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The transition period fin fish community structure of Amadi Creek, in Port Harcourt, Rivers State, Nigeria

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ABSTRACT

A four-month study of the fish community structure was conducted during the late dry season/transition period in the Amadi Creek in Port Harcourt, to close the information gap for the Creek. Landed Fish caught using a variety of fishing gears were collected from fishers, and the composition and abundance determined using standard methods. Results revealed composition of twelve (12) species in ten (10) genera and seven (7) families. The Cichlids were the dominant family (5 species), while the Mugilids (2 species), and the Claroteidae, Clupeidae, Eleotridae, Elopidae and Haemulidae (1 species each), were rare. Relative abundance revealed that, although the Cichlids were the most abundant family, species abundance showed the actual dominant and most abundant species were the *Sarotherodon melanotheron*(56.20%), followed by the *Coptodon* (=*Tilapia*) *guineensis* (36.33%) and then *Sarotherodon galilaeus* (6.19%), while *Coptodon zilli* (0.01%) *and Hemichromis fasciatus* (0.15%) were low in abundance. Mugilids, the next abundant family, revealed *Mugil cephalus* (0.68%) to be more abundant than *Parachelon* (=*Liza*) *grandisquamis* (0.13%). The 5 species from the 5 families that had very low relative abundance are *Sardinella maderensis* (0.15%), *Chrysichthys nigrodigitatus* (0.13%), *Elops lacerta (0.01%), Pomadasys perotaei* (0.01%) *and Eleotris senegalensis* (0.005%). The abundance score revealed that most of the species were rare.

Keywords: Abundance, Amadi Creek, Composition, Community Structure, Rare species.

INTRODUCTION

Fishes are known to be of great nutritional, medicinal, economic and aesthetic importance world-wide as also seen in Rivers State fisheries, and its value-chain are the primary economic occupation of the residents, outside petroleum and its allied product businesses. Inevitably therefore, fish make-up more than 70% of the protein consumed in Rivers State (Nwokolo, 1987) and in the Niger Delta Area (Chindah and Osuamkpe, 1994).

Pino-Del-Carpio *et al.* (2014) reported that, the diversity and community structure of fishes in any water body are important for conservation and management purposes. In many studies of fish populations in their environment, among several parameters, species composition, species richness, and abundance are used to describe and assess fish communities (Hewitt *et al*., 2008). Two fundamental attributes of a community are the number of species present and their abundance structure (Ibim and Njoku, 2018). King (1995) reported that, naturally the fish fauna assemblage of a watershed is an important resource, so also is the natural management and conservation of the fish

resources, which is based on the critical survey of the composition of the fish fauna. The Fish fauna is composed of species which combine to form genera, genera combine to form family and so on and so forth (Shabir *et al*., 2000). Abundance is said to be the total catch in number or biomass of the fish species (Sikoki *et al*., 2003). Data on the number of fish in the population as species abundance is essential to determine the effects of fishing, various human activities, natural climatic variations, and detect changes in a fish population (Jalal *et al*., 2012). Data on species abundance also gives insight into less obvious aspects of the aquatic ecosystem such as, competition and predatory behaviors of fish in the ecosystem (Thompson *et al*., 2015; Galib *et al*., 2013; Tahir, 2013). However, the fish composition, abundance, and diversity in rivers are dependent on many abiotic and biotic factors, which determine the success or failure of fish species assemblages, within the range of spatial distribution limits (Minns, 1989; Barita *et al*., 2000). Researches have also revealed that, anthropogenic activities could lead to the periodic or permanent elimination of estuarine dependent fish species from individual estuarine systems (Cyrus, 1991; Kennish, 2002; Abowei, 2010). Also, Lawson and Olusanya (2010), reported that, in Nigeria, fisheries resources are on the decline due to over exploitation, inadequate management to degradation of environment of inland and coastal.

Consequently, conservation of biodiversity and management of aquatic species and their environments has become a major concern in recent years (Abowei, 2010). Thus, for the sustainability of the fisheries resources in the Amadi Creek, adequate knowledge of the population structure of the fish species in the water body is necessary.

The Amadi Creek is a tributary of the Bonny River, and one of the many Creeks that constitute the hydrological system in Port Harcourt metropolis in Rivers State. It flows from Nkpogu community, through several communities (Amadi-Ama, Tera-Ama and Abuloma) and eventually empties into the Atlantic Ocean (Ibim and Njoku, 2018). The creek is also closely connected to Okpoka, Aboturu and Diobu Creeks (Allison *et al.*, 1997; Davies, 2009) as well as the Elechi Creek (Ibim and Njoku, 2018) all in the Port Harcourt metropolis.

This Creek is one of the economically important rivers in the Niger Delta region of Nigeria, as it provides breeding ground for a variety of fish species. The major economic activities in and around the Creek are fishing, (Ezeilo and Dune, 2012), and as the main source of fish food to the communities around it (Ibim and Njoku, 2018). The Creek also hosts several establishments, industries and factories such as the Marine base abattoir; Marine base Jetty, Federal fishing Terminal, the Nigerian Lignified Natural Gas (NLNG) complex. There are also smaller establishments and illegal and legal businesses and activities that introduce allocthonous materials existing in its shores such as; water transportation, dredging, sand mining, land-fills, oil bunkering, crop farming, fish farming, among others (Ezeilo and Dune, 2012; Ibim and Njoku, 2018). Also, it is used as a receptacle for industrial effluents, domestic waste (garbage) (Ibim and Njoku, 2018) as well as domestic sewage (Ezeilo and Agunwamba, 2014). These myriad of activities in the Creek would naturally affect the fish fauna assemblage therein.

There are two major seasons experienced in the area, the rainy or wet season which lasts from April to October, and the dry season which lasts from November to March. The dry season can be further subdivided into the early and late dry seasons. The early dry season which

commences in November is synonymous with a period of very low rains, followed by a drier and cold "harmattan period" (between late November and January). The "late dry" season literally referred to in this study as the "transition period" , commences in February as the Harmattan period ends and the "early rains" commences, until the April when the dry season ends and the Wet season commences, in early May.

The Amadi Creek water was reported to be fresh during the rainy season and saline during the dry season (Ezeilo and Agunwamba, 2014).

Several studies have been carried out on the population structure of some rivers in the Niger Delta Area. Scott (1966), studied the fisheries of the Niger Delta and identified over 250 species of fish. Akpan (2013), revealed a total of 28 species, in 14 families from the Uta-Ewa Creek, Akwa Ibom. Meye (2013) recorded 37 species of fish belonging to 20 families and 28 genera from the Orogodo River in Delta State. Opeh and Udo (2017) from the Cross River system, reported 26 genera of fish belonging to 22 families. In the lower Niger Delta basin, Lowe-McConnel (1964), studied the fish communities in Rupeenime River and observed 44 species. Alfred-Ockiya (1996) recorded 11 species from Kolo Creek. Sikoki *et al.* (1998) reported 57 species from the lower Nun River. Sikoki *et al*. (1999) reported 22 species from 11 families of the brackish zone of Brass River. Abowei (2000) recorded 36 species, 22 families in the lower Nun River, among others. In Rivers State specifically, Ezekiel *et al.* (2002), reported 25 species in 16 families in the Odhiokwu-Ekpeye local fish pond and flood plains that feed from the Orashi River. Ibim and Gogo (2013) recorded 41 species belonging to 38 genera, 25 families and 11 orders from the Upper Reaches of the New Calabar River, and Ibim and Igbani (2014), identified 50,404 fishes in the Lower New Calabar River. Onwuteaka (2015), in a study of Rivers Sombrero and Orashi, and New Calabar River reported 79 species in the Sombrero River. Ibim and Douglas (2017) reported 37 species in 20 families from the Upper Sombrero River; Ibim and Owhonda (2017), in a survey in the Omuihuechi stream, from the Upper New Calabar River reported 20 genera, 10 families and 4 orders. Ibim and Bongilli (2017 and 2018) reported 31 species in 20 families from the Middle Reaches of the Sombrero River, among others. Also, a considerable number of studies have been carried out on the fish fauna assemblage of the Bonny estuary (Wright, 1986; Ogamba, 1998; Nweke, 2000; Amakiri, 2006). Chindah and Osuamkpe (1994) studied the fish assemblage of the lower Bonny River and identified 25 families consisting of 57 species. The fish assemblage of the Elechi Creek in the Upper Bonny as reported by Allison *et al*. (1997) recorded 35 species in 20 families; Davies (2009), reported 11 species from 8 families in the Okpoka Creek. In the Amadi Creek however, there is paucity of information on the fish population structure. Only a wet season fish assemblage, revealing a total of 4 fin fish species in 3 families, indicating a very low composition, diversity and abundance (Ibim and Njoku, 2018), is available. There is no information on the early or late dry season. Thus, this study is targeted at bridging the gap in information of the Ichthyofaunal population structure, by providing information on the late dry season/transition period, in this economically important water body. This is pertinent to provide data for; the establishment of baselines against which future research/biomonitoring in the creek can be conducted, and the provision of appropriate management advices, strategies and policies to the stakeholders for the sustainability of the fish fauna, fisheries and environment.

MATERIALS AND METHODS

Study Area

The study was carried out in the Amadi Creek (Figure 1) in Port Harcourt, Rivers State, Nigeria. The Creek, a tributary of the Bonny River, flows from Nkpogu through Amadi Ama, Tera-Ama and Abuloma communities, and finally empties south-wards into the Atlantic Ocean. Three sampling points were identified within the Creek namely.

The vegetation in the Amadi Creek is sparse, consisting of few red and white mangrove (*Rhizophora mangle* and *Avicenia africana*, respectively), and the dominant Nypa palm (*Nypa fruticans*), (Wilcox, 1980). The main channel of the Creek has been deepened by dredging activities, and the intertidal banks are covered mostly with chikoko mud.

The major economic activity in the creek is artisanal fishing where the fishers use manually operated wooden (dug-out) canoes and traditional fishing gears (Ibim and Njoku, 2018).

The seasons in this area are the wet and dry seasons (Ibim and Njoku, 2018), and the Creek was fresh in the rainy season and saline in the dry season (Ezeilo and Agunwamba, 2014).

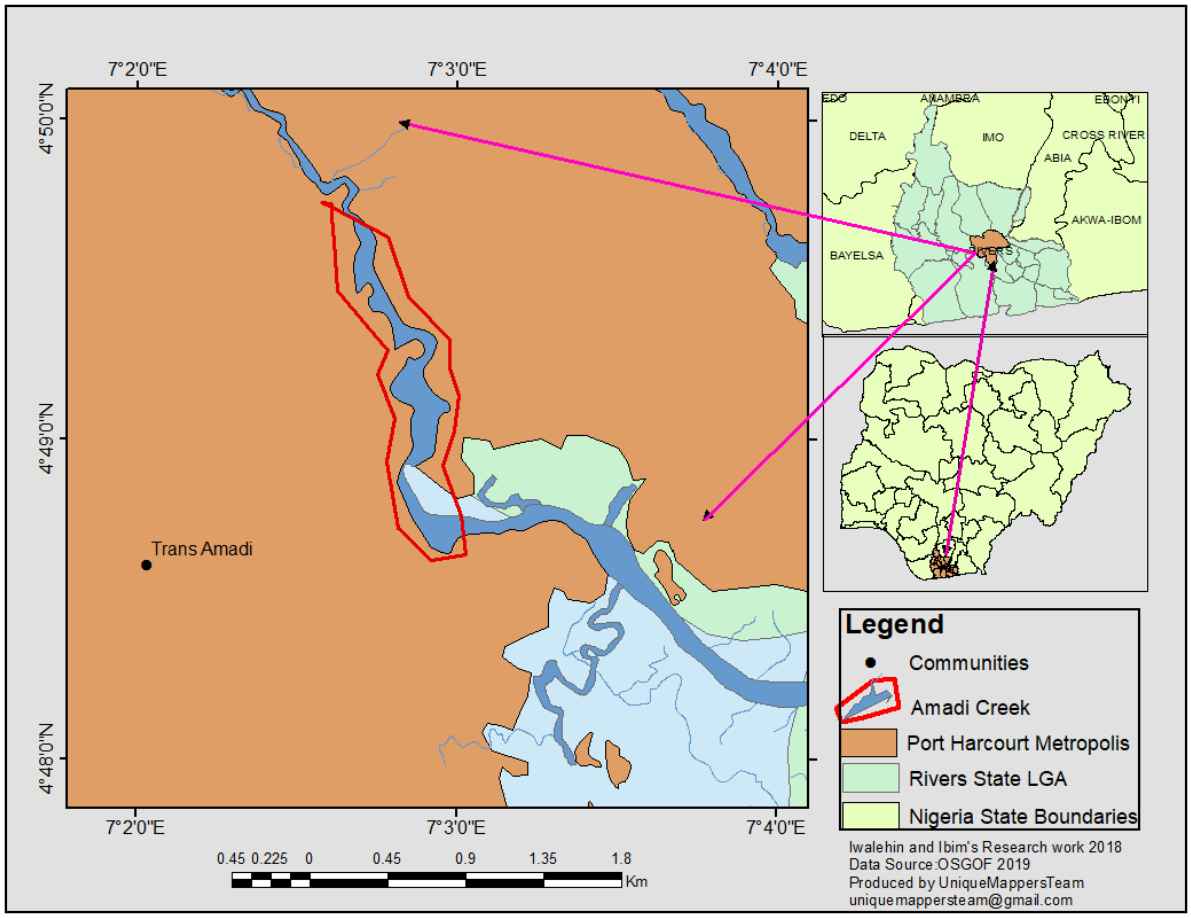

Fig. 1. Study location - Amadi Creek, Port Harcourt, Rivers State, Nigeria

Experimental Design, Sample Collection and Treatment

The experiment lasted for a period of four months, from February to May, 2018.

Landed fish specimens caught in the study area, using indiscriminate mesh sizes of cast, gill and seine nets, as well as non-return valve and basket traps, were collected weekly from the fisher folks. The fish samples were counted, sorted into families and species, preserved in 4% formalin solution and taken to the

laboratory for comprehensive identification.

Data Collection and Analysis

Fish Composition Determination

The fish composition was determined by the total count of landed fishes. The fishes were taken to the laboratory for detailed identification to the species level using standard manuals and monographs (Wheeler, 1994; Froese and Pauly, 2010 and Ibim and Francis, 2012).

Fish Relative Abundance Computation

The Relative abundance of each species was computed by dividing the population of the fish species by the total population of all the species and multiplying by 100. Secondly, abundance score was determined (Allison *et al.* 2003) thus; 1-50 = Rare (R), 51-100 = Few (F), 101-200 = Common (C), 201-400 = Abundance (A) and above 400 = Dominant (D).

RESULTS

Fish Composition

A total of 19,534 fish specimens were caught from the area within the study period. This was composed of 12 species from 10 genera in 7 families, as shown in the checklist of species (table 1). The composition of the fin fishes (table 2) from the study was moderately high. with the Cichlidae recording the highest composition with 5 species (*Sarotherodon melanotheron, Sarotherodon galilaeus, Coptodon guineensis, Coptodon zilli* and *Hemichromis fasciatus),* whereas the remaining 6 families encountered in the study recorded very low species composition with the family Mugilidae having 2 species (*Mugil cephalus* and *Parachelon grandisquamis)* and the rest families recording only 1 species each, as shown in table 2.

Table 1: Checklist of the Fin Fishes of the Amadi Creek, Port Harcourt, Rivers State

Family	Genus	Species	Common name
Cichlidae	Sarotherodon	*Sarotherodon melanotheron*	Black chin tilapia
		Sarotherodon galilaeus	Mango tilapia
	Coptodon	*Coptodon guineensis*	Guinean tilapia
		Coptodon zilli	Red belly tilapia
	Hemichromis	*Hemichromis fasciatus*	Banded jewelfish
Mugilidae	Mugil	*Mugil cephalus*	Flathead grey mullet
	Parachelon	*Parachelon grandisquamis*	Large scaled mullet
Clupeidae	Sardinella	*Sardinella maderensis*	Madeiran sardine
Claroteidae	Chrysichthys	*Chrysichthys nigrodigitatus*	Bagrid catfish
Elopidae	Elops	*Elops lacerta*	West African ladyfish
Eleotridae	Eleotris	*Eleotris senegalensis*	Sleeping gobies
Haemulidae	Pomadasys	*Pomadasys perotaei*	Parrot grunt

Table 2: Composition of the Fin Fishes of the Amadi Creek, Port Harcourt, Rivers State

S/N	Species	Families	Total catch
1	*Sarotherodon melanotheron*	Cichlidae	10,979
2	*Sarotherodon galilaeus*	″	1,209
3	*Coptodon guineensis*	″	7,097
4	*Coptodon zilli*	″	2
5	*Hemichromis fasciatus*	″	30
6	*Mugil cephalus*	Mugilidae	132
7	*Parachelon grandisquamis*	″	25
8	*Sardinella maderensis*	Clupeidae	30
9	*Chrysichthys nigrodigitatus*	Claroteidae	25
10	*Elops lacerta*	Elopidae	2
11	*Eleotris senegalensis*	Eleotridae	1
12	*Pomadasys perotaei*	Haemulidae	2
	Total		19,534

Fish Abundance

The abundance (Table 3) revealed a total of 19,534 fishes caught from the Amadi Creek during the sampling period. The numerical abundance showed that the family Cichlidae, with 19,317 fishes was the dominant family, followed by the Mugilidae with175 fishes, Clupeidae with 30 fishes, Claroteidae with 25 fishes; while the Elopidae with 2 fishes, Haemulidae with 2 fishes and Eleotridae with 1 fish, recorded the least numerical abundance. However species by species abundance, revealed that *Sarotherodon melanotheron* recorded the highest numerical abundance (10,979) and relative abundance 56.20%, followed by *Coptodon guineensis* with 7,097 fishes and a relative abundance of 36.33%, *Sarotherodon galilaeus* with 1,209 fishes and a relative abundance of 6.9 %. However, eight species recorded very low abundance as shown in Table 3, among which the least abundant were, *C. zilli*, *E. lacerta, and P, perotaei* (all with 2 fishes and a relative abundance 0.01%), and the *Eleotris senegalensis* (with 1 fish and relative abundance of 0.005%).

The abundance score (Table 3) also revealed that, though the Cichlidae were generally the dominant family, only the *Sarotherodon melanotheron, Sarotherodon galilaeus* and *Coptodon guineensis* were dominant (D), while the *Coptodon zilli* and *Hemichromis fasciatus* were rare (R). Among the Mugilidae, the *Mugil cephalus* was common (C) while *Parachelon grandisquamis* was rare (R). Finally, the rest species and their respective families; Clupeidae *(Sardinella maderensis)*; Claroteidae *(Chrysichthys nigrodigitatus)*; Elopidae *(Elops lacerta)*; Eleotridae *(Eleotris senegalensis)* and Haemulidae (*Pomadasys perotaei)* were recorded as rare (R).

Table 3: Family and Species Abundance of the Fish Fauna of Amadi Creek, Port Harcourt, Rivers State

Family /species	Abundance	Relative abundance %	Legend of rarity
Cichlidae	**19,317**		
Coptodon guineensis	7,097	36.33	D
Coptodon zilli	2	0.01	R
Hemichromis fasciatus	30	0.15	R
Sarotherodon galilaeus	1,209	6.19	D
Sarotherodon melanotheron	10,979	56.20	D
Claroteidae	**25**		
Chrysichthys nigrodigitatus	25	0.13	R
Clupeidae	**30**		
Sardinella maderensis	30	0.15	R
Eleotridae	**1**		
Eleotris senegalensis	1	0.005	R
Elopidae	**2**		
Elops lacerta	2	0.01	R
Haemulidae	**2**		
Pomadasys perotaei	2	0.01	R
Mugilidae	**175**		
Mugil cephalus	132	0.68	C
Parachelon grandisquamis	25	0.13	R

Note: 1-50=Rare (R), 51-100=Few (F), 101-200=Common (C), 201-400=Abundant (A) and above 400=Dominant (D)

DISCUSSION

The composition of the fin fishes in this "transition period" study in the Amadi Creek was fairly high, as twelve (12) species belonging to seven (7) families were recorded. This was contrary to the fin fish composition in the wet season study of this creek (Ibim and Njoku, 2018), which recorded only four (4) species from three (3) families. Thus, with an additional 8 species and 4 families recorded, there was an improved fin fish composition in this "transition period". A similar trend of higher catches in the dry than wet season was reported in the Lower Bonny River (Chindah and Osuamkpe. 1994); Lagos Lagoon (Nwadukwe, 1995); Kolo Creek, Rivers State (Alfred-Ockiya, 1996); Elechi Creek, Upper Bonny River (Allison et al., 1997); the Lower Okpoka creek (Davies, 2009); the Upper Sombreiro River (Ibim and Douglas, 2016); the Middle Reaches of the Sombreiro River (Ibim and Bongilli, 2017, 2018); among others.

Several factors have been implicated in seasonal differences in composition. The gradual drop in composition could be associated with the arrival of the rains in the wet season, resulting in the dilution of the creek water and consequently, altering the water physicochemistry (Soyinka and Kassem, 2008; Onwuteaka, 2015; Ibim and Douglas, 2016; Ibim and Bongilli, 2018). Soyinka *et al.* (2009), reported that difference in physicochemical parameters of the water body with seasons is a major reason for the variation in seasonal fish fauna composition. Davies (2009), also reported variations in the fin fish species of the Okpoka creek, and associated it to differences in physicochemical parameters. Soyinka *et al*. (2009), in the Badagry Lagoon reported salinity as the major

reason for the seasonal fish fauna composition. Ibim and Douglas(2016) in the Upper Sombrero River, reported that most of the true brackish water species were more available/abundant in the dry season period, as the salinity was highest, while the main freshwater species were available in the wet season, and some euryhaline species (Cichlids especially, *Sarotherodon* species) were available all through the year. Albaret *et al*. (2004), in his study in the Gambia estuary reported that, fluctuations of several environmental factors affect the dynamics of the fish assemblage.

The presence/absence of food organisms has also been observed as a major reason for seasonal difference in fish fauna composition. Soyinka and Kassem in the Ologe Lagoon (2008) and Davies in the Okpoka creek (2009) recorded high/dominant Clupeid presence in the dry season when there was high plankton density than in the wet season, as these fishes feed mainly on the planktons. Furthermore, Soyinka and Kassem (2008) reported that more fish in the dry season was mainly due to relatively stable water conditions and flow, and increased photosynthetic activities as a result of improved light penetration and high plankton density, which eventually results in greater food availability for fishes. Ezekiel *et al.* (2011) reported significant seasonal variation between the mean values of macrobenthic fauna (which are also food organisms) of the wet and dry season, with the dry season recording higher macrobenthos values than the wet season.

Ease of fishing and fishing gears can also influence the catch landed by the fishers (Allison *et al*., 1997). Ibim and Douglas (2016) reported that, fishing is preferred in the dry season when there is concentration of the large fish species in the rivers and reduced rains and water volume.

In tandem with the moderate composition of 12 species in 7 families in this current study, a similar fin fish composition of eleven (11) species from eight (8) families was reported in the Lower Okpoka Creek (Davies, 2009), one of the closest linked Creeks to this study area, in the Bonny Estuary. However, unlike the moderate fish composition reported in these Creeks, other water systems linked to the Amadi Creek, but a little further seawards, recorded higher compositions, such as was reported in; the Lower Bonny river, with 57 species in 25 families (Chindah and Osuamkpe, 1994); the Elechi Creek, in the Upper Bonny River with 35 species from 20 families (Allison *et.al*.,1997); the Upper New Calabar River with 41 species from 25 families (Ibim and Gogo, 2013);the Lower New Calabar River with 36 species from 29 families (Ibim and Igbani, 2014); and further down, the Middle Reaches of the Sombreiro River, with 31 species in 20 families (Ibim and Bongilli, 2018); the Upper Sombreiro River with 37 species in 20 families (Ibim and Douglas, 2016); among others.

The moderate composition in the Creek could be due to the fact that these Creeks are inland waters in the metropolitan area of Port Harcourt and receive inflows from various plants and runoffs from drainages that affect the fish fauna. Studies have shown that various anthropogenic activities have adversely impacted the fish species composition in similar inland Creeks such as in the Okpoka Creek (Davies, 2009), and in Majidun Creek Lagos (Lawson *et al*., 2013). Idelberger and Greenwood (2005), reported that, given the natural variability in environmental and biotic conditions, anthropogenic activities can potentially affect fish assemblages. These activities are likely to have affected the water chemistry of the Creek, and subsequently the fish fauna composition (Davies, 2009; Lawson *et. al*., 2013; Idelberger and Greenwood, 2005).Thus, the lower fish

fauna composition in the Amadi creek compared to the adjoining rivers, is probably due to the possible impact of the various anthropogenic activities taking place in the Creek.

Soyinka and Kassem (2008), and Lawson *et. al*. (2013), attributed the higher fish composition in some rivers to be as a result of proximity to the main source, the sea. Thus there is more exchange of fish species between rivers that are closer to, or having direct link with the sea than those further away from it.

Migration is a major issue also affecting fish fauna composition. The gradual drop in composition can be associated with the arrival of the rains. It is known that with the commencement of the rains most species that migrate for reproduction will be triggered to do so (Obande *et al.*, 2013). This migration of fish species for reproduction was reported in the Middle Reaches of the Sombrero River in the Niger Delta Area (Ibim and Bongilli, 2018).

The abundance of fish fauna through the transition period was moderate, with the numerical abundance of 7 the families as follows; the Cichlids -19,317 fishes; the Mugilidae -175 fishes; Clupeidae 30 fishes; Claroteidae -25 fishes; Elopidae and Haemulidae -2 each fishes; Eleotridae -1 fish. This was contrary to the wet season abundance of the Amadi creek (Ibim and Njoku, 2018), with a higher number of fishes and fish families in the late dry season. This is synonymous with several works in the Niger Delta Area (Davies, 2009; Onwuteaka, 2015; and others), and in other parts of Nigeria (Soyinka and Kassem, 2008; Soyinka *et al*., 2009 and others). The difference in abundance could be attributed to the change/variation in physicochemical parameters of the water body between the wet season and the transition period of the dry season (Davies, 2009), most important of which is decreased salinity in the wet season, increased salinity in the dry season (Soyinka *et. al.*, 2009).

Also, higher abundance in the dry season may be associated with a more stable environmental condition (Soyinka and Kassem, 2008), when the rains are low and run-offs/floods entering into the inland water bodies are minimal. Food organisms availability has also been implicated, as it was reported that, in the wet season the zooplankton and small fishes decreased. Thus the fishes with lower abundance at that point are mainly the carnivorous species of fishes like the *C. nigrodigitatus* (Abowei, 2000; Abowei *et al*., 2010; Ezekiel *et al*., 2011). Higher abundance in the dry season may also be associated with ease of fishing, as expressed by the fishers during this period. Other factors for higher abundance during the dry season include; concentration of catch due to less water volume (Ibim and Douglas, 2016).

Lower fish abundance in the as the rains come in lead could be associated to various factors such as, gradual migration of the brackish water species, due to gradual increase in rainfall (Fagade and Olaniyan, 1974; Chindah and Osuamkpe, 1994; Soyinka and Kassem, 2008; Soyinka *et al*., 2009; Davies, 2009; Onwuteaka, 2015; Ibim and Owhonda, 2017; and Ibim and Bongilli, 2018). Awiti (2011) reported that, rainfall affects water volume and depth which in turn affects the distribution of fish fauna and fish migration pattern. Davies (2009), reported that high water levels increase the size of the aquatic environment and enhances migratory and breeding movements of some fish species.

The Cichlids were the dominant and most abundant family, followed by the Mugilids which were few, while the rest families were rare. This dominance of the Cichlid

family is in agreement with the wet season findings in the Amadi Creek (Ibim and Njoku, 2018). It is also in agreement with the findings of Allison *et al*. (1997) in the Upper Elechi Creek, a directly linked Creek, also in the Bonny River. These inland waters however, are associated numerous anthropogenic activities, followed by constant environmental degradation from allocthonous materials of all kinds, wide fluctuations of water salinity associated with land based run-offs, low dissolved oxygen, among others. Thus, it is believed that, the Cichlid dominance is as a result of their ability to withstand poor environments and environmental degradation and are resistant to drastic environmental changes due to their hardiness, ability to reproduce easily, tolerate wide fluctuations/wide range of salinity (0-45ppt) as they are euryhaline, tolerate environments with dissolved oxygen as low as 0.1ppm (Pullin and Lowe-McConnel, 1982). This is evident in the Omuihechi stream, an inland tributary of the New Calabar River (Ibim and Owhonda, 2017). Also Awiti (2011), reported that the Cichlid family exhibit dominance due to their ability to tolerate a wide range of salinities and environments, and ability to utilize a wide range of foods in the lower trophic level as herbivores, as well as their high fecundity and prolific nature. However, this Cichlid dominance is contrary to the situation in most rivers in the Niger Delta Area, where the Clupeids are the most abundant species, followed by the Cichlids and Mugilids. The Mugilids as one of the next abundant species after the Cichlids in this study, is in agreement with their abundance in the Niger Delta Area (Chindah and Osuamkpe, 1994; Davies, 2009; Ibim and Douglas, 2016; Ibim and Bongilli, 2018). These three species are known to be plankton and epiphyton feeders, and their abundance could therefore be as a result of the high plankton abundance in the Niger Delta Rivers (Chindah and Osuamkpe, 1997; Davies, 2009; Ibim and Douglas, 2016; Ibim and Bongilli, 2018). The species abundance however showed that not all the Cichlids were dominant. The most abundant and dominant species and their relative abundance were; *Sarotherodon melanotheron (*56.20*%), Coptodon guineensis (*36.33*%) and Sarotherodon galilaeus(*6.19*%).* But the *Coptodon zilli (0.01%) and Hemichromis fasciatus (0.15%)* were low in abundance and thus rare. Even among the next abundant family, the Mugilids, only the *Mugil cephalus (*0.68*%)* was common, while the *Parachelon grandisquamis (0.13%)* was rare. All other species namely, *Chrysichthys nigrodigitatus (*0.13*%), Sardinella maderensis (*0.15*%), Elops lacerta (*0.01*%), Pomadasys perotaei (*0.01*%),* and *Eleotris senegalensis (*0.001*%),* were very low in abundance and thus rare. Though the occurrence/abundance of the *Sarotherodon melanotheron* was similar to the findings of Ibim and Njoku (2018) in the wet season in the Amadi Creek, the occurrence/abundance of all other species were not in agreement as only the *Coptodon guineensis* and *Mugil cephalus* existed, and were rare in the wet season, other species were absent. Seasonal variation is the most likely reason for this discrepancy in abundance of species (Soyinka and Kassem, 2008; Soyinka *et al*., 2010; Ibim and Douglas, 2016; Ibim and Bongilli, 2018; among others). Anthropogenic activities could also be responsible. Idelberger and Greenwood (2005) stated that, although the effects of environmental alterations on fish populations in estuarine areas are difficult to predict given the natural variability in environmental and biotic conditions, anthropogenic changes have the potential to affect these seasonal assemblages. The increased availability of the other species during the dry season could be attributed to the higher nutrient availability and/or stability in environmental conditions (Chindah and Osuamkpe, 1997; Abowei *et al*., 2008; Davies, 2009; Ezekiel *et al.*,

2011; Awiti, 2011). Abowei (2000), Abowei *et al*., (2008) and Ezekiel *et al*., (2011), reported that in the wet season, fishes with lower abundance are mainly the carnivorous species which have decreased food organism such as the zooplankton and small fishes, as breeding grounds are made more accessible by flooding of shallow breeding grounds.

The rarity of many species in this study, especially the very low status of the *Eleotris senegalensis is of great concern*. However, the very low status of the *Eleotris senegalensis* was similar to that reported in the Upper Sombrero (Ibim and Douglas, 2016). The reasons for this rarity are not known. However, the numerous anthropogenic activities in the area could have resulted in the rarity of these large numbers of species. Idelberger and Greenwood (2005) stated that, alterations to the natural environment may indirectly affect fisheries by causing permanent physical changes to habitat or by altering nutrient supplies that influence the timing, quality, and quantity of specific fish food resources.

Fishing pressure is another likely reason affecting fish species abundance, as fish is the main protein food, and fishing is the primary economic activity in the Rivers state. Thus there are numerous fishers in this water way that depend on this creek for their fish catch.
Maitland and Morgan (1997), reported that many fish species are declining in abundance as a result of overfishing, dam construction and loss of catchment, habitat degradation and destruction by human activities. These have often been the underlying factors responsible for the decline and extinction of some fish species rather than direct over exploitation.

Seasonality of fish in the creek also cannot be ruled out as the advent of the rains would affect the physicochemistry of the water body, causing the fishes that require certain conditions to migrate. Idelberger and Greenwood (2005) in their work stated that, changes in fish-assemblage structure occurred during the main periods of seasonal transition (April–May and September–October).

CONCLUSION AND RECOMMENDATION

The study of the fish fauna population structure of the transition period (late dry season) in this Creek revealed a fairly high fish fauna family and species composition, and moderate abundance. However, there was an improvement in the transition period (late dry season) population structure over that of the wet season. Although, a few species (*Sarotherodon melanotheron, Coptodon guineensis* and *Sarotherodon galilaeus*) were dominant/abundant, a majority of the fish species (*Coptodon zilli, Hemichromis fasciatus, Chrysichthys nigrodigitatus, Sardinella maderensis, Eleotris senegalensis, Elops lacerta, Pomadasys perotaei* and *Parachelon grandisquamis*) were reported to be rare in this transition period (late dry season). The rarity of several fish species is a major concern, considering the economic importance and the uses of the Amadi Creek. Thus, there is a dire need to conserve/protect the fishes, and manage the fisheries and the environment, to prevent the Amadi creek and its fish population/fisheries from collapsing into extinction.
It is therefore recommended that an all year-round and comprehensive research, geared towards elucidating the full seasonal population structure, identifying the true threats to the fish population, especially the role of the Fishery and other major human activities, be undertaken. In addition, a regular biomonitoring process that identifies the fish population status and the influence of various activities in the study area, over time should be encouraged.

REFERENCES

Abowei, J.F.N., 2000. Aspect of the fisheries of the lower Nun River. Ph.D Thesis. University of Port Harcourt, Nigeria.

Abowei, J.F.N., 2010. Salinity, Dissolved Oxygen, pH and Surface Water Temperature Conditions in Nkoro River, Niger Delta, Nigeria. *Advance Journal of Food Science and Technology* 2(1), 36-40

Abowei, J.F.N., Tawari, C.C., Hart, A.I. and Garicks, D.U. 2008. Finfish species composition, abundance and distribution in the lower sombriero river, niger delta, Nigeria. *International Journal of Tropical Agricultural and Food System.* 2(1), 46-53.

Akpan, I.I., 2013. Species composition and Abundance in Uta Ewa Creek, Niger Delta Region, Nigeria. IOSR *J. Agric. Vet. Sci*. 3(3),56-60.

Albaret, J.J. Simier, M. Darboe, F.S. Ecouti, J.M. Raffray, J. and Tito de Morias, L., 2004. "Fish diversity and distribution in the Gambia estuary, West Africa, in relation to environmental variables." *Aquatic Living Resources*, 17, 35-46.

Alfred-Ockiya, J.F., 1996. Studies on the Ichthyofauna of Kolo Creek River State, Nigeria. *Niger Delta Biologia*, 1 (2), 24 -28.

Allison, M. E. Gabriel, U. U. Inko-Tariah, M. B. Davies, O. A. and Uedeme-naa, B., 1997. The fish assemblage of Elechi Creek, Rivers State, Nigeria. *Niger Delta Biologia*, 2, 53-61.

Allison, M.E. Gabriel, U.U. Inko-Tariah, M. B. Davies, O. A. and Uedeme-Naa, B., 2003. The fish assemblage of Elechi Creek, Rivers state, Nigeria, *Niger Delta Biologia*. 2, 53-61.

Amakiri, N.E., 2006. Aspects of the biology of *Pseudotolithus elongatus* (Bowditch, 1825) of Bonny estuary, Niger Delta, Nigeria.

Awiti, A. O., 2011. Biological Diversity and Resilience: Lessons from the Recovery of Cichlid Species in Lake Victoria. *Ecology and Society* 16(1), 9.

Barita, Y.T. Williams, R.D. and Stauffer, R.J., 2000.The influence of stream order and selected stream red parameters of fish diversity in Rays town branch, Pennsylvania: Susquehanna R. drainage.

Chindah, A.C. and Osuamkpe, A., 1994.The Fish Assemblage of the Lower Bonny River, Niger Delta, Nigeria. *Afr. J. Ecol*. 32, 58-65.

Cyrus, D.P., 1991. Fish conservation in South African estuaries: Pressures, problems and prospects. *S. Afr. J. Aquat. Sci*. 17, 19–27.

Davies, O. A., 2009. Finfish assemblage of the Lower Reaches of Okpoka Creek, Niger Delta, Nigeria. *Research Journal of Applied Science, Engineering Technology*, 1(1), 16:21.

Ezeilo, F.E. and Dune, K.K., 2012. Effect of environmental pollution on a receiving water bodies: A case study of Amadi Creek, Port Harcourt, Nigeria. *Transnational Journal of Science and Technology*, 2(8), 30-42.

Ezeilo, F.E. and Agunwamba, J.C., 2014. Analysis of heavy metal pollution status of Amadi creek, Port Harcourt, Nigeria. *Health, Safety and Environment* 2 (3), 88- 96.

Ezekiel, E. N. Abowei, J.F.N. and Hart, A.I., 2002. The Fish Assemblage of the Local Fish Ponds in the Flood Plains of the Odhiokwu-Ekpeye , Niger Delta. *Intl J. Sci. Technol*., 1, 54-67.

Ezekiel, E.N. Hart, A.I. and Abowei, J.F.N., 2011. The Distribution and Seasonality of Benthic Macro-Invertebrates in Sombreiro River, Niger Delta, Nigeria, *Research Journal of Applied Sciences, Engineering and Technology* 3(4), 264-271

Fagade, S. O. and Olaniyan, C. I. O., 1974. Seasonal distribution of the fish fauna of the Lagos Lagoon. *Bull. De I'.I.F.A.N.T. Ser.* A. 36(1), 244 - 252.

Froese, R. and Pauly, D. (Eds.), 2010. *Fish Base World Wide Web electronic publication*. http://www.fishbase.org.

Galib, S.M. Abu Naser, S.M. Mohsin, A.B.M. Chaki, N. and Fahad, F.H., 2013. Fish diversity of the River Choto Jamuna, Bangladesh: Present status and conservation needs. *Int. J. Biodivers. Conserv.*, 5, 389-395.

Hewitt, M.L. Koracs, T.G. Dube, M.G. Maclatchy, D.L. and Martel, P.H., 2008. Altered Reproduction in Fish Exposed to Pulp and Paper Mill Effluents. Roles of Individual Compounds and Mill Operating Conditions. *Environ. Toxicol. Chem.*, 27, 682-697.

Ibim, A.T. and Gogo, O. O., 2013 Composition, Diversity and Abundance of Ornamental Fish Fauna of the Upper New Calabar River, Niger Delta Area, Nigeria. *International Journal of Research and Development*, 1(2), 1-12.

Ibim, A.T. and Igbani, F., 2014. Fish species composition, diversity and abundance of the lower New-Calabar River, Rivers State. *Journal of Aquatic Sciences*, 29(1), 57- 69.

Ibim, A.T. and Bongilli, B., 2017. Ichthyofaunal composition and diversity of middle reaches of Sombreiro River in Degema and Akuku -Toru Local Government Areas, *Journal of Aquatic Sciences* 32 (1A): 1-12. DOI: https://dx.doi.org/10.4314/jas.v32i1A1.

Ibim, A.T. and Bongilli, B., 2018. Fish Stock Status of the Middle Reach of the Sombreiro River of the Niger Delta Basin, Nigeria. *Proceedings of 6th NSCB Biodiversity Conference*; Uniuyo. 2018 (346 - 360pp).

Ibim, A.T. and Douglas, S. (2016). Status of the Fin Fish of the Upper Sombriero River, Abua/Odua Local Govt. Area, Rivers State, Nigeria. *Journal of Agriculture and Social Research* 16(1), 37-58.

Ibim, A. T. and Francis, A., 2012. Album of Marine and Brackish Water Ornamental and Food Fishes of the Niger Delta of Nigeria. Published By *University of Port Harcourt Press.* ISBN: 978-978-50992-5-6. 42pp.

Ibim, A.T. and Owhonda, M., 2017. Composition and Diversity of the Fish Fauna of Omuechi Stream, Aluu, Rivers State, Nigeria. *IOSR Journal of Environmental Science, Toxicology and Food Technology* (11)(1 Ver. III), 34-39.

Ibim, A.T. and Njoku, L., 2018. Fish assemblage of Amadi creek, Port Harcourt, Rivers State, Nigeria. *American Scientific Research Journal for Engineering, Technology and Sciences*, 39(1), 2313-4410.

Idelberger, C.I. and Greenwood, M. F. D., 2005. Seasonal Variation in Fish Assemblages within the Estuarine Portions of the Myakka and Peace Rivers, Southwest Florida. *Gulf of Mexico Science*, (2), 224–240.

Jalal, K.C.A. Azfar, M.A. John, B.A. Kamaruzzaman, Y.B. Shahbudin, S., 2012. Diversity and Community Composition of Fishes in Tropical Estuary, Pahang, Malaysia. *Pakistan Journal of Zoology*. 44(1), 181-187.

Kennish, M. J., 2002. Environmental threats and environmental future of estuaries. *Environmental Conservation*, 29 (1), 78-107
·DOI: 10.1017/S0376892902000061

King, M. K., 1995. Fisheries Biology Assessment and Management. *Fishing News Books, Blackwell Science, Ltd*, London, 341pp.

Lawson, O.E. and Olusanya, M.O., 2010. Fish Diversity in three tributaries of River Ore, South West Nigeria. *World Journal of Fishery and Marine Science*, 2(6), 524-531.

Lawson, O. E. Doseku, P.A. and Ajepe, R.G., 2013. Fish Assemblage of the Majidun Creek, Lagos, Nigeria. *Asian Network for Scientific Information. Jour. Of Biol.* Sc.13 (7), 577 – 586. DOI:10.3923/jbs.

Lowe-McConnel, R.H., 1964. Fish Communities in Tropical Freshwaters. *Longman Limited, London*, 340pp.

Maitland, P.S. and Morgan, N.C., 1997. Conservation Management of freshwater habitat: lakes, rivers and wetlands. *Kluwer Academic Publishers*.

Meye, J.A., 2013. Fish species composition and distribution in an urban perturbed stream, Southern Nigeria. *African Journal of Aquatic Sciences.* 8(2), 215-234.

Minns, C.K., 1989. Factors affecting fish species richness in Ontario lakes. *Trans. Am. Fish. Soc.*, 118, 533-545.

Nwadukwe, F.O. 1995. Species Abundance and Seasonal Variations in catch from 2 mangrove habitats in the Lagos Lagoon. Environ. Ecol., 13 (1), 121-128.

Nweke, A., 2000. Impact of organic waste pollution on Macrobenthos and fish fauna of Elechi Creek. *PhD Thesis* RSUST, Port Harcourt, 386pp.

Nwokolo, E., 1987. Nutrients composition of Tropical shell fishes; *Nutritional Report International* 36, 25 1-295.

Obande, R. A. Dambo, A. and Adah, P.M., 2013. Migration in Fishes: A Review. *Nigerian Journal of Fisheries and Aquaculture* 2 (1), 1 -5.

Ogamba, E. N., 1998. A baseline study of the fisheries of Elechi Creek. *M.Sc. Thesis*, RSUST, Port Harcourt, Rivers State.

Onwuteaka, J., 2015. Fish Association Dynamics in the Three Clearwater and Blackwater River Systems in the Eastern Delta of Nigeria. *Journal of Advances in Biology and Biotechnology*, 4 (2),1-16

Opeh, B.P. and Udo, P.J., 2017. Biodiversity of Fishery Resources of the Cross River System: Implication for Conservation and Management. *J Aquac. Mar. Biol.* 6(3), 00154. DOI: 10.15406/jamb.2017.06.00154

Pino-Del-Carpio, A. Arino, A.H. Villarroya, A. Puig, J. and Miranda, R., 2014. The Biodiversity Data Knowledge Gap: Assessing Information Loss in the Management of Biosphere Reserves. *Biological Conservation*. 173, 74-79.

Pullin, R. and Lowe-McConnell, R., 1982. The Biology and Culture of Tilapias. *The International Conference on the Biology and Culture of Tilapias* 1-351.

Scott, J.S., 1966. Report of the Fisheries of Niger Delta Special Area. *Niger Delta Development Board Report*, 109pp.

Shabir, A. D. Mohd, A. Majahid, K. and Najar, A.M., 2000. Conservation Strategies for Fish Biodiversity, Aquafind.com aquatic Fish Database, ext. *Ph.D scholar*, Central Institute of Fisheries Education Versova, Mumbai, India-400061.

Soyinka, O. O. and Kassem A.O., 2008. Seasonal variation in the distribution and fish species diversity of a tropical lagoon in south-west *Nigeria. J. Fish. Aqua. Sci*. 3(6), 375 – 383.

Soyinka, O.O. Kuton, M.P. and Ayo-Olalusi, C.I., 2010. Seasonal distribution and richness of fish species in the Badagry Lagoon, South-West, Nigeria. *Estonian J. Ecol.*, 59, 147-157.

Sikoki, F.D. Hart, A.I. and Abowei, J.F., 1998. Gillnet selectivity and fish abundance in the lower Nun River, Bayelsa State, Nigeria. *J. Appl. Sci and Environmental Mgt.*, 1(1), 13-19.

Sikoki, F. D. Hart, A.I. and Seth, A., 1999. Studies on the fish and fisheries of Brass River system and adjoining coastal Water in Bayelsa State, Nigeria. *J. Applied Sci. Environ. Manage*, 2, 63-67.

Sikoki, F.D. Hart, A.I. and Abowei, J.F.N., 2003. Gill Net Selectivity and fish

Abundance in the Lower Nun River, Bayelsa State, Nigeria. *J. Applied Sci. Environ. Mgt*, 1 (1), 14-19.

Tahir, M. A., 2013. Fish species composition, abundance and size distribution of Kalgwai dam, Jigawa state using catch statistics. MSc. Thesis, Department of Fisheries and Aquaculture. University of Agriculture Makurdi Nigeria. 182 pp.

Thompson, P.L. Davies, T.J. Gonzalez, A., 2015. Ecosystem Functions across Trophic Levels Are Linked to Functional and Phylogenetic Diversity. *Liang W, ed. PLoS ONE.* 2015; 10(2):e0117595. doi:10.1371/journal.pone.0117595.

Wheeler, A., 1994. Field key to the shore fishes of the British Isles. *Field Studies.* 8, 481-521.

Wilcox, B.H.R., 1980. "Angiosperm flora of a Niger Delta Mangrove. A taxonomic review", In: *Abstracts of workshop on the Niger Delta Mangrove Ecosystem*, University of Port Harcourt.19111 May 1980:1-350.

Wright, J.M., 1986. The ecology of fish occurring in shallow water creeks of Nigerian Mangrove Swamp. *J. Fish. Biol.* 29, 431-441.