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The Ornamental Fish Fauna Assemblage in the Upper Reaches of New Calabar River in Rivers State, Nigeria.

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Abstract

A thirteen week investigation was conducted to document the ornamental fish assemblage of the upper reaches of New Calabar River, Rivers State. Four sample stations along the river's course were selected. Landed fish species were collected from local fishers. Fish composition and abundance was estimated by standard methods. Results of composition revealed forty one (41) species belonging to thirty five (35) genera, in twenty five (25) families. Family composition revealed among the twenty five (25) ornamental families, the Cichlidae was most dominant with nine (9) species from five (5) genera. Species composition revealed *Malapterurus electricus* (Malapterurudae) as most dominant species. Species richness was highest at Station D (3.95), slightly lower in Stations B (2.91) and C (2.60), and least in Station A (1.84). Family relative abundance revealed Cichlidae (20.16%) as the most abundant family, followed by Malapterurudae (9.91%), Alestidae (8.81%), and few others. However, several families recorded low abundance, with Mastacemblidae the least (0.04%). Species abundance also, revealed *Malapterurus electricus* as most abundant (9.99%), followed by *Erpetocheithys calabaricus* (7.78%), *Brycinus longipinnis* (7.35%), before *Tilapia zilli* (7.22%), and *Aethiomastacemblus nigromarginatus* the least abundant (0.02%). Abundance score revealed most fish species were dominant (D) to abundant (A), however five species were rare (R), including an economically important ornamental species, *Gnathonemus petersii.* Analysis of variance of species abundance revealed that, Stations B and C were similar, but significantly different from Stations A and D at (p=0.05). In conclusion, the river supports a considerable assemblage of ornamental ichthyofauna, however a few are rare.

Keywords: Ichthyofauna, New Calabar River, Ornamental fishes, Species composition, Species abundance

Introduction

Ornamental fish is often used as a generic term to describe attractive and/or colorful fishes, invertebrates (such as corals), crustaceans (e.g. crab, hermit crab, shrimps, etc), mollusk (e.g. snail, clams, scallops, etc.), Mammals (such as Whales), and also various forms of live rocks, which are kept for fun and fancy, in confinements or receptacles referred to as an aquarium or garden pool (Ibim and Udeme-Naa, 2011). Ornamental fishes are usually kept in glass aquarium and hence popularly known as ''Aquarium Fishes''. These precious living jewels need not always have bright colours, but peculiar characteristic morphology such as body shape, mode of feeding, movement pattern, among others, may also add to their attractiveness (Livengood and Chapman, 2009). These fishes are of economic importance. The ornamental fish trade is the primary export business of most of the Asian countries as it is a high foreign exchange (FOREX) earner world-wide.

The New Calabar River is an economically important waterway located in Rivers State, Nigeria (Erondu and Chinda, 1991). It is of enormous economic importance, as it supports a number of communities, and a wide variety of human and industrial activities in the Niger Delta Area. The upper reaches of the river commences from Isiokpo community and transverse through several other communities, transiting from fresh to brackish water as it moves down to the Akpor community, all in Rivers State. Several studies exist on the assemblage and distribution of a variety of food fishes in the wild, especially in the Niger Delta Area, and specifically in the New Calabar River. However, there is a dearth of information on the ornamental fish species composition and abundance in the New Calabar River, and the upper reaches of this river, in particular. Meanwhile, there is a great need to identify sources for ornamental species that can sustainably enhance the development of the ornamental fishery business to create jobs and wealth for the teaming unemployed persons in Nigeria. This study was carried out to assess the ornamental fish species composition and abundance in the upper reaches of the New Calabar River. It would therefore serve as a document for identifying sources of indigenous ornamental fishes that will fast-track the sustainable development and management of the ornamental fisheries industry.

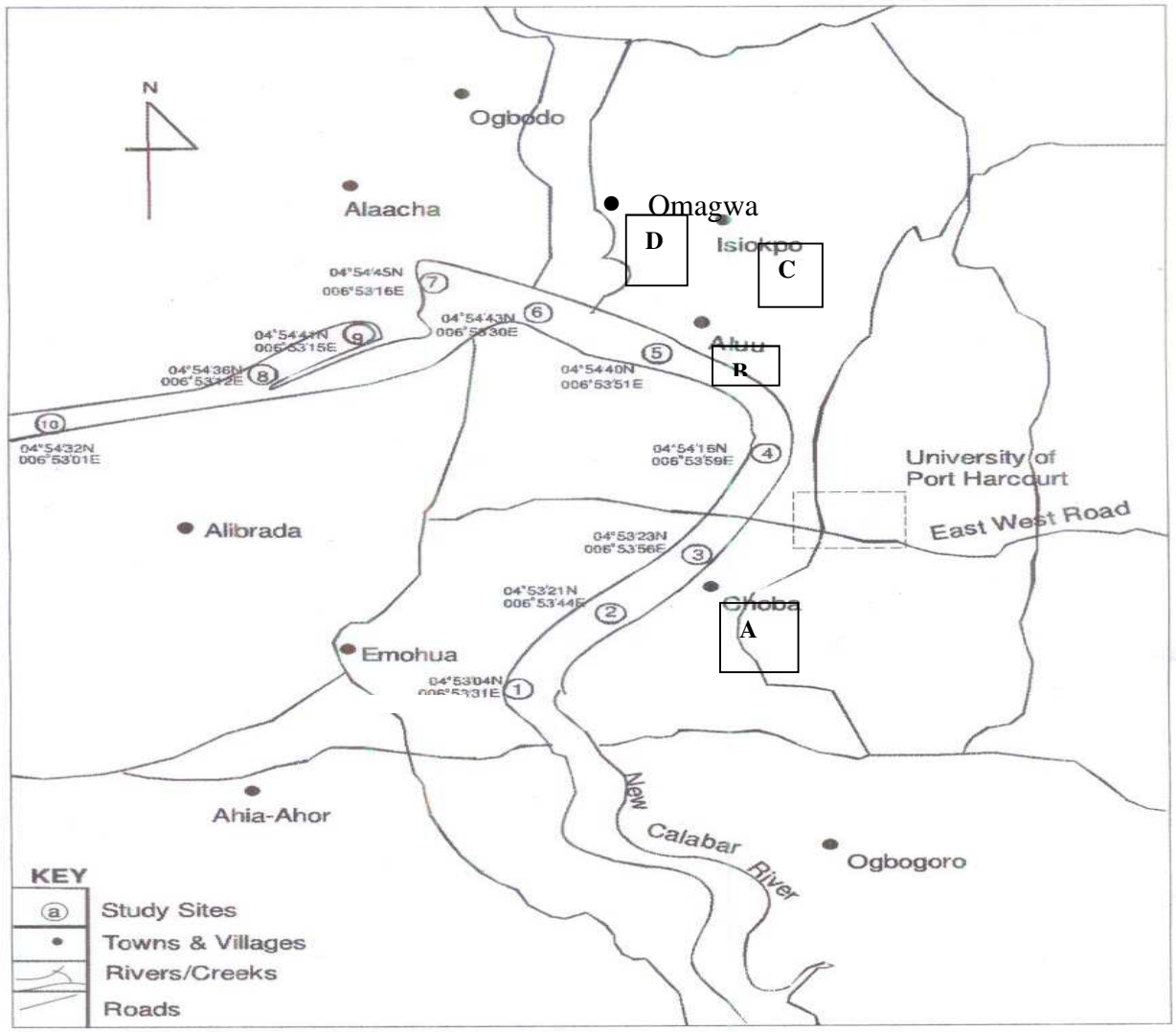

Figure 1: Map showing the four (A-D) stations on the Upper New Calabar River, Niger Delta. Where A = Choba, B = Aluu, C = Omagwa, D = Isiokpo

MATERIALS AND METHODS

Study Area and Sample Station Selection

The study was carried out at the Upper New Calabar River (Figure 1) located in the Southern part of Niger Delta basin. It drains the Niger Delta into the Atlantic Ocean. The river is located between Latitude: 4°25¹ N; Longitude: 7°16¹ E in the Niger Delta, central part of Southern Nigeria (NDES, 2003). Four sampling stations were randomly selected along the course of this section of the river namely; Choba (station A), Aluu (station B), Omagwa (station C) and Isiokpo (station D).

Sample Collection

Ornamental fish fauna were obtained from fisher folks twice weekly as they landed their catch, for thirteen weeks, from March to May at each sampling station. Total fish catch and the number of fishes of ornamental value (selected based on attractive characteristic feature such as body colour, attractive or unique shape, etc) were counted and samples collected.

Data Collection

Fish composition: This was determined by initially counting the total landed fish species, after which samples of the various species in the catch were collected, preserved, and identified using standard identification keys such as Wheeler (1994), Nigeria Freshwater Fishes (Olasoebikan and Raji, 2004), Taxonomy, Ecological Notes, Diet and Utilization (Idodo-Umeh, 2003), Fin Fishes of the Andoni River in Niger Delta (Sikoki and Francis, 2007) and the Fish base online website (Froese and Pauly, 2010).

Species richness: This was assessed using the Margelef's species richness index (d) = $\frac{S-1}{In\ N}$, where S is the number of species in the sample station and $In\ N$ is the natural logarithm of the total catch (Krebs, 1999).

Fish Abundance: This was determined by relative abundance method according to Allison *et al*; (2003). The abundance score for the species were estimated following the criteria of Allison *et al*; (2003) as: 1-50 = Rare (R), 51-100 = Few (F), 101-200 = Common(C), 201- 400 = Abundant (A) and > 400 = Dominant (D).

Data Analysis

Analysis of variance (ANOVA), at probability, $p < 0.05$ was used to assess the difference between sample stations, to determine if the fish species abundance were significantly different between stations.

RESULT

Fish species composition:

Generally a total composition of thirty thousand and fifty five (30,055) fishes consisting of forty one (41) ornamental species, belonging to thirty five (35) genera, twenty five (25) families and eleven (11) orders, as shown in the Checklist of fish species (Table 1), were caught from the four sampling stations in the upper reaches of the New Calabar River. The composition (Table 1) also revealed that, the Cichlidae recorded the highest occurrence of species having nine species (*T. zilli*, *S. malanotheron, T. mariae*, *H.* fasciatus, *C. guentheri, P. pulcher, P. taeniatus, T. dageti, T. guineensis*), belonging to five genera. This was followed by the families Mormyridae, and Claroteidae with three species each, belonging to three and two genera respectively. The families Notopteridae, Channidae, and Mastacembelidae were presented with two species each belonging to two genera, and Alestidae had two species belonging to one genera. All other families namely; Polypteridae, Polynemidae, Distichodontidae, Sphyraenidae, Monodactylidae, Carangidae,

Nandidae, Anabantidae, Hepsetidae, Malapterurudae, Aplocheilidae, Paralichtyidae, Schilbeidae, Clupeidae, Pantodontidae, Cyprinidae, Palaemonoidae, and Clariidae each recorded a single species belonging to one genera each.

However, fish species (numerical) composition through the study period (Table 2) showed that, from a total catch of 30,055, the *Malapterurus electricus* (Malapterurudae) was dominant with a total catch of 3002, followed by *Erpetoichythys calabaricus* (Polypteridae) with 2339 individuals, Brycinus longippinis (Alestidae) with 2210, Tilapia zilli (Chiclidae) with 2,171. The least species were *Channabelus apus* (Claridae) and *Gnathonemus petersii* (Mormyridae) with twelve individuals each, and *Aethiomastacemlbus nigromarginatus* (Mastacemblidae) with seven individuals.

Table1: Checklist of total ornamental fish caught in the upper reaches of New Calabar River

S/N	Species	Genus	Family	Order
1		*Tilapia*	Cichlidae	Perciformes
	1 *Tilapia zilli*			
2	*Tilapia mariae*	//	//	//
3	*Tilapia guineensis*	//	//	//
4	*Tilapia dageti*	//	//	//
5	*Hemichromis fasciatus*	*Hemichromis*	//	//
6	*Pelvicachromis pulcher*	*Pelvicachromis*	//	//
7	*Pelvicachromis taeniatus*	//	//	//
8	*Sarotherodon melanotheron*	*Sarotherodon*	//	//
9	*Chromidotilapia guentheri*	*Chromidotilapia*	//	//
10	*Channa obscura*	*Channa*	Channidae	//
11	*Parachanna africana*	*Parachanna*	//	//
12	*Polydactylus quadrifilis*	*Polydactylus*	Polynemidae	//
13	*Polycentropsis abbreviata*	*Polycentropsis*	Nandidae	//
14	*Ctenopoma kingsleyae*	*Ctenopoma*	Anabantidae	//
15	*Monodactylus sebae*	*Monodactylus*	Monodactylidae	//
16	*Sphyraena barracuda*	*Sphyraena*	Sphyraenidae	//
17	*Caranx hippos*	*Caranx*	Carangidae	//
18	*Brycinus macrolepidotus*	*Brycinus*	Alestidae	Characiformes
19	*Brycinus longipinnis*	//	//	//
20	*Hepsetus odoe*	*Hepsetus*	Hepsetidae	//
21	*Phago loricatus*	*Phago*	Distichodontidae	//
22	*Malapterurus electricus*	*Malapterurus*	Malapterurudae	Siluriformes
23	*Parailia pellucida*	*Parailia*	Schilbeidae	//
24	*Parauchenoglanis akiri*	*Parauchenoglanis*	Claroteidae	//
25	*Parauchenoglanis balayi*	//	//	//
26	*Chrysichthys nigrodigitatus*	*Chrysichthys*	//	//
27	*Channallabes apus*	*Channallabes*	Clariidae	//
28	*Syacium guineensis*	*Syacium*	Paralichtyidae	Pleuronectiformes
29	*Epiplatys sexfasciatus*	*Epiplatys*	Aplocheilidae	Cyprinodontiformes
30	*Xenomystus nigri*	*Xenomystus*	Notopteridae	Osteoglossiformes
31	*Papyrocranus afer*	*Papyrocranus*	//	//
32	*Hipoppotamystus pictus*	*Hipoppotamystus*	Mormyridae	//
33	*Gnathonemus petersii*	*Gnathonemus*	//	//
34	*Petrocephalus ansorgii*	*Petrocephalus*	//	//
35	*Pantodon buchholzi*	*Pantodon*	Pantodontidae	//
36	*Aethiomastacembelus nigromarginatus*	*Aethiomastacembelus*	Mastacembelidae	Synbranchiformes
37	*Caecomastacembetus decorsei*	*Caecomastacembetus*	//	//
38	*Sardinella maderensis*	*Sardinella*	Clupeidae	Clupeiformes
39	*Barbus macrops*	*Barbus*	Cyprinidae	Cypriniformes
40	*Machrobrachium machrobrachion*	*Machrobrachium*	Palaemonoidae	Decapoda
41	*Erpetoichtys calabaricus*	*Erpetoichtys*	Polypteridae	Polypteriformes

Fish species richness:

The fish species richness values (Table 3), showed the highest value at Station D (3.95), a slightly lower value in Station B (2.91), and still lower value in Station C (2.60), and the least value in Station A (1.84)

Table 2: Species Composition (Numerical) of Ornamental Fishes collected Weekly from the Upper Reaches of New Calabar River

S/N	Species	Total number of fish caught	Weekly Total Catch												
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	13
1	*Tilapia zilli*	2,171	69	43	161	82	222	188	253	191	209	206	255	139	**153**
2	*Tilapia guineensis*	1,116	20	13	56	190	45	0	123	131	240	48	94	68	**88**
3	*Tilapia mariae*	630	18	18	0	93	147	0	0	0	0	112	124	75	**43**
4	*Hipoppotamystus pictus*	676	0	15	0	47	43	77	0	0	0	127	60	184	**123**
5	*Petrocephalus ansorgii*	158	0	0	0	0	52	0	0	0	0	45	0	0	**61**
6	*Hemichromis fasciatus*	1,597	27	41	25	192	142	215	151	198	118	224	157	73	**34**
7	*Tilapia dageti*	67	15	0	0	0	0	0	52	0	0	0	0	0	**0**
8	*Sarotherodon melanotheron*	110	0	0	0	0	0	0	0	110	0	0	0	0	**0**
9	*Pantodon bucholzi*	418	0	0	0	43	0	0	0	0	0	0	51	324	**0**
10	*Erpetoichthys calabaricus*	2,339	76	52	129	147	178	179	201	286	132	286	357	316	**0**
11	*Malapterurus electricus*	3002	0	0	43	0	208	124	218	668	662	290	340	206	**243**
12	*Chromidotilapia guntheri*	826	25	17	46	83	53	40	40	94	184	106	0	76	**62**
13	*Pelvicachromis pulcher*	80	0	0	0	26	40	0	0	0	0	14	0	0	**0**
14	*Pelvicachromis taeniatus*	64	0	0	0	0	6	0	43	0	0	0	15	0	**0**
15	*Sardinella maderensis*	430	0	0	76	56	0	66	0	72	63	0		47	**50**
16	*Parailia pellucida*	350	0	0	0	0	0	48	0	0	12	33	110	89	**58**
17	*Polydactylus quadrifilis*	237	0	0	0	0	0	16	0	0	0	134	32	20	**35**
18	*Channa obscura*	226	22	17	24	0	0	23	18	63	51	0	0	0	**8**
19	*Parachanna africana*	459	7	17	35	0	0	0	56	102	220	0	0	0	**22**
20	*Brycinus logipinnis*	2,210	0	0	35	95	237	233	208	353	364	119	104	267	**195**
21	*Gnathonemus petersii*	12	0	0	0	0	0	0	0	0	0	0	0	0	**12**
22	*Chrysichthys nigrodigitatus*	1,810	61	85	115	96	89	132	182	215	110	236	191	139	**159**
23	*Xenomystus nigri*	1,044	35	25	19	150	47	185	54	0	0	178	217	134	**0**
24	*Papyrocranus afer*	1,088	25	88	54	76	65	35	60	53	126	144	205	129	**28**
25	*Brycinus macrolepidotus*	439	0	0	35	25	35	0	86	0	0	125	133	0	**0**
26	*Sphyraena barracuda*	279	0	0	19	45	45	15	76	15	0	0	64	0	**0**
27	*Hepsetus odoe*	314	35	13	15	9	52	0	5	43	10	87	0	0	**45**
28	*Epiplatys sexfasciatus*	638	0	0	0	0	0	48	101	161	155	34	139	0	**0**
29	*Monodactylus sebae*	218	0	0	0	22	42	35	16	55	10	19	19	0	**0**
30	*Syacium guineensis*	76	4	0	0	26	18	19	0	9	0	0	0	0	**0**
31	*Ctenepoma kingsleyae*	2,004	0	0	0	0	0	0	0	65	126	412	433	415	**553**
32	*Parauchenoglanis balayi*	722	0	16	26	99	111	62	0	123	144	69	0	0	**72**
33	*Polycentropsis abbreviate*	2,166	32	42	55	154	145	161	182	193	266	208	256	472	**0**
34	*Parauchenoglanis akiri*	88	3	0	0	0	0	0	85	0	0	0	0	0	**0**
35	*Aethiomastacembelus nigromarginatus*	7	0	0	0	0	0	0	0	0	0	0	0	0	**7**
36	*Barbus macrops*	104	0	0	0	0	41	14	0	0	0	24	25	0	**0**
37	*Phago loricatus*	730	18	15	0	0	14	28	89	164	174	63	110	37	**18**
38	*Machrobrachium machrobrachion*	15	0	0	0	0	0	0	0	0	0	0	15	0	**0**
39	*Caranx hippos*	1,109	0	0	67	0	0	140	120	154	120	242	0	125	**141**
40	*Channabelus apus*	12	0	12	0	0	0	0	0	0	0	0	0	0	**0**
41	*Caecomastacembetus decorsei*	14	0	0	0	0	0	0	0	0	0	0	0	0	**14**
	Total	30,055	492	529	1035	1756	2077	2083	2419	3518	3496	3585	3506	3335	2224

Fish species richness:

The fish species richness values (Table 3), showed the highest value at Station D (3.95), a slightly lower value in Station B (2.91), and still lower value in Station C (2.60), and the least value in Station A (1.84)

Table 3: Ornamental Fish Species Richness of the Upper Reaches of New Calabar River.

Index	Station A	Station B	Station C	Station D
Species Number	17	27	24	28
Species Richness Index (d)	1.839	2.914	2.597	3.947

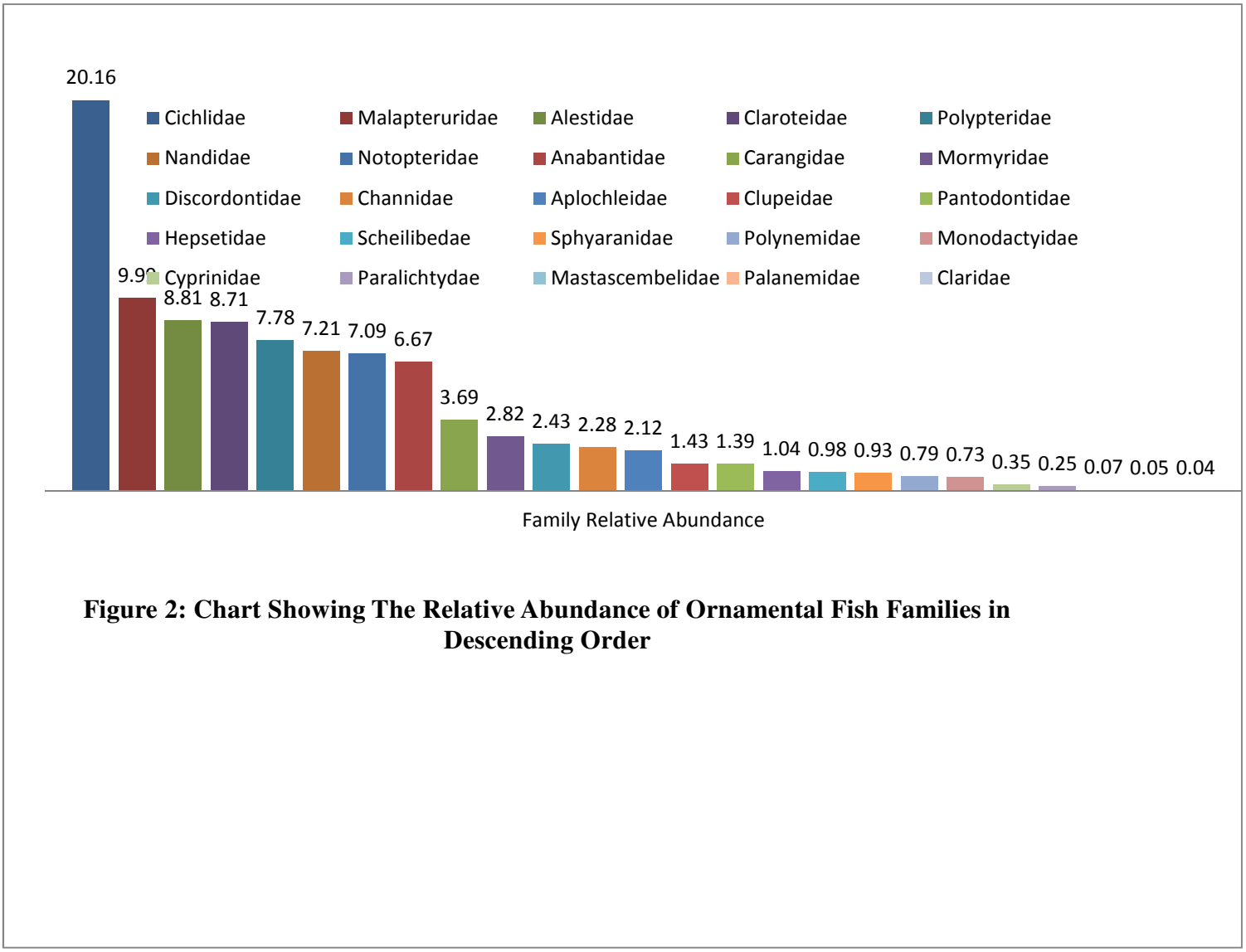

Figure 2: Chart Showing The Relative Abundance of Ornamental Fish Families in Descending Order

Table 4: Relative Abundance and Abundance Score of Ornamental Fish Species of the Upper Reaches of the New Calabar River

S/N	Species	Family	Total number of fish caught	Relative Abundance (%)	Abundance Score
1.	*Tilapia zilli*	Cichlidae	2,171	7.22	D
2.	*Hemichromis fasciatus*	//	1,597	3.31	D
3.	*Chromidotilapia guentheri*	//	826	2.75	D
4.	*Tilapia mariae* `	//	630	2.10	D
5.	*Tilapia guineensis*	//	1,116	3.71	D
6.	*Pelvicachromis pulcher*	//	80	0.27	F
7.	*Pelvicachromis taeniatus*	//	64	0.21	F
8.	*Sarotherodon melanotheron*	//	110	0.37	C
9.	*Tilapia dageti*	//	67	0.22	F
10.	*Erpetoichtys calabaricus*	Polypteridae	2,339	7.78	D
11.	*Channa obscura*	Channidae	226	0.75	A
12.	*Parachanna africana*	//	459	1.53	D
13.	*Polydactylus quadrifilis*	Polynemidae	237	0.79	A
14.	*Polycentropsis abbreviata*	Nandidae	2,166	7.21	D
15.	*Ctenopoma kingsleyae*	Anabantidae	2,004	6.67	D
16.	*Brycinus macrolepidotus*	Alestidae	439	1.46	D
17.	*Brycinus longipinnis*	//	2,210	7.35	D
18.	*Malapterurus electricus*	Malapterurudae	3,002	9.99	A
19.	*Syacium guineensis*	Paralichtyidae	76	0.25	F
20.	*Epiplatys sexfasciatus*	Aplocheilidae	638	2.12	D
21.	*Sphyraena barracuda*	Sphyraenidae	279	0.93	A
22.	*Hepsetus odoe*	Hepsetidae	314	1.04	A
23.	*Xenomystus nigri*	Notopteridae	1,044	3.47	D
24.	*Papyrocranus afer*	//	1,088	3.62	D
25.	*Hipoppotamystus pictus*	Mormyridae	676	2.25	D
26.	*Gnathonemus petersii*	//	12	0.04	R
27.	*Petrocephalus ansorgii*	//	158	0.53	C
28.	*Phago loricatus*	Distichodontidae	730	2.43	D
29.	*Parailia pellucida*	Schilbeidae	350	1.16	A
30.	*Aethiomastacembelus nigromarginatus*	Mastacembelidae	7	0.02	R
31.	*Caecomastacembetus decorsei*	//	14	0.05	R
32.	*Monodactylus sebae*	Monodactylidae	218	0.73	A
33.	*Caranx hippos*	Carangidae	1,109	3.69	D
34.	*Sardinella maderensis*	Clupeidae	430	1.43	D
35.	*Pantodon buchholzi*	Pantodontidae	418	1.39	D
36.	*Barbus macrops*	Cyprinidae	104	0.35	C
37.	*Machrobrachium machrobrachion*	Palaemonoidae	15	0.05	R
38.	*Parauchenoglanis akiri*	Claroteidae	88	0.29	F
39.	*Parauchenoglanis balayi*	//	722	2.40	D
40.	*Chrysichthys nigrodigitatus*	//	1,810	6.02	D
41.	*Channallabes apus*	Clariidae	12	0.04	*R*
	Total		**30,055**		

Table 5: Data Analysis for Fish Species Abundance between Stations in the Upper New Calabar River (P= 0.05)

Stations	Abundance
A	445.9^{b}
B	575.3^{ab}
C	550.0^{ab}
D	707.7^{a}
Mean (± S.E)	572.3
(DF = 37)	49.54

Note: Means with the same letter are not significantly differ

Relative abundance

The family relative abundance (Figure 2) revealed that the Cichlidae with 20.16% were the most abundant and dominant family, followed by the Malapterurudae (9.91%), Alestidae (8.81%), Claroteidae (8,71%) and few other families. However several families were low in abundance with the Mastacemblidae the least abundant family with 0.04%.

The species relative abundance (Table 4) contrarily revealed that the *Malapterurus electricus* was most abundant (9.99%), followed by *Erpetocheithys calabaricus* (7.78%), *Brycinus longipinnis* (7.35%), before the most abundant Cichlid Tilapia zilli (7,22%). The *Aethiomastacemblus nigromarginatus* among a few, was the least occurring with 0.02%. The abundance score further revealed that although most of the species of fishes were numerous, and dominant to abundant (A), there were a high number of the ornamental fishes that were few (F) and five were even rare (R), including the economically important ornamental *Gnathonemus petersii.* The data analysis (Table 5) revealed that stations B and C were similar and not significantly different from each other. However, Stations A and D were significantly different from each other, and significantly different from B and C.

DISCUSSION

The total ornamental fish composition recorded in this river was high as it comprised of a total of forty one (41) ornamental species belonging to twenty five (25) families and thirty five (35) genera. This was supported by the species richness also having a comparatively high species composition (station D – twenty eight (28) species, station B – twenty seven (27) species, station C – twenty four (24) species and station A seventeen (17) species).

Though there is paucity of information on ornamental fish species composition/richness in the upper reaches of New Calabar River, the number of species and families agrees with the studies on food fishes by Nwadiaro and Ayodele (1992) and Olori (1995), who worked on a small section of the upper reaches of the New Calabar River only (Choba end), but similarly reported a good number of composite fauna. Also, Ibim *et al.* (2016) in agreement with this study composition reported a high food fish fauna in the New Calabar River. However, nationwide survey on ornamental fishes in 2001, by the Nigerian Institute for Freshwater Fisheries Research (NIFFR), in the major river basins, indicated ten (10) ornamental species for the Niger Delta basin (NIFFR, 2001).

The dominance of the Cichlids among the twenty five (25) ornamental fish families, agrees with most studies carried out by majority of researchers on Nigerian water bodies, where Cichlids are commonly found to be dominant (Ibim and Douglas, 2016; Ibim and Owhonda, 2017). This could be attributed to the occurrence of several species in this family, and their wide tolerance of various types of environmental parameters, ability to utilize a wide range of foods in the lower trophic level as herbivores, and their high fecundity and prolific nature (Lowe McConnel, 1987; Awiti, 2011).

The higher fish abundance noted in station D than other stations, might have been as a result of less busy, rural and further inland and pristine nature of that station, whereas the lower abundance of station A may be connected to its very busy nature, supporting a higher population of fishers, amongst others. Inter/intra specific competition could also be responsible for lower species presentation in some families in certain stations.

The higher family relative abundance of the Cichlids than other families, is in agreement with most studies in the Niger Delta Area, especially in a closely linked Omuechi stream (Ibim and Owhonda, 2017). This high family abundance as seen in this study area, can be attributed to their tolerance

range of environmental parameters, utilizing a wide range of foods in the lower trophic level as herbivores, opportunistic feeding, high fecundity and prolific nature (Lowe McConnel, 1987; Awiti, 2011).

The case of families with low abundance, could be as a result of them recording only one species in some cases. Alternatively, anthropogenic enrichment of pollutants from municipal and industrial wastes noticed in especially the Choba section of the river system could be responsible for the largely low fish family abundance in this study. It has been reported that changes in water quality caused by pollutants, affect the diversity and abundance of aquatic resources including fish (Lowe McConnel, 1987; Victor and Tetteh, 1988; Ogbeibu and Ezeunara, 2002 and Oguzie, 2003).

The reason for the higher species abundance of the *M. electricus, E. calabaricus* and others above the Cichlid species is not known, but it could most likely be that, they are not commonly fished for food, when compared to the Cichlid species, which are known common fishes for food in the Niger delta Area (*Personal Communication*).

The abundance score confirmed high abundance and dominance of many species such as, *M. electricus, E. calabaricus, T. zilli, H. sexfasciatus, etc.* This may be due to their high fecundity, prolific breeding, and hardiness, among others. However, there existed five rare species. Their rarity may not be unconnected with the undocumented exploitation of such species for instance the *Gnathonemus petersii* for export markets, as they have been reported to be of high market value in the international export market of ornamental species (Areola, 2004). The Nigerian Institute for Oceanography and Marine Research (NIOMR), confirmed the export of about forty (40) species to foreign markets (Areola, 2004). Also, the lower abundance/rarity of some species could be as a result of intense fishing pressure of the species as they are highly appreciated as food fish. Bukar and Gubio (1985), and Ita (1993) reported that fishing pressure was responsible for reduction of species diversity and abundance in Lakes Chad and Kainji, respectively.

CONCLUSION AND RECOMMENDATION

In conclusion, the Upper New Calabar River could be said to be rich in composition and abundance of ornamental ichthyofauna. The presence of some well known highly priced export ornamental fishes such as *E. sexfasciatus, G, petersii*, *E. calabaricus*, *P. pulcher, P. taeniatus*, *P. abbreviata* and *P. bucholzi* further highlights the potentials of the river in the international ornamental fisheries trade. Thus, the documentation of the ornamental fish species of the Upper New Calabar River cannot be overemphasized, in the need to sustainably grow this high potential and promising sector. If properly managed, the River will go a long way in boosting the socio-economic status of the locals, Rivers state and Nigeria at large, as it is endowed with some highly priced species.

However, it is recommended that, appropriate attention must be given to these fishes, especially the rare ones, in order to ensure that their exploitation is sustainable, as well as ensuring that adequate conservation/protection and enforced strategies are employed in the fishery. Also, it is recommended that this preliminary study be expanded and a longer and more detailed study be carried out to further investigate and document any other species possibly left out in this short pilot study. This material would therefore serve as reference point for future research in sustainable exploitation and management of ornamental fisheries resources in the upper reaches of the New Calabar River.

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