Mesh and Gear Types in Riparian Communities in New-Calabar River and the Bonny Estuaries, Port-Harcourt, Rivers State, Nigeria.

Binaebi, D. E[1] & Jamabo, N. A[2].
[1]Department of Fisheries and Aquatic Environment,
Rivers State University, Nkpolu-Oroworukwo,
P. M. B. 5080, Port Harcourt,
Rivers State, Nigeria.
[2]Department of Fisheries,
Faculty of Agriculture,
University of Port Harcourt, Choba,
Rivers State, Nigeria.
Postcode of Port Harcourt City: 500272
binaebidbm742@gmail.com, nene.jamabo@uniport.edu.ng

Abstract
Mesh and gear types which are important tools for fisheries policy making were investigated at riparian communities along New-Calabar River and the Bonny Estuaries, Port-Harcourt, Rivers State, Nigeria. The mesh and gear sizes were subject to One-Sample t-test analysis due to the 76mm mesh size and 500m combination of net length permitted by the Nigerian Inland Fisheries Act 108 of 1992. The result obtained from the landing sites revealed that the most sorted after mesh sizes by fishers were 1, 1¼, 1½, 1⅝, 1⅞, 1¾, 2, 2¾, 2¼, 2½ and 2⅝ inches and the One-sample t-test for mesh sizes at the landing sites were Ogbogoro; 55.2733mm, t (14) = -2.311, p = 0.037, Mgbuosimini; 56.4321mm, t (13) = -1.934, p = 0.075, Isaka-Bundu; 63.5196mm, t (22) = -1.874, p= 0.074 and Borikiri Rex-Lawson Waterside; 58.105mm, t (19) = -2.618, p= 0.017, which indicate none compliance to the established Act due to open access to the marine resources. The gear lengths analysed reveal that Ogbogoro; 125.89±53.94m, t (30) = -38.62, p= 0.000, Mgboshimini; 109.05±61.88m, t (43) = - 41.91, p = 0.00, Isaka-Bundu; 138.61±90.41m, t (56) = -30.18, p = 0.00 and Borikiri Rex-Lawson waterside; 123.58±63.80m, t (51) = -42.55, p= 0.00. The test is significant and the total length requirement is not violated. 70.45% of fishers have hook and lines and 8.52% have other fishing gears. This survey call for government application of every instrument of policy to meet contemporary challenges and ensure aquatic resource sustainability.

Key words: *Coastal communities, fishing, Mesh size, gears.*

Introduction

For a riparian community, fishing is one of the major occupation of its inhabitants all over the world. In a third world nation like Nigeria, small-scale fishing takes a place of pride in coastal communities. Fishing has been so established as an occupation that it can simply be called a way of life of the common people in riparian communities. This has led to some communities having special days of festivity for fish and eulogising craftsmanship and artistry in fishing. For fishing activities to be successful there must be the fishing crafts and tools such as fishing boats and gears. Fish gears are developed to catch specific species and size of fish. Gears are tools for fishing without which the fisher cannot gain access to the fish. In a typical coastal Nigerian community all edible fish species are consumed and no size of fish is exempted. Therefore, gears are constructed so as to obtain the maximum catch from every exploit of the

living aquatic resources. This has resulted in the use of small size gears to catch fish species. Enyenihi (1990), reported that the use of small mesh size gears to catch fish had resulted in overfishing and ecosystem destabilization, due to the harvesting of juveniles fish species which would have been recruited into the fishery were caught along with the adults. Seisay and du Feu (1997), also reported change in species composition due to overfishing in Kainji Lake. Eyo (2004), reported a massive poaching of juvenile fishes on Lake Kainji by foreign fishermen who utilize gill net and beach seines (Dala) less than 3 inches (76mm) as stipulated by the Inland Fisheries Act 108 of 1992 of Nigerian.

In Nigerian inland water fishery resources are common property resources (Olomola, 1993), therefore, the exploitation of these resources is free for all. The instrument of fishing employed includes anything that can give the fisher access to the fish. Based on several surveys in various inland water bodies of Nigeria gear types in use include; Traps, Hook and line/longline, spears, cast-nets, fence, Drift/gill nets and others (Bankole *et al*, 2003; Binyotubo 2011, Ita, 1993; Kingdom and Kwen, 2009; Kwen *et al*, 2013; NIFFR, 2002; Yisa *et al*, 1995; and Bene and Neiland, 2003). These gears have low rate of by-catch and do not alter substrates (Kingdom and Kwen, 2009; Jennings and Kaiser, 1998). The Inland Fisheries Act 108 of 1992 made provision for fishers to utilise nets of not more than 500m at every fishing. Small scale fishing on the riparian communities along the New Calabar River and the Bonny estuaries in Port Harcourt, Rivers State is a common activity. Fisheries resources of these water ways are regularly exploited mostly as subsistence or commercial use. These communities are landing sites and the use of fishing gears of different kinds are common. There has not been relevant documentation on mesh size and gear type survey on the communities in these water ways. This research hypothesed that H_{O1}, there is no significant difference in the mesh size in use and 75cm mesh size required by law and H_{O2}, there is no significant difference in the total length of each household and 500m total length required by law. This survey was aimed at investigating the mesh size and gear types in use in some landing sites in Rivers State, Nigeria for policy review and implementation.

Materials and Methods

Study Area

The area of study are coastal settlements and landing sites along the New Calabar River and the Bonny estuaries in Port Harcourt which are homogenous water bodies. The sampling stations are basically artisanal fishing communities of Ogbogoro, Mgbuosimini, Isaka-Bundu and Borikiri Rex-Lawson Waterside. The New Calabar River its coordinates are 4°25'0" N and 7°1'60" E. The Bonny River coordinates are 4°22'60" N and 7°6'0" E. The four landing sites lies at geographical coordinates of latitude 4° 50'48" N and 4°44'56" N, and longitude 6°55'50" E and 7°2'6" E. The landing sites lie within the wet and humid tropical hot climate with mean annual temperature of 26°C and 27°C and precipitation of 232.7 mm (Ayo *et al.*, 2017; Mamman *et al.*, 2000; Timeanddate.com, 2017). The vegetation of the upper reaches of the New Calabar River is thick rain swamp forest (Uzukwu *et al.*, 2014) and mangrove with Nypa palm species at the lower reaches with gentle slope topography that flows into the Bonny estuaries. The predominant coastal vegetation of the Bonny estuaries is the red mangrove *Rhizophora racemosa* and *Rhizophora mangle*, white mangroves *Avicennia africana* and Nypa palm form more than nineteen percent (19%) of the saline swamps (Nwilo and Badejo, 2008).

Simple random sampling technique was used to select the sampled population from each community. The respondents were identified and a total of 320 questionnaires were administered in this research; 80 questionnaires to each community. Useful information from respondents on

the mesh sizes and kinds of gears in use were obtained. 300 questionnaires were retrieved from the sampled fishers.

Statistical analysis: One sample t-test

One sample t-test compares how a sample mean of a normally distributed variable significantly differs from a known hypothesized value which is the population mean (Statistics How To, 2017). It is utilised when the population size is small or without population standard deviation (StatTrek.com, 2017). Small sample size means the sample size is less than 30, i.e., N<30 (Spiegel and Stephens, 2011) or less than 100 (Visweswara, 2007). For this research the hypotheses values 76mm mesh size and 500m of the combination of nets allowed by the law for fisher to use in fishing. The formula for one sample t-test is provided below;

$$t = \frac{\bar{x} - \mu_o}{s/\sqrt{n}}$$

t = t-statistics for a one sample
n = sample size
s = standard deviation of the sample
μ_o = population mean
$\bar{x}$ = sample mean

Assumptions of a one sample t-test (Statistics Solutions 2017).

1. The dependent variable must be continuous (interval/ratio).
2. The observations are independent of one another.
3. The dependent variable should be approximately normally distributed.
4. The dependent variable should not contain any outliers.

For a One sample t-test, t-test will either be positive or negative, if t-test is negative it means the sample mean is less than the population mean and if it is positive the sample mean is greater than the population mean. If t calculated is greater than the theoretical value of t, it is inferred that there is significant difference and therefore, null hypothesis will be rejected. If the p-value is less than 0.05 it means that the difference between the sample mean and population mean is big enough to be declared statistically significant but if more than 0.05 the difference between the sample mean and population mean is not big enough to be declared statistically significant.

Result

The Social characteristics of fishers

The social characteristics of the fishers on the landing sites were analysed. These characteristics includes; gender, age of fishers and active fishers at landing sites. The percentage distribution is provided in table 1.

Table 1: Short summary (%) of the key demographic factors in the study sites

Social characteristics of fishers		Ogbogoro		Mgboshimini		Isaka-Bundu		Borikiri Rex-Lawson Waterside	
		N	P (%)	N	P (%)	N	P (%)	N	P (%)
Gender	Male	73	91.30	63	88.73	68	94.44	71	92.21
	Female	7	8.80	8	11.27	4	5.56	6	7.79
Age of fishers	1-10	2	2.50	0	0.00	1	1.39	0	0.00
	11-20	34	42.50	23	32.40	12	16.67	8	10.39
	21-30	9	11.25	21	29.58	21	29.17	25	32.47
	31-40	15	18.75	21	29.50	17	23.61	24	31.17
	41-50	16	20.00	4	5.63	17	23.61	15	19.48
	51-60	3	3.75	2	2.82	4	5.56	3	3.90
	61-70	1	1.25	0	0.00	0	0.00	2	2.60
	Adult	1	1.25	6	7.50	19	23.75	9	11.25
Active fishers at landing sites	Household of 2	2	2.50	2	2.50	8	10.00	13	16.25
	Household of 3	6	7.50	10	12.50	5	6.25	3	3.75
	Household of 4	10	12.50	11	13.75	17	21.25	14	17.50
	Household of 5	7	8.75	10	12.50	2	2.50	7	8.75
	Household of 6	5	6.25	5	6.25	6	7.50	5	6.25
	Household of 7	0	0.00	0	0.00	0	0.00	1	1.25

Source; Field survey from the questionnaire. N= number of respondents, P= percentage

Gender

The investigation revealed that all 300 fishers sampled were of both sexes. There were 73 men representing 91.30% and 7 women representing 8.80% at Ogbogoro landing site. The Mgboshimini landing, 63 fishers were men representing 88.73 % while 8 fishers were women representing 11.27%. The Isaka-Bundu landing, 68 fishers were men representing 94.44% while 4 fishers were women representing 5.56 % and Borikiri Rex-Lawson waterside landing, 71 fishers were men representing 92.21% while 6 fishers were women representing 7.79%.

Age of fishers

The age of fishers as investigated ranges from 9 to 63 years. At Ogbogoro 34 fishers representing 45% were below 20 years of age, 24 fishers representing 30% were of the age range 21 to 40 years, 19 fishers representing 23.75% were of the age range 41 to 60 years and 1 fisher representing 1.25% of the age range 61 to 70 years. At Mgbuosimini 23 fishers representing 32.40% were below 20 years of age, 42 fishers representing 59.16% were of the age range 21 to 40 years and 6 fishers representing 8.45% were of the age range 41 to 60 years. At Isaka-Bundu 13 fishers representing 18.06% were below 20 years of age, 38 fishers representing 52.78% were of the age range 21 to 40 years and 21 fishers representing 29.17% were of the age range 41 to 60 years. At Borikiri Rex-Lawson Waterside 8 fishers representing 10.39% were below 20 years of age, 49 fishers representing 63.64% were of the age range 21 to 40 years, 18 fishers representing 23.38% were of the age range 41 to 60 years and 2 fishers representing 2.60% were of the age range 61 to 70 years.

Active fishers at landing sites

The household of the active fishers sampled in all four-landing site indicate that most of the families were large from 1 and 7 household. Ogbogoro landing site had 1.30% of single adults involved in fishing, 2.50% family of 2, 7.50% family of 3, 12.50% family of 4, 8.80% family of 5 and 6.30% family of 6. 61.30% were family members who were actively involved in fishing. At Mgboshimini landing site 7.50% were single adults involved in fishing, 2.50% family of 2, 12.50% family of 3, 12.80% family of 4, 12.50% family of 5 and 6.30% family of 6, 45.00 % were family member who were actively involved in fishing.

At Isaka-Bundu landing site 23.80% were single adults involved in fishing, 10.00 % family of 2, 6.30% family of 3, 21.30% family of 4, 2.50% family of 5 and 7.50% family of 6. 28.80% were family members who were actively involved in fishing. At Borikiri Rex-Lawson Waterside landing site, 11.30% were single adults involved in fishing, 16.30% family of 2, 3.80% family of 3, 17.50% family of 4, 8.80% family of 5, 6.30% family of 6 and 1.30% family of 7. 35.00 % were family members actively involved in fishing.

Mesh size

The nets were imported by net dealers who in-turn sell to fishers. The dealers go for nets that were on demand, such as twine thickness and length of nets. Fishers prefer length with 80 and 85yards. All nets either 80, 85, 100 or 400 yards have a depth of 400 meshes which they locally call 400 eyes. The most sorted after mesh sizes by fishers were 1, 1¼, 1½, $1^{5}/_{8}$, $1^{7}/_{8}$, 1¾, 2, 2¾, 2¼, 2½ and $2^{5}/_{8}$ inches. Table 2 shows the frequency of mesh sizes in use from the sampled stations. The number of mesh sizes in use in the landing sites were Ogbogoro 15 different mesh sizes; Mgbuosimini 14 different mesh sizes; Isaka-Bundu 23 different mesh sizes and Borikiri Rex-Lawson Waterside 20 different mesh sizes. These mesh sizes were analysed using One-Sample t-test to test if the variables significantly differ from the hypothesized value of 76mm mesh size required by law, which is the population mean. Table 3 shows the result of the analysis.

Data obtained from Ogbogoro landing site showed that there were 15 different mesh sizes ranging from 10mm to 127mm. The 76mm was used as the test value or the population mean. The one sample t-test was used to test the hypothesis. This research hypothesed that H_{O1}, there is no significant difference in the mesh size in use and 75cm mesh size required by law. The result obtained showed a mean mesh size of 55.2733, t (14) = -2.311, p= 0.037. From the one-sample t-test the p value is 0.037 which is less than 0.05 significant level, this means that the difference between the sample mean and population mean is big enough to be declared statistically significant, therefore, the null hypothesis is rejected.

At Mgbuosimini landing site there were 14 different mesh sizes ranging from 10mm to 127mm. The result obtained showed a mean mesh size of 56.4321, t (13) = -1.934, p= 0.075. From the one-sample t-test the p value is 0.075, which is greater than 0.05 significant level. The one sample t-test is significant at 0.05 significance level. This infers that the difference between the sample mean and the population mean is not big enough to be declared statistically significant, therefore, the null hypothesis is accepted.

Data obtained from Isaka-Bundu landing site showed that there were 23 different mesh sizes ranging from 10mm to 127mm. The result obtained showed a mean mesh size of 63.5196, t (22) = -1.874, p= 0.074. From the one-sample t-test the p value is 0.074, which is greater than greater 0.05 significant level. This infers that the difference between the sample mean and the population mean is not big enough to be declared statistically significant, therefore, the null hypothesis is accepted.

At Borikiri Rex-Lawson waterside landing site showed that there were 20 different mesh sizes ranging from 10mm to 127mm. The result obtained showed a mean mesh size of 58.105, t (19) = -2.618, p= 0.017. From the one-sample t-test the p value is .017 which is less than 0.05 significant level, this means that the difference between the sample mean and population mean is big enough to be declared statistically significant, therefore, the null hypothesis is rejected.

Table 2. Frequency of the mesh size measured in millimetres (mm) at the landing sites

Mesh sizes at landing sites	Ogbogoro	Percentage (%)	Mgboshimini	Percentage (%)	Isaka-Bundu	Percentage (%)	Borikiri Rex-Lawson Waterside	Percentage (%)
Less than one fingers 10mm	2	2	5	4	5	3	4	2
Less than one fingers 16.00mm	1	1	6	5	4	2	2	1
Half finger 18.00mm	3	3	8	7	8	4	7	4
One fingers 25.40mm	15	15	11	10	12	6	30	16
One fingers 31.75mm	9	9	14	12	17	9	22	12
One finger 33mm	11	11	8	7	15	8	12	7
One and half Fingers 38.00mm	16	16	12	10	11	6	25	14
Two fingers 50mm					12	6	7	4
Two and half fingers 57.15mm	10	10	10	9	9	5	9	5
Two fingers 60.00mm	6	6			13	7	10	5
Three fingers 63.50mm	10	10	16	14	25	13	12	7
Three fingers 67mm					14	7	5	3

Three fingers 70.00mm					7	4	4	2
Three fingers 72mm					2	1	1	1
Three fingers 74mm					2	1	5	3
Four fingers 76.70mm	3	3	5	4	5	3	6	3
Four fingers 84.00mm	3	3	3	4	6	3	3	2
Four fingers 87mm	2	2			3	2	2	1
Four fingers 88.90mm					2	1		
Fist 101.60mm	2	2	4	3	6	3	7	4
Fist 102.00mm					3	2		
Fist 107.95mm			6	5	3	2		
Clasped fist 127.00mm	5	5	7	6	7	4	9	5
Total	98	100	115	100	191	100	182	100
Number of mesh sizes	15		14		23		20	

Table 3. The statistical result of mean of mesh sizes at landing sites compared to population mean of 76mm

Landing site	Average mesh size in use	One sample t-test				Inference
		df	t_{cal}	$t_{(0.05)tab}$	p-value	
Ogbogoro	55.27±34.74	14	-2.311	2.145	.037	Significant difference
Mgboshimini	56.43±37.85	13	-1.934	2.160	.075	No significant difference
Isaka-Bundu	63.52±31.93	22	-1.874	2.074	.074	No significant difference
Borokiri Rex-Lawson Waterside	58.11±30.57	19	-2.618	2.093	.017	Significant difference

Source; Field survey from the questionnaire. N= number of respondents, P= percentage.

The kind of gears in use for fishing

Gear were bought from the market or constructed locally. The fishing gears sampled were; gillnets, encircling nets, beach seine nets, cast-nets, hook and line scoop-nets and others. Other means of catching marine organisms is the use of hands to pick periwinkles and rock snails or mangrove whelks. Machetes for cutting down mangrove roots and branches to harvest oysters that are attached to the mangrove plant. The gear types sampled in theses riparian communities are provided on Table 4. The Inland Fisheries Act No 108 provided that no fisher should have more than a total of 500m length of net in his possession while fishing. Sampled size of household actively involved in fishing at each landing sites of Ogbogoro, Mgboshimini, Isaka-Bundu and Borokiri Rex-Lawson waterside is 31, 44, 57 and 52. The sample mean of each landing site was compared with the population mean which is 500m. One sample t-test is used to test the hypothesis and it is shown on table 5. Data obtained from Ogbogoro landing site shows that about 31 household with about 98 nets, of 35.71% cast-nets for fishing and 64.29% of gill-nets for fishing. One sample t-test was used to test the hypothesis. The null hypothesis H_{O2}, states that there is no significant difference in the total length of each household and 500m total length required by law. The result obtained showed a mean length of 125.89±53.94m, t (30) = -38.62, p= 0.00. From the one-sample t-test the p value is 0.00, which is less than 0.05 significant level. The one sample t-test is significant; therefore, the null hypothesis is rejected. The sample mean is not the population mean, which is 500.00m, the difference is big enough to be declared statistically significant.

At Mgboshimini landing site shows that about 44 household with about 115. nets, 36.52% of cast-nets for fishing and of 63.48% gill-nets for fishing. The result obtained showed a mean length of 109.21±61.88m, t (43) = - 41.91, p= 0.00. From the one-sample t-test the p value is 0.00, which is less than 0.05 significant level. The one sample t-test is significant; therefore, the null hypothesis is rejected. The sample mean is not the population mean, which is 500m, the difference is big enough to be declared statistically significant. At Isaka-Bundu landing site shows that about 57 household with about 191 nets, of 34.03% cast-nets for fishing and 65.97% of gill-nets for fishing. The result obtained showed a mean length of 138.61±90.41m, t (56) = -30.18, p= 0.00. From the one-sample t-test the p value is 0.00, which is less than 0.05 significant level. The one sample t-test is significant; therefore, the null hypothesis is rejected. The sample mean is not the population mean, which is 500m, the difference is big enough to be declared

statistically significant. Data obtained from Rex-Lawson waterside landing site shows that about 52 household with about 182 nets, 28.57% of cast-nets for fishing and 71.43% of gill-nets for fishing. The result obtained showed a mean length of 123.58±63.80m, t (51)= -42.55, p= 0.00. From the one-sample t-test the p value is 0.00, which is less than 0.05 significant level. The one sample t-test is significant; therefore, the null hypothesis is rejected. The sample mean is not the population mean, which is 500m, the difference is big enough to be declared statistically significant.

Other gears in use by fishers

From the data obtained the gears in used apart from gill-nets and cast-nets are the Hook and lines, crab traps, scoop nets, shrimp preservation tools and machetes. At Ogbogoro landing site, out of 31 household 22 families have hook and lines. At Mgboshimini 27 families out of 44 have hook and lines while only three families have other gears. At Isaka-Bundu 29 families out of 57 have hook and lines while only nine families have other gears. At Rex-Lawson waterside 46 families out of 52 have hook and lines while only three families have other gears. From the sampled population 70.45% have hook and lines 8.52% of other fishing gears which are not named in the provisions of the Inland Fisheries Act as tools of fishing.

Table 4. Frequency of the types of gears at landing sites.

Types of gears	Ogbogoro		Mgbuosimini		Isaka-Bundu		Rex-Lawson Borikiri waterside	
	N	P (%)	N	P (%)	N	P (%)	N	P (%)
beach seine 1 (13.72m)	0.00	0.00	5.00	3.47	0.00	0.00	0.00	0.00
beach seine 3 (15.55m)	0.00	0.00	0.00	0.00	1.00	0.44	1.00	0.43
beach seine 8 (20.12m)	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.43
beach seine 10(21.95m)	6.00	5.00	9.00	6.25	1.00	0.44	9.00	3.90
beach seine 11(22.86m)	3.00	2.50	5.00	3.47	4.00	1.76	7.00	3.03
beach seine 12(23.77m)	6.00	5.00	0.00	0.00	6.00	2.64	3.00	1.30
seine seine 13(24.69m)	5.00	4.17	4.00	2.78	12.00	5.29	10.00	4.33
beach14(25.6m)	0.00	0.00	0.00	0.00	15.00	6.61	19.00	8.23
beach15 (26.52m)	0.00	0.00	0.00	0.00	22.00	9.69	8.00	3.46
beach seine 16(27.43m)	9.00	7.5	3.00	2.08	12.00	5.29	27.00	11.69
cast-net(1.8m)	5.00	4.17	7.00	4.86	11.00	4.85	10.00	4.33
cast-net1(3.6m)	7.00	5.83	11.00	7.64	12.00	5.29	14.00	6.06
cast-net2(5.4m)	11.00	9.16	12.00	8.33	12.00	5.29	13.00	5.63
cast-net3(7.2m)	12.00	10.00	12.00	8.33	18.00	7.93	15.00	6.49

encircling (73.15m)	0.00	0.00	0.00	0.00	5.00	2.02	0.00	0.00
encycling1(77.72m)	0.00	0.00	0.00	0.00	2.00	0.88	2.00	0.87
encircling3 (121.62m)	0.00	0.00	0.00	0.00	6.00	2.64	3.00	1.30
gillnet(73.15m)	11.00	9.16	11.00	7.64	16.00	7.04	17.00	7.36
gillnet1(77.72m)	8.00	6.67	20.00	13.89	15.00	6.61	8.00	3.46
gillnet2(91.44m)	8.00	6.67	9.00	6.25	12.00	5.29	6.00	2.60
gillnet3(121.62m)	7.00	5.83	7.00	4.86	9.00	3.96	9.00	3.90
Hook and lines	22.00	18.33	26.00	18.06	27.00	11.89	46.00	19.91
Others	0.00	0.00	3.00	2.08	9.00	3.96	3.00	1.30
Total	120.00		144.00		227.00		231.00	

Source; Field survey from the questionnaire. N= number of respondents, P= percentage

Table 5. The statistical result of mean length of nets at landing sites compared to the population mean of 500m

Landing site	Average length of net in use	One sample t-test				Inference
		df	t_{cal}	$t_{(0.05)\,tab}$	p-value	
Ogbogoro	125.89±53.94	30	-38.62	2.042	.000	Significant difference
Mgboshimini	109.05±61.88	43	-41.91	2.018	.000	Significant difference
Isaka-Bundu	138.61±90.41	56	-30.18	2.003	.000	Significant difference
Borokiri Rex-Lawson Waterside	123.58±63.80	51	-42.55	2.008	.000	Significant difference

Source; Field survey from the questionnaire. N= number of respondents, P= percentage

Discussion

The Social characteristics of fishers

The fishers sampled on the landing sites showed men were more active in fishing than women. The participation of women in fishing indicates no gender bias. This is in agreement with reports of women actively participating in fishing in Nigeria by (Adeyemo, 2011; Kwen *et al*, 2013; Lahia *et al*, 2000; Olaoye *et al*, 2011). Women also play a key role in this fishing business as some market women buy nets for fishers so the catch will be theirs. Most often the catch is sold to market women and little is left for consumption.

The age of the fishers sampled from the four-landing site is 9 to 63 which is beyond the economically active age of the countries work force or labour force which is persons from the age 15 and 64 based on (National Bureau of Statistics, 2016) report on economically active labour force, and also as reported by (Enaikele & Olutayo, 2010; Nwabeze & Erie, 2013;

Nwabeze et al., 2011). This indicate that children below the age of 15 have started contributing to the economy of the family for fishing is a family business. Children below 14 do not go too far for fishing from the landing sites except when they accompany older member of the family like their fathers, mother or older brother. The children take great pride in the art and talk about their exploits with joy.

The household of the active fishers at the landing sites were relatively large, which is in agreement with (Nwabeze & Erie, 2013) that report the large household is due to extended family members. Single adult mostly involves in group fishing.

Mesh size and gear description

There were 20 different mesh sizes ranging from less than one fingers 10mm, less than one fingers 16.00mm, half finger 18.00mm, one fingers 25.40mm, one fingers 31.75mm, one finger 33mm, one and half fingers 38.00mm, two fingers 50mm, two and half fingers 57.15mm, two fingers 60.00mm, three fingers 63.50mm, three fingers 67mm, three fingers 70.00mm, three fingers 72mm, three fingers 74mm, four fingers 76.70mm, four fingers 84.00mm, four fingers 87mm, four fingers 88.90mm, fist 101.60mm, fist 102.00mm, fist 107.95mm and clasped fist 127.00mm. The data obtained from the sample stations, 81.00% of mesh sizes of nets were less than 76.00mm or 3 inches. Fishers says that the most sorted after mesh sizes were 1, 1¼, 1½, $1^5/_8$, $1^7/_8$, 1¾, 2, 2¾, 2¼, 2½ and $2^5/_8$ inches, as these mesh sizes ensure catch of all desired sizes of fish. The net's mesh sizes indicate that there is exploration of all fish sizes, that is immature fish species were been explored which is in agreement with (Enyenihi, 1990; Seisay and du Feu, 1997; Eyo, 2004, Jamabo and Ibim, 2010), which reported that overfishing has resulted in depletion of stock. This indicates that illegal fishing is unabated which is in agreement with (African Economic & Financial Brief, 2013) which reported the prevalence of illegal fishing in Africa. The mesh sizes indicates that violation is due open access to the marine resources as reported by (Oruonye, 2014), and lack of enforcement by the relevant authorities contrary to report by (Enaikele & Olutayo, 2010) in Lagos which reported violation due to ineffective implementation of the law by the relevant authorities.

The kind of gears in use for fishing

The nets in use based on the data obtained revealed that fishers use beach seine nets, encircling nets, cast-nets and gill-nets. Beach seine, encircling nets are all gillnets. The nets in use were the same as reported by several authors which are used in Nigeria (Kingdom and Kwen, 2009; NIFFR, 2002; Yisa *et al*, 1995; Bankole *et al*, 2003 and Bene and Neiland, 2003). The beach seine nets were mostly of small mesh sizes ranging from 10.00mm to 31.75mm. The length of the gears in use ranges from 15.00yards (13.72m) to 30.00yards (27.43m). Cast-nets are measured in fathom which is 1.83 meters. The mesh size obtained from the sampled fishers includes 1 finger and 1½fingers that is 25.40mm and 38.00mm. Gill-nets and encircling nets have length of 80.00yard (73.15m), 85.00yards (77.72m), 100.00yards (91.44m) and 133.33yards or 121.92m. The mesh sizes obtained were 1½fingers (38.00mm) to fist (127mm). Fishers involved in fishing as observed in this investigation utilises 21 different sizes of net and the do not use a combination of nets more than 500m as provided in the Inland Fisheries Act No. 108 of 1992. The implication is that the fishers were not violating the provision of the law concerning the length of nets permitted by law.

Other gears in use by fishers

The use of other gears apart from nets indicate that fishers make use of gears not mention in the provisions of the law as a tool for fishing. The implication of this is that monitoring and defining what is illegal fishing is limited, therefore, the need for review of the policy to make provision

for the inclusion of these gears as was done by the Niger and Kebbi State government (Salzwedel *et al*, 2000). The gear in use on these landing sites were the same with those used in Nigeria generally as reported by (Ita, 1993; Binyotubo 2011 & Kwen *et al*, 2013).

Conclusion and Recommendation

The survey of the mesh sizes and gear used for fishing on some riparian communities along the New Calabar River and the Bonny estuaries in Port Harcourt, Rivers State, Nigeria call for the urgent need for intervention on the part of government for policy review and implementation. This should be done by applying every instrument of policy, by equipping and upgrading the institutions of governance to be able to meet cotemporary challenges, so as to ensure sustainable use of the aquatic resources.

References

African Economic & Financial Brief. (2013). Fishing industry in Africa. Market brief, 4, 16.

Ayo, V. O., Andrew. O & Ogoro, M. (2017). Mapping land cover determinants of malaria in Obio Akpor Local Government of Rivers State, Nigeria *IOSR Journal Of Humanities And Social Science (IOSR-JHSS),*22(6), 4.

Bankole, N.O., Raji, A., Adikwu, I. A & Okwundu, E.C. (2003). Fishing Gear Survey of Lake Alau. In: A.A. Eyo and E.A. Ajao (Eds.), Proceedings of the 16th Annual Conference of the Fisheries Society of Nigeria (FISON). pp: 99-103.

Bene, C.& Neiland, A.C. (2003). Contribution of Inland fisheries to rural livelihoods in Africa: an overview from the Lake Chad basin areas. In: Welcome, R. and Petr, T. (Eds.), Proceedings of the Second International Symposium on the Management of Large Rivers for Fisheries Vol. II. FAO Reg. Office for Asia and the Pacific, Bangkok, Thailand. RAP Publication 2004/17. pp: 1-14.

Binyotubo, T. E. (2011). A guide to fishing gear technology. National Institute For Freshwater Fisheries Research, P.M.B. 6006, New Bussa, Niger State, Nigeria.

Enyenihi, U.K. (1990). Biological conservation for environmental stability and food production. *Trans. Nig. Soc. Boil. Conserve*, (1)4 – 10.

Eyo, A. A. (2004). Provost alerts federal. Government over foreign fishermen In Lake Kainji. In The Guardian Newspaper Thursday, October 7, 2004 Vol. 21, No. 9,451 pg. 50.

Inland Fisheries Act 108 of 1992.

Ita, E. O. (1993). Inland Fisheries Resources Of Nigeria. CIFA Occasional Paper No. 20 FAO Rome, 120p.

Jamabo, N. A. & Ibim, A. T. (2010). Utilization and protection of the brackish Water ecosystem of the Niger delta for sustainable fisheries development. *World Journal of Fisheries Development*, 2, 138-141.

Jennings, S & Kaiser, M. J. (1998). The Effects of Fishing on Marine Ecosystems. Advance Marine Biol., 34: 201-352.

Kwen, K. I., Davies, O. A & Binyotubo, T. E. (2013). Survey of fishing gear and status of Fishers in Igbedi Creek, Nigeria Delta, Nigeria. *International Journal of Scientific Research in Knowledge (IJSRK),*11,493-501.

Kingdom, T & Kwen, K. (2009). Survey of Fishing Gear and Methods in the Lower Taylor Creek Area, Bayelsa State, Nigeria. World Journal of Fish and Marine Sciences 1 (4): 313-319, 2009.

Mamman, A. B., Oyebanji, J. O., & Petters, S. W. (2000). Nigeria: A People United, A Future *Assured.* Abuja: Millenium Edition, Gabumo Publishing. N.B.C. (2008). Annual Report.

NIFFR. (2002). National Surveys of Fishing Gear and Crafts on Nigerian Inland

Water Bodies. National Institute for Freshwater Fisheries Research (NIFFR) Occasional Paper No. 4 IX, pp: 54.

Nwilo, P. C &Badejo, O. T. (2008). Impacts and management of oil spill in Nigerian coastal environment. Proceedings of the International Conference on the Nigerian State, Oil Industry and the Niger Delta. pp. 1217-1232.

Olomola, S. A. (1993). The National Approach Towards Sustainable Management of Common Property Fishery Resources in Nigeria.*MAST*,6 (1/2) 92-109.

Seisay, M. D. B. & Du Feu, T. A. (1997). The Effect Of Long Term Exploitation By Gill Net Fishery On The Multi-Species Fish Stocks In Kainji Lake. Nigerian Germany Kainji Lake Fisheries Promotion Project Technical Report Series 11. 58p.

Spiegel, M. R & Stephens, L. J. (2011). Statistics. Fourth Edition. 508 fully solved problems. Mc Graw Hill Companies, Inc. U. S. A. pp 275.

Statistics How To. (2017). One Sample T Test: How to Run It, Step by Step. Retrieved from: <http://www.statisticshowto.com/one-sample-t-test/ >6/05/2017

StatTrek.com. (2017). Student's t distribution. Retrieved from: <http://stattrek.com/probability-distribution/t-distribution.aspx.>6/05/2017

Timeanddate.com. (2017) Climate & Weather Averages in Port Harcourt, Nigeria. Retrieved from <https://www.timeanddate.com/weather/nigeria/port-harcourt/climate>29/08/2016.

Uzukwu, P. U., Leton, T. G & Jamabo, N. A. (2014). Survey of the physical characteristics of the upper reach of the New Calabar River, Niger Delta, Nigeria. *Trends I Applied Science Research,* 9 (9),494-502.

Visweswara, K. R. (2007). Biostatistics a manual of statistical methods for use in health, nutrition and anthropology. Jaypee Brothers Medical Publication (P) Ltd, New Dehli. Pp 143.

Yisa, Z., F. Apeloko, A. Kasali. (1995). Fishing Gear Survey of Kainji Lake. NIFFR Annual Report, pp: 212-215.