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INFLUENCE OF NUMBER OF VALVES ON CATCH COMPOSITION OF A FISHING POT TRAP (*LEGE*) IN RIVER RIMA, NORTH WESTERN NIGERIA

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ABSTRACT

Three types of prototype (*Lege*) traps with different numbers of entrance valves were evaluated in River Rima, North Western Nigeria. The traps contained 4,6 and 8 valves, tagged 4-V, 6-V and 8-V, respectively. The experiment was carried out in a randomized complete block design with one factor each replicated three times. Data collected on fish diversity, number, biomass and sizes were subjected to descriptive statistics and analysis of variance. The results of the catch composition showed close diversity index of 0.86 for 6-V, 0.80 for 8-V and 0.60 for 4-V *Lege* traps. However, the number (41 %) and biomass (48 %) of fish caught in the 6-V *Lege* trap were significantly ($P < 0.05$) higher than those caught in the other traps. There was no definite trend in the sizes (length and girth) of fish caught in the traps. On the basis of species diversity, and the number and biomass of fish caught, the 6-V *Lege* showed preference for adoption than the other two traps. However, further studies are recommended on the appropriate mesh size net for the trap in line with the provisions of fisheries edicts.

INTRODUCTION

The fishing gear and techniques employed in artisarnal fisheries, such as in the inland freshwater of Nigeria, are known to be labour intensive with low catch per unit effort and low income to the fishermen. Therefore, improvement on the fishing gears, particularly the traditional ones, or development of new and more efficient gear, is highly desirable. However, the improvement or development of a new gear should be made in such a way that the materials are locally available, the design is simple to copy and cheap. The improved or new gear should also be more efficient and, at the same time, ensure conservation of fisheries resources unlike the conventional ones being used .

Ipinjolu *et al.* (2004) conducted an exploratory survey of the *Malian* and *Ndurutu* traps widely used in northwestern Nigeria. Based on the findings in the study, a new fishing pot trap, chistened *Lege* trap, was developed as reported by Agbelege *et al.* (2004). The report showed that the new trap was more efficient than the *Malian* and *Ndurutu* traps. The better performance of the new trap was attributed mainly to its 8 non-return valves (7 inlet and one inner valves) compared to the *Malian* with 3 inlet valves and *Ndurutu* with one inlet and another inner valve that lead to the inner chamber.

Provision of valves in traps involves costs on materials and labour. Therefore, this study was aimed at optimizing the number of valves in *Lege* trap through comparative assessment of the catches of three types of the trap having 4, 6 and 8 valves

MATERIALS AND METHODS

Study Area

This study was conducted in River Rima around Sokoto, Sokoto State in the north western part of Nigeria. The State, located in the extreme northwestern corner of Nigeria lies

within the Sudan Savannah zone where water constitutes the most limiting resource to development including food production. The climatic characteristics of the area have been earlier described (Mamman *et al.*, 2004 ; Ipinjolu *et al.*, 2004 ; Agbelege *et al.*, 2004). River Rima is the most important perenial river network in the northwest of Nigeria (Umar and Ipinjolu, 2001). The experiment was conducted in the river at Kwalkwalawa along the road to the main campus of Usmanu Danfodiyo University, Sokoto.

The *Lege* Traps

Three types of *Lege* trap with 4,6 and 8 non-return valves (V) were fabricated and tagged as 4-V and 6-V and 8-V *Lege* trap, respectively. In the 4-V trap, there were no side valves at either of the chambers while the 6-V had side valves only on the second chamber. The 8-V *Lege* was as described in the preceding paper (Agbelege *et al.*, 2004). The traps were fabricated following the configuration and specifications of the 8-V trap Agbelege *et al*. 2004), except for the number and position of the non-return valves on the sides of the traps A total of nine traps, three of each type were fabricated.

Setting, Baiting and Inspection of Traps

The design of the experiment was the randomised complete block design (RCBD) with one factor (trap type) at three levels, each replicated three times. Each of the nine traps was baited with two balls of *bulla* (local bait) in the first chamber and one in the second chamber They were tagged and randomly set in the littoral zone of River Rima on the same day and at the same time. The traps were anchored to the ground using stones and stakes. Rebaiting was done after every inspection. The inspection of traps also involved cleaning and repairs of damages of the traps before resetting.

Collection and Analysis of Data

The traps were inspected on alternate days (between 3.30 pm and 4.00 pm) and catches were recorded for each trap. Fish caught were counted and species identified following the descriptions of Reed *et al.* (1967), Holden and Reed (1972) and Olaosebikan and Raji (1998) Total length (cm) was measured on a graduated measuring board, while the total weight (g) was obtained using a spring balance of 1 kg maximum capacity. The data collected were subjected to simple statistical analysis using mean, standard deviation and percentage Analysis of variance (ANOVA) was carried out using the Statistical Package for the Social Sciences (SPSS, 1999).

RESULTS

Species Composition

The various types of fish caught in the three types of the *Lege* trap are shown in Table 1. A total of 15 fish species belonging to nine families was recorded. Mormyridae and Mochokidae families were each represented by four and three species, respectively, while the family Bagridae was represented by two species. The other six families had one species each.

Table 1: Composition of fish caught in the different types of *Lege* traps

Family	Species	Trap Type		
		4-VLege	*6-VLege*	*8-Vlege*
Clariidae	***Clarias gariepinus***	X	X	X
Mormyridae	*Gnathonemus cyprinoides*	-	X	X
	Marcusenius isidori	X	X	X
	Hyperopisus bebe occidentalis	-	-	X
	Mormyrus rume	X	X	-

Mochokidae	*Synodontis clarus*	X	X	X
	Synodontis eupterus	X	X	X
	Synodontis gobroni	-	X	-
Cichlidae	*Oreochromis niloticus*	X	X	X
Bagridae	*Bagrus bayad*	X	X	X
	Clarotis laticeps	-	X	X
Citharinidae	*Citharinus distichodoides*	-	X	-
Characidae	*Alestes nurse*	X	X	X
Schilbeidae	*Schilbe mystus*	X	X	X
Malapteruridae	*Malapterurus electricus*	-	-	X
Total Species	15	9	13	12
Diversity Index		0 60	0 86	0 80

X=Recorded
-=Nil recorded

Out of the 15 fish species caught in the three Lege traps 13 were caught in the 6-V *Lege* trap, giving a species diversity index (SDI) of 0 86 This was almost the same with the SDI of 0 80 obtained for the 8-V *Lege*, but higher than the value of 0 6 for 4-V *Lege* trap The types of species caught in the three traps were the same except *M rume* that was not caught in the 4-V trap

Number of Fish Caught

The number and proportion of each fish species caught in the traps are shown in Table 2. A total of 515 fish was caught, out of which about 25 and 35 % were caught in 4-V and 8-V *Lege* traps respectively *O niloticus* accounted for the largest proportion of the fish caught in the three traps Among the species caught in 4-V trap, *S clarias* and *O. niloticus* accounted for 35 and 31 % respectively In the 6-V trap, the two species accounted for lower roportions of 33 and 22 %, respectively In the 8-V trap, *S clarias* accounted for a higher proportion (37 %) than the other two traps The distribution of the number of fish caught showed that *S. clarias*, *O. niloticus*, *B. bajad* and *C ganepinus* accounted for 35, 25, 11 and 10 %, respectively. The numbers of fish caught in the three types were significantly different ($P < 0.05$) from each other (Table 3).

Biomass of Fish Caught

Values for the biomass of the fish caught in the three traps are contained in Table 2. A total of 37 68 kg was caught, of which the largest biomass (48 4 %) was caught in the 6-V trap. The 4-V and 8 V traps accounted for about 20 and 32 % of the total biomass of fish caught, respectively. Tilapia (*O niloticus*) dominated the catches and it accounted for 55 4, 30 7 and 34 6% of the biomass of fish caught in the 4-V, 6-V and 8-V traps, respectively with overall mean of 36 8%. The biomasses of fish caught in the 4-V and 8-V *Lege* traps were not significantly ($P > 0.05$) different from each other, but both were significantly lower than the biomass of fish caught in the 6-V *Lege* trap ($P < 0.05$) (Table 3).

Table 2

Table 2: Number and biomass (g) of fish caught in three different types of *Lege* trap

Species	Traps										
	4-Lege				*6-Lege*				*8-Lege*		
	No.	%	Biomass	%	No	%	Biomass	%	No	%	Biomass
C. gariepinus	8	6.25	606	8.20	26	12.44	2553	14.02	18	10.11	1359
G. cyprinoids	-	-	-	-	2	0.96	250	1.37	1	0.56	50
M. isidori	1	0.78	5	0.07	3	1.43	29	0.16	2	1.12	14
H. bebe	-	-	-	-	-	-	-	-	2	1.12	353
M. rume	2	1.56	151	2.04	8	3.83	1186	6.51	-	-	-
S. clarias	46	35.94	1373	18.58	68	32.54	2431	13.35	65	36.52	2254
S. eupterus	6	4.69	255	3.45	8	3.83	347	1.91	6	3.37	242
S. gobroni	-	-	-	-	2	0.96	403	2.21	-	-	-
O. niloticus	40	31.25	4090	55.36	45	21.53	5591	30.70	44	24.72	4166
B. bajad	8	6.25	444	6.01	24	11.48	2553	14.02	23	12.92	2396
C. laticeps	-	-	-	-	3	1.43	730	4.01	3	1.69	730
C.distichodoides	-	-	-	-	2	0.96	1530	8.40	-	-	-
A. nurse	5	3.91	166	2.25	10	4.78	411	2.26	3	1.69	89
S. mystus	12	9.39	298	4.03	8	3.83	196	1.08	10	5.62	287
M.electricus	-	-	-	-	-	-	-		1	0.56	100
Overall	128	100	7388	100	209	100	18210	100	178	100	12040
%		24.85		19.63		40.58		48.38		34.56.	

Table 3: Mean number and biomass of fish caught in the three types of *Lege* trap

Parameter	Trap type	No. of Catches*	Total Fish No.	Mean	SD	Min	Max
Number	4-V	39	128	3^{c}	1 07	2	5
	6-V	41	209	5^{a}	1.69	2	9
	8-V	42	178	4^{b}	1.76	1	9
Biomass	4-V	39	128	$189\ 44^{b}$	106 30	60	564
	6-V	41	209	442.20^{a}	322 52	55	1295
	8-V	42	178	286.67^{b}	199 65	32	833

Means in the same column with same letter are not significantly different ($P > 0.05$)
*No of time of fish collection from the traps.

Length of Fish Species

Table 4 shows the summary of the mean lengths (cm) of the various fish species caught in the traps There was no definite relationship between the lengths of the various species caught and the trap types. The lengths of the fishes caught reflect more of species morphology and size than the effects of the trap type The *C. gariepinus* and *B. bajad* were significantly longer ($P < 0.05$) than those of the other fish species caught in the 4-V trap. In the 6-V trap. *M. rume* was significantly longer ($P < 0.05$) than the other species. while in the *8-v Lege*, *B. bayad* and *C gariepinus* had lengths that were significantly higher ($P < 0.05$) than the lengths of the other fish species (Table 5).

Weight of Fish Species

Table 6 presents the weights of some of the fish species caught in the three *Lege* traps The mean weight of fish caught in 4-V trap was 57.86 ± 48 84 g. *O. niloticus* had the highest mean weight of 102.25 ± 55.71 g. In the 6-V trap, *M. rume* had the highest mean weight of 148 25 ± 101 84 g. while the overall mean weight of fish caught in the trap was 77 50 ± 65 87 g. In the 8-V trap, *B. bayad* had the highest mean weight of 104.17 ± 74 99 g while the overall mean weight recorded for the trap was 64.48 ± 46.26 g. Therefore. the weight of each fish species recorded was influenced by its length and not necessarily the

Table 4: Minimum, maximum and mean total lengths (cm) of fish caught by the three types of *Lege* trap

Species	Type of *Lege* trap										
	4-Valves				6-Valves				8-Va		
	No.	Min.	Max.	Mean ± SD	No.	Min.	Max.	Mean ± SD	No.	Min.	Ma
C. gariepinus	8	15.00	25.00	20.37± 3.29	26	13.0	32.00	20.50 ± 4.93	18	14.00	27.(
M. rurme					8	17.0	38.00	25.19 ± 7.42			
S. clarias	46	8	16.00	11.72 ± 1.95	68	9.0	16.00	12.30 ± 1.80	65	8.00	16.(
S. eupterus	6	12	13.00	12.58 ± 0.49	8	12.0	13.00	12.31 ± 0.46	6	12.00	13.(
O. niloticus	40	9	40.00	18.37 ± 5.18	45	9.0	30.00	19.39 ± 5.61	44	9.00	27.(
B. bayad	8	15	30.00	19.81 ± 5.85	24	14.0	33.00	22.75 ± 6.31	23	14.00	33.5
A. nurse	5	10	15.00	13.00 ± 2.00	10	10.0	16.00	13.35 ± 2.38			
S. mystus	12	12	17.80	15.11± 2.23	8	12.0	19.00	14.56 ± 2.47	10	12.00	20.5
Total	125	8.00	40.00	15.34 ± 4.93	197	9.00	38.00	16.94 ± 6.13	16 6	8.00	33.5

Table 5: Mean lengths, weights and girths of the various fish species caught in the different types of *Lege* traps

Parameter	Species	Traps		
		4-*Lege*	6-*Lege*	8-*Lege*
Length	*S. mystus*	15.11^{ab}	14.56^{c}	15.20^{c}
	S. clarias	11.72^{c}	12.30^{c}	11.80^{d}
	A. nurse	13.00^{c}	13.35^{c}	-
	S. eupterus	12.58^{c}	12.31^{c}	12.17^{d}
	B. bayad	19.81^{a}	22.75^{ab}	22.96^{a}
	C. gariepinus	20.37^{a}	20.50^{b}	20.50^{a}
	O. niloticus	18.37^{ab}	19.39^{b}	17.92^{b}
	M. rume	-	25.19^{a}	-
Weight				
	S. mystus	24.83^{c}	24.50^{c}	28.70^{c}
	S. clarias	26.85^{c}	35.75^{c}	34.68^{c}
	A. nurse	33.20^{c}	41.10^{c}	-
	S. eupterus	42.50^{c}	43.37^{c}	40.33^{c}
	B. bayad	55.50^{ab}	106.37^{b}	104.17^{ab}
	C.gariepinus	75.75^{ab}	98.19^{b}	75.50^{b}
	O. niloticus	102.25^{a}	124.24^{ab}	94.98^{ab}
	M. rume	-	148.25^{a}	-
Girth				
	A. nurse	3.50^{b}	3.63^{c}	-
	S. clarias	3.65^{b}	3.98^{bc}	3.86^{c}
	C.gariepinus	3.81^{b}	4.24^{bc}	4.08^{c}
	B. bayad	4.12^{b}	4.98^{b}	5.20^{b}
	S. mystus	4.26^{b}	3.90^{c}	3.97^{c}
	S. eupterus	4.50^{b}	4.00^{bc}	4.00^{c}
	O. niloticus	6.30^{a}	6.74^{a}	6.52^{a}
	M. rume	-	6.79^{a}	-

Means in the same column with same letter are not significantly different (P>0.05) trap type. In the 4-V trap, the weight of *O. niloticus* was significantly heavier (P < 0.05) than the other species caught in the trap, while in the 6-V trap, the mean weight of *M. rume* was significantly higher (P < 0.05) than those of the rest species in the trap. In the 8-V trap, *B. bayad* had a significantly higher (P < 0.05) mean weight than the other species trapped in the gear (Table 5).

Girth of Fish Species

Table 7 contains the summary of the girth lengths of fish species caught in the three *Lege* traps. *O. niloticus* had a mean girth length of 6.30 ± 1.41 cm, which was significantly higher (P < 0.05) than those of the other species caught in the trap. However, the mean girth

Table 6. Mean total weight of fish caught by the three types of *Lege* trap

Species	Type of *Lege* trap										
	4-Valves				6-Valves				8-Valve		
	No.	Min.	Max.	Mean ± SD	No.	Min.	Max.	Mean ± SD	No.	Min.	Max
C.Gariepinus	8	50.00	120.00	75.75 ± 29.75	26	20.00	280.00	98.19 ± 70.42	18	30.00	160
M.Rume					8	78.00	360.00	148.25 ± 101.84			
S .clarias	46	10.00	49.00	29.85 ± 10.43	68	10.00	52.00	35.75 ± 8.94	65	12.00	55.(
S .enpterus	6	35.00	50.00	42.50 ± 8.24	8	40.00	50.00	43.37 ± 3.54	6	30.00	50.(
O niloticus	40	15.00	350.00	102.25 ± 55.71	45	15.00	260.00	124.24 ± 61.41	44	20.00	150
B. bayad	8	20.00	160.00	55.50 ± 61.56	24	22.00	240.00	106.37 ± 79.83	23	15.00	250
A. Nurse	5	18.00	50.00	33.20 ± 13.75	10	20.00	59.00	41.10 ± 14.49			
S. Mystus	12	10.00	39.00	24.83 ± 10.45	8	15.00	45.00	24.50 ± 11.11	10	10.00	80.(
Total	125	10.00	350.00	57.86 ± 48.84	197	10.00	360.00	77.50 ± 65.87	166	10.00	250

Table 7

Table 7 Summary of the girth lengths (cm) of fish caught in the three types of Lege trap

Species	Type of *Lege* trap											
	4-Valves				6-Valves				8-Valves			
	No.	Min.	Max.	Mean ± SD	No.	Min.	Max.	Mean ± SD	No.	Min.	Max.	Mea
C. gariepinus	8	3.00	6.00	3.81 ± 1.13	26	2.00	8.00	4.24 ± 1.43	18	2.00	8.00	4.08
M. rume					8	4.50	10.50	6.79 ± 2.46				
S. clarias	46	2.00	5.00	3.65 ± 0.80	68	2.50	5.00	3.98 ± 0.74	65	2.00	5.00	3.86
S. eupterus	6	4.00	5.00	4.50 ± 0.55	8	3.50	5.00	4.00 ± 0.46	6	3.50	4.50	4.00
O. niloticus	40	3.00	9.00	6.30 ± 1.41	45	3.00	10.00	6.74 ± 1.58	44	4.00	9.00	6.52
B. bajad	8	3.00	6.00	4.12 ± 1.22	24	3.00	6.50	4.98 ± 1.21	23	3.00	7.50	5.20
A. nurse	5	2.50	4.00	3.50 ± 0.71	10	2.30	4.00	3.63 ± 0.63				
S. mystus	12	3.00	5.00	4.26 ± 0.86	8	3.00	5.00	3.90 ± 0.73	10	3.00	6.50	3.97
Total	125	2.00	9.00	4.63 ± 1.58	197	2.00	10.50	4.86 ± 1.69	166	2.00	9.00	4.79

lenghts of all other fish species were not significantly different ($P < 0.05$) from each other. In the 6-*v Lege* trap, *O. niloticus* and *M. rume* had mean girth lengths of 6.74 ± 1.58 and 6.79 ± 2.46 cm, respectively. Both were significantly higher ($P < 0.05$) than the mean girth lenghts of all the other fish species caught in the trap (Table 5).

DISCUSSION

There was close similarity in the effectiveness of the three types of the *Lege* trap in fish trapping. Their modifications could not have had much inlfuence on the types of fish species caught. However, the absence of side valves in the 4-V trap appeared to be the only reason that could be advanced for its comparatively lower species diversity. There is no sufficient evidence from the results to indicate higher trapping efficiency of any of the traps for any species. The presence of certain species, such as *M. isidori, S. clarias, B. bayad, Alestes sp.* and *Schilbe* sp. in all the three traps may probably suggests their more relative abundance than the other species as at the time of the study. The diversity of the fish caught in the three traps in the littoral zone of the water body further indicates the significance of the zone in fishing.

Twenty one fish species and species diversity index (SDI) of 0.9 were obtained for 8-V *Lege* trap in earlier sampling in the same water body (Agbelege *et al.* 2004, and those are higher than the values recorded with the trap in the present study. This could be attributed to differences in time of sampling, season and relative abundance of the fish species.

The main thrust of this study was to rationalise and optimise the number of valves of the traps with a view to reducing cost without sacrificing much on the quantity and quality of fish caught. The results showed that 6-V trap recorded the highest number of fish caught. This trap had side valves only on the first chamber while the 8-V trap had valves on the two chambers. The fact that the 6-V trap caught more fish than the 8-V trap deserves further scrutiny. The results obtained from the 8-V trap did not follow the logic of 'the more the valves, the higher the number of fish to be caught'. It rather indicated a disadvantage. The adverse effect of having an entrance valve on the second chamber could have arisen from the fact that most of fish caught congregated in this chamber. As such, overcrowding of fish in this chamber could have interfered with the setting and arrangement of the valves, resulting in possible escape of some fish through the valve. Perhaps, the design, nature of materials and positioning of the second chamber valves call for further investigations.

The results on the sizes of fish caught showed the ability of the three traps to catch small-size and large-sized commercial fishes. The latter could be due to the presence of the 17 cm diameter central valve at the front of the traps. Since the difference between the three traps was only in the number of entrance side valves, not much differences were expected in the sizes of fish species caught. Generally, the size range (length) of the individual fish caught in the three traps (Table 4) contravened Section 3 (a) of the Sokoto State Fisheries Edict of 1988 which prohibits the catching of individuals such as *Hyperopisus* and *Bagrus species* shorter than 30 cm and *Tilapia* shorter than 12 cm. It is also to be noted that the net mesh size of the three traps (25.3 mm or 1 inch) is the one used by the artisanal fishermen in the study area. This also contravenes Section 4 No. 1 (d) of the State's Edict, which prhibits the use of webbing traps less than 51 mm (2 inches) mesh size. Therfore, it is expected that the next phase of this development process will focus on the optimum net mesh size for the trap.

CONCLUSION

In this study, three types of *Lege* traps with 4, 6 and 8 valves were compared for efficiency. The three traps demonstrated the ability to trap fish species of different types of habits

and habitats and also showed close ties in their effectiveness in fish trapping. The lower species diversity recorded for the 4-V trap could have been due to the absence of side valves. The findings from this study showed that; of the three traps, the 6-V trap recorded the highest number and biomass of fish caught. Based on the main thrust of this study, which was to assess the influence of number of valves on catch composition, with a view to reducing cost, and taking into consideration the quantity and sizes of fish catch, the adoption of the *6-v Lege* trap is recommended. However, there is the need to modify the mesh size used in constructing the trap to prevent the trapping of under-sized and juvenile fish.

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