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The Ichthyofaunal Assemblage of the Lower and Upper Reaches of New Calabar River, Rivers State, Niger Delta, Nigeria

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Abstract
A study was carried out to identify the food and ornamental fish assemblage of the Lower and Upper Reaches of the New Calabar River, Rivers State, Nigeria. Surveys were carried out at the Lower (brackish) and the Upper (fresh) water course of the River for a period of fifteen weeks. A total composition of 92,385 fish specimens, representing 61 species, belonging to 54 genera, 41 families and 15 orders, were recorded from both sections of the river. An assessment of species abundance revealed the following sequence - *Sardinella maderensis* (19.48%), followed by *Mugil cephalus* (15.23%), *Sierrathrissa* spp (13.45%),*Chrysichthys nigrogitatus* (6.73%), T*ilapia zilli* (4.67%), *Malapterurus electricus* (3.25%) and the least were *Callinectus marginatus* (0.01%), *Aplocheilichthys spilauchen* (0.00%). Similarly, family abundance revealed that, the family Clupeidae dominated the river's fish fauna having (32.93%) of the total catch, followed by Mugilidae (15.23%), Cichlidae (11.82%), Claroteidae (7.60%), Carangidae (4.32%), Alestidae (3.88%) while Belonidae (0.01) and Cyprinodontidae (0.00%) were the least abundant families. The abundance score of species indicated that, thirty four (34) species were dominant, four(4) species abundant, eleven(11) few and twelve(12) species rare. It was thus deduced that, the stretch of the river surveyed had a high total species composition, however the species/family abundance varied considerably. This phenomenon may be due to differences in fish species tolerance for the varied physico-chemical parameters, as the river comprises of fresh and saline regimes. Further more, this variation in the physico-chemical parameters of the river system is also known to affect the food organism availability and their natural distribution, which in turn affects fish species composition, abundance and diversity. Also, environmental disasters, fishing pressure on certain species and hydrocarbon pollution along the river system are likely factors responsible for the variation in the composition, abundance and diversity of fish species. Also, for the species that were rare, their low numbers is no confirmation that these species are threatened/over-exploited. Rather there could be other reasons such as inter/intra-specific competition, natural low population, amongst others. It is therefore recommended that further studies be carried out to ascertain the true cause of the variations. This study is essential, as it can be used as a baseline study for knowledge development, and a guide for the management and development of the New Calabar River fish species for Aquaculture and Ornamental fisheries sector, and the Protection/Conservation of the fish species. The document can also be used as a guide for Biological monitoring of the river system in case of Hydrocarbon Exploration/Pollution and for the management and development of the New Calabar River Fisheries.
Keywords: Ichthyofaunal Assemblage, Lower New Calabar River, Upper New Calabar River, Niger Delta Area.

1.0 Introduction

Fishes are of tremendous importance to man and other living organisms. They can be arbitrarily separated into Food fishes and Ornamental fishes. The Food fishes are mainly used for consumption either by man or animals and the ornamental fishes popularly known as ''Aquarium Fishes'' are usually kept in glass aquarium and generally used in decorations of homes, parks offices or institutions. However, there is no clear cut line between the two groups as their uses can be interchanged. Both fish types are commercially important, as they are marketed nationally and internationally and serve as major source of income for many countries.

The New Calabar River is an economically important waterway located in the Rivers State, south of Nigeria (Erondu and Chinda 1991). It is a tributary of the Niger Delta Basin. It spans from Isiokpo, at the Upper Reach, in the north to the Bight of Bonny in the south. This River is unique as it is euryhaline (brackish) from Iwofe to the Choba/Aluu juncture (Lower Reach) and fresh from Aluu to Isiokpo (Upper Reach). This river is of enormous economic importance as it supports a number of communities and a wide variety of human and industrial developmental activities in the Niger Delta Area, especially Rivers State as it provides them with a source of water, fish, transportation and other activities. It has been reported by locals around its course to have a rich and unique biodiversity with a variety of indigenous ornamental and food fishes, however there is a paucity of information on this River system.

Studies on fish assemblage in the Niger Delta Basin have been carried out by several researchers. In the Lower Bonny River and its connecting Creeks, Chindah and Osuamkpe (1994), reported 57 species from 25 families. Alison *et.al*. (1997), studying the assemblage of the Elechi Creek, in the Upper Bonny River reported 37 species from 22 families, from a total catch of 5,867. In the Lower Nun River, Sikoki *et. al.* (1998) revealed 57 species, from 15 families. Alfred-Ockiya (1998), observed 11 species from the Kolo Creek River. Sikoki *et*

*al.(*1999), reported 22 species from 11 families from the brackish zone of Brass River. Abowei (2000) reported 36 species from 22 families in lower Nun River and Ezekiel *et. Al., (*2002), reported 25 species from 16 families in Odhiokwu-Ekpeye local fish pond and flood plains. In the New Calabar River Alfred-Ockiya and Njoku (1995) studied the length-weight relationship of Mullet. Nwadiaro and Ayodele (1992) working along the Choba axis alone, using both cast and gill nets, harvested fish of the families Cichlidae, Mugilidae, Clupeidae, Sciaenidae, Bagridae and Haemulidae. Olori (1995) also working at the Choba end, reported 14 fish species: *Chrysichthys nigrodigitatus, Chrysicthys auratus, Tilapia Malanorium, Chromidotilapia guentheri, Hemichromis elongatus, Tilapia mariae, Pellonala afzeliusi, Psettias sebae, Alestes nurse, Alestes longipenus, Eliotris diaganensis, Channa obscura, Hepsetus odoe and Brienomyias niger* . Dickson *et al*., (1999) working on the New Calabar River reported catching, many species of fish belonging to the family Lutjanidae, Clupeidae, Cichlidae, Bagridae, with the Bagridae (catfish) and Cichlidae (Tilapia) most abundant. Still, there is a dearth of information on the fish species assemblage (composition and abundance) in the stretch of the Upper and Lower reaches of the New Calabar River.

This study is therefore essential in providing a database for; Improving the knowledge base of the Endemic Fish species Assemblage of the Upper and Lower reaches of the New Calabar River which will further serve as a; guide for the Management and Development of the River Fisheries; and fish species Protection, Conservation and Biomonitoring of the River system, as well as Ornamental fisheries sector development.

1.1 Materials and Methods

1.1.1 Study Area

The study was carried out in the Upper and Lower reaches of the New Calabar River (fig. 1). The New Calabar River is located on Latitude: 4°25¹ ON; Longitude: 7°16¹ OE, in the Niger Delta, central part of Southern Nigeria (NDES, 2003). It stretches from Isiokpo in the north to the Bight of Bonny in the south. It is euryhaline (brackish) from the Iwofe to the Choba/Aluu juncture and fresh from Aluu to Isiokpo The River is among the important water resources in the Niger Delta region of Southern Nigeria. It is one of the numerous rivers that drain the Niger Delta at its Lower Reach into the Atlantic Ocean. It is also in the vicinity of the rapidly expanding oil city of Port Harcourt in Rivers State, Southern Nigeria.

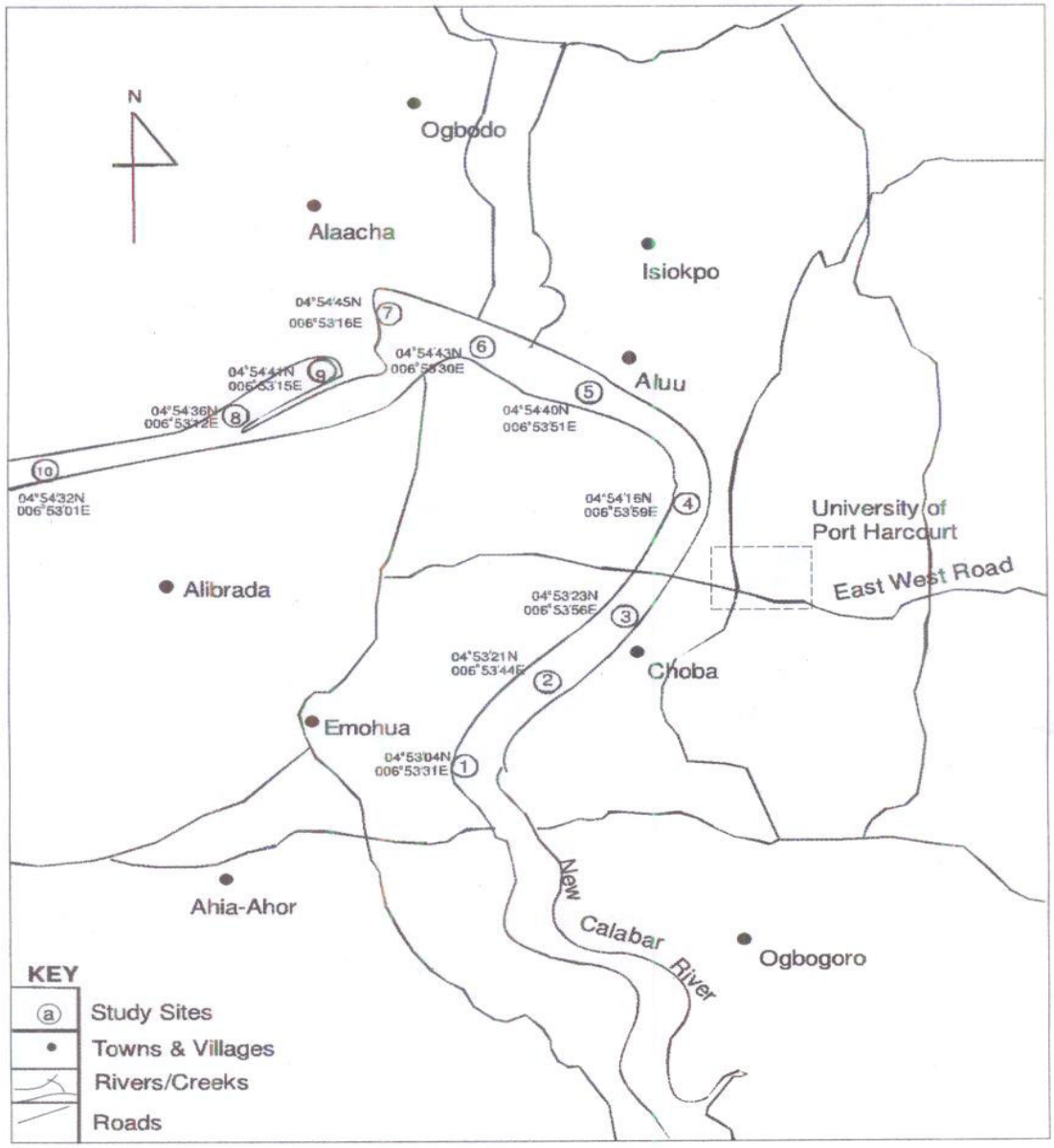

Figure 1. Map showing the five (A-E) sample stations on the Upper and Lower Reaches of the New Calabar River, Niger Delta; Where A = Isiokpo, B = Omagwa, C = Aluu, D=Emohua, E=Choba, F= Rumuokparali G= = Ogbogoro

1.1.2 Fish Sample Collection

Fish samples were collected from seven different sampling stations along the lower and upper reaches of the New Calabar River from local artisanal fishers three times weekly for six months. Fishes were caught using traps, cast nets and gill nets of different sizes. Total numbers of fish species were counted. The collected specimens were preserved in 10% formalin and then taken for identification and classified to the species level. Fishes were identified using standard identification keys such as Album of Marine/Brackish Water Ornamental and Food Fishes of the Niger Delta of Nigeria (Ibim and Francis, 2012) Taxonomy, Ecological Notes, Diet and Utilization (Idodo-Umeh, 2003); FIN FISHES of the Andoni Rivers in Niger Delta (Sikoki and Francis, 2007) and Fishbase (Froese and Pauly, 2005); Nigeria Freshwater Fishes (Olaosebika and Raji, 1998) and Wheeler (1994).

1.1.3 Fish Species Abundance Determination

Abundance was determined by relative abundance method which involved counting the total number of fish species caught per sample site per time which were recorded and the relative abundance score of 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).

1.2 Results

The study revealed a total fish composition of 92,385 specimens representing 61 species belonging to 54 genera, 41 families and 15 orders were recorded (table 1). The composition indicated the presence of fish from fresh and brackish water origins.

The Relative abundance amongst species revealed that the catch was dominated by *Sardinella maderensis* (19.48%), followed by mullet, *Mugil cephalus* (15.23%), *Sierrathrissa* spp (13.45%), *Chrysichthys nigrodigitatus* (6.73%), *Tilapia zilli* (4.67%), *Malapterurus electricus* (3.25%) and the least was *Aplocheilichthys spilauchen* (0.01%) (table 2).

The abundance score indicated that thirty four (34) species were dominant, four (4) species were abundant, eleven (11) species were few and twelve (12) species were rare.

The Relative abundance amongst families revealed that, family Clupeidae dominated the river fish fauna by 32.93% followed by the Mugilidae (15.23%), Cichlidae (11.82%), Claroteidae (7.60%), Carangidae (4.32%), Alestidae (3.88%), whilst Belonidae (0.01%) and Cyprinodontidae (0.01%), were the least abundant families (fig. 2, table 3).

Table2: Checklist of Total Fish species Caught in the Lower and Upper reaches of The New Calabar River and relative abundance and abundance score

S/N	Species	Family	Total number of fish caught	Relative Abundance	Abundance Score
1	*Tilapia zilli*	Cichlidae	4,317	11.82	D
2	*Tilapia mariae*	//	630	//	D
3	*Tilapia guineensis*	//	1,116	//	D
4	*Tilapia dageti*	//	532	//	D
5	*Hemichromis fasciatus*	//	2,361	//	D
6	*Pelvicachromis pulcher*	//	80	//	F
7	*Pelvicachromis taeniatus*	//	64	//	F
8	*Sarotherodon melanotheron*	//	990	//	D
9	*Chromidotilapia guentheri*	//	826	//	D
10	*Elagatis bipinnulata*	Carangidae	2,880	4.32	D
11	*Caranx hippos*	//	1,109	//	D
12	*Lutjanus dentatus*	Lutjanidae	260	0.32	A
13	*Lutjanus spp*	//	34	//	R
14	*Eucinostomus melanopterus*	Gerridae	254	0.27	A
15	*Pseudotolithus elongatus*	Sciaenidae	1,188	1.29	D
16	*Epinephelus aeneus*	Serranidae	21	0.03	R
17	*Pomadasys peroteti*	Haemulidae	186	0.20	F
18	*Ephippus goreensis*	Ephippidae	21	0.02	R
19	*Channa obscura*	Channidae	226	0.74	A
20	*Parachanna africana*	//	459	//	D
21	*Polydactylus quadrifilis*	Polynemidae	1,304	1.41	D
22	*Polycentropsis abbreviata*	Nandidae	2,167	2.35	D
23	*Ctenopoma kingsleyae*	Anabantidae	2,004	2.17	D
24	*Monodactylus sebae*	Monodactylidae	1,062	1.15	D
25	*Sphyraena barracuda*	Sphyraenidae	630	0.68	D
26	*Eleotris senegalensis*	Eleotridae	3	0.05	R
27	*Eleotris Africana*	//	51	//	F
28	*Brycinus macrolepidotus*	Alestidae	1,371	3.88	D
29	*Brycinus longipinnis*	//	2,210	//	D
30	*Hepsetus odoe*	Hepsetidae	444	0.48	D
31	*Phago loricatus*	Distichodontidae	762	0.82	D
32	*Malapterurus electricus*	Malapterurudae	3,002	3.25	D
33	*Parailia pellucida*	Schilbeidae	350	0.38	A
34	*Parauchenoglanis akiri*	Claroteidae	88	7.60	F
35	*Parauchenoglanis balayi*	//	722	//	D
36	*Chrysichthys nigrodigitatus*	//	6,213	//	D
37	*Channallabes apus*	Clariidae	12	0.01	R
38	*Kryptopterus bicirrhis*	Siluridae	460	0.50	D
39	*Syacium guineensis*	Paralichtyidae	183	0.20	F
40	*Epiplatys sexfasciatus*	Aplocheilidae	638	0.69	D
41	*Xenomystus nigri*	Notopteridae	1,044	2.31	D
42	*Papyrocranus afer*	//	1,088	//	D
43	*Hipoppotamystus pictus*	Mormyridae	676	0.92	D
44	*Gnathonemus petersii*	//	12	//	R

45	*Petrocephalus ansorgii*	//	158	//	F
46	*Pantodon buchholzi*	Pantodontidae	418	0.45	D
47	*Aethiomastacembelus nigromarginatus*	Mastacembelidae	7	0.02	R
48	*Caecomastacembetus decorsei*	//	14	//	R
49	*Sardinella maderensis*	Clupeidae	17,995	32.93	D
50	*Sierrathrissa spp*	//	12,430	//	D
51	*Ilisha Africana*	Pristigasterida	69	0.07	F
52	*Barbus macrops*	Cyprinidae	104	0.11	F
53	*Machrobrachium machrobrachion*	Palaemonoidae	111	0.12	F
54	*Erpetoichtys calabaricus*	Polypteridae	2,339	2.53	D
55	*Elops lacerta*	Elopeidae	465	0.50	D
56	*Tylosurus acus rafale*	Belonidae	8	0.01	R
57	*Uca tangeri*	Ocypodidae	30	0.03	R
58	*Callinectes marginatus*	Portunidae	35	0.04	R
59	*Porugobius schelii*	Poecilidae	79	0.09	F
60	*Aplocheilichthys spilauchen*	cyprinodontidae	1	0.00	R
61	*Mugil cephalus*	Mugilidae	14,067	15.23	D

Table 1. Percentage Abundance of Ornamental and Food Fishes Assemblage of New Calabar River

Fish species	Percentage Abundance (%)
1. *Elagatis bipinnulata*	**3.12**
2. *Lutjanus dentatus*	**0.28**
3. *Lutjanus spp*	**0.04**
4. *Eucinostomus melanopterus*	**0.27**
5. *Pseudotolithus elongatus*	**1.29**
6. *Pomadasys peroteti*	**0.20**
7. *Mugil cephalus*	**15.23**
8. *Ilisha Africana*	**0.07**
9. *Elops lacerta*	**0.50**
10. *Ephippus goreensis*	**0.02**
11. *Kryptopterus bicirrhis*	**0.50**
12. *Tylosurus acus rafale*	**0.01**
13. Eleotris senegalensis	**0.00**
14. *Eleotris Africana*	**0.06**
15. *Uca tangeri*	**0.03**
16. *Epinephelus acneus*	**0.03**
17. *Callinectes marginatus*	**0.04**
18. *Sierrathrissa spp*	**13.45**
19. *Porugobius schelii*	

0.09

20. *Aplocheilichthys* *spilauchen*
0.00
21. *Tilapia* *zilli*
4.67
22. *Hemichromis* *fasciatus*
2.56
23. *Chromidotilapia* *guntheri*
0.89
24. *Tilapia* *mariae* `
0.68
25. *Tilapia* *guineensis*
1.21
26. *Pelvicachromis* *pulcher*
0.09
27. *Pelvicachromis* *taeniatus*
0.07
28. *Sarotherodon* *melanotheron*
1.07
29. *Tilapia* *dageti*
0.58
30. *Erpetoichtys* *calabaricus*
2.53
31. *Channa* *obscura*
0.24
32. Parachanna *africana*
0.50
33. *Polydactylus* *quadrifilis*
1.41
34. *Polycentropsis* *abbreviata*
2.35
35. *Ctenopoma* *kingsleyae*
2.17
36. *Brycinus* *macrolepidotus*
1.48
37. *Brycinus* *longipinnis*
2.39
38. *Malapterurus* *electricus*
3.25
39. Syacium *guineensis*
0.20
40. *Epiplatys* *sexfasciatus*
0.69
41. *Sphyraena* *barracuda*
0.68
42. *Hepsetus* *odoe*
0.48
43. *Xenomystus* *nigri*
1.13
44. *Papyrocranus* *afer*
1.18
45. *Hipoppotamystus* *pictus*
0.73
46. *Gnathonemus* *petersii*
0.01
47. *Petrocephalus* *ansorgii*
0.17
48. *Phago* *loricatus*
0.82

49. *Parailia* *pellucida*
0.38
50. *Aethiomastacembelus* *nigromarginatus*
0.01
51. *Caecomastacembetus* *decorsei*
0.02
52. *Monodactylus* *sebae*
1.15
53. Caranx *hippos*
1.20
54. *Sardinella* *maderensis*
19.48
55. *Pantodon* *buchholzi*
0.45
56. *Barbus* *macrops*
0.11
57. *Machrobrachium* *machrobrachion*
0.12
58. *Parauchenoglanis* *akiri*
0.10
59. *Parauchenoglanis* *balayi*
0.78
60. *Chrysichthys* *nigrodigitatus*
6.73
61. *Channallabes* *apus*
0.01

Table2: Composition - Checklist of Total Fish species Caught in the Lower and Upper reaches of The New Calabar River

S/N	Species	Genus	Family	Order
1	*Tilapia zilli*	*Tilapia*	Cichlidae	Perciformes
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	*Elagatis bipinnulata*	*Elagatis*	Carangidae	//
11	*Lutjanus dentatus*	*Lutjanu*	//	//
12	*Lutjanus spp*	//	Lutjanidae	//
13	*Eucinostomus melanopterus*	*Eucinostomus*	//	//
14	*Pseudotolithus elongatus*	*Pseudotolithus*	Sciaenidae	//
15	*Epinephelus aeneus*	*Epinephelus*	Serranidae	//
16	*Pomadasys peroteti*	*Pomadasys*	Haemulidae	//
17	*Ephippus goreensis*	*Ephippus*	Ephippidae	//
18	*Channa obscura*	*Channa*	Channidae	//
19	*Parachanna africana*	*Parachanna*	//	//
20	*Polydactylus quadrifilis*	*Polydactylus*	Polynemidae	//
21	*Polycentropsis abbreviata*	*Polycentropsis*	Nandidae	//
22	*Ctenopoma kingsleyae*	*Ctenopoma*	Anabantidae	//
23	*Monodactylus sebae*	*Monodactylus*	Monodactylidae	//
24	*Sphyraena barracuda*	*Sphyraena*	Sphyraenidae	//
25	*Caranx hippos*	*Caranx*	Carangidae	//
26	*Eleotris senegalensis*	*Eleotris*	Eleotridae	//

27	*Eleotris Africana*	//	//	//
28	*Brycinus macrolepidotus*	*Brycinus*	Alestidae	Characiformes
29	*Brycinus longipinnis*	//	//	//
30	*Hepsetus odoe*	*Hepsetus*	Hepsetidae	//
31	*Phago loricatus*	*Phago*	Distichodontidae	//
32	*Malapterurus electricus*	*Malapterurus*	Malapterurudae	Siluriformes
33	*Parailia pellucida*	*Parailia*	Schilbeidae	//
34	*Parauchenoglanis akiri*	*Parauchenoglanis*	Claroteidae	//
35	*Parauchenoglanis balayi*	//	//	//
36	*Chrysichthys nigrodigitatus*	*Chrysichthys*	//	//
37	*Channallabes apus*	*Channallabes*	Clariidae	//
38	*Kryptopterus bicirrhis*	*Kryptopterus*	Siluridae	//
39	*Syacium guineensis*	*Syacium*	Paralichtyidae	Pleuronectiformes
40	*Epiplatys sexfasciatus*	*Epiplatys*	Aplocheilidae	Cyprinodontiformes
41	*Xenomystus nigri*	*Xenomystus*	Notopteridae	Osteoglossiformes
42	*Papyrocranus afer*	*Papyrocranus*	//	//
43	*Hipoppotamystus pictus*	*Hipoppotamystus*	Mormyridae	Mormyriformes
44	*Gnathonemus petersii*	*Gnathonemus*	//	//
45	*Petrocephalus ansorgii*	*Petrocephalus*	//	//
46	*Pantodon buchholzi*	*Pantodon*	Pantodontidae	//
47	*Aethiomastacembelus nigromarginatus*	*Aethiomastacembelus*	Mastacembelidae	Synbranchiformes
48	*Caecomastacembetus decorsei*	*Caecomastacembetus*	//	//
49	*Sardinella maderensis*	*Sardinella*	Clupeidae	Clupeiformes
50	*Sierrathrissa spp*	*Sierrathrissa*	//	//
51	*Ilisha Africana*	*Ilisha*	Pristigasterida	//
52	*Barbus macrops*	*Barbus*	Cyprinidae	Cypriniformes
53	*Machrobrachium machrobrachion*	*Machrobrachium*	Palaemonoidae	Decapoda
54	*Erpetoichtys calabaricus*	*Erpetoichtys*	Polypteridae	Polypteriformes
55	*Elops lacerta*	*Elops*	Elopeidae	Elopiformes
56	*Tylosurus acus rafale*	*Tylosurus*	Belonidae	Beloniformes
57	*Uca tangeri*	*Uca*	Ocypodidae	Decapoda
58	*Callinectes marginatus*	*Callinectes*	Portunidae	//
59	*Porugobius schelii*	*Porugobius*	Cyprinodontidae	Cyprinodontiformes
60	*Aplocheilichthys spilauchen*	*Aplocheilichthys*	Poecilidae	,,
61	*Mugil cephalus*	*Mugil*	mugilidae	

Table 3. Family Percentage Abundance of Fish Assemblage of the New Calabar River

Family	**Percentage (%)**
Lutjanidae	0.32
Gerreidae	0.27
Sciaenidae	1.29
Haemulidae	0.20
mugilidae	15.23
Pristigasteridae	0.07
Elopidae	0.50
Ephippidae	0.02
Siluridae	0.50
Belonidae	0.01
Eleotridae	0.06
Ocypodidae	0.03
Serranida	0.03
Portunidae	0.04
Gobidae	0.09
Cyprinodontidae	0.00
Cichlidae	11.82

Polypteridae	2.53
Channidae	0.74
Polynemidae	1.41
Nandidae	2.35
Anabantidae	2.17
Alestidae	3.88
Malapterurudae	3.25
Paralichtyidae	0.20
Aplocheilidae	0.69
Sphyraenidae	0.68
Hepsetidae	0.48
Notopteridae	2.31
Mormyridae	0.92
Distichodontidae	0.82
Schilbeidae	0.38
Mastacembelidae	0.02
Monodactylidae	1.15
Carangidae	4.32
Clupeidae	32.93
Pantodontidae	0.45
Cyprinidae	0.11
Palaemonoidae	0.12
Claroteidae	7.60
Clariidae	0.01

1.3 Discussion

The composition indicated that the Ichtyofaunal assemblage of the Lower and Upper reaches of the New Calabar River were generally high having a total catch of 92,385 specimens composed of 61 species belonging to 54 genera, 41 families. Though there is a paucity of information on fish species assemblage in the New Calabar River and thus the results of this study lack support from previous work on the river system, it was observed that the fish assemblage in this study is much higher than other reports on rivers and streams located near the New Calabar River in the Niger Delta Area, for instance; the Lower Bonny River and its connecting Creeks (Chindah and Osuamkpe, 1994) having 57 species, 25 families; Elechi Creek, in the Upper Bonny River with 37 species from 22 families (Alison *et.al*.,1997);.the Lower Nun River having 57 species, from 15 families River(Sikoki *et al.,*1998) and in lower Nun River -36 species from 22 families(Abowei ,2000). Thus it can be said that this river possess a high composition and diversity of fish species.

The high ichtyofaunal composition/diversity of this study could be due to high productivity of the river, which is directly linked with the differences in physico-chemical parameters along the course of the river, which is a unique and rear future (Brackish and Fresh together). This is supported by the report of MBO (2007b), that low diversity is a function of low productivity.

This can be further confirmed by report on a small section (Choba axis alone) of the New Calabar River by Nwadiaro and Ayodele (1992) and Olori (1995). They harvested fish of the families Cichlidae, Mugilidae, Clupeidae, Sciaenidae, Bagridae and Haemulidae and, reported 14 fish species: *Chrysichthys nigrodigitatus, Chrysicthys auratus, Tilapia m` alanorium, Chromidotilapia guentheri, Hemichromis elongatus, Tilapia mariae, Pellonala afzeliusi, Psettias sebae, Alestes nurse, Alestes longipenus, Eliotris diaganensis, Channa obscura, Hepsetus odoe and Brienomyias niger,*; indicating a high diversity.

The observed dominance of *Sardinella. maderensis,* of the family Clupeidae is similar to the findings in the Lower reaches of Okpoka creek (Davies, 2009), in Odhiokwu-Ekpeye local fish pond and flood plains (Ezekiel *et al.,* 2002), and the Brass River(Sikoki *et al.,* 1999) all of the Niger Delta, Nigeria. This was attributed to high abundance of phytoplankton in the river (Davies, 2009). The Niger delta is known to be highly productive, and this productivity is said to be due to high abundance of Phytolanktons and Epiphytons (MBO,2007b).

Plankton communities serve as a base for the food chain that supports the commercial fisheries (MBO, 2007b). Thus, the Clupeidae (S*ardinella maderensis* and *Sieratrisha spp,* dominating the ichthyofaunal assemblage could also be linked to possible high abundance of phytoplankton and epiphyton (algae), which are major diet of *Sardinella maderensis*. *S. maderensis* is a typical algae feeder (Davies, 2009), and this species form the bulk of the fishery of Lower reaches of the New Calabar River.

The difference in dominance/abundance also could be due to physico- chemical differences of the different sections of the river and the tolerance of the species to the different salinity levels of the habitat as the

Lower reaches of the New Calabar River is known to be brackish whilst the Upper reaches is Fresh. The *Sardinella maderensis* are known brackish water species (Froese and Pauly, 2010, 2011 and 2014) and thus were dominant in brackish water sections of the Lower reaches whilst the fresh water *Malapterurus electricus and Erpetoichythys calabaricus* were found to be dominant in the Upper freshwater sections.

The abundance score also indicates that the Lowerer reaches (brackish) of the river course were dominated by S*ardinella madrensis, Mugil cephalus and Chrysichthys nigrogitatus* while the Upper freshwater was dominated by *Malpterurus electricus, Tilapia zilli* and *Erpetoichythys calabaricus.* In all, thirty four (34) species were dominant; four (4) species were abundant, eleven (11) were few and twelve species were rare.

1.4 Conclusion

The results of this study revealed that New Calabar River of Rivers State is highly rich in ichthyofaunal assemblage, both in the fresh and brackish water regions of the river. Thus, this river is capable of supporting the sourcing of Food and Ornamental fisheries development. Also for the purpose of developing knowledge, species protection and conservation, it is recommended that more detailed and lengthy work cutting across dry and rainy seasons should be conducted to establish the full position of the endemic fish species assemblage of the river. This material would therefore, serve as reference point for future research by relevant bodies in the development, management and conservation of fisheries resources of the River.

1.5 Recommendations

In view of the above conclusions, it is recommended that:

More elaborate and longer research work needs to be done on the fish assemblage of the Lower and Upper reaches of New Calabar River, in order to properly document the fisheries and their status for their sustainable use.

The fish species that are rare and few should be studied to ascertain the threat and to enable further action to be taken to support their survival.

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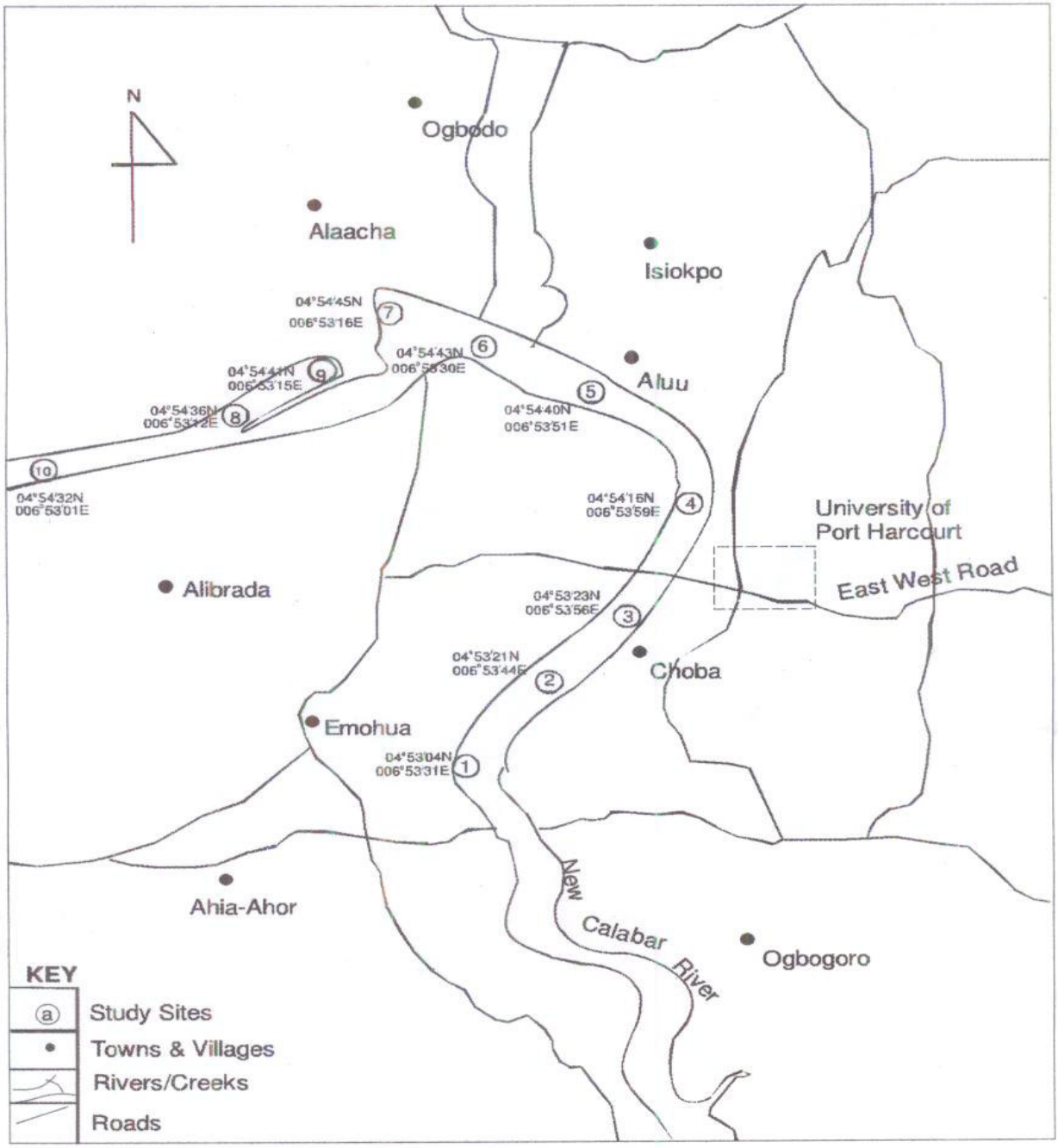

Figure 1. Map showing the five (A-E) sample stations on the Upper and Lower Reaches of the New Calabar River, Niger Delta; Where A = Isiokpo, B = Omagwa, C = Aluu, D=Emohua, E=Choba, F= Rumuokparali G= = Ogbogoro