The Influence of Cast Net Design and Size on fish Catch Efficiency

Eyo Ambrose* and Isangedighi Isangedighi

Department of Fisheries and Aquatic Environmental Management, University of Uyo, PMB 1017, Uyo Akwa Ibom State, Nigeria.
*Corresponding Author. E-mail: eyoambrose@yahoo.com

Abstract: Two comparative fishing experiments were carried out in the estuary of Ogbokuma river, Nigeria with a view to investigating the abundance of fish caught in cast net. In the first study, two cast nets A and B with the same size of 153.16m^2, but different design feature were compared. Cast net B was without pocket while cast net A was designed to incorporate pocket at the perimeter of the cone. In the second experiment, three cast nets without pocket but of different sizes of 153.16^2, 170.5m^2 and 190.2m^2, respectively cast nets B, C and D were compared. Twelve families and 23 species of fishes were caught during the study. T-test comparison of cast nets A and B showed that cast net A significantly ($p<0.05$); 0.01) caught more fish (746.kg) then cast net B (338.4kg). The weight of fish caught by cast nets B, C and D was significantly different (F-test, $p<0.05$). The highest weight of fish was caught by cast net D while the least was 338.4kg from cast net B in the second experiment.
[Eyo Ambrose and Isangedighi Isangedighi. **The Influence of Cast Net Design and Size on fish Catch Efficiency.** *Rep Opinion* 2016;8(10):16-20]. ISSN 1553-9873 (print); ISSN 2375-7205 (online). http://www.sciencepub.net/report. 4. doi:10.7537/marsroj081016.04.

Key words: Cast net, Pocket, Estuary, Catch efficiency.

Introduction

Cast net is a conically shaped falling gear with lead weight attached at regular intervals along the perimeter of the cone (FAO, 1975). A typical cast net has a retrieval line attached to the apical portion (Nedelec, 1982). The net is cast or thrown by hand in such a manner that it spreads out on the water and sinks. Azeez (1997) reported that fish are caught as the net is hauled back into the boat or basin. These nets are usually used in shallow waters and for efficient fishing operation, the fishermen must be strong enough to throw the size of the cast net in use. In order to lure fish to operational spot, several fishing ground enhancement techniques have been employed, such as garri (processed cassava, *manihot utilisima*) as bait (Udolisa and Solarin, 1979) and light (Azeez, 1997). Cast net operation is conducted throughout the year, and fishing during the day is more common than light fishing at night (Udolisa and Solarin, 1979). Emmanuel and kusemiju (2005) reported that more fish were caught using cast net in dry season than rainy season because of a more conducive environment created for euryhaline species. They reported further that cast net was an active gear, capturing live fishes.

FAO (1975) reported that the overall design, cutting and seaming of panels, and how well the net is constructed with pocket and segment greatly influence its overall performance and ease of use. Well constructed cast net, with differential distribution of mesh size in each panel/segment also determines its spread and sink rates (Nedelec, 1975). Earlier form of cast net design models were constructed without pockets (Von Brandt, 1972), but in recent years, cast nets are constructed with pockets. In pocketed cast net design, the lead rope per net is tucked underneath and attached at intervals to the inner side of the net to form pockets for trapping fish that would have escaped during hauling (FAO, 1975).

Fishers at Ogbokuma river estuary are not aware of the design of cast net with pockets. It was against this background that this research was commissioned to;(i) Improve on the design of cast net in the study area by incorporating pockets to increase fish catch. (ii) Assess the catch compositions and quantity of fish caught by cast net and. (iii) Determine the effects of size of cast net on the quantity of fish caught.

Materials and methods

Study site

The study site is Ogbokuma River in Nigeria. It lies between latitude $4^0 50^1$ and $6^0 50^1$N of the equator and longitude 6^0 and 7^0E of Greenwich meridian. It is located in mangrove rain forest with distinct dry and wet seasons.

Methods of cast net construction

Four cast nets A, B, C, and D were used in a daily fishing operation. Cast net A and B have the same size of 153.16m^2, but pocket were incorporated into the design of cast net A hitherto not incorporated in the design of cast nets in the area, while cast net B was operated without pocket. Cast net B, C, and D have no pockets, but were of different sizes, 153.16m^2, 170.5m^2 and 190.2m^2 respectively. The design and construction of cast net was done as described by FAO (1975), Udolisa *et al.,* (1994). The steps involved;

Calculation of the number of mesh sizes in length and depth of each segment: This was done using the method of Fridman (1986);

Segment Meshes

Perimeter meshes = perimeter length / Stretched mesh size

Subsequent division of perimeter meshes by 2 gave the length of adjoining segments/panel.

Counting and cutting of panels

Each of the proposed number of panels were cut from the main webbing following the calculated meshes in the length and depth of each panel using normal point cut and normal transverse cut respectively for vertical and horizontal tapering.

Joining and lacing

The first panel (apex) was joined to the second one using a take up ratio of 1:2, likewise the second panel was joined to the third with the same take up ratio. The side edges were laced together with a take up ratio of 1:1 to form the conical shape.

Rigging and Accessories;

The perimeter and meshes were mounted on the lead-line at 100% to form the mouth. Lead pieces were attached to the lead-line at a suitable interval so as not to make the net too heavy or too light. The retrieval rope was finally attached to the apex of the net.

Incorporation of Pocket Design

The lead-line was tucked underneath and attached at intervals to the inner side of the net to form pockets for trapping fish.

Determination of Size of Cast Net

The number of meshes used in the construction of the experimental cast net was converted into length and width using the formula developed by Fridman (1986);

$$D = \frac{MN}{1000}$$

Where D = length or depth of net, M = No of meshes

N = mesh size.

The area of panel (segment) was obtained by multiplying the length by the width. The summation of areas of all the segments gave the area of the cast net.

Method of Cast Net Operation

Two men fishing crew with paddled dugout canoe conducted the fishing operation. One man controls the boat with a paddle while the other man operated the gear actively. The net was thrown on sighting a school of fish in such a way that it opens and unfolds to cover the greatest possible area of the water surface, simultaneously, it was allowed to sink to the bottom of the water, trapping some of the fish species, while some were caught in the pockets. The net was left in that position for a few minutes (3-5 minutes) before it was gently but skillfully drawn towards the thrower by the use of the retrieving line into the canoe.

Data Collection and Analysis

Upon landings, the total weight and number of fish caught were taken; also, the catch composition was recorded. The fishes were sorted into species and families. The weight and number of the different species were recorded.

Students' T-test was used to compare weight of fish caught by cast net with pockets (experimental cast net) with the weight of fish caught by cast net without pocket (conventional cast net used in the area). Twenty replicate landings from each of the two cast nets were used in the analysis. The hypothesis that the weights of fish caught do not differ was tested.

One way ANOVA was also used to compare the weight of fish caught by the different sizes of cast nets with pocket used in the study, with the hypothesis that they caught equal weight/or number of fishes.

Results

The four cast nets used in the study were conical, two segment with iron sinkers rigged along the perimeter of the cone. The cast nets were made of polyamide material with thickness R 150 Tex and uniform mesh sizes of 25mm stretched.

Table 1 is the summary of weight and number of fish caught by the four cast nets A, B, C and D. Cast net A caught the highest mean weight of fish (37.33kg) while cast net B caught the least mean weight of fish (16.92kg).

Twelve families and 23 species of fish were caught during the study in the area. Table 2 is the summary of weight of fish caught by cast net with pocket and cast net without pocket with equal sizes ($153.16m^2$) in the study area. Cast net with pocket predominantly caught more fish (746.7kg) than cast net without pocket (338.4kg) from 20 replicate landings. T-test paired comparison was significant (t-test, $p<0.05$; 0.01).

The result of the study also shows that the efficiency of cast net depends not on the incorporation of pocket, alone, but also on the size of the cast net. The weight of fish caught increases as the size of the cast net increases. Three cast nets with different sizes of $153.16m^2$, $170.5m^2$, and $190.2m^2$ caught respectively 338.4kg, 341.2kg, and 371.2kg of fishes from 20 replicates landings (Table 3). F-test analysis was significant ($p<0.05$). Thus the null hypothesis that the three different sizes of cast net caught equal weight of fish was rejected. Cast net D caught the highest weight of fish, while cast net B, the least.

The families and species (in parenthesis) in order of abundance are as follows; *Ariidae (Arius gigas, arius latiscutatus), clupeidae (Ilisha africana, Ehtmalosa fimbriata, Sardinell maderensis), Lutjanidae (lutjanus agennes, Lutjanus campechanus, lutjanus dentatus), Mugilidae (Liza falcipinis, liza*

grandisquamis, Mugil curema), Sphyraenaidae (Sphyraena guachancho), (cichlidae (Sarotherodon melantheron, Tilapia zilli, Sarotherodon galilaeus), Sciaenaidae (Pseudotholithus typus, Pseudotholithus senegalensis, Pseudotholithus elongatus), Drepanidae (Drepane longimanus), Haemilidae (Pomadasys argenteus), Monodactilidae (Monodactilus sebae), Bagridae (Chrisichthys nigrodigitatus) Synodontidae (Saurida undosquamis).

Table 1: Summary of Weight and Number of fish caught by cast nets A, B, C and D

Day	CAST NET A		CAST NET B		CAST NET C		CAST NET D	
	No of fish	weight of fish	No of fish	weight of fish	No of fish	weight of fish	No of fish	weight of fish
1					45	2.9	131	13.8
2	58	62.6	54	18	43	15.4	56	19.7
3	42	23.9	46	14.5	79	21.4	77	17.1
4	53	32.3	55	21.6	28	13.3	90	15.8
5	71	40.4	58	20.1	57	15.6	80	14.6
6	53	22.4	58	15.7	46	20	81	11.6
7	74	22.4	51	27.6	41	11.7	97	15.8
8	45	36.5	53	11.1	63	15.3	113	14.3
9	65	38.6	55	18.2	54	13.5	72	11.5
10	59	24.3	47	18.9	46	13.1	128	18.1
11	72	49.2	65	21.1	62	25.0	82	17.9
12	58	35.2	62	22.4	42	21.3	122	18.8
13	89	47	34	35.1	48	12.3	123	16.1
14	71	51.1	56	19.8	53	12.7	93	13.7
15	62	41.3	51	18.9	72	18.8	124	22.1
16	80	47.8	48	28.6	65	133	85	14.9
17	71	23.5	48	25.8	52	14.7	82	14.6
18	50	45.8	54	14.4	54	16.4	118	11.6
19	48	40.3	38	15.3	83	23.6	92	17.8
20	52	25.9	59	17.3	42	21.9	109	18
TOTAL	1248	746.7	1051	338.4	1075	341.2	1955	371.2
MEAN	-	37.333		16.92		17.06		18.55

Table 2: Summary Of One-Tailed Paired T-Test Comparing The Weight (Kg) Of Fish Caught By Cast Net With Pocket (A) And Cast Net Without Pocket (B) Both With The Same Sizes = 153.16m^2 (A Versus B), N=20.

REPLICATION	**CAST NET A**	**CAST NET B**
	62.2	18
1	23.9	14.5
2	32.3	21.6
3	40.4	20.1
4	22.4	15.7
5	22.4	27.6
6	36.5	11.1
7	38.6	18.2
8	24.3	18.9
9	49.2	21.1
10	35.2	22.4
11	47.0	35.1
12	51.1	19.8
13	41.3	18.9
14	47.8	28.6
15	23.5	25.8
16	45.8	14.4
17	40.3	15.3
18	25.9	17.8
19	36.2	20.8
20	746.7	338.4
TOTAL	37.333	16.92

Table 3: Summaries of the weight (kg) of fish caught by three different sizes cast net without pocket that was used in F-test Analysis

REPLICATION	CAST NET B (153.16M^2)	CAST NET C (170.5M^2)	CAST D NET (190.2M^2)
1	18	2.9	13.8
2	14.5	15.4	19.7
3	21.6	21.4	17.1
4	20.1	13.3	15.8
5	15.7	15.6	14.6
6	27.6	20	11.6
7	11.1	11.7	15.8
8	18.2	15.3	14.3
9	18.9	13.3	11.5
10	21.1	13.1	18.1
11	22.4	25	17.9
12	35.1	21.3	18.8
13	19.8	12.3	16.1
14	18.9	12.7	13.7
15	28.6	18.8	22.1
16	25.8	13.3	14.9
17	14.4	14.7	14.6
18	15.3	16.4	11.6
19	17.8	23.6	17.8
20	20.8	21.9	18
TOTAL	338.4	341.2	371.2
MEAN	16.92	17.06	18.55

Discussion

Cast net is used where the water body is free of bottom obstructions. Capture of fish largely depends on the efficiency of throw and degree of opening of the entire circumference of the net. The cast net has often been considered as an inefficient fishing gear because most fish tend to escape when the net is splashed against the surface of the water. The sound of the splash causes movement of the fish in all directions. It's effectiveness however depends upon the experience of the fisherman. Cast net retain large number of under sized fish. In this regard, they can be compared with the beach seine in terms of damage done to the fish stocks (du Feu, 1997). Parsley *et al* (1989) argued in favour of the adoption of strict management measures for the cast net fishery since it is causing comparable damage to the stocks as the beach seines, which are now banned from most water body. This suggests that a thorough assessment of the cast net fishery to assess its present status and implications on the exploitation of the fish stocks is necessary.

Catch ability of cast net depends on its sinking speed, weight of sinkers, mesh size and size of fish, cast net perimeter and escape speed of the fish. On citing a fish or school of fish the net is thrown or cast and allowed to sink and cover the fish and then it is hauled or retrieved through the retrieval rope into the canoe. Cast net efficiency was experienced in clear water free from obstructions that can damage the net or entangle it. Cast net is an efficient fishing gear since it caught life fish, it was operated without bait. Cast net durability depends on how it is been used. Cast net can last for about 25yrs. Therefore, it is recommended that, after use it should be properly kept in a cool and dry place free from water, it should not be used in an area with obstructions which can damage the net. If there is a damage of the mesh, it should be amended immediately so it does not extend to other part of the net, also, avoids contact with chemicals. Wash it to remove sand and other dirt. Since cast net catches life fish, it's use should be encouraged in other to monitor the catch of unwanted fishes (by-catch). Undersized fish can be returned alive to the river to grow; only the desired size caught is taken. Cast net is one of commonest and cheapest fishing gear used by the artisanal fishers, this implies that more research to improve on its design and efficiency such as the use of cast net with pocket in other to enhance its catch ability instead of using cast net without pocket which this research have done.

The problems of artisanal fishing in the area studied include lack of storages facilities, lack of government support and seasonal change in the volume of the river. The study recommends among others; fishermen should be given adequate training

and the required assistance on modern fishing techniques and the use of modern fishing equipment to ensure sustainability. There is also the need to organize the farmers into cooperatives to enable them have better access to government programmes and credits. It is also recommended that the government should build mini cold rooms with good storage facilities to help the fishermen overcome the problem of fish spoilage which reduces the quality of their products; government should also make available good roads and electricity.

References

1. Azeez LO (1997). A comparative study of cast net and gillnet fishing gears in Lagos Lagoon.
2. Du Feu, T. A. (1997). Fisheries Statistics, Kainji Lake, Northern Nigeria, (1996). The Nigerian-German (GTZ) Kaibji Lake Fisheries Promotion Project.
3. Emmanuel BE, Kusemiju K. (2005). Variations in cast net catch in a Tropical Brackish Water Pond. *J. Sci. Technol. Environ*. 5 (1&2): 6-14.
4. FAO (1975); Catalogue of small-scale fishing gear design. Fishing News Books, England (199pp).
5. Fridman, A. L. (1986): Calculations for fishing gear design. FAO Fishing Manual, Rome, 238pp.
6. Mclusky, D. S. and Elliot, M. (2004): The Estuarine Ecosystem: Ecology, Threat and Management. New York: Oxford University pres. ISBN 0-19-852508-7, 151PP.
7. Nedelec. C. (1982): Definition and Classification of fishing gear categories. *FAO Fish Tech. Paper* (222): 51pp.
8. Parsly, M. H., D. E. Palmer and R. W. Burkhardt (1989) variation in capture efficiency of a beach seine for small fishes. North American Journal of Fisheries Management 9:239-244.
9. Udolisa REK, Solarin BB (1979). *Design Characteristics of cast nets and gillnets in Lagos Lagoon, Nigeria*. NIOMR Occ. Pap. 31:24.
10. dolisa, R. E. K., Solarin, B. B., Lebo, P. E. and Ambrose, E. E. (1994): *A catalogue of small scale fishing gear in Nigeria*. *FAO Regional Office for Africa publication,* RAFR/014/94/02:14200.
11. Von Brandt, A. (1972): Fish catching methods of the world. *Fishing News Books Ltd*. London, 240 pp.

10/25/2016