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Fish weight and species diversity of traditional and modified traps in selected fishing communities in lagos lagoon

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Abstract
The efficiency of modified and traditional traps was investigated based on fish weight and species diversity as well as condition factors of the most abundant species across four locations in Lagos lagoon. Sixty fishing traps comprised of ten of each of the designs; modified plastic traps (three) and traditional fishing traps (three) was used for the fishing operation from 6 May 2014 to 11 April 2016. Modified plastic cylindrical trap caught significantly (F – test, < 0.05) more fish (47.77g) and recorded the highest (6.22) condition factor (K) than other modified and traditional traps across stations. Twenty-one fish species from fourteen families were recorded from Lagos lagoon. Most abundant species with their aggregate percentages of the total catch in Abule-Agege, Elegushi, Ibeshe and Langbasa was *Bathygobious soporator* (59.9%), *Ethmalosa fimbriata* (32.48%), *Sarotherodon melanotheron* (42.95%) and *Chrysichthys nigrodigitatus* (29.42%) respectively. The use of modified traps could assist conservation and management of fisheries resources.

Keywords: Fishing traps, species diversity, fish weight, condition factor

1. Introduction
Lagoons represent 15% of the world coastal zone, and their productivity results from the interaction between oceanic and continental inputs which enable them to play a considerable biological and economic role far beyond their seemingly limited geographical extent [1]. Lagos Lagoon is a shallow water body and experiences environmental gradients linked to rainfall patterns [2]. It is an open and tidal lagoon which provides the only opening to the sea for the nine lagoons of South Western Nigeria [3].

Fishes exhibit very great diversity in size, shape, biology and the habitat they occupy. The fish fauna of Lagos lagoon were classified by Fagade and Olaniyan [4] into three main ecological groups namely: the marine group (made up of fishes that use the lagoon as a nursery ground and these were made up of thirty-one species), the fresh water fishes (that dominate the lagoon during the low salinity periods and consists of seventeen species) and the euryhaline group (included twenty-four species that were found in the lagoon throughout the year). The fish fauna in Lagos lagoon is composed of fresh, marine and brackish water species, depending on the season. Afinowi [5], reported that about 28 metric tonnes/ha/year of oysters are produced annually from the Lagos Lagoon ecosystem. Olaosebikan and Raji [6] reported that the fresh water food fishes in Nigeria inhabits over 34 well-known fresh water bodies which include rivers, lakes, reservoirs and lagoons. Several publications had documented the fish fauna and fish species of south-western lagoons among which is Ajagbe, *et al.,* [7] that gave a list of diversity of the edible fishes in Lagos lagoon during a one year survey and recorded a total of eighteen fish species. Emmanuel and Osibona [8] studied the ichthyofauna characteristics of a tropical low brackish open (Lekki) lagoon in South-Western Nigeria and recorded that the high number of species (81) recorded for Lekki Lagoon confirms the fact that the lagoon is a transition zone between brackish and freshwater systems.

Traps are simple fishing gears used majorly in shallow waters, but sometimes deep water fish are also trapped [9] depending on the availability of the present species. They are simple and passive fishing gears that allow fish to enter and then make it difficult for them to escape [10]. This is often achieved by putting chambers in the trap that are closed once the fish enters and by a funnel that make it difficult for fish to escape [11].

Various research works has been carried out on baskets traps by Udolisa, *et al.,* [12]; Solarin, [13]; Emmanuel [14]; Emmanuel and Awojide [15]. Udolisa, *et al.*, [12] reported that basket traps are the commonest types of traps used in rivers, lagoons, lakes and estuaries. The basket trap is conical in shape and is made of palm fronts strips and is made in various sizes, shapes and dimensions [14]. An advantage of trap fishing is that it allows some control over the species and sizes of the fish one catches. The trap entrance or funnel can be regulated to control the sizes of fishes. Design of the catching chamber in a fish trap can have many variations but the principle of catching is always the same [15]. Trap performance and catch efficiencies are influenced by factors such as: size, type and mouth opening [13,16], several studies have surveyed the traditional fishing traps but none has focused on modification of the traditional traps with plastic materials for a better performance; hence the need for modification of the traditional traps and their mode of operations being employed among the artisanal fishers. Hence, this study aims at investigating the efficiency of traditional and modified traps to determine selectivity in species based on fish weight and species diversity as well as condition factors of the most abundant species across different locations in Lagos lagoon.

2. Materials and Methods

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 (Figure 1). The Lagoon is more than 50 km long and 3 to 13 km wide, separated from the Atlantic Ocean by long sand spit (2 to 5 km wide), which has swampy margins on the lagoon side [7]. In this study, four fishing sites of the Lagos Lagoon were selected: 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').

Fig 1: Map of Lagos Lagoon and the study area

2.1 Sample Collection

At each station, sixty fishing traps were set in rows, comprised of ten of each of the designs (modified plastic traps (3) and the traditional fishing traps (3)) for twenty-four months from 6 May 2014 to 11 April 2016. The modified traps include; plastic cylindrical, plastic pot and plastic drum traps while the traditional traps include; big cylindrical, pot and drum traps. The trap types were set and spaced 10m apart with long stakes used to hold each trap firmly in the water. These were done in combination with stones (about 2 kg weights) as sinkers. Traps were set against the flow of water current to aid the movement of fishes into the traps. Catches retrieved from the set traps were preserved in transparent plastic buckets containing ice cubes in the field; six plastic buckets were labelled with the different six fishing traps. Catches were transferred into a deep freezer (-20^{0}C) till the next day for further analysis on samples in the laboratory. Specimens were transported to the research laboratory of the Department of Fisheries Resources, Nigerian Institute for Oceanography and Marine Research, Lagos, for further investigations.

2.2 Laboratory Procedures on Fish Species

The specimens were removed from each of the labelled bucket and poured into different trays which have been labelled according to the names of the fishing traps and were allowed to thaw. The specimens were sorted to the lowest taxonomy level and identified by using the following; Reed, *et al.*, [17], FAO [18], Schneider [19] and Olaosebikan and Raji [6].

Weight (in grams) of individual species was determined to the nearest 0.1 g using electronic weighing balance (Satorious – Werke GMBH Model). Sex of species was observed by both visual observation and internal examination by following Nikolsky [20]. The number of males and females for each species were counted and recorded. The proportion of the two sexes relative to one another was used to calculate the sex ratio [21].

3. Results

3.1 Effectiveness of modified traps over traditional ones based on fish weight across locations in Lagos Lagoon

The comparison of fish weight caught by traditional traps and the modified ones across four locations in Lagos Lagoon using two independent samples t-test is as presented in Table 1. In Abule-Agege station, the average fish weight caught by big cylindrical basket trap was 40.51 ± 16.05 and that of plastic cylindrical trap was 45.14 ± 17.53. There was significant difference in the mean fish weight caught by the two traps, ($t = -3.224$, $p < 0.05$). Likewise, there was a significant difference between the average weight of fish caught by pot trap (48.31±15.72) and that of plastic pot trap (42.73±17.42), ($t = 3.135$, $p < 0.05$); thus, indicating that pot trap caught averagely fishes of higher weight than that of plastic pot trap. Conversely, average weight of fish caught by drum trap was 41.58± 14.38 that of plastic drum trap was 39.57 ± 15.78. No significant difference was found between the average weights of fish caught by the two traps in Abule-Agege. At Elegushi, significant was found between the average weights of fish caught by big cylindrical basket trap (43.38 ± 23.04) and that of plastic cylindrical trap (48.14 ± 33.87) with $t = -2.404$ ($p < 0.05$). This indicates that plastic cylindrical trap caught average fish weight than that of big cylindrical trap. However, the average weight of fish caught by pot trap was 40.45±29.74 that of plastic pot was 44.75±28.38. No significant difference was found between the average weights of fish caught by the two traps. Likewise, there was no significant difference between the average weight of fish caught by drum trap (41.51± 19.23) and that of plastic drum trap (40.28 ± 20.69) in Elegushi.

At Ibeshe station, no significant difference was found between the average weight of fish caught by the plastic cylindrical trap (45.29 ± 34.75) and the big cylindrical basket trap (44.15 ± 19.09), also between pot trap (45.51±23.01) and the plastic pot trap (44.47±23.04), in the same vein between drum trap (47.45± 22.51) and plastic drum trap (44.75 ± 20.82) with $t = 1.715$ ($p > 0.05$). At Langbasa, no significant difference was found between the average weight of fish caught by big cylindrical trap (49.10 ± 28.93) and that of plastic cylindrical trap (53.52 ± 36.45). However, significant difference was found between the average fish weight caught by pot trap (54.92±36.52) and that of plastic pot trap (43.44±23.01) with $t = 4.236$ ($p < 0.05$), indicating that pot trap caught averagely fish of higher weight than the plastic pot trap. Average weight of fishes caught by drum trap was 55.05±33.17 that of the plastic drum was 57.58±32.77. No significant difference between the average weight fish weight caught by drum trap and plastic drum trap with in Langbasa.

Table 1: Comparison of fish weight in modified and traditional fishing traps across locations using two independent samples (t-test)

Location	Trap types	N	Mean weight (g)	Std. Deviation	t	df	p
Abule Agege	Big Cylindrical Basket trap	229	40.51	16.05	-3.224	588	.001
	Plastic Cylindrical trap	361	45.14	17.53			
	Pot trap	213	48.31	15.72	3.135	353	.002
	Plastic Pot trap	142	42.73	17.42			
	Drum trap	203	41.58	14.38	1.333	393.55	.183
	Plastic Drum trap	198	39.57	15.78			
Elegushi	Big Cylindrical Basket trap	356	43.38	23.04	-2.404	817.81	.016
	Plastic Cylindrical trap	472	48.14	33.87			
	Pot trap	304	40.45	29.74	-1.859	631	.063
	Plastic Pot trap	329	44.75	28.38			
	Drum trap	332	41.51	19.23	.824	721	.410
	Plastic Drum trap	391	40.28	20.69			
Ibeshe	Big Cylindrical Basket trap	417	44.15	19.09	-.604	969	.546
	Plastic Cylindrical trap	554	45.29	34.75			
	Pot trap	374	45.51	23.01	.591	686	.555
	Plastic Pot trap	314	44.47	23.04			
	Drum trap	342	47.4497	22.51	1.715	761	.087
	Plastic Drum trap	421	44.75	20.82			
Langbasa	Big Cylindrical Basket trap	341	49.10	28.93	-1.785	714	.075
	Plastic Cylindrical trap	375	53.52	36.45			
	Pot trap	263	54.92	36.52	4.236	447.85	.000
	Plastic Pot trap	233	43.44	23.01			
	Drum trap	290	55.05	33.17	-.919	571	.359
	Plastic Drum trap	283	57.58	32.77			

Generally in Lagos Lagoon, Figure 2 shows the mean fish weight between traditional and modified traps. The mean fish weights in modified traps are 47.77g, 44.08g and 45.41g as recorded in plastic cylindrical, plastic pot and plastic drum traps respectively while that of the traditional traps are 44.58g, 46.84g and 46.63g as recorded in the big cylindrical basket, pot and drum traps respectively.

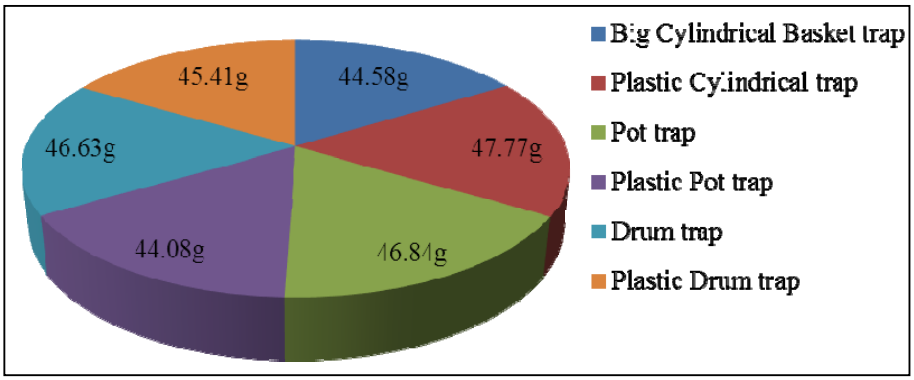

Fig 2: Mean fish weight of traditional and modified fishing traps in Lagos Lagoon

3.2 Species diversity in modified and traditional fishing traps from different locations in Lagos lagoon

The results in Table 2 reveal the effectiveness of modified traps over traditional traps based on species diversity across locations in Lagos lagoon. A total number of 11 species from 6 families were recorded from Abule-Agege station. Plastic pot trap caught the highest number of species (8) while big cylindrical basket trap, plastic cylindrical trap, drum trap and innovated trap caught seven species (7) each. Plastic drum trap caught six (6) fish species and the least fish catch was recorded from the pot trap as five (5). *B. soporator* maintained the fish species caught with the highest number in all the traps. The fish species with the least number in various traps include: *Elops lacerta* (Valenciennes, 1847) - Big cylindrical trap, *Cynoponticus ferox* (Costa, 1846) - plastic cylindrical trap, *Lutjanus goreensis* (Valenciennes, 1830) - pot trap, *E. lacerta* (plastic pot trap), *C. ferox* (drum trap), *C. ferox* (plastic drum trap) and *C. ferox* (innovated trap) with 0.4%, 0.5%, 3%, 1.1%, 4.2%, 1.5% and 1.0% respectively. A total of 20 fish species from 14 families were caught in Elegushi. It was observed that 16, 17, 14, 17, 16, 17 and 18 were the number of fish species caught by the big cylindrical basket trap, plastic cylindrical trap, pot trap, plastic pot trap, drum trap, plastic drum trap and innovated trap respectively. *E. fimbriata* was the highest caught species by all the traps; however, *Polydactylus quadrifilis* (Cuvier, 1829) was the least fish species caught by the big cylindrical basket trap (0.3%), plastic pot trap (0.2%) and drum trap (0.3%), while *Pseudotolithus senegalensis* (Valenciennes, 1833), *Cynoglossus senegalensis* (Kaup, 1858) and *Sardinella maderensis* (Lowe, 1838), *Cynoglossus senegalensis* (Kaup, 1858) and *Epnephelus aeneus* (Geoffroy Saint-Hilaire, 1817) were least fish species caught by plastic cylindrical trap (0.3%), pot trap (0.3%), plastic drum trap (0.5%) and innovated trap (0.2%) respectively.

In Ibeshe, a total of 15 fish species from 11 families were caught. The big cylindrical basket trap, plastic cylindrical trap, pot trap, plastic pot trap, drum trap, plastic drum trap and innovated trap caught 11, 12, 13, 13, 11, 13 and 12 fish species respectively. The fish species caught with the highest number of all the existing traps, modified and innovated trap is *S. melanotheron*. Nonetheless, the fish species caught with the lowest number in various traps are *Lutjanus agennes* (Bleeker, 1863) - big cylindrical basket trap, *P. quadrifilis* (plastic cylindrical trap), *L. agennes* and *Mugil cephalus* (Linnaeus, 1758) - pot trap, *P. quadrifilis* (plastic pot trap and drum trap) and *M. cephalus, E. lacerta* and *Tilapia zillii (*Gervais, 1848*)* - plastic drum trap and *M. cephalus* in innovated trap) given 0.7%, 0.3%, 0.3%, 0.4%, 0.3%, 0.2% and 0.2% respectively. An aggregate of 18 species from 13 families were caught in Langbasa. Additionally, 17, 14, 14, 16, 18, 13 and 16 were the number of fish species caught by big cylindrical basket trap, plastic cylindrical trap, pot trap, plastic pot trap, drum trap, plastic drum trap and innovated trap respectively. *C. nigrodigitatus* recorded the highest fish species caught by every other trap except big cylindrical basket trap whose highest catch was *S. melanoptheron.* The least fish caught by big cylindrical trap (0.6%), plastic cylindrical trap (0.4%), pot trap (0.3%), plastic pot trap (0.5%), drum trap (0.4%), plastic drum trap (0.4%) and innovated trap (0.9%) were *P. quadrifilis, E. lacerta, L. agennes, P. quadrifilis, Hemichromis fasciatus* (Peters, 1857), *E. lacerta* and *Coptodon guineensis (*Günther, 1862) respectively.

A total number of 21 fish species from 14 families were recorded from Lagos lagoon. The following percentages of *C. nigrodigitatus* in the modified traps were: 16.7%, 9.5% and 11.1% in plastic cylindrical, plastic pot, and plastic drum traps respectively; while in traditional traps a percentage of 6.6%, 13% and 7.6% were recorded in the big cylindrical basket trap, pot trap and drum trap respectively. The percentage of *S. melanotheron* observed in the modified traps were: 19.2%, 19.1% and 19.6% in plastic cylindrical, plastic pot, and plastic drum traps respectively; while in traditional traps a percentage of 19.1%, 17% and 17.4% was recorded in the big cylindrical basket trap, pot trap and drum trap respectively.

The percentage of *E. fimbriata* recorded in the modified traps were: 9.9%, 10.5% and 14.4% in plastic cylindrical, plastic pot, and plastic drum traps respectively; while in traditional traps a percentage of 10.1%, 15.8% and 9.9% was recorded in the big cylindrical basket trap, pot trap and drum trap respectively. The percentage of *B. soporator* recorded in the modified traps were: 25.7%, 21.1% and 20.3% in plastic cylindrical, plastic pot, and plastic drum traps respectively; while in traditional traps a percentage of 26.8%, 21.3% and 16.4% was recorded in the big cylindrical basket trap, pot trap and drum trap respectively.

Table 2: Effectiveness of all deployed traps based on species diversity across locations

	Species	Big Cylindrical Basket trap		Plastic Cylindrical trap		Pot trap		Plastic Pot trap		Drum trap		Plastic Drum trap	
		n	%	N	%	N	%	N	%	n	%	n	%
Abule Agege	*C. guineensis*	36	16	23	10.8	16	7.9	89	24.7	30	21.1	33	16.7
	H. fasciatus	8	3.5	6	2.8	11	5.4	6	1.7	12	8.5	12	6.1
	S. melanoptheron	23	10	22	10.3	19	9.4	39	10.8	11	7.7	15	7.6
	L. goreensis	14	6.1	6	2.8	6	3	25	6.9	7	4.9	5	2.5
	L. agennes	0	0	2	0.9	0	0	9	2.5	12	8.5	0	0
	M. cephalus	2	0.8	0	0	0	0	0	0	0	0	0	0
	B. soporator	145	63	153	71.8	132	65	176	48.8	64	45.1	130	65.7
	C. ferox	0	0	1	0.5	0	0	13	3.6	6	4.2	3	1.5
	E. lacerta	1	0.4	0	0	0	0	4	1.1	0	0	0	0
Elegushi	*C. nigrodigitatus*	15	4.2	15	4.9	7	2.1	26	5.5	4	1.2	7	1.8
	C. guineensis	17	4.8	9	3	31	9.3	42	8.9	28	8.5	16	4.1
	H. fasciatus	22	6.2	16	5.3	22	6.6	21	4.4	23	7	29	7.4
	S. melanoptheron	13	3.7	7	2.3	20	6	32	6.8	18	5.5	11	2.8
	S. mardirensis	0	0	0	0	1	0.3	0	0	0	0	0	0
	P. leonensis	4	1.1	8	2.6	2	0.6	7	1.5	17	5.2	6	1.5
	E.fimbriata	107	30	87	28.6	150	45.2	146	30.9	77	23.4	144	36.8
	L. goreensis	37	10	30	9.9	16	4.8	23	4.9	29	8.8	36	9.2
	L. agennes	4	1.1	11	3.6	10	3	9	1.9	5	1.5	5	1.3
	E. aeneus	0	0	0	0	0	0	3	0.6	3	0.9	0	0
	M. cephalus	11	3.1	11	3.6	12	3.6	29	5.8	17	5.1	19	3.8
	P. senegalensis	4	1.1	1	0.3	0	0	0	0	0	0	0	0
	P. elongates	3	0.8	0	0	0	0	7	1.5	9	2.7	10	2.6
	B. soporator	57	16	44	14.5	34	10.2	47	9.9	44	13.4	43	11
	C. senegalensis	2	0.6	8	2.6	1	0.3	3	0.6	0	0	2	0.5
	P. quadrifilis	1	0.3	3	1	0	0	1	0.2	1	0.3	3	0.8
	P. jubelini	13	3.7	14	4.6	6	1.8	19	4	11	3.3	11	2.8
	E. melanopterus	46	13	29	9.5	20	6	50	10.6	29	8.8	38	9.7
	E. lacerta	0	0	2	0.7	0	0	0	0	0	0	4	1
	C. ferox	0	0	9	3	0	0	8	1.7	14	4.3	7	1.8
Ibeshe	*C. nigrodigitatus*	41	9.8	37	9.9	40	11.7	49	8.8	21	6.7	52	12.4
	C. guineensis	9	2.2	8	2.1	13	3.8	20	3.6	34	10.8	7	1.7
	T. zilli	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2
	H. fasciatus	10	2.4	3	0.8	6	1.8	9	1.6	0	0	3	0.7
	S. melanoptheron	184	44	176	47.1	122	35.7	230	41.5	129	41.1	202	48
	L. goreensis	23	5.5	10	2.7	32	9.4	56	10.1	44	14	20	4.8
	L. agennes	3	0.7	3	0.8	1	0.3	2	0.4	0	0	0	0
	M. cephalus	0	0	0	0	1	0.3	5	0.9	0	0	1	0.2
	B. soporator	89	21	89	23.8	65	19	90	16.2	40	12.7	79	18.8
	C. senegalensis	5	1.7	5	1.3	4	1.2	7	1.3	6	1.9	3	0.7
	P. quadrifilis	0	0	1	0.3	6	1.8	2	0.4	1	0.3	0	0.0
	P. jubelini	23	5.5	23	6.1	23	6.7	41	7.4	20	6.4	30	7.1
	E. melanopterus	16	3.8	9	2.4	10	2.9	21	3.8	6	1.9	9	2.1
	E. lacerta	0	0	0	0	0	0	0	0	2	0.6	1	0.2
	C. ferox	12	2.9	10	2.7	19	5.6	22	4	11	3.5	13	3.1
Langbasa	*C. nigrodigitatus*	33	9.7	141	53.6	105	36.2	93	24.7	52	22.3	85	30
	T. guineensis	20	5.9	0	0	0	0	16	4.3	10	4.3	0	0
	H. fasciatus	17	5	0	0	0	0	4	1.1	1	0.4	0	0
	S. melanoptheron	37	11	16	6.1	37	12.8	36	9.6	19	8.2	26	9.2
	P. leonensis	0	0	0	0	2	0.7	0	0	4	1.7	0	0
	E.fimbriata	29	8.5	27	10.3	34	11.7	39	10.4	24	10.3	42	14.8
	L. goreensis	34	10	5	1.9	0	0	16	4.3	3	1.3	4	1.4
	L. agennes	5	1.5	3	1.1	1	0.3	6	1.6	6	2.6	0	0
	M. cephalus	16	4.7	7	2.7	18	6.2	18	4.8	15	6.5	16	5.7
	P. senegalensis	4	1.2	0	0	0	0	0	0	4	1.7	0	0
	P. elongates	6	1.8	7	2.7	8	2.8	11	2.9	14	6	6	2.1
	B. soporator	69	20	11	4.2	17	5.9	59	15.7	19	8.2	11	3.9
	C. senegalensis	18	5.3	12	4.6	16	5.5	22	5.9	14	6	24	8.5
	P. quadrifilis	2	0.6	4	1.5	6	2.1	2	0.5	4	1.7	7	2.5
	P. jubelini	16	4.7	11	4.2	20	6.9	8	2.1	15	6.4	15	5.3
	E. melanopterus	24	7	11	4.2	12	4.1	27	7.2	9	3.9	32	11.3
	E. lacerta	4	1.2	1	0.4	2	0.7	4	1.1	8	3.4	1	0.4
	C. ferox	7	2.1	7	2.7	12	4.1	15	4	12	5.2	14	4.9

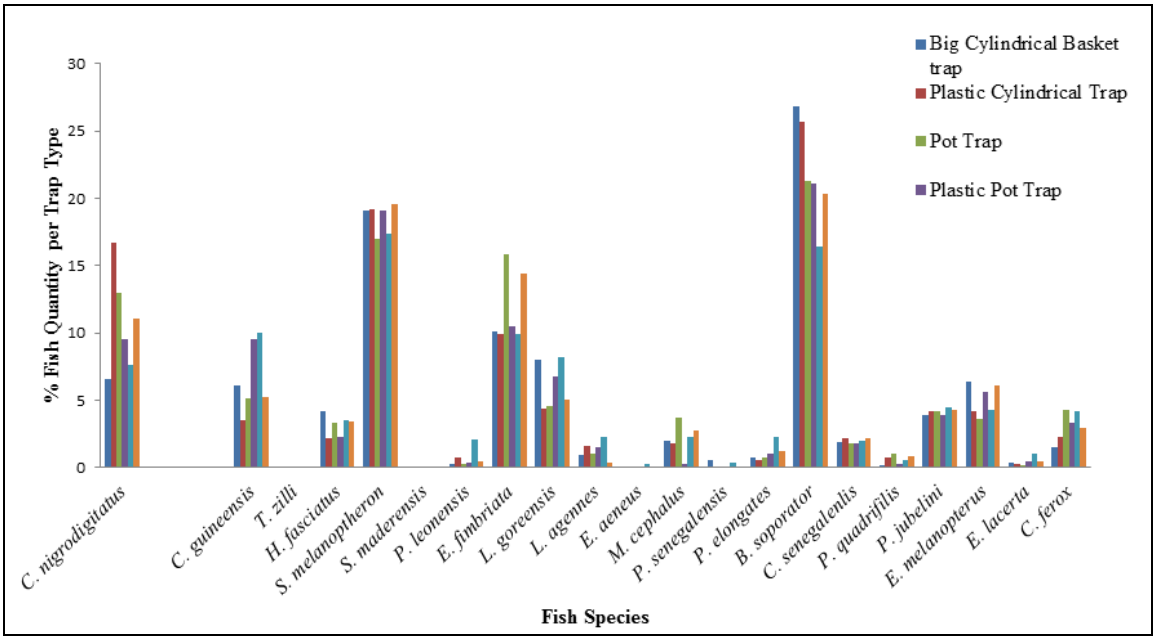

Fig 3: Specie diversity from traditional and modified trap types in Lagos Lagoon

3.3 Sex ratio and condition factors of the most abundant species from modified and traditional fishing traps across locations in Lagos lagoon.

The sex ratio (SR) and condition factor (CF) of the most abundant species across locations in the trap types in Lagos Lagoon is represented in Table 3. It was observed that the most abundant species in Abule – Agege was *B. soporator* while the most abundant species in Elegushi was *E. fimbriata*, Ibeshe had *S. melanotheron* to be the most abundant species and Langbasa reveal *C. nigrodigitatus* as the most abundant species. In Abule – Agege, the sex ratio of *B. soporator* from all trap types ranged from 77.78 to 153.85 which were observed in the plastic pot trap and drum trap respectively. The sex ratio of fish species in all trap types was noted as ratio 1:1 of male to female. The condition factor of the aforementioned species ranged from 1.37 to 1.63 which was observed from drum trap and plastic cylindrical trap respectively. The sex ratio of *E. fimbriata* ranged from 50 to 300 (2:1 and 3:1) which was observed from pot trap and plastic pot trap respectively in Elegushi while the condition factor of the species ranged from 0.55 to 1.37 from plastic pot trap and pot trap respectively.

In Ibeshe, sex ratio of *S. melanotheron* was between 37.93 to 68.97 from drum trap and plastic cylindrical trap respectively. The sex ratio of fish species from these traps was noted to be 3:1 and 1:1 from these traps respectively. The highest condition factor was noted in plastic drum trap while the least was observed from the plastic pot trap. Sex ratio of *C. nigrodigitatus* ranged from 22.37 in plastic cylindrical trap (4:1) to 92.59 in plastic pot trap (1:1) from Langbasa. Species from plastic cylindrical trap had the highest condition factor while the least was recorded from the big cylindrical trap and plastic pot trap with the value of 0.71.

Table 3: Sex ratio and condition factor of the most abundant species from trap types across locations in Lagos lagoon

Trap types	Condition Factor (CF) & Sex Ratio (SR)	AbuleAgege (*Bathygobius soporator)*	Elegushi (*Ethmalosa fimbriata*)	Ibeshe (*Sarotherodon melanotheron*)	Langbasa (*Chrysichthys nigrodigitatus*)
Big Cylindrical Basket trap	CF	1.47	0.76	1.15	0.71
	SR	110.14	87.50	46.43	50.00
Pot trap	CF	1.53	1.37	1.15	0.78
	SR	109.59	50.00	54.17	42.42
Drum trap	CF	1.37	0.60	1.08	0.96
	SR	153.85	133.33	37.93	56.72
Plastic Cylindrical trap	CF	1.63	0.72	1.11	6.22
	SR	100.00	85.71	68.97	22.37
Plastic Pot trap	CF	1.51	0.55	1.01	0.71
	SR	77.78	300.00	50.00	92.59
Plastic Drum trap	CF	1.46	0.88	1.68	0.93
	SR	106.35	75.00	44.44	30.77

SR, Sex ratio (number of male fish per 100 females); CF, condition factor

4. Discussion

All deployed traps were efficient in terms of fish weight; however the highest mean fish weight of 47.77g was recorded in the plastic cylindrical trap compared to the other traps which indicated that this trap was more efficient in terms of the total fish catch.

Bathygobious soporator was more represented in catches during the sampling period with the highest catch of this species recorded in the big cylindrical basket, followed by the plastic cylindrical trap from Abule Agege. However, from the

economical point of view, *Chrysichthys nigrodigitatus* (which was the most abundant fish species caught by the plastic cylindrical trap) could be the most important fish species caught by the artisanal fisherfolks as a result of its high commercial market value in Lagos Lagoon. This is in agreement with Yosvani and Olatunbosun [22] who reported that the new type pot was more efficient than conical and carapax pots in catching the rock crab which is of good commercial value in the seafood market of Iceland.

The most abundant species (*Bathygobious soporator*) was dominant in Abule Agege as a result of the brackish water condition present in this station that favours the abundance of this species. The second most abundant species was *Sarotherodon melanotheron* which was more abundant in Ibeshe station. However, this was not in agreement with Emmanuel and Ogunwenmo [23] who reported *Sarotherodon melanotheron* as the most abundant species in Abule Agege. The highest catch of this species was observed in the plastic drum trap (19.6%) followed by the plastic cylindrical trap (19.2%). The least percentage of this species was recorded from the pot trap.

Only a single species of *Tilapia zilli* was caught by plastic drum trap from Ibeshe station. Though, this species is noted as a fresh water species; however, the low number of this species present in Lagos lagoon could be as a result of freshwater incursion from adjacent fresh water bodies. High rainfall is also a key factor which affects salinity of the water body, hence, reducing salinity level and allowing freshwater species to thrive occasionally. This is in agreement with Soyinka and Ebigbo [24] who reported that variation in species present may be due to migrating fishes from the adjacent water bodies.

Traps constructed with plastics are of great advantage as they have a lighter weight, can be easily handled by fisher folks, easier to transport to the fishing site and it occupies less space as it can be easily stacked together while transporting with canoe to the fishing ground. This was in agreement with Yosvani and Olatunbosun [22] who reported that the new type pot was more efficient than the others and also handles better and occupies less space on deck.

The condition factor (K) values of *Bathygobious soporator* recorded at Abule Agege were greater than 1 especially the species caught by the plastic cylindrical trap (1.63). In the same vein, the K values of *Sarotherodon melanotheron* were also greater than 1 in all the traps in Ibeshe most especially in the plastic drum trap (1.68) which indicates that the fish were above average condition within the Lagoon. The K value recorded in both stations agrees with the values reported by Ayoade and Ikulala [25].

At Elegushi, the condition factor values (K) of *Ethmalosa fimbriata* caught by all the traps were less than 1 except that of the pot trap which had a value of 1.37. Also, in Langbasa, all the K values of *Chrysichthys nigrodigitatus* were less than 1 except that of the plastic cylindrical trap which had a value of 6.22 which was the highest condition factor value across all the stations during the sampling period. The K values of species caught by the plastic cylindrical trap stands as the best among all the other traps especially the K value of *Chrysichthys nigrodigitatus* (6.22) from Langbasa station. This may be as a result of the material (plastic) the trap is made up of; which will keep the fish unharmed even when caught, unlike the traditional traps.

5. Conclusion

Among all the fishing traps, the plastic cylindrical trap (modified trap) was most efficient than other modified traps and all the traditional traps, in terms of maximizing the catches and fish weight. The use of the plastic cylindrical trap could assist fishery management scientists in carrying out ecological studies in line with the strategies of conservation and management.

6. References

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