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FISH FAUNA COMPOSITION, ABUNDANCE AND DISTRIBUTION OF FORCADOS RIVER ESTUARY

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Abstract: This study was carried out to determine the fish fauna composition, abundance and distribution of Forcados river estuary. The monthly fish samples were collected for 24 months between April, 2016 and March, 2018, by using dragnet of stretched mesh sizes 6 mm, 15 mm and 25 mm, gill net and hand net through the services of motorised local artisanal fishers. A total of twelve thousand seven hundred and eighty fishes belonging to 18 families, 27 genera and 34 species were collected. Artisanal fishers should be educated on the importance of sustainable fishing practice to encourage the conservation of fishes in the estuary.

Keywords: Clupeidae, *Ethmalosa fimbriata*, Forcados River estuary, Mugilidae.

INTRODUCTION

Fish is a major source of food for all people and plays a vital role in Africa's nutritional status because a good number of its populace regularly feed on fish (World Fish Center, 2005). Fish in different forms (dried, fresh, smoked, or powder) provide important source of micronutrients and dietary protein to man (Anon, 2000). In addition, fish may also be the only available source of quality animal protein for low-income families in Africa (FAO, 2003). The composition of fish in Nigeria is currently being threatened as a result of water pollution from anthropogenic activities (Arimoro *et al*., 2007; Ogamba *et al*., 2014). In aquatic ecosystem food chains, fish occupy the topmost trophic level. Therefore, its composition reflects the water integrity of the environment. (Ajani and Balogun, 2015). Research works on fish composition in brackish water has shown that certain water quality parameters such as pH, temperature, salinity and dissolved oxygen affect the distribution of fish (Blaber and Blaber, 1980).

Forcados river estuary has been a great livelihood support base for the residence of Burutu, Forcados as well as the neighbouring communities. The estuary serves for both artisanal and aquaculture purposes, movement of people, good and services, wood production for fuel effluent discharge and waste disposal. The water body is one of the many rivers in Niger Delta area with a length exceeding 198 km, as its flora and fauna are characterized by great diversity. As far back as 1900, the estuary has been physically altered for navigation purpose being a major navigable channel of the Niger Delta (Encyclopedia Britannica, 2016).

Information on the fish fauna of Forcados river estuary is scanty despite its increasing usefulness and associated anthropogenic pressures in recent time. Available published works are the works of Egborge (1994), who examined some aspects of

the physical and chemical parameters while working on the biodiversity of Warri River. Opute (1990, 1992 and 2000) investigated the aspects of the physical and chemical properties and microflora while Akpoborie *et al.* (2012) worked on crude oil spills and its environmental management. Other related works carried out within the Niger Delta region of Nigeria include works of Ekpo and Udoh (2013) in Lower Cross River; Akpan (2013) in Uta Ewa creek; Arimoro *et al.* (2014) in a small creek (Ajijiguan). The present study was conducted to determine the fish fauna composition, abundance and distribution of Forcados river estuary. It will also fill some aspects of the existing gap by providing comprehensive data on the fish ecology of the water body.

MATERIALS AND METHODS

Description of the study area

The study was conducted in Forcados river estuary. It lies between latitude 5° 21¹ - 5 35° N and longitude 5° 31¹- 5° 51¹ E (Fig. 1). The Forcados river estuary originated from the merging and convergence of the Warri and Forcados rivers and their tributaries. From an average width of about 100 m in the narrowest parts, it spans over 3 km in the widest regions before emptying into the Atlantic Ocean at a south point within the Bight of Benin (Opute, 2000).

The waterway is affected by powerful tidal action especially in the dry season months. Common in the town are relicts of Port and harbour that existed during the colonial era in Nigeria (Ohwoghere-Asuma*et al.*, 2014). The main occupation in the area is fishing. The major means of transportation is by water with engine boats and canoes.

The study area has a tropical climate condition comprising of two distinct seasons: rainy and dry seasons. The wet season spans from April to November while the dry months are from November to March.

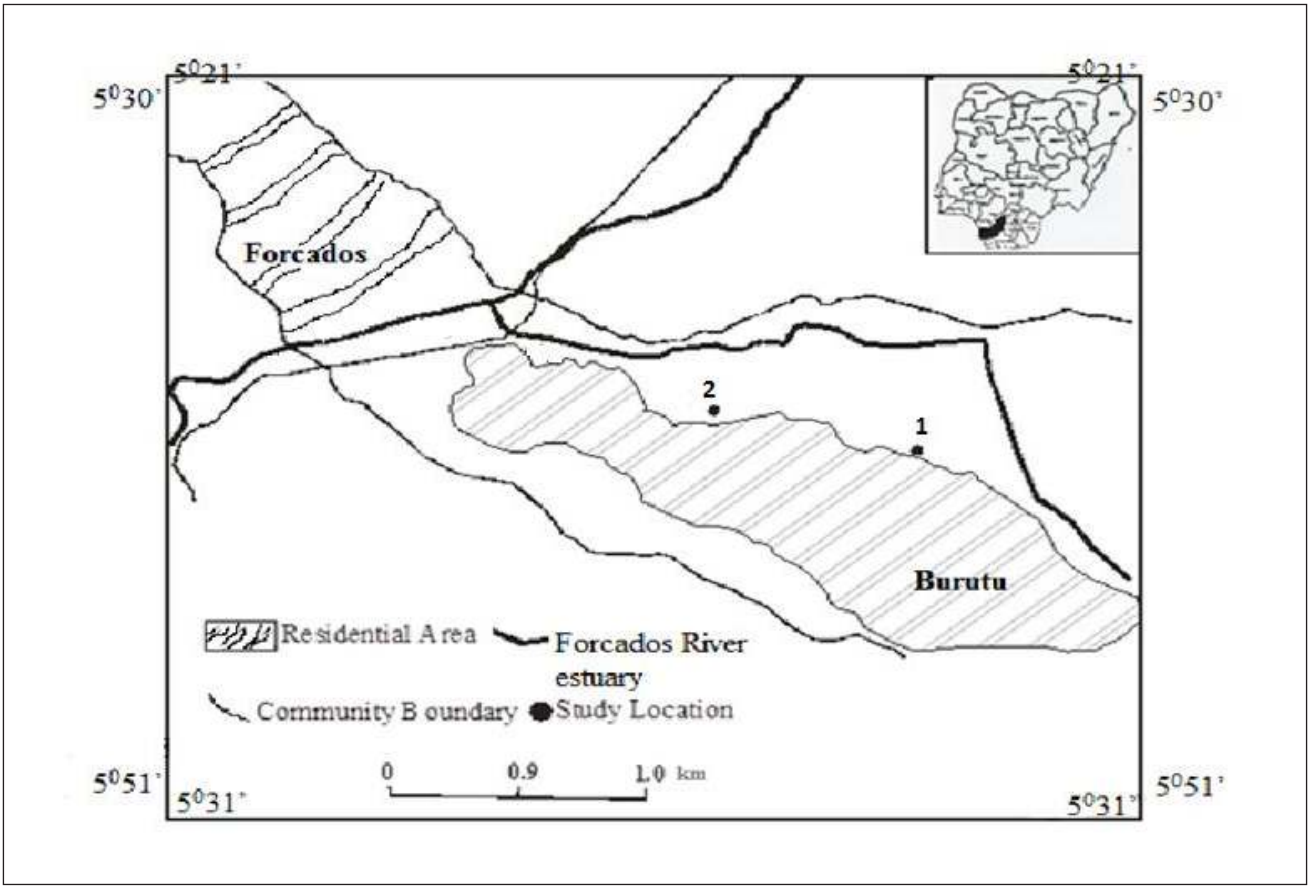

Fig. 1: Map to show the study and sampling areas.

Description of the study stations

Five stations were chosen on an 8 km stretch of the Forcados river estuary between Burutu and Forcados. The study stations were selected by land use patterns, human impacts, solid waste disposal, and substrate structure and bank types. The main features of the stations are described as follows;

Station 1: This station is located approximately 30.3 km from Warri. The river bed is sandy silt. The submerge vegetation includes *Eichhornia crassippes, Potamogeton* spp, *Vallisneria* spp, *Trapa* spp. The water flow velocity was about 2 m/s. The water depth at the bank is about 0.43-1.35 m. Human activities include jetty operations, selling of goods and petroleum products (with little or no environmental precautions), boat movement, dumping of organic and inorganic waste from Burutu market, marketing, log movement, laundering and washing of boats.

Station 2: This is situated about 1.5 km downstream of station 1. This station harbours residential structure. The water flow velocity at this station is about 0.40 m/s. The submerge vegetation includes; *Eichhornia crassippes*, *Trapa* spp, *Azolla* spp, *Nymphaea* spp, *Lemna* spp, while the riparian vegetation includes Buffel grass (*Cenchrus ciliaris*), Palm tree (*Elaeis guineensis*). The river bed is predominately sandy silt, mud and organic matter mainly decaying leaves. This location hosts to a number of human activities closed to the Delta State School of Marine Technology Burutu such as landing of boats and canoes, offloading of building materials, construction of a new jetty, fishing, defecating, swimming, bathing amongst others are the main activities in this station. The water depth at the bank is about 0.50 - 1.25 m.

Station 3: This is located about 1.5 km from station 2. The substratum is composed of sand. The submerge vegetation cover comprises occasional includes *Eichhornia crassippes* and *Nymphaea* spp. This station is without emergent vegetation cover. The main activity at this station is sand mining, loading and offloading of dredged sand. The water velocity at this station is about 0.90 m/s. Water depth is about 0.50-1.60 m.

Station 4: This station is located about 2 km from station 3. The bottom substratum is made up of mud. The vegetation covers include Fern, *Pistia, Pennisetum purpureum, Cenchrus ciliaris, Nymphaea* spp, *Trapa* spp, *Lemna* spp, *Ceratophyllum* spp. The main activity at this station is fishing. The water velocity at this station is about 2.30 m/s. Water depth is about 0.85-2 m.

Station 5: This station is located about 1 km from station 4. The station is without vegetation cover with the occasional presence of *Eichhornia crassippes*. Bottom substrates at this site were composed of sand. The main activity at this station is fishing, boat ferrying and occasional sand moving. The water velocity at this station is about of 2.25 m/s. Water depth is about 1.15-3 m.

3. Fish sampling

Fish were sampled monthly for 24 months (April 2016 to March 2018) using dragnet of stretched mesh sizes 6 mm, 15 mm and 25 mm, gill net and hand net through the services of motorised local artisanal fishers.

Laboratory studies

In the laboratory, the specimens were sorted, identified, counted and labelled in appropriate containers using fish identification keys according to Tobor and Ajayi (1979); Fischer *et al*. (1981); Schneider (1990) and Paugy *et al.* (2003).

Dominant, common, occasional and rare groups

A check list of the fish species is given. The terms and designations are "dominant" (++++), "common" (+++), occasional (++) and "rare" (+), as per literature of Odum (1959). The number of fish caught was used to determine the index of abundance. The list considers species comprising 10% and above of the total number as dominant. Species with a relative abundance of 1-9% as common; species which were caught more than once and comprises less than 1% as occasional and those caught only once and accounted for less than 1 % as rare.

Relative abundance of Macroinvertebrate and Fish species

The abundance (number of individuals) of species was established.

The relative abundance (Ra) of fish species was calculated using the equation:

$$Ra = Qi/N$$

where: Qi = Quantity of the given fish species I

N = Total number of all fish sampled.

RESULTS

Composition of fish families

The composition and abundance of fish families is shown in Table 1. The actual number of fish caught, their biomass or wet weight (g) in relative percentage is given. A total of 12,780 fish were captured and the total biomass amounted to 759, 350.9 g. Of the total of 18 families, 11 families accounted for 93.52% of the individuals and 92.59 % of biomass. The three dominant families in number and biomass were Clupeidae (20% by number and 21.35% by biomass), Scianidae (16.73% by number and 19.63% by biomass) and Mugilidae (15.29% by number and 14.53 by biomass). The subdominant families in terms of number were Cichlidae (7.16%), Pomadasyidae (6.21%), Cynoglossidae (4.36%), Sphyraenidae (4.32%), Polynemidae (4.25%), Ariidae (3.36%), Trichiuridae (2.08), Hepsetidae (1.37%), Elopidae (1.18%) and Lutjanidae (1.11%). The other families had a low relative abundance (<1%), both in terms of number and biomass except for the family Citharinidae which had a relative biomass of 1.15%.

Table 1: Composition of fish families (Arrangement according to abundance in number and biomass; 10% and above regarded as dominant and 0-9 % as sub-dominant).

S. No.	Fish family	No. of individuals	%	Biomass [wet weight (g)]	%
1.	Clupeidae	2556	20	162112.3	21.35
2.	Scianidae	2138	16.73	149101.5	19.63
3.	Mugilidae	1954	15.29	110301.9	14.53
4.	Carangidae	1247	9.76	101920.2	13.42
5.	Cichlidae	915	7.16	27451.0	3.62
6.	Pomadasyidae	793	6.21	25749.3	3.39
7.	Cynoglossidae	557	4.36	28431.0	3.74
8.	Sphyraenidae	552	4.32	22551.9	2.97
9.	Polynemidae	543	4.25	39867.8	5.25
10.	Ariidae	429	3.36	19822.4	2.61
11.	Trichiuridae	266	2.08	15801.0	2.08
12.	Hepsetidae	175	1.37	17940.1	2.36
13.	Elopidae	151	1.18	10152.0	1.34
14.	Lutjanidae	142	1.11	9267.2	1.22
15.	Gbioidae	124	0.97	1256.0	0.17
16.	Tetradontidae	120	0.94	2671.9	0.35
17.	Citharinidae	101	0.79	8724.1	1.15
18.	Clariidae	78	0.61	6229.3	0.82

Species composition and biomass of dominant families

Species composition of three dominating families *viz*. Clupeidae, Scanidae and Mugilidae are depicted in table 2.

Table 2: Species composition of Clupeidae, Scanidae and Mugilidae families.

S.No.	Species of Clupeidae	Number	%	Biomass (g)	%
1.	*E. fimbriata*	1133	44.32	110192.6	67.97
2.	*I. africana*	611	23.91	21564.1	13.30
3.	*S. maderensis*	812	31.77	30445.6	18.73
	TOTAL	**2556**	**100**	**162112.3**	**100**
S.No.	**Species of Scanidae**	**Number**	**%**	**Biomass (g)**	**%**
1.	*P. elongates*	1120	53.39	81411.3	54.60
2.	*P. senegalensis*	1018	47.61	67690.2	45.39
	TOTAL	**2138**	**100**	**149101.5**	**100**
S.No.	**Species of Mugilidae**	**Number**	**%**	**Biomass (g)**	**%**
1.	*L. falcipinnis*	1267	64.84	100695.2	91.29
2.	*L. gradisquamis*	275	14.07	4212.0	3.82
3.	*M. liza*	122	6.24	2976.2	0.03
4.	*M. cephalus*	290	14.84	2421.5	4.86
	TOTAL	**1954**	**100**	**110301.9**	**100**

Species composition and biomass of subdominant families

Table 3 (A to Q) presents the species composition of the 15 subdominant families in the study area.

Table 3: Species composition of the subdominant families.

S.No.	Family/Species	Number	%	Biomass (g)	%
A.	**CARANGIDAE**				
1.	*C. hippo*	470	37.69	38421.3	37.69
2.	*C. senegalus*	132	10.58	18723.9	18.37
3.	*C. lagubris*	27	2.16	1278.3	1.25
4.	*C. chrysurus*	35	2.80	2001.2	1.98
5.	*S. dorsalis*	583	46.77	41495.5	40.71
	TOTAL	**1247**	**100**	**101920.2**	**100**
B.	**CICHLIDAE**				
1.	*O. niloticus*	72	7.86	9811.8	4.12
2.	*H. fasciatus*	83	9.07	1200.1	4.73
3.	*S. melanotheron*	699	76.39	21443.2	89.07
4.	*T. zillii*	61	6.68	822	2.02
	TOTAL	**915**	**100**	**27451.0**	**100**

C	**POMADASYIDAE**				
1.	*P. peroteti*	248	31.27	4311.0	16.74
2.	*P. jubelini*	341	43.00	18561.4	72.05
3.	*P. macrolepsis*	143	25.72	2876.9	11.17
	TOTAL	**793**	**100**	**25749.3**	**100**
D.	**CYNOGLOSSIDAE**				
1	*C. senegalensis*	577	100	28431.0	100
	TOTAL	**557**	**100**	**28431.0**	**100**
E.	**SPHYRAENIDAE**				
1.	*S. sphyraena*	441	79.89	16914	75
2.	*S. afra*	111	20.10	5637.9	25
	TOTAL	**552**	**100**	**22551.9**	**100**
F.	**POLYNEMIDAE**				
1.	*G. decadactylus*	543	100	39867.8	100
G.	**ARIIDAE**				
1.	*A. gigas*	429	100	19822.4	100
	TOTAL	**429**	**100**	**19822.4**	**100**
J.	**TRICHIURIDAE**				
1.	*T. lepturu*	266	100	15801.0	100
	TOTAL	**266**	**100**	**15801.0**	**100**
K.	**HEPSETIDAE**				
1.	*H. odoe*	175	100	17940.1	100
	TOTAL	**175**	**100**	**17940.1**	**100**
L.	**ELOPIDAE**				
1.	*E. lacerta*	151	100	10152.0	100
	TOTAL	**151**	**100**	**10152.0**	**100**
M.	**LUTJANIDAE**				
1.	*L. goreensis*	142	100	9267.2	100
	TOTAL	**142**	**100**	**9267.2**	**100**
N.	**GBIOIDAE**				
1.	*P. papilia*	124	100	1256.0	100
	TOTAL	**124**	**100**	**1256.0**	**100**
O.	**TETRADONTIDAE**				**N**
1.	*L. lagocephalus*	120	100	2671.9	100
	TOTAL	**120**	**100**	**2671.9**	**100**
P.	**CITHARINIDAE**				
1.	*C. citharus*	101	100	8724.1	100
	TOTAL	**101**	**100**	**8724.1**	**100**
Q.	**CLARIIDAE**				
	C. lazera	78	100	6229.3	100

DISCUSSION

Forcados river estuary is blessed with abundant and diverse fish species. A total of twelve thousand seven hundred and eighty fish belonging to 18 families, 27 genera and 34 species specimens were caught. 34 species caught in this study is higher than 28 species reported in the Po estuary by Vitali and Braghieri (1981); 16 species in the Gialova Lagoon by Dounas and Koutsoubas (1996); 28 species collected in the Uta Ewa Creek by Akpan (2013); 16 species found in a coastal wetland in Ghana (Okyere and Blay, 2012). In addition, Emmanuel and Onyema (2007) recorded 21 fish species from 12 families while working in a tidal creek that broke out from the Lagos Lagoon. In the same vein, Soyinka and Kassem (2008) recorded 25 fish species representing 16 families in Ologe Lagoon while Ajagbe *et al*. (2012) recorded 18 fish species in Lagos Lagoon. However, the record in this study is lower than observations made in a similar study in Ajijuguan creek of the Benin River where Arimoro *et al.* (2014) recorded a total of 56 fish species in 20 families. Soyinka *et al.* (2010) recorded 37 fish species that represent 21 families in the Badagry Lagoon, Nigeria; Fagade and Olaniyan (1974) collected 72 species from the Lagos Lagoon while 43 species were observed in the Strymon estuarine system in Northern Greece by Koutrakis *et al*. (2000a). Koutrakis *et al*. (2000b) recorded 35 species in the Porto (Lagos Lagoon).

The deeper water stations (4 and 5) showed greater fish diversity and abundance. This can be attributed to water depth since station 4 and 5 were deeper, wider with expectedly better resource abundance than stations 1 to 3. This finding corroborates reports by Paterson and Whitfield (2000) who linked fish distribution to water depth in their study at Kariega estuary (South Africa).

The preponderance of *E. fimbriata* in this water body can be linked to the fact that this species is endemic to the coastal and inland waters of Nigeria and West African Coast (Arimoro *et al.,* 2007; Oribhabor and Ogbeibu, 2012; Soyinka and Ebigbo, 2012; Ogamba *et al*., 2014). *L. falcipinnis* was also one of the most dominant finfish documented in this study. *E. fimbriata* is one of the most widely spread mullets species (Sivalingam, 1975; Dankwa and Gordon, 2002). Okoye-Okyere *et al*. (2011) also had a similar observation while working on Essei fish community in Ghana.

CONCLUSION

Forcados river estuary has a diverse fish fauna composition with the deeper water stations (4 and 5) showing greater fish diversity and abundance. Artisanal fishers should be educated on the importance of sustainable fishing practice to encourage the conservation of fishes in the estuary.

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