E-ISSN: 2347-5129
P-ISSN: 2394-0506
(ICV-Poland) Impact Value: 5.62
(GIF) Impact Factor: 0.549
IJFAS 2019; 7(6): 355-358

www.fisheriesjournal.com
Received: 19-09-2019
Accepted: 23-10-2019

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Unique improved selective fishing traps with adjustable escape gaps for effective fisheries management

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Abstract
Unique improved selective fishing traps that can be used by fish farmers for the harvest of table size fishes are developed. The consistent decrease in fish catches and harvest of undersized fishes by the traditional fishing traps among fish farmers around Lagos and Epe Lagoons fishing communities predicts a risk of food security which necessitated the development of this novel device. This ecological friendly fishing traps made with plastic material and with the inclusion of escape gaps for the release of undersized fishes is proposed to be mandatory for fish farmers around the fishing communities in Nigeria. The unique improved selective fishing traps operate in shallow water of 1-2 meters depth. Traps are set against the flow of water current to aid movement of fishes into the traps. The invention was designed using long Bamboo as stalks to peg each trap against loss of trap in water. Stones of about 2 kg weights are used as sinkers with a head rope connecting the traps in a row. Traps are spaced at about 10 m apart to inhibit the potential of bait transfer from one trap to the other. The invention is more effective than the traditional fishing traps in terms of total fish catch. The average catch per month of matured fishes of table sizes caught by the invention is approximately 61% compared with approximately 23% fishes usually caught by the traditional traps and often undersized. With the proposed mandatory development of the unique improved selective fishing traps for fisherfolks, the resultant higher fish catch and harvest would create economic empowerment for fish farmers and provide a source of sustainable animal protein for societal consumption at large.

Keywords: fishing traps, invention, plastic, escape gaps, harvest

1. Introduction
1.1 Background of the invention
Fish is a food of excellent nutritional value, providing high quality protein and a wide variety of vitamins and minerals, including vitamins A and D, phosphorus, magnesium, selenium, and iodine for humans. Fishing is the main source of income in the fishing communities in Lagos and Epe Lagoons and contributed to fisher folks survival in terms of food supply and occupation. Akinnigbagbe [3] reported that the use of fishing traps cannot be undermined in both lagoons as most of the villagers participate in trap fishing more than other fishing gears like the stow nets, cast nets, seine nets, hooks and lines and gill nets. This may be attributed to the facts that trap fishing does not require their full-time, hence can be combined with other occupation of the fisher folks and fishes are trapped alive which will in turn yield higher market value. Conversely, there is a decline in fish catch and harvest of the undersized fishes among fish farmers with the use of the traditional fishing traps which contravenes the Sea Fisheries Act of Nigeria of 1992, that prescribes limits to the size of nets or the mesh of nets that may be employed in the taking of fish within the territorial waters of Nigeria, or in any specific area therein. Furthermore, it shall be an offence to catch, or retain for ultimate sale, fish less than the minimum total length published in respect of each species. Most of the traditional fishing traps are made of bamboo splinters which subjects them to putrefaction leading to lesser life span of a few months as reported by Baruah *et al.* [5], they are not affordable and the materials used for their construction are not readily available. Akinnigbagbe [2] highlighted the factors which affects fish productivity to be availability of the materials for constructing the traditional traps and its durability. The challenge of insufficient source of animal protein (fish) for human consumption can be solved with the use of this developed device. The invention provides a solution by catching matured fishes of approximately 61% table size

based on monthly average compared with approximately monthly average of 23% fishes usually caught by the traditional traps and often undersized according to Akinnigbagbe [3] thus, provides a continuous source of animal protein for human consumption.

2. Materials and Methods

2.1 Materials

The materials used in the making of the unique improved selective fishing traps are: plastic multipurpose perforated vessel, imperforated vessel, plastic funnel, kuralone rope and polyethylene nets. The invention is fabricated using plastics made of polypropylene materials with the inclusion of adjustable escape gaps of 8cm by the sides of each trap. However, the entrance valves on this invention are fabricated using polyamide nets of 20mm and are attached the lid of each vessel with kuralone ropes.

2.2 Experimental layout

The construction details of the four unique improved selective (Plastic cylindrical with funnel valve, plastic cylindrical, plastic 'pot' and plastic drum) traps are shown in this section. The dimensions of the invention are adjustable but this present dimensions are based on the specification of the existing traditional fishing traps which has been tested. Also, escape gaps are provided on the invention and these can be adjusted depending on the targeted fish species. Therefore, each modified design still retains the dimension of the existing traditional fishing trap. Plastic cylindrical, plastic 'pot', plastic drum and plastic cylindrical with funnel valve traps were modified using plastics made of polypropylene materials with the inclusion of escape gaps of 8cm by the sides of each trap type while polyamide nets of 20 mm were used as the non-return valve. In addition to the fourth modified (Plastic cylindrical with funnel valve) trap; funnel plastic was attached to the polyamide net with the use of a kuralone rope to form the non-return valve for better efficiency. Plastic 'pot' trap was perforated at equidistance of 6cm apart using pillar flex impact drilling machine where it is necessary. Appropriate measurements of all traps were taken with the use of vernier caliper (To the nearest millimetre) and measuring tape (To the nearest centimetre).

3. Results

3.1 Plastic cylindrical with funnel valve trap

A multipurpose plastic basket of 58cm height, 31cm base diameter and 37mm mesh sizes was used. Attached with the trap is a big funnel (Sacvin Nigeria Limited) of 31cm width. One entrance valve made with polyamide net of 20mm, 115cm width and length of 115cm was attached to the funnel with the use of kuralone rope. An escape gap of 8cm was designed at both sides of the trap (Fig. 1).

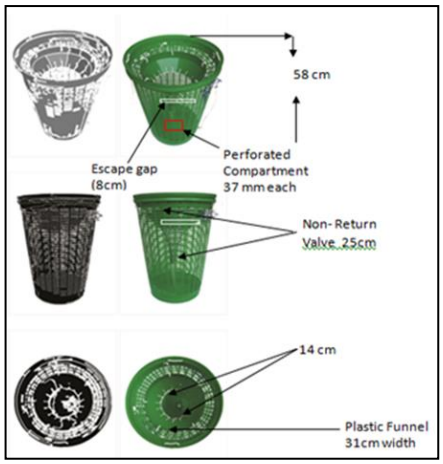

Fig. 1: Designed and constructed plastic cylindrical with funnel valve trap

3.2 Plastic cylindrical trap

A multipurpose plastic basket of 58cm height, 31cm base diameter and 37mm mesh sizes was used. Attached to the lid of the basket is the one entrance valve made with polyamide net of 20mm, 213cm width and length of 20cm. An escape gap of 8cm was designed at both sides of the trap (Fig. 2).

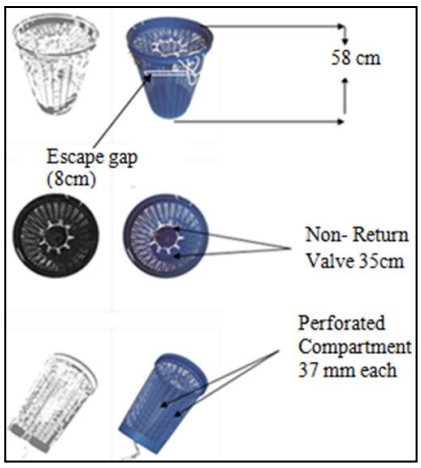

Fig 2: Designed and constructed plastic cylindrical trap

3.3 Plastic 'Pot' trap

The plastic 'pot' trap is a white plastic bucket with a base diameter of 30 cm and height of 38 cm having an escape gap of 8 cm at both sides with PP written at the base (Fig. 3). It was perforated with 150 pores which are evenly distributed at equidistance of 60cm apart. Has one entrance valve made with polyamide net of 20 mm mesh size, 20 cm width and length of 20 cm to form a cone shape in the trap and was attached to the lid of the plastic trap. By the sides of the trap are kuralone ropes which will be tied with a pole when traps are set in water to avoid trap lost which can lead to ghost fishing.

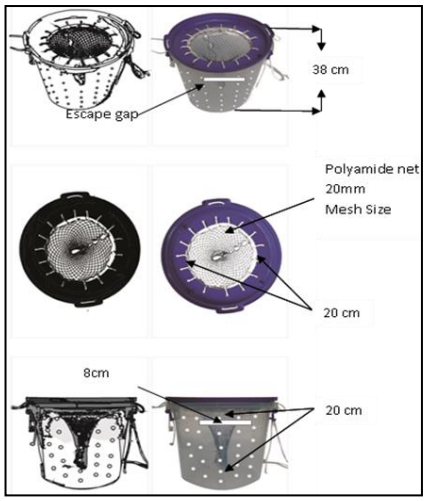

Fig 3: Designed and constructed plastic 'pot' trap

3.4 Plastic drum trap

A black plastic bucket (Dana plast (DP 1710)) with height of 40 cm and base diameter of 27 cm was used. Constructed on this trap was an escape gap of 8 cm on either sides of the trap with an entrance valve which was made with polyamide net of 20 mm mesh sizes, 18 cm width and 16 cm length (Fig. 4).

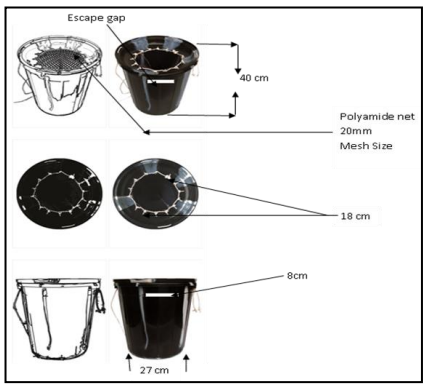

Fig 4: Designed and constructed plastic drum trap

4. Discussion

Currently, more than two-third of fish harvest by Artisanal fisherfolks using traditional fishing traps constitutes undersize fishes and this affects sale returns. Additionally, traditional fishing traps are equally associated with overfishing thereby distorting the fish ecosystem. Thus, the fishing community needs a fishing trap that guarantees improved harvest of matured fishes while making provision for the escape of undersize fishes back into the lagoon for the conservation of fish species. These aforementioned issues led to the design of the unique improved selective fishing traps which is developed to provide better fishing practice/culture and experience for fisherfolks than the traditional fishing traps. Though, it functions similarly like the traditional fishing traps, but it provides better incentive in that only matured fishes would be harvested while preserving the ecosystem of fish by eliminating the incidence of overfishing which is a major problem with the traditional fishing trap. Araoye [4] reported the need for escape gap on fishing traps to disallow trapping of undersized fishes. Also, FAO [6] reported that traps can be made with plastic materials of any colour and shape; however, escape ports should be provided by the sides to serve as means of escape for the undersized fish. Gear types with the inclusion of escape gaps helps to improve the degree of species selectivity as smaller fishes can freely escape in order to prevent the depletion of fishery resources and metamorphosed into adulthood, thereby, preventing the overfishing of fish species and provides a sustainable fish production. The diversity of matured edible fish species which is the target of the fisherfolks around Lagos and Epe Lagoons exhibits different growth patterns which are mostly of table-sizes. Hence, Sea Fisheries Act of Nigeria 1992 legislated against the fishing of the small sized fishes to ensure the continuity of fish species that would have naturally gone into extinction if the use of traditional fishing traps (without the escape gaps) is not discouraged in the lagoon system. Other conservative measures include limitation of the number of fishing gears deployed, regulation of fishermen numbers, prohibition of obnoxious fishing methods and introduction of closed seasons to farmers to reduce the total fishing pressure on stocks as reported by Solarin [8] and Kapesky [7]. The unique improved selective fishing traps were designed using plastics made of polypropylene materials with the inclusion of escape gaps of 8cm by the sides of each trap type while polyamide nets of 20mm were used as the non-return valve. In addition, funnel plastic was attached to the polyamide net with the use of a kuralone rope to form the non-return valve for better efficiency. The unique improved selective fishing traps operate in shallow water between 1-2 meters depth. This can be measured with the use of a long stick which will further be read with a meter rule. Traps will be set against the flow of water current to aid movement of fishes into the traps. The invention was designed to use long Bamboo as stalks to peg each trap and avoid loss of trap in water. Stones of about 2 kg weights are used as sinkers with a head rope connecting the traps in a row. Traps are spaced at about 10m apart to inhibit the potential of bait transfer from one trap to the other. According to Akinnigbagbe [1], it was discovered that the unique improved selective fishing traps are most efficient than and all the traditional traps, in terms of maximizing the catches and fish weight hence can assist fishery management scientists in carrying out ecological studies in line with the strategies of conservation and management.

5. Conclusion

The unique improved selective fishing traps made with plastic material is highly recommended as they are more effective in boosting fish catch efficiency and are more durable. In addition, the incorporation of the escape gap on the invention aids the reduction of trapping undersized fishes; hence, the need of an escape gap of at least 8cm on fishing traps is recommended to all fishing communities.

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