Original Article

Fish catch composition of selected small scale fishing gears used in the Bonny River, Rivers State, Nigeria

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Abstract

Fish catch composition of some selected small scale fishing gears (gill net, cast net, beach seine and long line) were investigated in Bonny River, Rivers State, Nigeria from August 2014 to January 2015. A total number of 25 fish species from 18 families were recorded during the study. The Mugilidae with only one species constituted the dominant family while Cichlidae, Lutjanidae, Clupeidae, had three species and Scianidae had two species of fish caught and the remaining families had one species each. *Mugil cephalus* constituted 28.48% of the total catches followed by *C. nigrodigitatus* (22.48%). In the dry season *M. cephalus* forms the major component landings (32.65%), followed by *C. nigrodigitatus* (26.53%) and *S. galilaeus* (12.24%) while in the wet season *M. cephalus* (31.06%), *C. nigrodigitatus* (18.63%) and *T. zillii* (11.80%) were the dominant fish species. Cast net was the most efficient fishing gear while gill net was the least efficient. The comparison analysis between the wet and dry seasons using *t*-test showed no significant difference between dry and wet seasons ($t = 0.092$, $P > 0.05$).

Keywords: Fishing gear; catch composition; fish richness; seasonal abundance; Bonny River

1 | INTRODUCTION

Nigeria has a wide variety inland waters which are rich in many and diverse finfish and shellfish. A total of 268 fish species have been identified from different inland waters in Nigeria (Ita 1993) and nearly all the species recorded are commercially important. The inland fisheries give about 82% of domestic fish production (FDF 1993). The inland water has been exploited by artisanal fishers operating in rivers, streams, estuaries, wetlands, brackish water natural and man-made lakes. The inland fish species have acquired a wide variety of forms and habitats and these cause deployment of many and curious design of fishing gears by artisanal fishers.

The types of fishing gears used and the way they are op-

erated in Nigeria are influenced by various factors such as tribe's pattern, financial status of the fishers, seasons of the year, depth of the water to be fished, types of fish and the shoreline pattern (Adesulu and Sydenham 2007). Information on types of fishing gear, catching principles and constructions are very important for decision making in fisheries management and conservation of other aquatic resources. This is because observations on catch, effort and the fishery, together with observations on the fish (ecology and biology) in commercial catches can tell the state of the fishery and the effectiveness of the fishery regulations (Witte and Densen 1995).

The river fishery in Nigeria is still predominantly employing canoes and traditional gears and catch composition of

these traditional fishing gears often depends on experience and skills of the fishers. It also varies among gears, among habitats, among species, and even among sizes of the same species. This means that all fishing gears are only able to catch a certain part of the total (multispecies) fish community present. However, the indiscriminate use of different traditional fishing gears and occasional use of harmful techniques threatens the fish biodiversity in the rivers in Nigeria because of huge participation and it is open. It is very important to study the nature of gears commonly used that may lead to selective fishing, thus minimizing the stress on a particular size group of fishes (Srivastava and Srivastava 2002). This study presents a preliminary analysis of catch composition of commonly traditional fishing gears used in Bonny River in Rivers State, Nigeria.

2 | METHODOLOGY

2.1 | Study area

The Bonny River is an arm of the Niger River delta in Rivers state, southern Nigeria. It is a river estuary lies between 4°45'–4°50'N and 7°05'–7°15'E at the edge of the Atlantic Ocean and covers an area of 206 km². The climate is tropical with temperature varying with seasons. The rainy season starts in April and extends to October with an annual rainfall ranging between 1,500 and 4,000 mm (Kuruk 2004). The dry season with harmattan winds from the Sahara is during November to March.
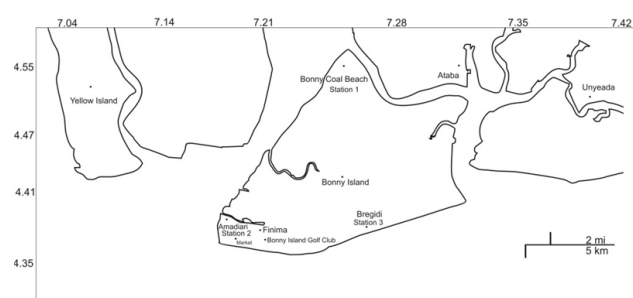

FIGURE 1 Map of the Bonny River showing sampling sites.

2.2 | Sampling

The study was carried out in three different landing sites which include: Bonny Coal Beach, Amariaria/ Lighthouse and Bregidi (Figure 1). Species specificity of the fishing gear was assessed twice in a month from August 2014 to January 2015 from the three landing sites. Fish specimens of the commonly fishing gears (cast nets, gill net, beach seine and long line) used were sampled directly from the fishermen catches and all sampled fishes were identified to species level using standard literature (Reed *et al.* 1967; Holden and Reed 1972; FAO 1979). Total length (TL) body and weight (BW) of each species were recorded to the nearest 1 cm and 0.01 g respectively. Contribution

of each gear was estimated by direct observations and record of the fish species harvested at each field visit and types of fishing gears used to catch them. Gear performances at the different seasons were also observed as an index of abundance for the total stock for the two seasons.

2.3 | Data analysis

Biometric tools such as species relative abundance, species composition and simple statistical techniques such as average, percentage and t-test were used to analyze the data collected. All the statistical analyses were considered at the significance level of 5%. The statistical Package for Social Sciences (SPSS, version 16) and Microsoft Office Excel software were used in the study.

3 | RESULTS

The types of fishing gear used by the fishers in the Bonny River and based on the usage of materials and fabrication, the fishing gears may be classified as (i) net fishing gears (fishing gears which are predominantly constructed of net for example cast net, beach seine and gillnet); (ii) tackles fishing gears in which hooks are an important part to catch fish individually such as long line.

Cast net (3.2–10 mm mesh), locally called *Gbon* was the most common gear used by the fishers. The length of the net is 1.7 m and the circumference of net mouth ranged from 6.5 to 7.75 m with knotted mesh. The beach seine (locally called *Ngolo*) without pocket was commonly used by the fishers. The head rope is 5.5 m; the depth is 3 m with knotted mesh sizes of 2.5–10 mm and multifilament polyester material. Long line (*Kobee*) was also one of the common fishing gears used in the Bonny River. The hook size is 11 and the length of the hook was 320 mm with a spread of 12 mm. It is operated by 1–2 fishers with the aid of a canoe throughout the year. Gill net (*Teemen*) was another commonly used fishing gear which was made from knotted multifilament polyamide material with a head length of 30 m and depth of 4.5 m. The mesh size ranged between 10 – 50.8 mm.

A total number of 25 fish species from 18 families were recorded during the study (Table 1). The fish composition was represented by marine and freshwater fish species. The Mugilidae was the dominant fish family represented by only one species while the other notable fish families were Cichlidae, Lutjanidae, Clupeidae represented by three species each. Sciaenidae had two species while the remaining fish families in the study had one species each (Table 1). *Mugil cephalus* constituted 28.48% of the total population, followed by *Chrysichthys nigrodigiratus* (22.48%) while the least species were *Corvina nigrita* (0.32%) and *Umbrina canariensis* (0.32%; Table 1). In

terms of biomass *C. nigrodigiitatus* had the highest (47.44%) of the total fish biomass, followed by *M. cephalus* (18.41%) and *Tilapia zillii* (10.60%) while *E. dorsalis*, (0.34%), *Carangoides chrysophrys* (0.29%) and *Sardinella maderensis* (0.28%) had the least biomass.

TABLE 1 Total fish catch composition.

Species	Individuals		Weight	
	N	%	g	%
Monodactylidae				
Monodactylus sebae	11	3.48	12.9	0.50
Sciaenidae				
Pseudotolithus enlongatus	4	1.27	75.5	2.95
Pseudotolithus sebegalensis	3	0.95	18.6	0.73
Clupeidae				
Ethmalosa fimbriata	9	2.85	63.5	2.48
E. dorsalis	7	2.22	7.1	0.28
Sardinella maderensis	4	1.27	8.7	0.34
Congridae				
Corvina nigrita	1	0.32	80	3.13
Stromateidae				
Stromateus fiatola	2	0.63	13.9	0.54
Serranidae				
Serranus aranus	4	1.27	18.4	0.72
Acanthuridae				
Adioryx hestatus	6	1.90	49.0	1.92
Callionymidae				
Canary drum	5	1.58	8.3	0.32
Trypterygildae				
Umbrina cunariensis	1	0.32	3.3	0.13
Gerreidae				
Eucinostomus malanopterus	3	0.95	7.4	1.33
Scaridae				
Sciana umbra	2	0.63	21.2	0.83
Lutjanidae				
Lutjanus campenchanus	8	2.53	63.1	2.47
L. dentatus	5	1.58	35	1.37
L. goreensis	4	1.27	42.4	1.66
Haemulidae				
Pomadasys commersonnii	4	1.27	11.2	0.44
Polynemidae				
Galeoides decadactylus	1	0.36	11	1.87
Cichlidae				
Sarotherodon galilaeus	25	7.91	34.3	3.34
S. malanotheron	11	3.48	21	0.82
Tilapia zillii	29	9.18	271.2	10.60
Mugilidae				
Mugil cephalus	90	28.9	471	18.41
Claroteidae				
Chrysichthys nigrodigitatus	71	22.5	1213.7	47.44
Carangidae				
Carangoides chrysophrys	6	1.90	7.5	0.29
Total	**316**	**100**	**2558.2**	**100**

Table 2 below shows the seasonal variation in the number of various species caught in Bonny River during the study. In the dry season *M. cephalus* (32.65%) forms the major component landings, followed by *C. nigrodigitatus* (26.53%) and *S. galilaeus* (12.24%). Among the fish species, in order of abundance in wet season were *M. cephalus* (31.06%) followed by *C. nigrodigitatus* (18.63%) and *T. zillii* (11.80%). The general trend of higher catch in the dry (51.9%) than the rainy season (48.1%) was observed. The highest numbers of individual was caught in December (60) followed by January (56) while the least number was recorded in August (44). The number of fish species caught during the remaining months showed uneven fluctuation (Tables 2 and 3).

TABLE 2 Seasonal variations of fishes in the Bonny River.

Species	Wet Season				Dry Season			
	Aug	Sep	Oct	%	Nov	Dec	Jan	%
M. sebae	0	2	0	1.36	0	9	0	5.59
P. enlongatus	4	0	0	2.72	0	0	0	0
P. senegalensis	0	0	0	0	3	0	0	1.86
E. dorsalis	0	3	4	4.76	0	0	0	0
E. fimbriata	0	0	5	3.40	0	0	4	2.48
S. maderensis	0	0	0	0	0	0	4	2.48
C. nigrita	0	0	0	0	0	1	0	0.62
S. fiatola	0	2	0	1.36	0	0	0	0
S. aeneusn	0	0	0	0	4	2	0	3.73
A hastatus	0	0	1	0.68	0	2	0	1.24
C. drum	0	1	0	0.68	0	4	0	2.48
U. canariensis	0	1	0	0.68	0	4	0	2.48
E. malanopterus	0	3	0	2.04	0	0	0	0
S. umbra	1	0	0	0.68	0	0	0	0
L. campenchanus	0	1	0	0.68	0	0	11	6.83
L. dentatus	0	2	1	2.04	2	0	2	2.48
L. goreensis	0	0	0	0	0	0	0	0
P. commersonai	0	0	0	0	0	1	0	0.62
G. decadactylus	0	0	0	0	0	3	0	1.86
S. galilaeus	9	4	5	12.24	0	0	0	0
S. malanotheron	0	8	7	7.48	0	0	0	0
T. zillii	0	0	0		9	12	1	11.80
M. cephalus	16	24	8	32.65	12	23	15	31.06
C. nigrodigitatus	14	7	18	26.53	15	11	4	18.63
C. chrysophrys	0	0	0	0	0	0	6	3.73
Total				**100**				**100**

t = 0.092, P < 0.05

The fishing gear catch composition in Table 3 below shows that cast net caught 30.4% of the total catch, followed by beach seine (26.9%) and long line (25.0%) while the least was recorded in gill net (17.7%). The best catches of these gear consisted of the following families Mugilidae, Claroteidae and Cichlidae. *M. cephalus*, *C. nigrodigitatus* and *S. gaillaeus* were divergent species caught by cast net while *C. nigrodigitatus, E. fimbriata S. galilaeus, S. malanotheron* and *T. zillii* were dominant species caught by gill net in this study. The catch were

dominated by immature fishes with length of most the of fish caught ranged from 9 to 41 cm while only one species of *L. dentatus* had up to 105 cm. In terms of weight, the values varied between 1.20 and 640 g.

TABLE 3 Sizes of fish species caught in commonly used fishing gears in Bonny River.

Species	Length range (cm)	Weight range (g)	Cast net	Beach seine	Gill net	Long line
P. seabe	9–16	9–13.66	1	3	5	
P. enlongatus	25–32	12–18	-	-	-	5
P. sengelensis	15–23	8.2–10.2	4	-	3	-
E. fimbriata	13–28	2.3–2.8	-	-	6	3
E. dorsalis	9–13.5	6–11	4	-	-	-
J. menderensis	9.9–15	1.2–3.2	4	3	-	-
C. nigrita	17	80	1	-	-	-
S. fiatolu	22.9–30	4.7–9.2	-	-	-	2
S. aranus	19	1.8–12.1	1	-	-	-
A. hastatus	40–41	24–25	-	-	-	2
C. drum	22–30	3.3–12	4	-	-	-
U. canariensis	22	3.3	-	-	-	1
E. melanopterus	16–17	2.3–2.8	-	4	-	3
J. campenchanus	16–38	4.2–12.5	-	-	-	7
L. dentatus	15–105	2–22.4	2	-	-	3
L. gorensis	28–39	9.6–12	-	-	4	-
P. commersonni	18–20	2.3–3.1	-	-	-	4
G. decadactylus	40	640	1	-	-	-
S. malanotheron	15–19	2.6–4.8	-	7	4	-
S. galilaeus	13–22	1.2–3.1	8	20	4	-
T. zillii	9.5–12	1.4–2.6	4	3	4	18
M. cephalus	10.9–28	9–13.66	36	42	-	5
C. nigrodigitatus	9–38	1.2–94	23	-	26	26
C. chrysophrys	10–10.5	1.2–1.4	3	3	-	-
Total			**96**	**85**	**56**	**79**
Percentage (%)			30.30	26.89	25	17.72

4 | DISCUSSION

The four types of gear identified in this study, namely cast net, gill net, beach seine and long line were the commonest gears observed also in Kaniji lake (Yisa *et al*. 1995; Du feu *et al*. 1997), Lake Alau (Bankole *et al*. 2003) and Lake Chad basin (Bene and Neiland 2003), all in Nigeria. Similar findings were also reported by other researchers from other continents (e.g. Galib *et al*. 2009; Sultana and Islam 2016). Adeyemi *et al*. (2009) also reported that gill net, cast net, *Malian* trap and long line were commonly fishing gear used in of most Nigeria's waters. In this study, a total of 18 families and 25 fish species were identified. Comparing the results from faunal surveys made around the Niger Delta, the study recorded low fish abundance and

fish diversity. Meye and Ikomi (2002) reported 35 species and 24 families in Rivers Orogodo in Niger Delta. Sikoki *et al*. (1998) also recorded 37 species but lower number of fish families (15) in Lower Nun River. The variation in the number fish species, and families could be attributed to differences in the sampling methods and sampling effort, as well as differences in geomorphology and topography of estuaries. However, the number of recorded fish species is much lower than rivers in other tropical countries (e.g. Bangladesh; Galib *et al*. 2013, 2016; Mohsin *et al*. 2013, Chaki *et al*. 2014; 2014; Galib 2015; Joadder *et al*. 2015).

The Mugilidae was the dominant fish family during the study. Mugilidae is permanent and often abundant in coastal ecosystems, estuaries, and lagoons (Albaret and Legendre 1985). In the present study, the species such as *M. cephalus, C. nigrodigitatus, S. galilaeus* and *T. zillii* formed the mainstay of the fishing. Nwaduke (1995) recorded Cichlidae as the most abundant in the canal and Mugilidae as the most abundant family in the lagoon shores. Fish assemblage of Bonny River are characterized by both fresh and marine water fish species but, generally, virtually all the fresh water fish species in Table 2 also feature in the list provided by earlier workers in Nigeria Rivers (Daget 1954; Reed *et al*. 1967; Moses 1979). However, marine fish species dominated the catch composition during the study. This is an indicative that estuary is dominated by marine forms. The catches were dominated by immature fishes with length of most of fish caught ranged from 9 to 41 cm. This is an indication of a declining fishery and stock depletion. In Nigerian water bodies, intensive fishing activity has impacted negatively on fish size as they are not allowed to grow to maximum size (Atobatele and Ugwumba 2011).

The study revealed that more fish were caught during the dry season than wet season. Allison *et al*. (1997) observed higher fish abundance in the dry season in Elechi Creek. This was attributed to greater and easier accessibility of fishing gears deployed by the fishers during dry season due to reduced water volume.

Cast net was the most efficient out of the four gears in the study area. This could be attributed to small mesh size and flexibility. Gill net was the least efficient in terms of species fish caught with only 8 fish species recorded. The efficiency of gill net is affected by several factors that can influence the catchability of the gear directly or indirectly. Brandt (1984) listed some those factors as the mesh size, visibility, hanging ratio, twine size and exposed net area. *C. nigrodigitatus*, *E. fimbriata*, *S. galilaeus, S. malanotheron, L. gorensis* and *T. zillii* were dominant species caught by gill net during this study. Bankole *et al*. (2001) observed that the most susceptible species with gill net

was tilapia spp. *Sarotherodon galileaus, Oreochromis niloticus* and *Tilapia zillii.*

5 | CONCLUSION

The commonest gear types in Bonny River include gill net, cast net, beach seine and long line. The species composition is appreciable and species such as *M. cephalus, C. nigrodigitatus, S. galilaeus and T. zillii* formed the mainstay of the fishery but based on observations on gear usage and the size of fishes caught during the study the Bonny River fishery is declining and the situation is likely to continue unless efficient fishery conservation and management is put in place.

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CONTRIBUTION OF THE AUTHORS

OAO research design; **NGS & HD** primary data collection; **OAO** research supervision; **OAO** manuscript preparation.