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Ichthyofaunal composition and diversity of Stubbs Creek, Ibeno, in Akwa Ibom State, Nigeria

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Abstract. The fish abundance and distribution of Stubbs Creek were examined in order to provide information for the management and sustainable exploitation of the ecosystem services. Fish samples obtained from the fishermen landing sites were identified using FAO species identification guide. Data were analyzed using descriptive statistics. Species diversity and community abundance were determined using Shannon-Weiver diversity index (H) and Margalef's species richness (d). Twenty nine fish species, twenty two genera in nineteen families and eight orders were identified from the three landing stations during the study. Station 1 (Iwokpom) recorded the highest taxa (24) consisting of 993 fishes (43.14%) of the total catch. Landing site 2 (Iwuchang) and 3 (Ubenekang) both recorded 22 taxa each comprising 556 (24.15%) and 753 (32.71%) fishes, respectively. Iwokpom recorded the highest diversity in fish species d = 3.333, but the lowest general ecosystem diversity (H = 2.781). Ubenekang (Station 3) had the lowest species richness d = 3.17, but recorded the highest biodiversity (H = 2.839) in the study. Evenness was generally high among the stations but Iwopom recorded the lowest value of e = 0.6722 and Ubenekang had the highest, e = 0.7769. Iwuchang (Station 2) came next to Iwopon in species richness d = 3.322, but was next to Ubenekang in general diversity (H = 2.833) and evenness e = 0.7725, respectively. The present study indicated that stub creek is rich in fish biodiversity. Therefore users of this water body should maintain responsible fishing activities in order to conserve this biodiversity.

Keywords: Fish; Biodiversity; Stubbs creek; Conservation.

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Introduction

Fish constitute the most abundant and valuable pelagic animals in the aquatic environment, and plays a key role in most natural food webs (Dobson and Frid, 2009). The Niger Delta region is endowed with a large network of rivers, streams, wetlands and reservoirs as well as brackish water in lagoons and coastal creeks which provide suitable habitats for fish (Usman et al., 2014). Fisheries contribute significantly to food security by providing the primary source of animal protein, assist in poverty alleviation and also serve

as a recreation (FAO, 2012). Fish can also serve as environmental indicators of polluted waterbodies (Esenowo and Ugwumba, 2010).

Fish species composition, diversity and relative abundance of different species have long been a major method of evaluating biological communities of fish fauna (Muzvondiwa et al., 2013). Species diversity and abundance are affected by various factors such as heavy harvest, anthropogenic influences, destruction of habitat, as well as chemical pollution. Fisheries resources in the Niger Delta coastal communities including Ibeno have been found to be of great economic importance. Consequently, exploitation of these aquatic resources has been on the increase due to population increase and the demand for protein by man (Oluwasi-Peters and Ajibare, 2014). According to Oguntade et al. (2014), fisheries resources are on the decline in the Niger Delta and this they have attributed to over-exploitation and inadequate management of the coastal ecosystems. Odo et al. (2007) attributed the decline to water resources and ecosystems degradation to extensive on-shore/off-shore Oil activities as well as indiscriminate domestic wastes disposal practices. Thus assessment of the status, trends and changes in the ecosystem health is very significant in order to ensure sustainability of the ecosystem resources.

This study is therefore aimed to investigate the species composition of the fish fauna of Stubbs Creek.

Materials and methods

Study area

The study was carried out in Stubbs Creek (Figure 1) in Ibeno, Akwa Ibom State, Nigeria. It is strategically located at the Qua Ibo River Estuary in Ibeno, Akwa Ibom State. Three landing Stations (Iwokpom, Iwuchang and Ubenekang) were established along the spatial grid of Stubbs Creek.

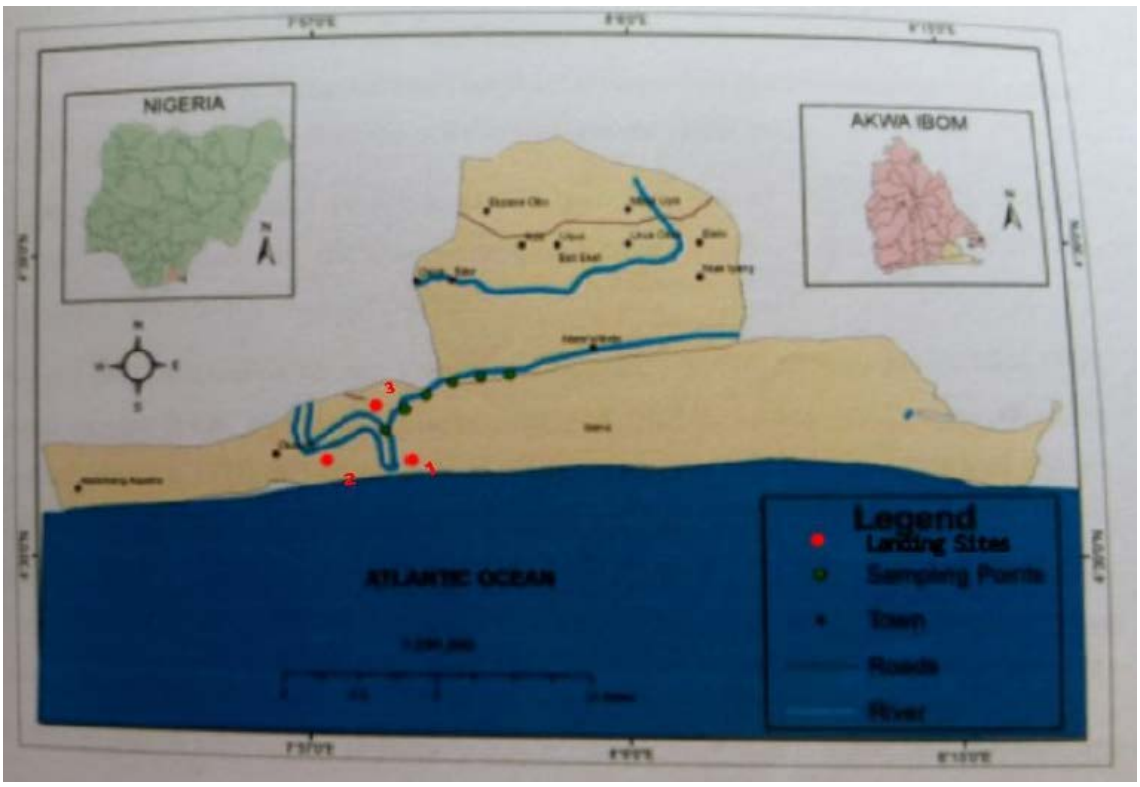

Figure 1. Map of Stubbs Creek showing sampling locations and fishermen landing sites.

Collection and identification of samples

Fish samples were collected from subsistence and artisanal fisheries landings across the three landing Stations (Iwokpom, Iwuchang and Ubenekang) between August 2014 and July, 2015. Fish samples obtained from the fishermen landing sites were identified using FAO species identification guide. Twenty nine fish species, twenty two genera in nineteen families and eight orders were identified from the three landing stations during the study.

Statistical analysis

Data were analyzed using descriptive statistics. Species diversity and community abundance were determined using Shannon-Weiver diversity index (H) (Shannon and Wiever, 1963), Evenness (e) and Margalef's species richness (d) (Margalef, 1970).

Results

Summary of the ichthyofaunal composition and ecological indices of Stubbs Creek is presented in Table 1. Twenty nine fish species, belonging to twenty two genera, nineteen families and eight orders were identified from the three landing stations during the study. Station 1 (Iwokpom) recorded the highest taxa (24) consisting of 993 fishes (43.14%) of the total catch. Landing site 2 (Iwuchang) and 3 (Ubenekang) both recorded 22 taxa each, comprising 556 (24.15%) and 753 (32.71%) fishes, respectively. Also, Iwokpom recorded the highest diversity (d = 3.333) in fish species but the lowest general ecosystem diversity (H = 2.781). Ubenekang (Station 3) had the lowest species richness (d = 3.17) but recorded the highest biodiversity, (H = 2.839) in the study. Evenness (e) was generally high among the stations but Iwokpom recorded the lowest value of e (0.6722) and Ubenekang had the highest (e = 0.7769). Iwuchang (Station 2) came next to Iwokpom in species richness (d = 3.322) but was next to Ubenekang in general diversity (H= 2.833) and evenness (e = 0.7725), respectively.

Table 1. Summary of fish species taxa and diversity in Stubbs Creek.

	Station 1	Station 2	Station 3
Number of orders	7	7	8
Number of families	16	15	16
Number of genera	18	17	19
Taxa_S	24	22	22
Individuals	993	556	753
Dominance_D	0.08583	0.06979	0.06867
Simpson_1-D	0.9142	0.9302	0.9313
Shannon_H	2.781	2.833	2.839
Evenness_e^H/S	0.6722	0.7725	0.7769
Brillouin	2.723	2.746	2.771
Menhinick	0.7616	0.933	0.8017
Margalef	3.333	3.322	3.17
Equitability_J	0.875	0.9165	0.9183
Fisher_alpha	4.431	4.575	4.244
Berger-Parker	0.2034	0.1205	0.1169
Chao-1	24	22	22

Table 2. Fish species distribution and abundance in Stubbs Creek, Ibeno, Akwa Ibom State Nigeria.

Order	Family	Species	Common Name	Landing stations			Total
				1	2	3	
Carcharhiniformes	Sphyrnidae	*Sphyrna lewni*	Barracuda	49	17	15	81
Characiformes	Alestidae	*Macrolestes elongates*	-	0	16	0	16
	Characidae	*Brycinus nurse*	-	12	19	23	54
Clupeiformes	Clupeidae	*Ethmalosa fimbriata*	Bonga	58	22	9	89
		Ilisha africana	Sardine	128	32	1	161
		Sardinella maderensis	-	38	0	0	38
Myliobatiformes	Dasyatidae	*Taeniura grabata*	Ray	15	42	22	79
Osteoglossiformes	Osteoglossidae	*Heterotis niloticus*	-	0	0	42	42
Perciformes	Carrangidae	*Caranx hippos*	Threadfin	3	27	87	117
		Caranx senegalus	-	0	64	0	64
		Chloroscombus chrysurus	-	0	57	78	135
	Channidae	*Parachanna africana*	-	25	20	33	78
	Cichlidae	*Oreochromis niloticus*	Tilapia	202	18	0	220
		Tillapia zilli	Tilapia	44	12	30	86
		Hemichromis fasciatus	-	50	0	0	50
	Gobiidae	*Periopthalmus papillio*	Mud skipper	0	0	39	39
	Pomadasidae	*Polydactylus quadrifilis*	Shiny nose	45	5	32	82
		Pomadasys peroteti	-	2	7	13	22
	Sciaenidae	*Pseudotolithus typus*	Croaker	22	7	43	72
		Pseudotolithus senegalensis	-	23	1	19	43
Pleuronectiformes	Cynoglossidae	*Cynoglosus browni*	Tongue sole	53	45	20	118
	Soleidae	*Bathysoleapro fundicola*	-	8	0	0	8
Siluriformes	Ariidae	*Arius gigas*	Catfish	61	32	54	147
	Clariidae	*Heterobranchus longifilis*	-	27	12	4	43
		Clarias gariepinus	-	46	11	15	72
	Claroteidae	*Chrysichthys nigrodigitatus*	-	42	67	31	140
		Chrysichthys furciatus	-	10	0	88	98
		Chrysichthys walkeri	-	15	23	55	93
	Malapteruridae	*Malapterurus electricus*	-	15	0	0	15
8	19	29	-	993	556	753	2302

Species abundance and distribution of fishes in Stubbs Creek

The species abundance in Table 2 showed that a total of 2,302 fishes were collected from Stubbs Creek. The Order Perciformes with six families (Carangidae, Cichlidae, Channidae, Gobiidae, Pomadasidae and Sciaenidae) occurred most with 1008 fishes, constituting about 43.79%. This was followed by the Siluriformes with four families (Ariidae, Clariidae, Clarotidae and Malapteruridae) belonging to five genera. Together, they pooled 608 fishes accounting for 26.41%. The Clupeiformes (Clupeidae) were next with three species from one family and having 288 fishes making up 12.51%. The fourth abundant species were the Pleuronectiformes consisting of 126 organisms from two genera, two families and two species (*Bathysoleapro fundicola* and *Cynoglossus browni*). This group accounted for 5.47% of the total landings. The Carcharhiniformes and Myliobatiformes with one specie from one family each had 81 and 79 fishes, thus contributing 3.52% and 3.43%, respectively. Characiformes had two species from one

genus and two families amounting to 70 fishes which contributed 3.04% to the total catch. The least abundant species encountered was *Heterotis niloticus* from the Order, Osteoglossiformes having one genus, one family and 42 fish specimens. This accounted for 1.82%.

Discussion

Fishes are organisms adapted to living in water, possessing internal or external skeletal frame that could be a fin or non-fin fish (Ibim and Owhonda, 2017). Fishes show great diversity in size, shape, colour, morphology, physiology and in the habitat they adapt to. Fishes are mobile and the resident community in any area may be affected by the migratory activities connected with breeding and feeding during flooding. Fish movements are controlled by ecological conditions and the diversity of a community in one area could be affected by changes in the adjacent area (Olele et al., 2008). The ichthyofaunal composition and diversity of Stubbs Creek with a total fish fauna of twenty nine species belonging to nineteen families as recorded in this study were generally low when compared with Omuihuechi Stream in Aluu, Rivers State, in which two hundred and fifty two fish species belonging to ten families, twenty genera and four orders were reported (Ibim and Owhonda, 2017). A similar study in the Lower Cross River Floodplain recorded seventy seven species distributed into fifty two genera, twenty nine families and nine orders (Ekpo and Udoh, 2013). Also from Onah lake, Asaba, Delta state, fourty six species found in thirty five genera and twenty five families were reported (Olele et al., 2008). The study of the Coastal waters of Ondo State revealed the presence of sixty seven species belonging to thirty six families (Bolarinwa et al., 2015).

The compositional mix of Stubbs Creek fish fauna was also low when compared with Warri River where thirty four species found in seventeen families were recorded (Aghoghovwia et al., 2015). However, the report of this study corroborated favourably with other reports on similar water body in the Niger Delta region. For example, Udo (2012) reported nineteen fish species belonging to sixteen genera from thirteen families in the study of ichthyofauna assemblages of Iba-oku Stream, Ikpa River. The lower abundance of fish species experienced in this study may be due to slow tidal influence coupled with salt ingression, which poses serious challenge to the survival of purely fresh water species (Ekpo and Udoh, 2013). Besides, the invasion of the exotic *nipa palm* to the Ibeno coastal region has greatly disrupted the mangrove ecosystem and has resulted to increased flooding and erosion, loss of habitat, loss of biodiversity, and loss of breeding/nursery grounds for fish. Changes in rainfall patterns induced by Climate Change phenomena may have also contributed to the low species mix encountered at Stubbs Creek. Furthermore, the observed differences in fish abundance may be attributed to greater sampling duration and intensity and the use of varied fishing gears. Fish are good indicators of broad habitat conditions because they are mobile. According to Olele et al. (2008), some fish species may have emigrated into the adjoining Imo and Qua Ibo Rivers either for breeding, feeding or during the flood. Ekpo and Udoh (2017) reported that a minimum of 33 marine species (from 28 genera, 16 families and 8 Orders) cross into the fresh water ecosystem of the Niger Delta region. This present study however, recorded 41.38% of the Marine Invasive species. Fishes co-habiting both freshwater as well as brackish waters include *Caranx hippos, Pseudotolithus typus* and *Sphyrna lewni* amongst others. These species may have entered through the tidal waves effect which can penetrate as far as sampling station 5 (~8 km from the Ibeno Beach). Still others could have come searching for food, spawning site for laying of eggs or nursery grounds for growth and eventually became adapted (Ekpo and Udoh, 2017). Dredging of the Stubbs Creek may also have contributed to the low taxa experienced during the study period. According to Sikoki (1979), during dredging, bottom materials are carried in suspension

leading to increase in surface water turbidity. This in turn will reduce light penetration and restrict photosynthetic processes of plants and the visibility for animals. Finely divided materials at high concentration are known to interfere with feeding of animals that obtain their food by filtration. They may also be abrasive to sensitive structures such as gills and eyes of fish.

Conclusion

The present study indicated that stub creek is rich in fish biodiversity. Therefore users of this water body should maintain responsible fishing activities in order to conserve this biodiversity.

Conflict of interests

Authors declare that there are no conflicts of interest.

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