Comparative fishing trials of pot and ring traps for catching blue crab in Elechi Creek, Nigeria.

Eyo Ambrose* and Isangedighi Isangedighi

Department of Fisheries and Aquatic Environmental Management, University of Uyo, PMB 107, Uyo Akwa Ibom State, Nigeria
*Corresponding Author, E-mail: eyo.ambrose@yahoo.com

Abstract: Comparative fishing trials of a newly developed pot with ring trap for catching blue crab, *Callinectes amnicola* species was carried out in Elechi creek, Rivers State of Nigeria. The newly developed pot trap has a conical shape, broadened at the base (43.5cm) and tapers at the top (30cm). The mouth aperture (15cm) is a plastic collar recessed in the entrance. The trap is covered by polyamide netting. The metal frames are galvanized iron and are made into four hoops. The ring trap is a bag of netting attached to an iron rim. Fishing trials were conducted from January to December, 2015. Fifteen replicate landings were obtained from both gears for analysis. Comparative field evaluation of the two crab fishing gears showed that the ring net trap caught more crab (16.339kg) than the pot trap (3.5309kg). T-test paired comparison detected a significant ($P< 0.01$) difference in the weight of crab landed by pot rap and ring net. Test of significant using ANOVA showed that there is no difference in the weight of crab caught between soaked period of 5 to 30minutes in both ring trap and pot trap (F-test, $p> 0.05$, 0.01). Ring net and pot trap soaked for a period of 10minutes caught more crab respectively 3.8576kg and 0.8446kg than all other soak periods. The least weight of crab from ring net and pot trap were 1.5562kg and 0.2591kg caught respectively at a soaked periods of 30minute and 15minutes.
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1. Introduction

Fishing traps are commonly used in rivers, estuaries and lagoons. It is operated at low tide period. In Nigeria, traps are mainly used along the coastal zones to catch fin fishes and shell fishes, one of the shell fishes which is highly vulnerable to trap gear is the swimming blue crab *Calinectes amnicola.* Skills can be acquired by practice. The performance of the gear can be improved by better design hence, the need for this work. Fishing gear is best designed and fabricated to suit different local fisheries. However their efficiency is dependent on the skills and experience of the operator. (Brandt,1984). Ring lift net is one of the most widely used artisanal fishing gears in Nigerian brackish and coastal waters. In most artisanal fisheries, ring lift net often constitute about 50-60% of the total fishing gears in use (Solarin and Udolisa, 1978). The design varies from circular to rectangular shape and are made with materials like bicycle wheels, metals rim and wood depending on the user and the locality.

Although crabs come in a variety of shapes and sizes they all have the same general body plan. All crabs have one pair of cheliped and four pairs of walking legs. Also referred to as claws nippers or pincers, the cheliped are the first pair of legs on a crab and their most distinguishing structure, cheliped are used for holding and carrying food, digging, cracking open shells and warding off would be attackers. The carapace is the hard cover or exoskeleton which protects the internal organs of the head, thorax and gills. (Abby-Kalio, 1982). Crab enters the estuary at the megalopa stage when they are carried by water current. These species are sought for because of their sweet, delicately flavoured meat and it is a good source of protein and mineral, which are necessary in human diet as well as animal feeds (Hadden, 2002). In various parts of the world swimming crabs are exploited and utilized as food by both the low and high strata of the same society.

The crab form an important commercial species second in value and demand to shrimp among all the shell fishes consumed in Nigeria. Despite these, its production figure is very low and has been declining over the years from 68 metric tones (MT) in 1988 to 28 MT in 1994 and 78MT in 1998 to 45MT in 2007 (FDF, 2007). These production figures are very low to match Nigeria teaming population. The declining trend is not an indication of resources limitation, but poor fishing techniques like the conventional ring net. There is need to develop an efficient fishing gear and method for small scale crab fisheries exploitation in coastal waters (estuaries, creeks and lagoon) to bridge the wide gap between demand and production. The present research was therefore conducted with a view to: (1). Making a comparative study of the efficiency of conventional crab ring net and newly developed pot trap in catching the swimming crab *Callinectes species*

in brackish coastal water. (2). Determining the weight of crab caught by the newly developed pot trap per setting duration or soak periods of 5, 10, 15, 20, 25 and 30 minutes.

2. Materials and methods

2.1 The Study Area

The project was carried out at Elechi creek, Rivers State, Nigeria. The site lies between longitude 6^0 45' and 7^0 20'E latitude 4^0 34' and 5^0 5' N. it is situated at the upper limits of Bonny estuary and include its adjoining mangrove creeks situated near the Eagle Island by the River State University of Science and Technology, Nkpolu, Port Harcourt. The vegetation is predominantly (Mangrove) *Rhizophora species and Nypa species.*

2.2.1 Design and Construction of Ring Net

It was constructed by attaching a netting bag of polyamide (PA) material with mesh sizes of 25mm to an iron rim (hoop) of diameter 40cm (Udolisa, *et al,., 1994).*The length of the bag is 30cm. At the apex, empty shells of clam were attached to serve as sinkers. A retrieval twine rope of length 6m which carries an indicator buoy at the other end is attached to the sides (circumference) of the iron rim by three polyethylene (PE) ropes.

2.3 Design and Construction of Pot Trap

The materials used in the construction of the new pot gear are cheap and locally available. Each of them has a closed substitute. Iron rod, aluminum rod, stainless steel rod, and cane wood, all serve the same framing function. In this construction iron rod was used because it is the cheapest. Poly ethylene (PE) was used as a frame cover material. Plastic with a diameter of 10cm serve as trap mouth. The design and construction of the pot gear was done as described by FAO (1975). The steps involved were, drawing of different design models of prototype pot gear, fabrication and assemblage of parts (netting, hoop, collar and side rods), and recording of the designs features and taking picture of the fabricated pot gear.

2.4 Fishing Operation with Ring Net

The ring net was operated by two men from a canoe. The net after baiting with dead and rotten fish, or newly killed premature goat was set at the bottom of the water with the aid of retrieval rope. It was soaked for 10 minutes. On recovering, the gear was lifted with the aid of the retrieval rope and the catches pull immediately on to canoe.

2.5 Fishing Operation with Pot Trap

The pot trap developed was used in a daily (6am to 4am) fishing in the creek. The frequency of operation was once per week. The baits were freshly killed premature goat (200-500g) enclosed in a perforated polyethylene bag. This was suspended from the entrance of the pot trap. Lifts were made at soak intervals of 5, 10 15, 20 25, and 30 minutes to check the catches.

2.6 Collection of Catch Data

The total crabs caught by both the ring net and pot trap were counted and weighed separately. The crab caught by the ring net and pot trap at each soak periods of 5, 10 15, 20 25, and 30 minutes were recorded, for each of these treatments, 15 replicate landings were used in the analysis. Thus, a total of (90) homogenous experimental units w re used.

2.7 Analysis of Catch Data

a. T- test was used to test the hypothesis that the total weight of crabs caught from the ring net and pot trap do not differ.

b. A one way analysis of variance was used to test the hypotheses that the weight of crab caught by the pot trap and ring net at each soak period of 5, 10, 15, 20, 25, 30 minutes do not differ.

3. Result

3.1 Quantity of Crab Caught by Ring Net and Pot Trap

The species of crab exploited in the study area is the blue crab *Callinectes amnicola.* The results of this study are presented in tables 1, 2 and 3. The ring net trap caught more blue crab 16.33395kg with mean weight of 1.0893kg as compared with the pot trap which caught 3.5309lg of crab (Table 1). Significant differences was detected on the weight of crab caught by both fishing gears at probability levels of $xp< 0.05$; $xp<0.01$.

3.2 Weight of Crab Caught by Ring Net at Different Soaked Periods

The target species for both the ring net and pot trap are the swimming crab (blue crab) *Callinects species.* Ring net soaked for a period of 10 minutes caught more crab (3.857kg) than all other soak periods. The least weight of crab (1.5862kg) was caught at a soak period of 30 minutes by ring net (Table 2). Also analysis of variance (ANOVA) showed that there is no significant difference ($p>0.05$) in the weight of crab caught by ring net trap between the soak periods of 5 to 30minutes.

3.3 Weight of Crab Caught by POT Trap at Different Soaked Period.

It was observed from table 3 that pot trap soaked for a period of 10 minutes caught crab weighing 0.8446kg as the highest weight followed by 30 minutes while the least weight of crab (0.2591kg) was caught at a soak period of 15 minutes by pot trap. Test of significance using ANOVA detected that there is no difference in the weight of crab caught between soak period of 5-30mins in the newly developed pot trap F-cal 1.23< F-tab (2.37) at $P< 0.05$.

Table 1: Total and mean weights of crab caught by ring net (RN) and pot trap (PT) that was used for T-test paired comparison (n=15); PT versus RT;*p<0.05; **p0.01; *yp* >0.05; *yyp* >0.01

Replications	Ring net weight of crab (kg)	Pot trap weight of crab (kg)
1.	0.6027	0.109
2.	0.632	0.0956
3.	1.3235	0.1895
4.	0.8007	0.1493
5.	1.0055	0.2192
6.	1.3224	0.1091
7.	1.3737	0.2707
8.	0.9501	0.634
9.	1.513	0.2745
10.	1.002	0.3666
11.	0.5094	0.2022
12.	0.1518	0.3127
13.	1.4003	0.319
14.	1.8532	0.1613
15.	0.8992	0.1182
Total	16.3395	3.5309
Mean	1.0893	0.2353 ***

Table 2: Summaries of total and mean weights of crab caught by ring net a different soak periods of 5-30minutes that was used for F- test analysis (n=5)

No. of replication	**5min**	**10min**	**15min**	**20min**	**25min**	**30min**
1.	0.1634	0.1584	0.1339	0.1031	-	0.0439
2.	0.0709	0.1412	0.1546	-	0..106	0.1593
3.	0.198	0.3169	0.2089	0.2909	0.1479	0.1599
4.	0.1792	0.1931	-	0.222	0.2064	-
5.	0.29	0.2415	0.185	0.1975	-	-
6.	0.1071	0.383	0.203	0.1975	0.3149	0.1139
7.	0.2887	0.322	0.222	0.219	0.1825	0.1758
8.	0.2214	0.2471	0.1259	0.2507	0.105	-
9.	0.1428	0.2308	0.2533	0.2701	0.388	0.228
10.	0.1645	-	0.2257	0.1045	0. 3064	0.2009
11.	0.1591	01173	-	0.0929	0.114	-
12.	0.2603	01281	0.1341	0.4059	0.1226	0.1008
13.	0.3104	0.5288	0.1405	0.0538	0.1757	0.1911
14.	0.2929	0.5399	0.1488	0.3379	0.3481	0.1866
15.	0.0579	0.3095	0.175	0.2454	0.1116	-
Total	**2.9066**	**3.8576**	**2.3107**	**3.0877**	**2.6291**	**1.5562**
Mean	**0.19377333**	**0.25717333**	**015404667**	**0.20584667**	**0.17527333**	**0.10374667**

Table 3: Summaries of total and mean weight of crab caught by pot trap at different soak periods of 5-30minute that was used for F-test analysis (n=15)

NO. OF REPLICATION	5MIN	10MIN	15MIN	20MIN	25MIN	30MIN
1.	-	-	0.0505	0.022	-	0.031
2.	0.0288	-	0.0267	0.0129	-	0.0406
3.	0.0279	0.0688	-	0.055	0.0483	0.015
4.	0.0627	0.047	-	0.0167	0.0229	-
5.	0.0232	0.019	-	0.063	0.114	-
6.	0.0642	0.0259	-	0.019	-	-
7.	0.064	0.068	0.034	-	0.028	0.0767
8.	-	0.1815	-	0.041	0.0726	0.3389
9.	0.026	0.1	-	0.052	0.026	0.0705
10.	0.0755	0.0854	-	0.071	0.0319	0.1028
11.	0.0233	0.03269	-	0.0119	0.0591	-
12.	0.0506	0.1086	-	0.0986	0.0186	0.0361
13.	-	0.0677	0.0588	0.0665	0.066	0.06
14.	0.0279	0.0458	0.0289	0.0369	-	0.0169
15.	-	-	0.0602	0.058	-	-
TOTAL	**0.4741**	**0.8446**	**0.2591**	**0.7321**	**0.4874**	**0.7806**
MEAN	**0.0316067**	**0.0563067**	**0.0172733**	**0.04880667**	**0.0324933**	**0.05204**

4. Discussion

Based on the data from the present study, it appears that the catch rate was consistently higher in the ring trap than the newly developed pot trap in respect of time. It is because the gear type is structurally different. This is in agreement with (Udolisa *et al.,* 1994) and (Brandt, 1984) who reported that traps are of different types operated in different ways depending on the mode of fishing and locality. The pot trap is more in height which takes more time for the crabs to climb before getting the bait. It was observed that baited trap performed better than non baited trap this agrees with Solarin (2008) who reported that, with shorter intervals of soak time, the catch per unit effort increased and with longer intervals, the catch per unit effort decreased due to saturation. This was not the case of pot trap; the longer the soak time the higher the number of crab caught and this was aided by the newly killed premature goat bait in the trap. The pot trap caught few numbers of fishes because of the netting body and the height of the gear which scared away crabs and acts as an entry barrier. The pot trap caught juveniles crab that are of low economic values.

Significant difference occurred in weight (kg) of crabs caught by the two gear. The result shows that the highest catch per day was made from catches of the ring trap. Therefore the ring net trap realized more catches than the newly developed pot trap. Crabs of all sizes were caught in the ring net trap when they become entangled in the net by the spine present in t heir carapace and chelipeds. The test results showed that crab caught in the ring trap and the pots were significantly different. The ring trap caught both small and big sized ranging from 4-6 (carapace width) while the pot caught smaller and few mid size of crabs. The garter efficiency of the ring net trap can be attributed to the way they lay flat on the creek bottom this allows crabs to crawl over them from any direction while they follow the bait odur trail. Pots trap, on the other hand, have entrance through which the crabs must enter to reach the bait. The capture mechanism of the ring net trap and pots is different even though they both have the same mesh size. Ring net trap work by entangling crabs from spines and appendages while pots do not (Lawal – Are, 2009). Ring traps have many advantages over pots. They are easily constructed, require less material, and cost less and occupy less space on deck so that more can be carried on board by the fisher man (Emmanuel, 2008). They are easy to handle and can be operated by a single fisher. Furthermore, ring traps are simple and powerful gear that can be used to catch several species of swimming crabs and that they are probably much more efficient than the pots that are currently used in eradication studies and research (Hadden, 2002).

The ring net trap can be fished with much shorter soaking times, so they can be used more frequently and require a smaller quantity of bait. Their deployment can be easily done from land and canoes. Ring net trap have a long history as gear for harvesting lobster and crabs than pot trap (Brandt 1984). The

newly developed pot trap was designed for crab at the Elechi creek but it caught other species of fish. The effectiveness of the trap to catch different species in the creeks made it good for small scale fishing gear, this agrees with Brandt (1984) and Emmanuel (2008), who jointly reported that good artisanal or small scale fishing gear should be good for catching more than two different species. Ring net trap can be used as hand nets and large number of the gear are often operated by a fisherman mostly for catching crabs (Woods, 1993). Ring trap are usually set separately even when used in large number. The reason is that they have to be lifted carefully without loosing the prey. It is understandable that in commercial fisheries, the ring net trap are mostly used to catch crabs, which do not escape as quickly as fish do. But many variations in gear construction are known in fisheries to prevent the escape of crabs from the bag of the ring net trap. Generally speaking, fish trap is a means whereby targeted preys enter catching chamber in which escaping back becomes difficult or eve impossible (Brandt 1984).

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