+
I. Africana	39	8.30	12.50	10.70±0.90	6.50	35.60	12.15±2.97	+	-
P. leonensis	4	15.60	15.60	15.60	3.70	15.80	8.27±5.37	+	-
S. madrenesis	7	9.60	21.00	13.20±5.10	8.80	50.04	20.92±17.52	+	+
S. leonensis	5	4.90	5.60	5.30±0.50	1.00	9.80	4.58±3.35	+	-
C. senegalensis	2	9.50	12.20	10.80±1.10	11.60	25.50	30.50±6.74	+	+
B. ablabes	7	13.40	22.70	16.00±3.10	21.40	115.60	45.57±29.34	+	-
B. callipterus	18	4.80	8.50	6.50±1.00	1.50	9.00	4.14±1.87	+	-
L. parvus	15	9.90	20.70	13.00±5.00	3.20	80.03	30.30±28.56	+	+
N. ansorgii	6	6.20	9.20	7.20±1.40	3.50	12.30	6.13±3.22	+	+
P. dimidiatu s	3	6.20	6.40	6.30±0.10	3.50	4.00	3.83±0.24	+	+
B. africanus	51	10.00	25.00	20.20±3.60	3.20	179.60	57.20±48.12	+	-
E. kribiensis	4	7.00	7.60	7.20±0.30	3.60	3.90	5.50±1.00	+	+
E. senegalensis	61	3.70	24.30	10.70±4.80	1.80	179.00	27.56±36.67	-	+
E. vittata	14	5.20	10.20	7.90±1.50	2.20	4.80	7.06±3.85	+	+
E. lacerta	9	7.30	23.6	20.30±5.10	3.10	65.70	49.02 ±20.40	-	+
C. lateristriga	21	5.10	13.80	8.40±2.50	1.40	42.00	10.25±10.18	+	+
P. barbarous	1	5.20	5.20	5.20	1.60	1.60	1.60	+	+
P. schlegelli	59	5.30	12.40	7.10±2.10	2.40	23.60	5.32±3.05	-	+
H. odoe	33	15.40	32.50	22.70±3.90	23.80	260.06	89.83±65.28	-	+
I. besse	4	13.20	14.10	13.60±0.50	9.60	11.30	10.25±0.64	+	+
I. monody	5	12.70	18.80	15.10±2.30	9.80	36.40	19.36±9.33	-	+
P. loricatus	4	10.40	13.40	12.00±1.40	5.20	9.50	7.38±1.98	-	+
L. agennes	2	10.20	21.20	15.70±7.80	16.50	169.60	93.05±76.55	-	+
M. electricus	16	11.10	21.50	17.10±2.70	30.07	133.00	91.64±29.86	+	-
M. min jiriya	3	17.00	17.50	17.30±0.40	90.00	103.10	97.13±5.41	+	+
S. courteti	24	9.10	19.70	13.80±2.50	7.80	74.80	33.16±15.60	+	+
S. eupterus	13	9.20	18.70	13.20±2.50	10.07	53.70	28.68±13.22	+	+
S. filamenteous	2	21.70	21.70	21.70	23.80	77.70	44.67±23.63	-	+
S. gobroni	6	11.40	15.80	13.00±1.60	13.70	43.30	36.08±10.53	-	+
S. guttatus	5	12.80	16.10	14.60±1.20	24.80	28.80	35.68±10.91	-	+
S. nigrita	7	11.60	17.00	14.00±2.00	22.50	61.00	35.24±13.78	-	+
S. obesus	6	12.20	19.10	14.80±2.80	22.90	82.50	43.54±19.17	-	+
S. occellifer	3	9.20	16.70	14.00±4.10	9.50	43.00	29.23±14.31	+	+
S. resupinatus	2	12.00	15.00	13.50±2.10	21.60	48.60	35.10±13.50	-	+
S. schall	4	14.80	17.60	16.70±1.30	39.80	53.30	40.50±6.38	-	+
S. sorex	2	15.20	24.10	19.70±6.30	24.80	127.00	75.90±51.10	-	+
S. violaceus	1	25.80	25.80	25.80	115.70	115.70	115.70	+	+
S. waterlo ti	2	18.60	12.00	19.80±1.70	59.80	84.10	71.95±12.15	-	+
M. sebae	10	7.30	9.70	8.30±0.80	11.50	27.00	18.01±4.84	-	+
B. brach yistus	2	5.30	6.20	5.80±0.60	1.50	1.80	1.12±0.55	+	+
G. debonen sis	15	9.20	20.50	13.80±4.10	4.70	63.50	18.68±13.78	-	+
G. cyprinoides	14	8.80	21.70	13.20±4.40	5.00	79.50	21.76±23.44	+	+
G. petersii	7	18.30	21.40	20.00±1.30	23.80	46.00	38.86±6.88	+	+
G. pictus	2	6.50	18.70	11.10±6.60	2.70	6.00	4.35±1.65	+	+
G. sen egalensis	13	8.70	20.20	15.50±3.80	5.30	67.50	29.74±18.50	-	+
I. henrgii	3	7.80	12.20	10.00±2.20	4.40	12.30	8.00±3.26	+	+
M. delicious	1	19.00	19.00	19.00	45.40	45.40	45.40	-	+
M. ihuysi	5	8.00	9.80	8.60±0.70	4.80	10.05	6.39±1.90	+	-
M. isidori	3	6.50	8.10	7.60±0.90	3.00	6.20	4.93±1.39	-	+
M. mento	1	15.80	15.80	15.80	24.30	24.30	24.30	-	+
M. macrophthalmus	1	15.70	15.70	15.70	24.40	24.40	24.40	-	+
M. rume	6	19.50	30.30	24.40±3.70	52.60	146.80	97.05±32.85	-	+
P. ansorgii	31	5.90	13.20	9.90±1.60	1.90	28.40	10.07±4.59	+	+
P. bovei	30	3.00	14.00	9.60 ±2.50	1.50	25.40	9.58±6.58	-	+
P. simus	23	8.10	13.90	10.40±1.30	4.90	29.30	11.58±5.73	-	+
P. adspersus	2	6.80	10.00	8.40±2.30	3.50	10.02	6.76±3.26	-	+
L. falcipinn is	29	12.20	22.50	16.60±2.30	22.70	120.07	43.49±19.24	-	+
L. grand isquamis	39	13.30	21.60	17.40±1.80	21.00	91.40	46.98±14.16	+	-
M. cephalus	15	15.00	22.20	18.00±2.00	30.03	662.80	54.42±16.75	+	-
P. afer	5	17.6	39.00	28.10±9.30	41.60	134.80	80.28±33.93	+	-
H. niloticus	8	26.30	32.20	29.40±2.20	31.40	338.70	246.70±92.57	+	+
G. decadactylus	3	17.50	26.50	23.30±5.00	30.04	129.00	88.65±42.41	+	+
P. quadrifilis	1	21.20	21.20	21.20	60.30	60.30	60.30	+	-
P. macrocepis	1	16.70	16.70	16.70	33.20	33.20	33.20	-	+
P. jubelini	6	13.20	16.80	15.30±1.50	23.20	56.50	43.10±13.13	+	-
P. peroteti	26	12.40	20.80	15.50±2.70	22.60	121.30	50.80±32.74	+	-
P. rogeri	1	18.50	18.50	18.50	81.20	81.20	81.20	+	+
P. typus	1	13.90	13.90	13.90	15.80	15.80	15.80	+	-
E. buffei	9	5.10	13.80	7.10±2.90	1.00	27.70	2.60±8.18	+	-
P. pellucid a	577	1.10	9.70	7.50±1.20	1.00	11.90	2.60±0.87	-	+
S. intermedius	20	9.50	16.80	13.10±2.50	4.20	39.50	18.81±11.96	-	+
S. micropogon	1	18.70	18.70	18.70	37.70	37.70	37.70	-	+
S. mystus	16	6.40	20.80	13.90±4.50	2.20	77.70	22.73±21.44	-	+
S. uranoscopus	22	11.00	22.30	16.10±2.60	7.60	95.70	30.07±21.95	+	+
S. senegalensis	1	12.90	12.90	12.90	16.90	16.90	16.90	+	+
D. lakdo ensis	1	11.10	11.10	11.10	13.60	13.60	13.60	-	+
S. afra	1	15.40	15.40	15.40	13.60	13.60	13.60	+	-
No. of species present	2307							+	-
Total No. of species present								93	105
Relative abundance (%)								136	
+ = Present								69.40	77.77

Moreover, they enter the freshwater system with the saline tongue and increased salinity due to evapo-transpiration during the dry season gives them a more conducive environment to survive. King and Akpan (1998) found two genera in Qua Iboe River system which empties into the Atlantic Ocean: *Liza* and *Mugil* comprising four species: Liza *grandisquamis*, *L. falcipinnis*, *L. dumerili* and *Mugil curema*. The difference in the Mugilidae species composition in this present study may be occasioned by the fact that the former was carried in the estuary (the second author is the present researcher) and not in the river. In the schilbeid fisheries resources of the lower Cross River, Lebo and King (1998) reported 2 genera: *Schilbe* and *Parailia* comprising four species (*Schilbe intermedius, S. mystus, S. uranoscopus* and *P. pellucida)*, with *P. pellucida* as the most abundant in the wet season and least in the dry season. But the present finding on the occurrence of schilbeids in Nwaniba, Ikpa River revealed three genera: *Eutropius* in addition to the other two.

The total fish population was quite high and very similar to those obtained in similar water bodies: King (1989) had a total population of 1512 mormyrids, 1888 specimens were sampled (Udoidiong and King, 2000), 13,064 specimens (Pinto and Araujo, 2007), 98,159 specimens (Iorchor *et al*., 2007) and 552 piscine specimens (Onuoha *et al*., (2010). The pooled abundance data have been shown that the mormyrids made the highest contribution of 25.57% and on the species level, *Brienomyrus brachyistus* (64%) dominated (King 1989; Udoidiong and King, 2000), Characiformes had 41.18% (Giller and Malmqvist, 2002; Pinto and Araujo, 2007); Characidae was the dominant family (442 specimens; 80.06%) while *B. longipinnis* was the dominant species by number and preponderance 46 specimens (28.45%) and 48.70% respectively (Onuoha *et al*., 2010). This result showed that the following fish families made their greatest contribution in a descending order: Characidae, Cichlidae and Mormyridae; these have been considered as river families indeed (Welcomme, 1985; King, 1989; Giller and Malmqvist, 2002). Their abundance may be caused by their small sizes, genetic materials, favourable environmental conditions and early maturation. In addition, the cichlids have been known to exhibit some high levels of parental care together with the fact that they are prolific breeders.

The species of fish inhabiting rivers cover a wide range of size as is depicted by the maximum recorded total lengths of the individual fish species. Small - sized individuals have generally been associated with shallow inland water bodies but Nwaniba beach houses several large fish of economic, commercial and food values which are sold and exported within Akwa Ibom State and its environs (Ekpo and Udoh, 2010). Hence, the deeper the water the larger the organisms found in it. Large riverine species have been reported by researchers such as Onuoha *et al*., (2010) had *Hepsetus odoe* of 27.70cmTL; 103.80gTW in Ntak Inyang stream (Ikpa River); Welcomme (1985) reported *Lates niloticus* to attain length of 1.5m in Africa; King (1989) recorded the smallest and largest length of *B. brachyistus* to be 3.1 and 16.0cmTL in a rainforest stream; King (1998) discovered the maximum size of *Tilapia mariae* to be 34.7cmTL also in Ikpa River; but in the present study 20.4cmTLmax. Apart from being a genetic factor, the reduction or decrease in the maximum size of *T.* mariae in Ikpa River may be caused by location differences, gear – type, sampling intensity and frequency or effect of anthropogenic perturbation which is seriously threatening the ecosystem. However, King (1998) reported that allometry growth in body depth relative to total length of *T. mariae* was also isometric, a trait which has a significant aquaculture implication and overall length growth performance portrayed a high growth impetus which with normal feeding regime in aquaculture ponds, *T.* m*ariae* would be ready for harvesting within 8months, a duration which can be further shortened by intensive feeding. This is good news to aquaculturist whose fear of timely harvest had been on reaching table size since a lot of people prefer the scaly species but for their small sizes and many bones. Welcomme (1985) reported that small size is advantageous as the species can mature more rapidly (often within one year), can seek refuge in the root masses of vegetation, can colonize the surface area of the water, and speedily exploit the neuston or allochthonous food sources found there.

Some characteristic freshwater species such *Epiplatys* sp, *Mastacembelus*, *Erpetoichthys* and *Xenomystus nigri* were significantly absent from the present study and this observation had been reported by Sikoki *et al.,* (2008). *Epiplatys* fishery is very important in carnivorous and piscivorous food chain /web because of its unique small size even at maturity. This absence may be due to selectivity of the mesh sizes of the gear used and being that sampling was concentrated in the river channel and not on the floodplains or swampy areas. But Welcomme (1985) observed that in tropical African forest stream, several genera of cyprinodonts occupy the water surface, particularly *Epiplatys* and *Aphosemion* although some characins such as *B. macrolepidotus* are also found there. However, species similar to it is *Barbus callipterus* which was caught and landed. In deoxygenated systems, there are provisions for adaptations for air-breathing in fish such as Channidae, Anabantidae and Clariidae. The ability to breathe atmospheric oxygen enables fish to colonize water which would have been otherwise uninhabitable thereby reducing interspecific competition. Several physostomous families have modified swim bladders which act in an almost identical manner e.g. included Osteoglossidae, Mormyridae, Notopteridae, etc. *X. nigri* had been reported to possess accessory breathing organ which enables it to tolerate low dissolved oxygen levels and its family member, *P. afer* (Notopteridae) is among the fish species sampled in this work. Hence, the human anthropogenic activities such as bathing and washing with soap and detergents, timber saw-dust chippings, etc in the beach water should not be an excuse for absence. These activities result in allochthonous organic inputs to the aquatic systems, which in turn require high oxygen demand for their aerobic respiration or oxidative processes. Welcomme (1985) noted that elongated-shaped fish are found in the rocks and also occur in the floating vegetation at the fringes of the pools as the sinuous habit is equally adapted to such conditions. *Mastacembelus* and *Erpetoichthys* particularly are conspicuous in such environments as they also frequent similar vegetation. This system is therefore an ideal environment for them to occur; therefore their absence is disturbing desiring an immediate action, hoping that they are not extinct. The rarest cichlid species observed in Udoidiong and King (2000) did not conform to this study as shown by its high abundance except in *P. taeniatus* and *H. bimaculatus* (with a single species only); this may be caused by high gear efficiency and sampling intensity together with the fact that this is a downstream river.

The high number of species recorded in this work may be explained in the following ways: the physical configuration, water dimension (min = 3.70; max = 35.40 and mean

=5.33±0.97m) (Ekpo *et al.,* 2011) and gradient may be supportive of diverse microhabitat requisite for diverse residents; high diversity is a function of high productivity, which is a common feature of large water bodies especially in the tropics (Welcomme, 1985 and Lowe-McConnell, 1987) and lastly, higher diversity occurs in older habitats than in newly formed systems, which depends on stability over time. Abundance was higher during the wet season than during the dry season. This may be as a result of the expanded living area by the inundation of the floodplains, admixture of species from first order streams uniting to form subsequent orders in the stream hierarchy and the lower Cross River which it empties into, increased spawning and feeding grounds, more nutrient accumulation from surface run-offs, more allochthonous food resources and non-avoidance of the gear by the fish because of low transparency. The high fish production of aquatic ecosystems had been attributed to the meandering reaches and the braided channels further south (Moses, 1987) and appropriate food sources (Matzen and Berge, 2005). Other authors have reported on similar trends (Abowei, 2000 and Iorchor *et al*., 2007). In contrast, many researchers have also reported on higher fish density (by number) during the dry season (Ezenwa *et al*., 1987, King, 1989, Francis 2003, Sikoki and Zabbey, 2006, Sikoki *et al*., 2008 and Onuoha *et al*., 2010). They attributed higher catches during dry season to decreasing water dimension, making the fish to be more concentrated in the main river channel and more vulnerable to capture. However, Welcomme (1985) reported that the considerable differences in the number of species inhabiting the various river systems are largely attributable to the size of the river as represented by its basin area or some correlate of it such as length of main channel or stream order. Food resources availability in the aquatic system has been correlated with the stomach content of fish species. Thus, Malami *et al*., (2007) noted that the frequency occurrence of gizzards with food were higher in the early dry and flood season because of food abundance during flood season and insects and grains/seed availability in the early dry season. This, however, supported the work of Lowe-McConnell (1987) of the report on explosive growth of plants, invertebrates and fish during the rainy season in tropical waters, which is characterized by active feeding activities by the fish. Abundance and occurrence was highest during the wet season which is the growing, reproductive (by some freshwater species) and feeding season. The Siluriformes occurred most and the most abundant species (*P. pellucida* and *E. buffei*) were the smallest individuals obtained in the same order and in the samples as a whole.

Generally, most of the species caught were undersized. Hence, there is a great need to allow the fish stock to grow and be recruited into the fishery before capture in order to sustain the fishery and to be used to subsidize for the protein nutrition. This will be possible by monitoring the types of gear used and the mesh sizes, so that juveniles are not harvested and landed along with the adults. The following recommendations are therefore proffered: wastewater should be pre-treated before emptying into the river course, more holistic aquatic scientific researches should be encouraged, water crafts should be monitored, timber chippings from the timber mill should be controlled and unorthodox fishing methods and illegal fishing implements should be discontinued so as to encourage growth and recruitment of the fishery. This piece of work has serve as benchmark/baseline information for further researches in Ikpa River, Nigeria.

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