FISH SPECIES COMPOSITION AND BAIT PREFERENCE IN SELECTED ARTISANAL FISHING TRAPS IN LAGOS AND EPE LAGOONS

[1]*AKINNIGBAGBE, R. O. & [2]EMMANUEL, B. E.
[1]Nigerian Institute for Oceanography and Marine Research (NIOMR), Victoria Island, Lagos, Nigeria.
[2]University of Lagos, Department of Marine Sciences, Akoka, Lagos, Nigeria.
* Corresponding Author: Tel: +234 8038 216 520. E-mail: toyinorims@yahoo.com

Abstract
The fish species composition and bait preference in selected three artisanal fishing traps used in Lagos and Epe lagoons were carried out between May 2014 and April 2016. Prior to the field work, investigation on the trap types and bait preference was evaluated by administering eighty questionnaires in each of the four sampling stations in Lagos and Epe lagoons from March, 2013 to February, 2014 using simple random sampling technique. For the field experiment, at each station, thirty fishing traps were set in rows, comprised of ten of each designs. The traps were set without bait for the first eight months (May, 2014 to December, 2014), Maize chaff was used as bait for the next eight months (January, 2015 to August, 2015) and dead small fishes as baits for the last eight months (September, 2015 to April, 2016). Fisherfolks in both Lagoons reported that the use of bait(s) is insignificant to fish abundance. There was also no significant difference (P>0.05) in bait used across all trap types in both Lagoons. Fishing trap performance and catch efficiency were influenced by trap types and Lagoon regardless of the bait used in the trap.
Key words: Questionnaire, Design, Catch Efficiency.

Introduction

The Lagoons in south western Nigeria and their fisheries potentials, including the performance of fishing gear types of synthetic origin and well known designs have been documented by FAO (1969), Kusemiju (1981) and Solarin (1998).Lagos Lagoon is a major water body in the Lagos metropolis. It consists of three main segments: the Lagos harbour, the metropolitan end and the Epe segment (Ajagbe *et al*., 2012). It also serves as fisheries and fish farming sites (Onyema 2009a, Chukwu and Nwankwo, 2004a), most especially for the small scale artisanal fishery sector which remains the backbone of fish production in Nigeria, contributing a minimum of 70% of the total fish production in the last decade (Solarin *et al.,* 2003). It offers fishing opportunities for artisanal fisherfolk around the region, using different kinds of fishing methods (Emmanuel *et al*., 2010). Ajagbe *et al*.,(2012) reported that Lagos Lagoon is about 6354.708 sq km in area and 285 km in perimeter, separated from Atlantic Ocean by along sand spit 2 to 5 km wide which has swampy margins on the Lagoon side. Epe Lagoon is located in Lagos State and experiences the same hydroclimatic conditions as the rest of South-western Nigeria such that there are two main seasons (wet and dry). Epe Lagoon has a surface area of more than 243 km^2 (about 225 km2) (Soyinka and Ebigbo, 2012).Artisanal fisheries accounts for the major fish supply in the developing countries (FAO, 1991). It is normally characterized by low technology, lack of modern equipment and capital, resulting in labour intensive activities, with little or no opportunities to expand (Ibrahim *et al.,* 2009). Abiodun and Ayanda (2008) reported that profitability of artisanal fishing is directly related to available capital invested on fishing equipment and fishing method. Artisanal fishers are generally low income earners and their insufficient investment capitals in turn affect their net profit (Ogundiwin, 2014).Fishing gear can be described as any kind of equipment used in harvesting, cropping, or capturing fish from any water body (Kingdom and Kwen, 2009), while fishing method is how the gear is being used. Different types of fishing gears and method are adopted in small-scale fisheries, this include traditional fishing techniques with traps: a passive fishing method which is used to lure and catch demersal or bottom dwelling fish species or aquatic animals alive in order to attract higher market values and it is not time consuming (Araoye, 2009; Umar and Ipinjolu, 2001). Traps are simple fishing gears used majorly in shallow waters but sometimes deep water fish are also trapped (Ambrose, 2016) depending on the availability of species. They are simple and passive fishing gears that allow fish to enter and then make it difficult for them to escape (Emmanuel, 2008). Trap fishing techniques have developed in all regions of the world, including Africa. It is used in catching particularly demersal fish species of table sizes (Umar and Ipinjolu, 2001; Miller *et al*., 1990). Fishing bait is any substance used to attract and catch fish. Slack – Smith (2001), reported that bait must be effective in attracting fish, readily available, easy to store and conserve and cheap enough to allow the operation to be profitable. Emmanuel and Awojide (2016) reported that baits may include rotten meat, dead fish, palm nuts, corn, coconut and bar soap, while bait fish is classified as the small fish caught for bait to attract large

predatory fish, particularly in game fishing. Bait can be divided into two main categories which include: artificial baits and natural baits (Udolisa *et al*., 1994 and Emmanuel, 2009). Artificial bait is man-made material designed to resemble the appearance and/or the movement of a prey to entice predator while natural bait is something living or once living used to entice predator. Bait type affects catches as target species are influenced and easily lured by the odours of some bait types than others (Whitelaw *et al.,* 1991 and Furevik and LØkkerborg, 1994). Ambrose (2016) studied baited conical fish traps which were set forth-nightly for one year in five different habitats, namely: mangrove habitat, nypa palm habitat, shallow water with muddy bottom habitat, deep water with sandy bottom habitat and water hyacinth habitat in estuary of new Calabar River; the highest catch was recorded from the mangrove habitat while the lowest weight of fish caught was recorded from water hyacinth habitat. However, capital required in constructing fishing traps and canoe with cost of getting baits are not encouraging compared to the financial outcome on the gear (Emmanuel and Salawu, 2009); hence, this study aim at comparing the catches from selected three traditional traps without bait and with two bait types and consider if there will be need for bait in trap fishing operation in Lagos and Epe lagoons.

Materials and Methods

Two major Lagoons (Lagos and Epe) in the South western Nigeria were used for this study. Lagos Lagoon is the largest Lagoon along the coastline. It lies between latitude 6º 26' - 6 º 37' N and longitude 3º 23' - 4 º 20' E in the western part of Nigeria (Fig. I). Four fishing sites within each of the Lagoon were selected. Lagos stations were Langbasa (N06° 30.618' and E003° 34.608'), Ibeshe (N06° 33' and E003° 28.218'), Elegushi (N06° 27.324' and E003° 29.88') and Abule - Agege Creek (N06° 29.964' and E003° 23.592') while Epe stations were Ebute-Afuye (N06° 34.922' and E003° 59.691'), Igbonla (N06° 38.014' and E004° 03.452'), Erepoto (N06° 34.588' and E003° 58.238') and Ejirin (N06° 36.69' and E003° 54.198'). Geographical locations were read with the use of hand-held Garmine-Trex water proof Hiking Global Positioning System (GPS).

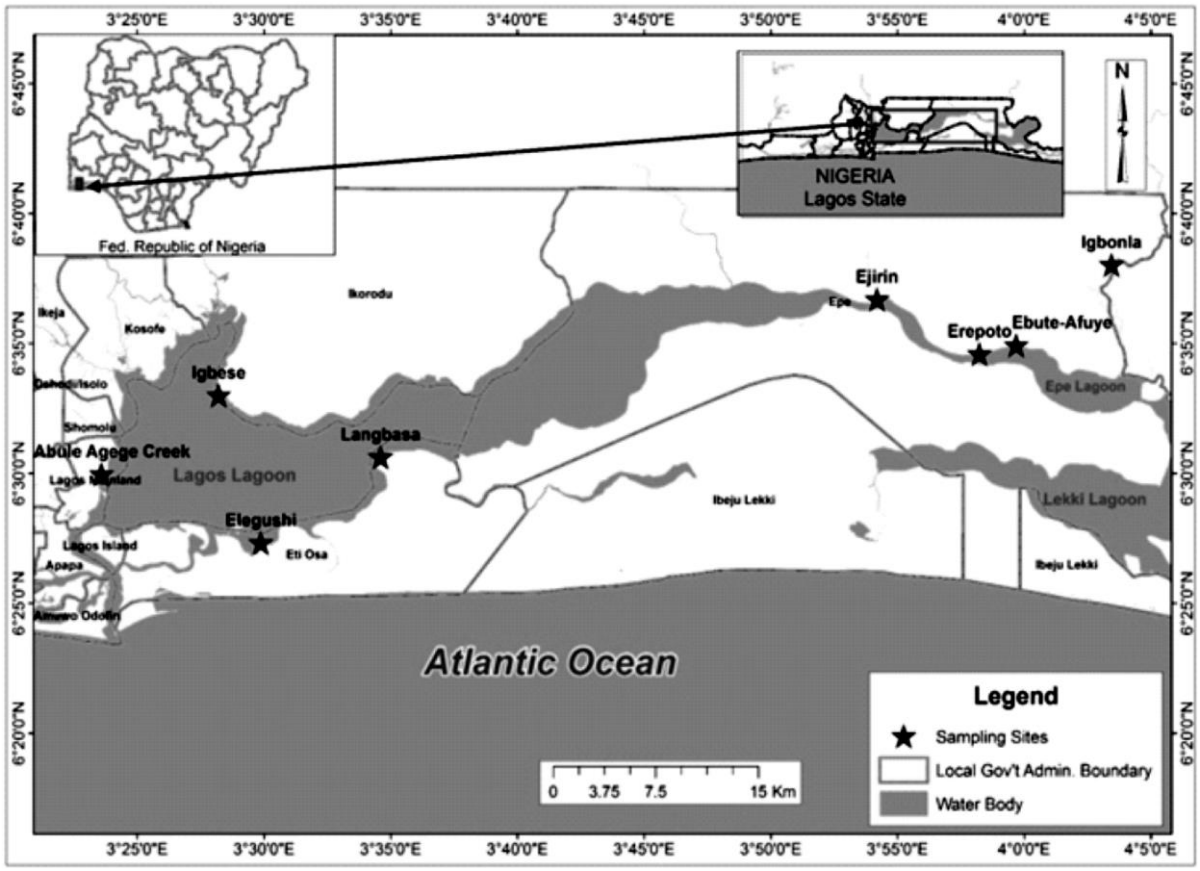

Fig.I: Map of Lagos and Epe lagoons

Sample Collection

Eighty (80) questionnaires were administered in each sampling station using simple random sampling technique. The survey lasted for one year (March, 2013 to February, 2014) to have an in-depth understanding of traditional trap fishing operations in relation to baits used in Lagos and Epe lagoons. Three most used traditional fishing traps from both Lagoons were selected which include: Big cylindrical basket trap, pot trap and the drum trap as shown in Plate 1,2 and 3.

PLATE 1: POT TRAP

PLATE 2: BIG CYLINDRICAL BASKET TRAP

PLATE 3: DRUM TRAP

Traditional Fishing Traps

Field operation of traditional fishing traps

At each station, thirty fishing traps were set in rows, comprised of ten of each of the designs for twenty-four months from May 2014 to April 2016.In order to determine the bait preference among fish species, traps were set without bait for the first eight months (May, 2014 to December, 2014), Maize chaff were used as bait for the next eight months (January, 2015 to August, 2015) and dead small fishes as baits for the last eight months (September, 2015 to April, 2016). Long bamboo was used as stalks to peg each trap to avoid lost of trap in water and each trap was set against the flow of water current. Fishing traps were retrieved and catch was harvested into three different transparent small buckets for labelling based on different traps. This was done once in a month throughout the study period. Catches were transported to Nigerian Institute for Oceanography, Marine Biology Laboratory for analysis.

Laboratory Analysis of basket traps catches

The specimens were removed from each of the labelled bucket and poured into three trays which have been labelled according to the names of the fishing traps and were allowed to thaw. Weight (in grams) of samples from each trap was determined using weighing balance (Kitchen scale - CAMRY Model). The specimens were sorted to the lowest taxonomy level and identified following Reed, *et al*., (1967), FAO (1990), Schneider (1990) and Olaosebikan and Raji (1998).

Statistical Analysis of Experimental Data

The data was subjected to statistical analysis with Principal Components Analysis (PCA) using PAST (Paleontological statistics) version 3.0 packages to analyse trap and bait preferences among fisherfolks in both Lagoons. Also, analysis of variance (One-way ANOVA) was used to analyse bait preference in relation with trap types during the study period while descriptive statistics of percentages was used to analyse the fish composition caught by traditional traps in both Lagoons.

Results

Baits types used in traditional traps among fisherfolks in Lagos and Epe Lagoons

The relationship between different bait types used in three (3) trap types among fishing trap users (fisherfolks) in eight (8) fishing communities in Lagos and Epe lagoons is analysed and shown in Fig. III, IV and V. On the principal component loading analysis, the baits are indicated as follows: maize chaff (MC), dead fish (DF), dead crab (DC), dead shrimp (DS), rotten meat (RM), cassava (CASS) and bread (BRD). Also, NB indicates no bait and NR is noted for no response among fisherfolks.

Baits used in Big Cylindrical Basket Trap in Lagos and Epe lagoons

The relationship between the eight (8) stations and the different bait types used with the big cylindrical basket trap is shown in Fig. III. It was observed that the only bait used in the big cylindrical basket trap among respondents from Epe stations is the maize chaff as reported among 29.1% of the fisherfolks while 70.9% of the fisherfolks do not use bait. In Lagos lagoon, maize chaff is used as bait with the big cylindrical basket among fishers in Iwaya, Elegushi and Langbasa than fisherfolks in Ibeshe. Also in Elegushi and Langbasa the use of dead fish is noted with this trap among fisherfolks.

The principal component (PC) analysis revealed that most fisherfolks from Lagos and Epe Lagoons do not use bait with big cylindrical basket, these revealed the highest percentage variance (90%) shown in PC 1 followed by use of maize chaff and dead fish among fisherfolks as noted in PC 2 and PC 3 respectively (Table I). Use of dead crab and bread with this trap is practiced among few fisherfolks and that makes their values on principal component analysis not significant.

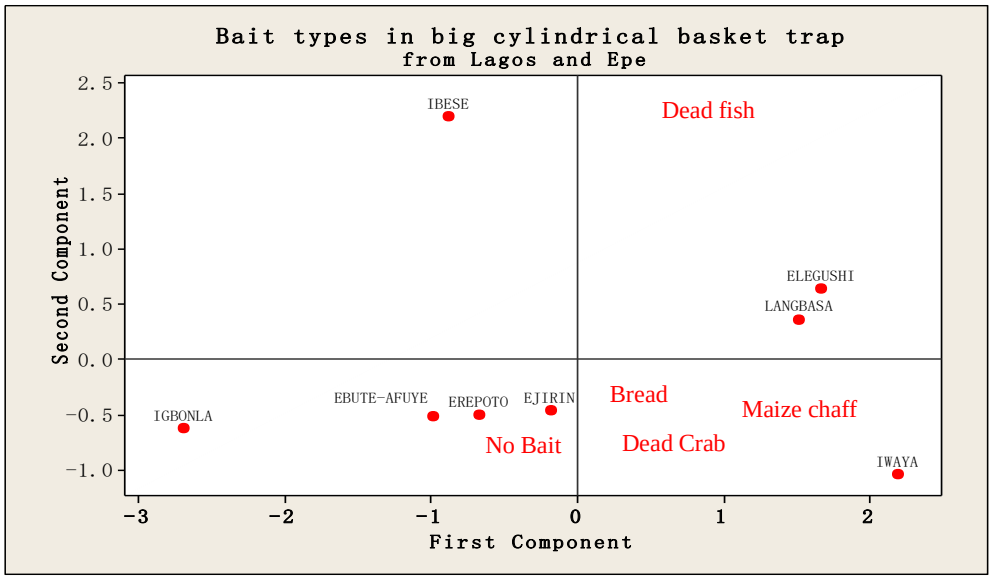

Fig.III: A principal component analysis of bait types in big cylindrical basket trap in Lagos and Epe lagoons

Baits used in Pot Trap in Lagos and Epe lagoons

The bait types used with pot trap in Lagos and Epe lagoons is shown in the principal component analysis of Fig. IV. In Lagos lagoon, it was discovered that 69.7% of the fisherfolks with pot trap do not use bait, 11.6% make use of maize chaff as bait and 17.1% use dead fish while there was no response from 1.6% fisherfolks while in Epe lagoon, 98.1% of the fisherfolks use no bait and 1.9% make use of maize chaff.

Nevertheless, all the fisherfolks in Erepoto do not use bait. The percentage variance of bait types used in pot trap in both Lagoons is shown in Table II. In both Lagoons, 99% of the fisherfolks do not use bait and approximately 1% percentage variance on PC 2 is noted for the fisherfolks with the use of dead fish.

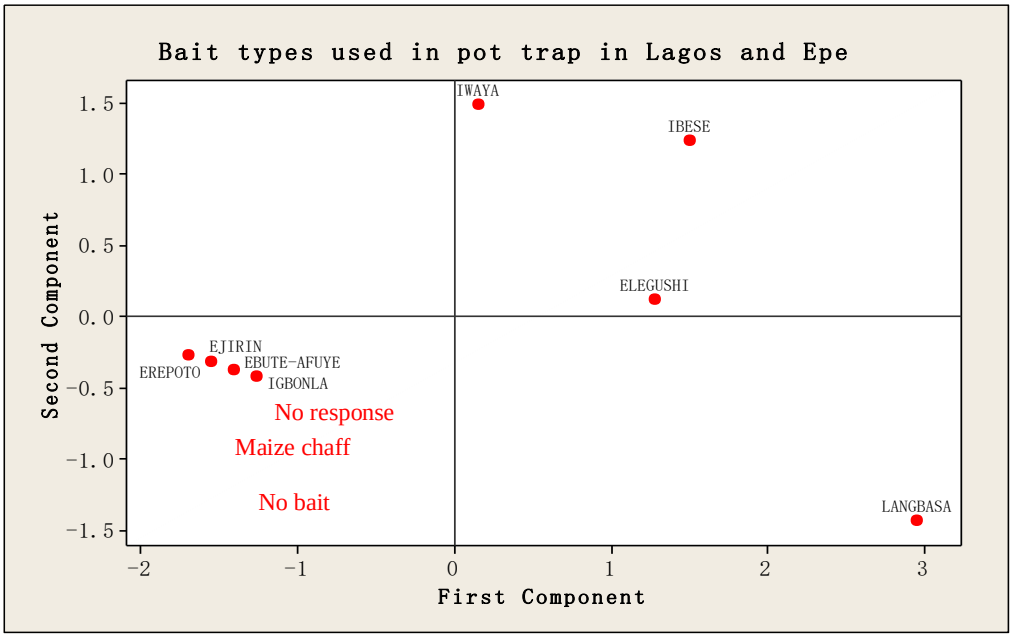

Fig. IV: A principal component analysis of bait types used in pot trap from Lagos and Epe lagoons

Baits used in Drum Trap in Lagos and Epe lagoons

The principal component analysis shows the bait types used with drum trap in Lagos and Epe lagoons (Fig.V). In Lagos lagoon, 43.1% of the fisherfolks do not use bait with the drum trap, 28.4% use maize chaff, 1.3% use cassava while 21.2% did not respond at all. But, in Elegushi station of Lagos lagoon, none of the fishers use the drum trap. However, in Epe lagoon, 99.1% of the fishers do not use bait with drum trap while 0.9% use maize shaft. None of the fisherfolks from Ebute Afuye and Ejirin use bait in Epe lagoon. The principal component analysis revealed that most fisherfolks from Lagos and Epe lagoons do not use bait with drum trap, which accounts for 79% of the percentage variance in PC 1, 20% on PC 2 is noted for non-responding fisherfolks and PC 3 indicates that about 1% of the fisherfolks in both Lagoons use maize chaff as bait with the drum trap as shown in Table III.

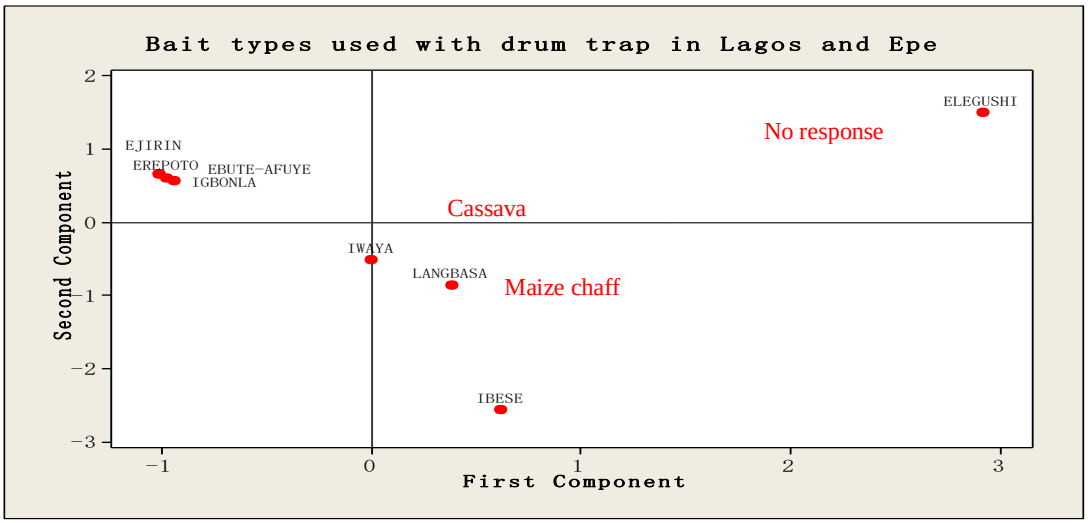

Fig.V: A principal component analysis of bait types used in drum trap from Lagos and Epe lagoons

Determination of bait preference in the field operation of the three selected traps in Lagos and Epe lagoons

The baits used in different trap types in Lagos and Epe lagoon are shown in Table IV. In big cylindrical basket trap, maize chaff had the highest fish catch (791) with an average fish weight of 37.67±48.87 while dead fish had the least (753) with an average fish weight of 35.86± 48.42. In pot trap, no bait had the highest fish catch (655) with an average fish weight of 34.47±57.68 while dead fish had the least (596) with an average fish weight of 31.37± 43.75. Also, traps with no bait had the highest fish catch in the drum trap (703) with an average fish weight of 33.48±51.53 while dead fish had the least (617) with an average fish weight of 29.38±46.32. The analysis of variance (ANOVA) showed no significant difference among all the baits used in all the deployed traps in both Lagoons.

Fish species composition of the traditional traps in Lagos and Epe lagoons

The total number and percentage composition of fin and shell fish species caught by the traditional fishing traps from both Lagoons are represented in Table V. A total number of 20 species from 14 families were recorded from Lagos lagoon while total number of 22 species from 15 families was reported in Epe lagoon. *Epenephelus aeneus* and *Sardinella maderensis* were observed in Lagos lagoon but was not captured in Epe lagoon while *Tilapia zilli, Synaptura lusitanica, Synaptura cadenati* and *Synodontis obesus* species were recorded in Epe lagoon but not found in Lagos lagoon. Abundant species in Lagos lagoon include: *Ethmalosa fimbriate* (184) and *Chrysiththys nigrodigitatus* (152), mostly caught by the pot trap; also *Bathygobious soporator* (360), *Sarotherodon melanotheron* (257) and *Lutjanus goreensis* (108), mostly caught by the big cylindrical basket trap while *Coptodon guineensis* (102) was mostly caught by the drum trap. The least species observed from Lagos lagoon was *Sardenella maderensis* (1) which was caught by the pot trap. The most abundant species in Epe lagoon was *Chrysiththys nigrodigitatus* which was caught by all traps; however, the big cylindrical basket trap recorded the highest count (466) of the aforementioned species. *Synaptura lusitanica* (1) was the least species found in Epe Lagoon which was caught by drum trap.

Table I: Eigen value and percentage of variance of bait types in big cylindrical basket trap in Lagos and

Baits	Eigen values	Percentage variance	Cumulative percentage	PC
No bait	445.38	90.97	90.97	PC 1
Maize chaff	34.89	7.13	98.00	PC 2
Dead fish	6.95	1.42	99.42	PC 3

Table II: Eigen value and percentage of variance of bait types used in pot trap in Lagos and Epe lagoons.

Bait	Eigen value	Percentage variance	Percentage cumulative	PC
No bait	297.87	99.03	99.03	PC 1
Dead fish	2.22	0.74	99.77	PC 2

Table III: Eigen value and percentage of variance of bait types used in drum trap in Lagos and Epe lagoons

Bait	Eigen value	Percentage variance	Percentage cumulative	PC
No bait	1456.83	79.46	79.46	PC 1
No response	374.56	20.43	99.89	PC 2
Maize chaff	1.94	0.11	100	PC 3

Table IV: Baits in different trap types in Lagos and Epe lagoons

TRAP TYPES	BAIT TYPES	N	Mean	SD	F	df	P
Big cylindrical basket trap							
	No bait	787	37.48	53.5	3.15	2	0.99
	Maize chaff	791	37.67	48.87			
	Dead fish	753	35.86	48.42			
Pot trap							
	No bait	655	34.47	57.68	3.17	2	0.98
	Maize chaff	647	34.05	49.88			
	Dead fish	596	31.37	43.75			
Drum trap	No bait	703	33.48	51.53	3.15	2	0.96
	Maize chaff	681	32.43	48.13			
	Dead fish	617	29.38	46.32			

Table V: Fish composition caught by traditional traps in Lagos and Epe lagoons

Lagoon	Species	Big Cylindrical Basket trap		Pot trap		Drum trap	
		n	%	N	%	N	%
Lagos Lagoon	*C. nigrodigitatus*	89	6.6	152	13	77	7.6
	C. guineensis	82	6.1	60	5.1	102	10
	H. fasciatus	57	4.2	39	3.3	36	3.5
	S. melanotheron	257	19.1	198	17	177	17.4
	S. maderensis	0	0	1	0.1	0	0
	P. leonensis	4	0.3	4	0.3	21	2.1
	E. fimbriata	136	10.1	184	15.8	101	9.9
	L. goreensis	108	8	54	4.6	83	8.2
	L. agennes	12	0.9	12	1	23	2.3
	E. aeneus	0	0	0	0	3	0.3
	M. cephalus	29	2	31	3.7	33	2.3

	P. senegalensis	8	0.6	0	0	4	0.4
	P. elongates	9	0.7	8	0.7	23	2.3
	B. soporator	360	26.8	248	21.3	167	16.4
	C. senegalenlis	25	1.9	21	1.8	20	2
	P. quadrifilis	3	0.2	12	1	6	0.6
	P. jubelini	52	3.9	49	4.2	46	4.5
	E. melanopterus	86	6.4	42	3.6	44	4.3
	E. lacerta	5	0.4	2	0.2	10	1
	C. ferox	19	1.5	50	4.3	43	4.2
Epe Lagoon	*C. nigrodigitatus*	466	46.1	446	53	287	40.1
	C. guineensis	38	3.8	50	5.9	35	4.9
	C. zilli	19	1.9	8	1	15	2.1
	H. fasciatus	11	1.1	25	3	10	1.4
	S. melanotheron	36	3.6	49	5.8	23	3.2
	P. leonensis	30	3	3	0.4	10	1.4
	E. fimbriata	93	9.2	64	7.6	69	9.6
	L. goreensis	45	4.5	35	4.2	44	6.1
	L. agennes	5	0.5	5	0.6	5	0.7
	M. cephalus	46	4.5	37	4.4	38	5.3
	P. senegalensis	11	1.1	11	1.3	0	0
	P. elongates	35	3.5	15	1.8	22	3.1
	B. soporator	66	6.5	54	6.4	65	9.1
	C. senegalenlis	31	3.1	7	0.8	21	2.9
	P. quadrifilis	10	1	3	0.4	20	2.8
	P. jubelini	2	0.2	0	0	0	0
	E. melanopterus	19	1.9	9	1.1	13	1.8
	E. lacerta	16	1.6	3	0.4	8	1.1
	C. ferox	2	0.2	1	0.1	5	0.7
	S. obesus	16	1.6	15	1.8	24	3.4
	S. lusitanica	0	0	0	0	1	0.1
	S. cadenati	14	1.4	2	0.2	1	0.1
	Total	1011	100	842	100	716	100

Discussion

Among the traditional fishing traps used in this study, it was observed that maize chaff was the only bait used in the big cylindrical basket trap among respondents from both Lagoons while a greater percentage of the fishers does not use bait; in addition, dead fish was reported to be used among few fisherfolks in Lagos lagoon. This study revealed that most fisherfolks from both Lagoons do not use bait with big cylindrical basket trap; however, the percentage of fisherfolks that use bait mostly use maize chaff than dead fish. This may be attributed to the fact that maize chaff is readily available and can be obtained from diverse sources with little cost. This was in agreement with those of Emmanuel and Awojide (2016) who reported that local maize extract (maize chaff) was obtained from a nearby market (Ebute-Ilaje) in Lagos lagoon.

Likewise, this study revealed that 69.7% of the fisherfolks with pot trap in Lagos lagoon do not use bait, while 17.1% use dead fish and 11.6% make use of maize chaff as bait. In Epe lagoon, 98.1% of the fisherfolks use no bait while few of the fisherfolks (1.9%) make use of maize chaff. Nevertheless, all the fisherfolks in Erepoto do not use bait. This study shows that 99% of the fisherfolks with pot trap do not use bait in both Lagoons.

Also, the findings on drum trap in this study followed the same trend as the aforementioned traps; as a greater percentage of the fisherfolks in Lagos and Epe lagoons do not use bait with the drum trap. However, the few that use bait use maize chaff in both Lagoons with cassava being the bait with the least percentage (1.3%) used with the drum trap among the fisherfolks in Lagos lagoon. Hence, 79% of the fisherfolks from Lagos and Epe lagoons do not use bait with drum trap while about 1% of the fisherfolks in both Lagoons use maize chaff as bait with the drum trap. The percentages of fisherfolks using maize chaff or dead fish in both Lagoons are low because of the live female fish which is usually kept in both the drum and pot traps to attract the male fish. Observation from the operation of the two aforementioned traps by the fisherfolks reports that the sound of the female fish in these traps attracts the male fish automatically without the use of bait.

This study revealed that majority of the fisherfolks in both Lagoons does not use bait. This is in agreement with Moran and Jeken (1989) who reported that the trap itself sometimes can lure the fish. Although, in this study analysis revealed that preference was given to maize chaff compared to dead fish by fisherfolks as maize chaff had the highest fish catch (791) in the big cylindrical basket trap, pot trap (647) and the drum trap (681). This finding agrees with that of Emmanuel and Awojide (2016) who reported the use of maize chaff as bait to be efficient in catching fish species more than coconut in the basket traps. The use of bait(s) in fishing traps may not be necessary especially in the creeks where fish can easily find aquatic macrophytes in abundance than the quantity of bait in the set trap. Aquatic macrophytes contribute to an increase in fish abundance when compared with water bodies devoid of macrophytes (Emmanuel, 2009). Ambrose (2016) recorded the highest number of fishes with the mean weight of 0.209kg been attracted by the Mangrove, *Rhizophora racemosa* fishing ground or habitat in estuary of new Calabar River. In this study, the fish composition caught by the selected three traditional traps revealed that fishing trap performance and catch efficiency are influenced by the type of the trap and Lagoon regardless of the bait used in the trap. The finding was in agreement with those of Solarin and Kusemiju (2003) who reported that the efficiency of fishing traps can be attributed to the trap type. In Lagos lagoon, the pot trap was efficient in catching *Etmalosa fimbriata* (184) and *Chrysiththys nigrodigitatus* (152) than the other traps, big cylindrical basket trap was efficient in catching *Bathygobious soporator* (360), *Sarotherodon melanotheron* (257) and *Lutjanus goreensis* (108) more than the other traps while the drum trap was efficient in catching *Copnodon guineensis* (102) more than the rest of the traps. However, in Epe lagoon, the three traditional traps were very efficient in catching *Chrysiththys nigrodigitatus* which is the most abundant fish species in Epe lagoon.

Conclusion

Fishers in both Lagoons in this study reported that the use of bait(s) is insignificant to fish abundance; hence fisherfolks prefer to set traps without bait as the catches seem to be the same. The results from the experimental phase of this study confirmed that higher catches was obtained when no bait was used and most importantly fish that are of high commercial market value from the two Lagoons were recorded without the use of bait.

References

Abiodun, J. A. and Ayanda, J. O. (2008). Economics of fishing gears for sustainable fish production and development in inland water bodies in Nigeria. *Continental J. Agricultural Economics.* **2**:23–27.

Ahmed, Y.B., Adimula, A.B. and Agbontaen, E.F. (2005). Study on the effects of three fishing baits on the catch composition of Malian traps in Lake Kainji, Nigeria. *Aquatic Commons.* 557-562.

Ajagbe, F.E., Osibona, A. O. and Otitoloju, A. A. (2012).Diversity of the edible fishes of the Lagos Lagoon, Nigeria and the public health concerns based on their Lead (Pb) content. *International Journal of Fisheries and Aquaculture*. **2**(3): 55-62.

Ambrose, E. I. (2016). Ingress rate of fish population to baited traps at varied fishing grounds in estuary of New Calabar River, Nigeria. *International Journal of Fisheries and Aquatic Studies*. **4**(2): 250-253.

Araoye, P. A. (2009). The use of traps and the need for conservation of *Synodontis* fisheries in Asa lake, Ilorin, Nigeria. *African journal of biotechnology*. **8** (10):2379-2384.

Chukwu, L.O. and Nwankwo, D.I. (2004a). The impact of land based pollution on the hydro-chemistry and macrobenthic community of a tropical West African Creek. *The Ekologia.* **2** (1-2): 1-9pp.

Emmanuel, B.E. (2008). The Fishery and bionomics of the swimming crab, *Callinectesamnicola* (DeRochelburne, 1883) from a tropical lagoon and its adjacent creek, Southwest, Nigeria. *Journal of Fisheries and Aquatic Science.* **3**(2):114-125pp.

Emmanuel, B.E. (2009). The artisanal fishing gears, crafts technology and their efficiency in the Lekki Lagoon, Nigeria. Ph.D Thesis. University of Lagos. 256pp.

Emmanuel, B. E. and Salawu, A. T. (2009). Techno-economics of Lined Single Valve Basket Trap Fishery and Environmental Conditions in a Tropical Open Lagoon in South-Western Nigeria. *Journal of Fisheries and Hydrobiology*.**4**(2): 46-54.

Emmanuel, B. E., Chukwu, L. O. and Solarin, B. B. (2010). An evaluation of Iken fishing strategy in tropical Lekki lagoon, Nigeria. *African Journal of Environmental Science and Technology*. **4**(8):535-539.

Emmanuel, B. E. and Awojide, A. M. (2016). Bait preference in basket trap fishing operation and heavy metal contamination in the fishes caught from the Lagos Lagoon, Nigeria. *Journal of Aquatic Sciences*. **31**(1):185-203.

Food and Agricultural Organization (FAO) (1969). Fisheries Survey in the Western and Mid-Western Regions of Nigeria. FAO/Sf: 74/NIR 6. 142pp.

Food Agricultural Organization (FAO) (1990). Field guide to the commercial marine resources of the gulf of Guinea. FAO species identification sheets for fishery purposes. RAFR. 268pp.

Food and Agricultural Organization (FAO) (1991). FAO year book fisheries statistic catches and landing 1989, fisheries series 36 and FAO Statistic series 68. Rome, FAO.

Furevik, D.M. and LØkkeborg, S. (1994). Fishing trials in Norway for torsk (*Brosmebrosme*) and Cod (*Gadus morhua*) using baited commercial pots. Amsterdam: Fisheries research.

Ibrahim, B. U., Auta, J., and Balogun, J. K. (2009). A survey of the Artisanal Fisheries of Kontagora Reservoir, Niger State, Nigeria. *Bayero Journal of Pure and Applied Sciences*. **2**(1): 47-51.

Kingdom, T. and Kwen, K. (2009). Survey of fishing gear and methods in the lower creek area, Bayelsa State, Nigeria. *World journal of fish and marine sciences.***1**(4): 313-319.

Kusemiju, K. (1981). The hydrobiology and fishes of Lekki lagoon, Nigeria. *Nig. J. Nat. Sci*. **3**(1-2):135-146.

Mbawuike, B. C. and Ajado, E. (2005). Assessment of ornamental fish species and fishing methods in Ibiajegbende, Lagos State, Nigeria. *Journal of Applied Zoology and Environmental Biology*. **7**: 23-27.

Miller, J.M., Pietrafes, L.J. and Smith, N. (1990). Principles of hydraulic management of coastal lagoons for aquaculture and fisheries. *FAO Fisheries Technical Paper*. **314**: 88pp.

Moran, M.J. and Jenke, J. (1989). Effects of Fish trapping in the Shark Bay snapper fishery. West Australian Fisheries. *Department Fisheries Report.* **82:** 29pp.

Ogundiwin, D. I. (2014). Survey of artisanal fishing gear and craft. A case study of Kainji Lake lower basin, Nigeria. Master's thesis in International Fisheries Management. UIT The Arctic University of Norway. 76pp

Olaosebikan, B.D. and Raji, A. (1998). Field guide to Nigeria Freshwater Fishes. Federal College of Freshwater Fisheries Technology, New Bussa, Niger state, Nigeria. 106pp.

Onyema, I.C. (2009a). Notes on the existence of an additional lagoon in South-western Nigeria: Apẹsẹ Lagoon. *Journal of American Science*. **5**(4):151-156pp.

Reed, W.J., Burchard, J.A., Hopson, J.Y., Jennes, J. and Ibrahim, Y. (1967). Fish and fisheries of Northern Nigeria. Ministry of Agriculture, Northern Nigeria. Gaskiya Corporation, Zaria. **1**:226pp.

Schneider, W. (1990). FAO Species Identification Sheets for Fishery Purpose. Field Guide to the Commercial Marine Resources of the Gulf of Guinea. FAO, Rome. 268pp.

Slack- Smith, R. J. (2001). Fishing with traps and pots. *Report in FAO.* **26**: 62pp.

Solarin, B.B. (1998). The hydrobiology, fishes and fisheries of the Lagos lagoon, Nigeria. Ph.D Thesis. University of Lagos. 235pp.

Solarin, B. B., Udolisa, R. E., Omotoyo, N. O., Lebo, P. E. and Ambrose, E. (2003). Hook, line and sinker-The small scale fishing gear in Nigeria. ICSF Chennai, India/Brussels, Belgium. *Samudra*. **3**(5): 41-46.

Solarin, B. B. and Kusemiju, K. (2003). Fish shelter as fisheries enhancement techniques in the Lagos Lagoon, Nigeria. *Nigeria Journal of Fisheries.* 1:57-61.

Soyinka, O.O. and Ebigbo, C.H. (2012). Species diversity and growth pattern of the fish fauna of Epe Lagoon, Nigeria. Department of Marine Sciences, University of Lagos, Nigeria. *Journal of Fisheries and Aquatic Science*.**7**(6): 392-401pp.

Udolisa, R.E., Solarin, B.B., Lebo, P. and Ambrose, E.E. (1994). A catalogue of small scale fishing gear in Nigeria. RAFR Publication. 142pp.

Umar, K. A. and Ipinjolu J.K. (2001). The efficiency of baited Malian and Ndurutu trap in three freshwater bodies in North West Nigeria. *Journal of Agriculture and Environment.***2**(1): 101-111.

Whitelaw, A.W., Sainsbury, K.J., Dews, G.J. and Campbell, R.A. (1991). Catching characteristics of four fish-trap types of the north west shelf of Australia. *Australian Journal of Marine and Freshwater Research.***42**(4): 369-382.