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Original Article

Efficiency and species selectivity of baited galvanized wire gauze trap in Abule Agege and Abule Eledu Creeks of the Lagos Lagoon

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Abstract
An investigation into the effectiveness and selectivity of wire gauze traps (total = 20) in Abule Agege and Abule Eledu Creeks was conducted between March – August 2019. Processed cassava (Fufu) and coconut were used as baits, and the traps were set - up day and night. The swimming crab (*Callinectes amnicola*) was the most abundant shellfish from both Creeks with 73 and 72.13% occurrence respectively. *Sarotherodon melanotheron* was the most abundant fin fish caught in the study with the highest catch recorded in the month of July in Abule Eledu Creek where nine specimens were caught per trap. *Cardiosoma armatum* had the lowest number of catch rate in both creeks where occurrences of 1.5 and 1.63% were recorded respectively in both creeks. The catch recorded using this gear was relatively low which made it not very efficient for artisanal fishing in the creeks. The fufu baited trap was recorded to catch higher number of species compared to the coconut baited trap. Except for salinity, which varied greatly from 0.384% in July to 0.93% in August and Total Suspended Solid which ranged between 104.0 and 140.0ppm in July and August, the physicochemical parameters of the two sampling stations fluctuated throughout the sampling period. The selected trap was selective for shallow water species, but the catch rate was low due to human activity on the water body during the sampling period. Due to its high selectivity, the selected fishing gear will be best suited to help improve species abundance in the ecosystem.

INTRODUCTION

Fishing is one of the oldest ways by which people have fed themselves and their families which also involves the gathering of shellfish by hand and spearfishing (Von Brandt, 1984). In early times, flowing water caused by tidal movement and changes in river and lake levels were probably used to trap fish behind rudimentary barriers, often made from sticks and stones. The heavy materials used for fishing materials in the primitive times were developed as the time moves on to lighter, more readily available materials such as tree branches, brushes, nets (Slack-Smith, 2001).

Traps are simple, passive fishing gear that when fish enter to and then made it hard for

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them to escape, which is achieved by putting chambers in the trap or pot that can be closed once the fish enters, having a funnel that makes it difficult for the fish to escape (FAO, 2001; Emmanuel, 2009). Traps can vary, from simple structures such as rock corrals which is able to hold various fish species passing by to highly specialized equipment such as lobster pots (Emmanuel, 2008).

The widely different habits and habitats of the vast variety of West African freshwater and brackish water fishes, the striking seasonal variations in their environment and the ingenuity of local fishermen have all contributed to the development throughout the region of a bewildering array of traditional fish-catching devices (Holden and Reed, 1991; Emmanuel, 2004; Emmanuel and Kusemiju, 2005). It is well recognized that estuaries, lagoon and enclosed embayment are important spawning habitats and nursery areas for inshore fishes (Potter *et al*., 1990; Emmanuel and Kusemiju, 2005).

The frames used in making the traps are made from strong materials that prevent the traps and pots from losing their shape during fishing and storing (Aitken, 1997: personal communication). Trap frames can be made from steel rods, timber, some sticks, etc. The modern traditional traps are covered with wire netting, nylon mesh, plastic-covered steel, wielded steel mesh, etc. Trap consists of funnels which lead from the outside to the inner chamber of the trap (Emmanuel, 2008). The river fishery in Nigeria is still predominantly employing canoes and traditional gears and catch composition of these traditional fishing gears often depends on experience and skills of the fishers. It also varies among gears, among habitats, among species, and even among sizes of the same species. This means that all fishing gears are only able to catch a certain part of the total (multispecies) fish community present. However, the indiscriminate use of different traditional fishing gears and occasional use of harmful techniques threatens the fish biodiversity in rivers in Nigeria because of huge participation and it is open.

It is very important to study the nature of gears commonly used that may lead to selective fishing, thus minimizing the stress on a particular size group of fishes (Srivastava and Srivastava, 2002). A traditional dugout canoe between 3-18 meters long is used for artisanal fishing. Artisanal fishers used gears that include cast nets, hand lines, basket traps, longlines, set gillnets, etc. The coastal artisanal fisheries are divided into two major sectors which are the brackish water fisheries with fishing activities in creeks and estuaries where the freshwater flowing down the rivers mix with the salt water moving up with high tide and the artisanal fisheries with fishermen operating in waters of less than 40m depth (Ssentongo *et al.,* 1983).

The creek and lagoons of South-Western Nigeria, apart from their ecological and economic significance, serve as a link for the disposal of an increasing array of waste type (Onyema, 2007). Tidal creeks are known to be fertile coastal environment used as feeding and nursery grounds by a large number of fishes and aquatic crustaceans (Kusemiju, 1991). The creeks are dominated by many influences such as industrial and municipal waste discharges, fertilizers, and pesticides from agricultural soils, chemical leakages from

landfills/waste disposals pits, leaching animal and human wastes. Human activities such as fishing, transportation, dredging, sand mining and mangrove cutting all which affect the physical and chemical characteristics of the water body directly and indirectly affect the distribution and production of fish and other aquatic organisms (Obot *et al*., 2016). A creek refers to a small waterway that contains mixed water origin. It is the part of a stream that is affected by ocean tides. A tidal creek is also called tidal channel and has variable electrical conductivity and salinity. During low tides, the creeks may dry up forming a muddy channel while on the other hand, during high tides, they have large amounts of water (Omondi, 2018). Creeks are found along rivers, coasts, and estuaries, which flood and drain by the tidal movement of the adjacent estuary, sea and ocean. There are numerous creeks associated with the Nigerian coastal environment. They are two types of tidal freshwater/brackish creeks which are surrounded partly by mangrove and partly by freshwater swamps from points beyond the reach of tidal influence, while the non-tidal creeks are surrounded by freshwater and are infested by aquatic macrophytes all year round (Adesalu and Nwankwo, 2008). Traps performance and selectivity are influenced by factors such as size, type and the mouth opening (Solarin, 1998). Numerous studies have examined traditional fishing traps but none have examined the effectiveness and species selectivity of baited galvanized wire gauzed trap. Hence, this study aims at investigating the efficiency and selectivity of a galvanized wire gauze trap using two different types of baits and also the species abundance of the Lagos lagoon.

MATERIALS AND METHODS

Description of the study areas

Abule Eledu is a shallow creek situated between 6°31.30'North and 3°23.15'East latitude of the Lagos lagoon. It is a brackish

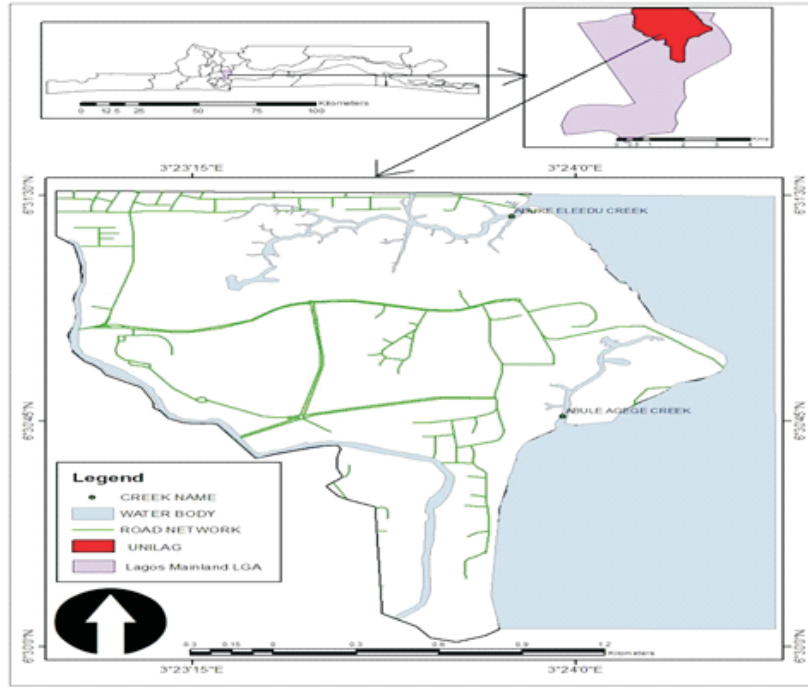

Figure 1: Map showing the sampling stations

shallow creek with depth of less than 1m during low tides and dry season. It is one of the numerous sluggish creeks that empty into the Lagos lagoon (Emmanuel and Olojede, 2010). It is tidal with a depth which decreases inland. It is located in the wet tropics where the alternations of the dry and wet seasons are phenomenal. Abule Agege is an isolated freshwater swamp that is part of a creeklet that empties into the Lagos lagoon. It is located between the coordinates of 6° 30.45'North and 3° 24.0' East. It falls within the rain forest belt and receives creek with an average depth of ($\leq$ 1m) (Emmanuel, 2004).

Design Study and Description of Wire Gauze Trap

The wire gauze trap was constructed using wire mesh (36mm), cane stick and thread on both sides. The trap had a single funneled entrance known as valve of no-return. The mesh was curved to make a bag like shape. The diameter of the trap was 50cm and the length of the trap was 55cm. The traps were threaded at the sides so as to allow the retrieval of the catch from the trap. The mesh size of the trap was 36mm.

Sampling Procedures and fish Identification

Sampling was done twice a month for a period of 6 months between March and August, 2019 in two different creeks. A total of 20 wire gauze traps with a mesh size of 36mm were used throughout the duration of the study. The traps were divided into 10 for each location; the 10 traps for each location were divided into five traps baited with coconut and processed cassava at each station. Fish caught were identified with the aid of literatures (Schneider, 1990; Holden and Reed, 1991; Emmanuel, 2009). The measurements of the catch were taken by placing the fish on the fish measuring board and the measurement of the carapace width for shellfishes and the total length (tip of the mouth to tip of the tail) for the fin fishes were taken using a meter rule and recorded in nearest centimeter. The specimens were

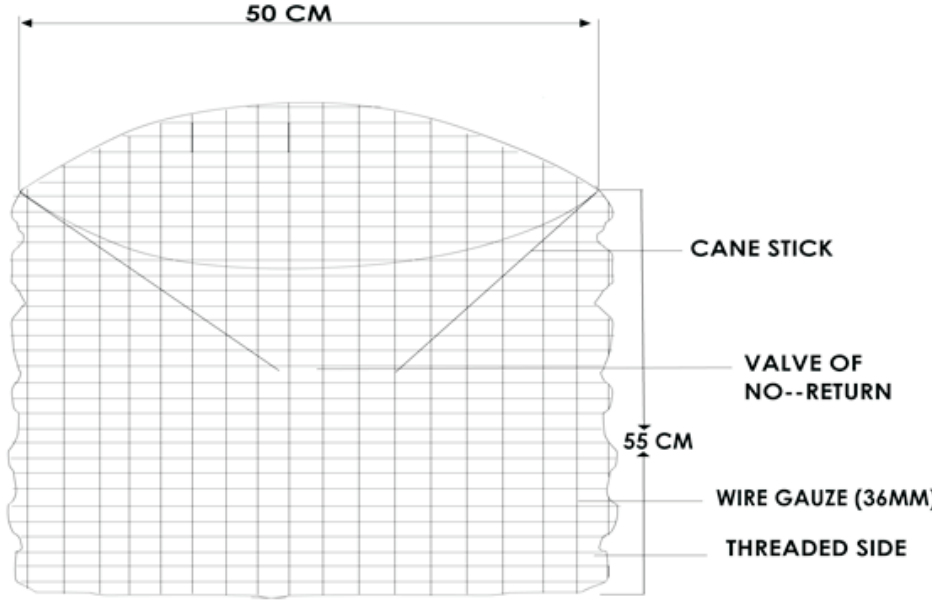

Figure 2: A Galvanized Wire Gauze Trap

also weighed on a sartorius weighing balance to the nearest gram.

RESULTS

General survey of fauna in Abule Agege and Abule Eledu Creek

A total of 64 fin fish and shell fish specimens of weight range 10 - 106.6g and length range of 4 – 25cm were caught at the Abule Agege Creek during the sampling period (Table 1). The family Portunidae, represented by *Callinectes amnicola* had 73% occurrence which was the most abundant of the species caught during the study period. Cichlidae, represented by *Sarotherodon melanotheron* with 14.06%, *Hemichromis fasciatus* with 3.12%, *S. melanopleura with* 1.5%, Claridae, represented by *Clarias gariepinus* had 3.12% occurrence, Lutjanidae, represented *Lutjanus goreensis* had 3.12% and Family Gecarcinidae, represented by *Cardiosoma armatum* had 1.5% occurrence. At Abule Eledu, a total of 61 fin fish and shell fish specimens of weight range 8.0 - 80.9g and length of 8.0 – 52.0cm were caught.

The species caught were from the families of Portunidae, represented by *Callinectes amnicola,* had 72.14% which was the most abundant of the species caught during the study period. The family Cichlidae, represented by *Sarotherodon melanopleura,* had 8.19% occurrence, *Sarotherodon melanotheron* had 18.03% and the family Gecarcinidae, represented by *Cardiosoma armatum,* had 1.63% occurrence (Figure 3).

Day and night variation, bait preference in Abule Agege and Abule Eledu Creeks

In Abule Agege, processed cassava (fufu) baited traps caught a total of 19 fish: *Callinectes amnicola* (12), *Sarotherodon melanotheron* (3), *Hemichromis fasciatus* (1), *Clarias gariepinus* (1), and *Lutjanus goreensis* (2) while coconut baited traps caught 11 fish: *Callinectes amnicola* (19), *Sarotherodon melanotheron* (1), and *Cardiosoma armatum* (1) during the day. A total of 26 fish: *Callinectes amnicola* (21), *Sarotherodon melanotheron* (2),

Table 1: Finfish and Shell fish caught in Abule Agege Creek

Family/Species	Weight range(g)	Total length(cm)	% Occurrence
Portunidae			
Callinectes amnicola	10.0 - 69.0	4.0-20	73
Cichlidae			
Sarotherodon melanopleura	27.0	9.00	1.5
Hemichromis fasciatus	22.1-39.0	10.0-13.0	3.12
Sarotherodon melanotheron	11.0-27.0	9.0-14.0	14.06
Claridae			
Clarias gariepinus	78.5-83.1	24.0-25.0	3.12
Lutjanidae			
Lutjanus goreensis	39.5-106.6	14.0 - 20.0	3.12
Gecarcinidae			
Cardiosoma armatum	41.0	15.0	1.5

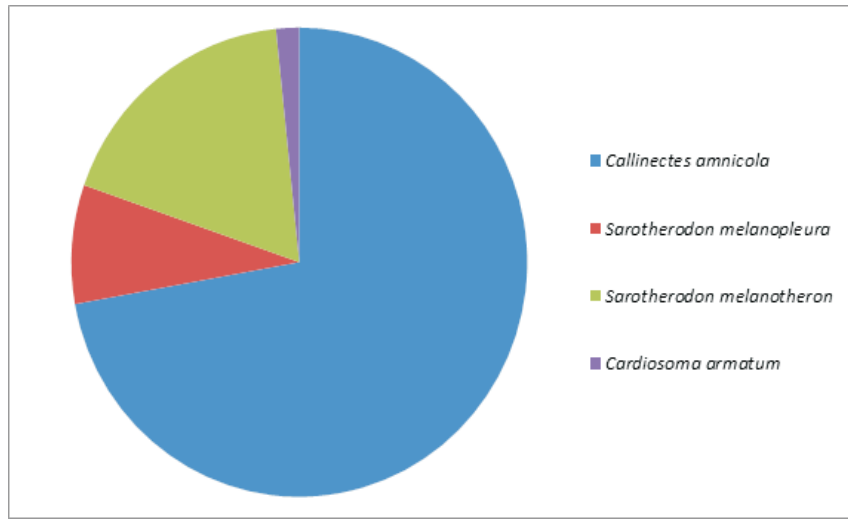

Figure 3: Graphical representation of the Species Occurrence in Abule Eledu Creek

Sarotherodon melanopleura (1), *Hemichromis fasciatus* (1), and *Clarias gariepinus* (1) were caught in the day using processed cassava (fufu) as the bait while a total of 8 fish: *Callinectes amnicola* (5), *Sarotherodon melanotheron* (3) were caught in the night using coconut as the bait (Table 2). A total of 61 fin fish and shell fish were caught in Abule Eledu with processed cassava (fufu) as the bait consisting 19 fish: *Callinectes amnicola* (14), *Sarotherodon melanotheron* (3), and *Sarotherodon melanopleura* (2) while using coconut as the bait caught 18 fish: *Callinectes amnicola* (14), *Sarotherodon melanotheron* (2), and *Sarotherodon melanopleura* (2) all catch were recorded during the day. Eleven fish were caught in the night using processed cassava (fufu) as the bait: *Callinectes amnicola* (10), *Cardiosoma*

Table 2: Day and night variation and bait preference in Abule Agege Creek

Species	Day catch		Night catch	
	% catch (fufu)	% catch (coconut)	% catch (fufu)	% catch (coconut)
Portunidae				
Callinectes amnicola	63.15	81.81	80.76	62.5
Cichlidae				
Sarotherodon melanotheron	15.78	9.0	7.69	37.5
Cichlidae				
Hemichromis fasciatus	5.26	-	3.84	-
Cichlidae				
Sarotherodon melanopleura	-	-	3.84	-
Claridae				
Clarias gariepinus	5.26	-	3.84	-
Gecarcinidae				
Cardiosoma armatum	-	9.0	-	-
Lutjanidae				
Lutjanus goreensis	10.52	-	-	-

armatum (1) and 13 fish: *Callinectes amnicola* (6) *Sarotherodon melanotheron* (6), *Sarotherodon melanopleura* (1) were caught using coconut as the bait in the night (Table 3).

Table 3: Day and variation and bait preference in Abule Eledu Creek

	Day Catch		Night Catch	
Species	% Occurrence (fufu)	%Occurrence (coconut)	% Occurrence (fufu)	% Occurrence (coconut)
Portunidae				
Callinectes amnicola	73.68	77.77	90.90	46.15
Cichlidae				
Sarotherodon melanotheron	15.78	11.11	-	46.15
Cichlidae				
Sarotherodon melanopleura	10.52	11.11	-	7.69
Gecarcinidae				
Cardiosoma armatum	-	-	9.09	-

Catch per unit effort (CPUE) of Galvanized basket trap in Abule Agege and Abule Eledu Creeks

The catch per unit effort (CPUE) of both creeks was based on catch per trip per the number of traps used during the sampling period. In Abule Agege, the highest average catch per unit of 24 fish was recorded in March, while 10 in April, 9 in May, 10 in June, 7 in July, 4 in August were recorded using the same number of traps (10) during the sampling period (Figure 4).

The CPUE in Abule Eledu recorded highest in the month of March with 18 fish, 12 in April, 9 in May, 7 in June, 9 in July and 6 were recorded in August with the equal number of fishing traps of 10 (Figure 4).

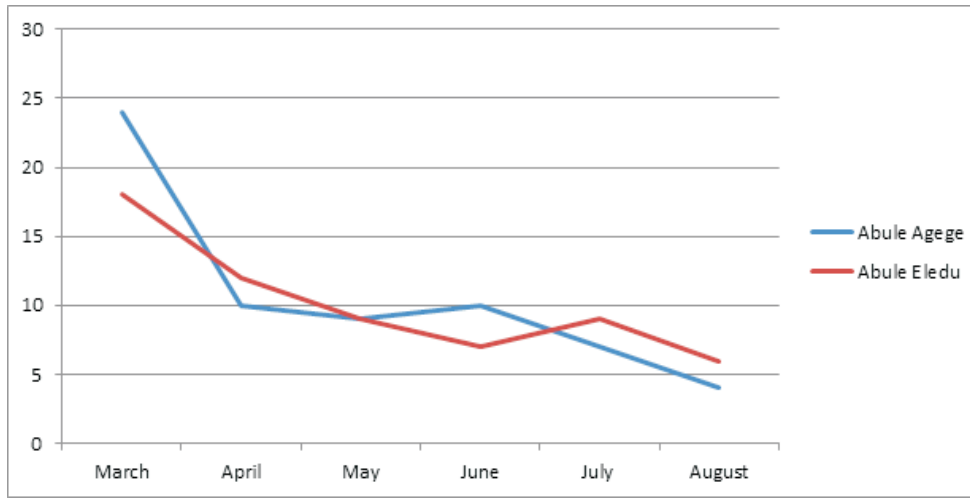

Figure 4: Graphical representation of the Catch per unit effort of Abule Agege and Abule Eledu

Physico-chemical characteristics of the creeks

The salinity of the Abule Agege creek ranged from 0.384 – 2.14% with standard deviation of 0.702. The recorded values of dissolved oxygen varied by 2.0ppm with maximum value of 5.5 ppm and a minimum value of 3.5 ppm. The pH of the Abule Agege creek ranged from 6.4 – 8.2 with a mean of 7.5. The Biochemical Oxygen Demand (BOD) declined in August to 10ppm in the creek while the highest value of 60ppm was recorded in the month of May. Turbidity varied slightly all through the six months; the highest value 109.1 was recorded in April. The salinity had standard deviation of 0.072 and ranged from 0.345 - 0.584% with a mean value of 0.487. The highest value of dissolved oxygen was recorded to be 6ppm in the month of July. The pH values were relatively constant all through the sampling period. Recorded values of turbidity ranged between 7.0 and 7.8 with a standard deviation of 0.279. Also, highest value of BOD was recorded in April, June and July. The lowest turbidity value was recorded in May to be 101.6 but peaked in August to 105.0. Total Suspended Solid (TSS) ranged from 115.9 - 135.0 with a standard deviation of 6.30 and the highest temperature value was recorded in March with the lowest value recorded in July (Table 4).

Physico chemical characteristics of Abule Eledu creek

The salinity had standard deviation of 0.072 and ranged between 0.345 and 0.584‰ with a mean value of 0.487. The highest value of dissolved oxygen was recorded to be 6ppm in the month of July. The pH values were relatively constant all through the sampling period. Recorded values of turbidity ranged from 7.0 – 7.8 with a standard deviation of 0.279. Also, the highest BOD value was recorded in April,

Table 4: Physico- chemical characteristics of Abule Agege Creek

Parameter	Mar	April	May	June	July	Aug	Range	Mean±SD
Salinity (%)	2.14	2.05	1.10	0.85	0.384	0.93	0.384-2.14	1.24± 0.702
D.O(ppm)	4.0	4.4	4.5	3.5	5.5	5.3	3.5-5.5	4.5±0. 694
pH	7.8	7.6	8.2	7.6	7.1	6.4	6.4-8.2	7.5±0.625
BOD (ppm)	31	27	60	35	15	10	10-60	29.7±16.121
Turbidity (FTU)	100.8	109.1	108.1	107.0	101.0	109.0	101.0-109.1	105.8±3.556
TSS (ppm)	120.0	120.0	100.0	90.0	104.0	140.0	90.0-140.0	112.3±16.346
Temperature (ºC)	28.6	28.7	27.8	26.1	24.6	22.6	22.6-28.6	26.4±2.230

S D: Standard Deviation

Table 5: Physico- chemical characteristics of Abule Eledu Creek

Parameter	March	April	May	June	July	August	Range	Mean±SD
Salinity (%)	0.345	0.477	0.523	0.512	0.584	0.483	0.345-0.584	0.487±0.072
Dissolved Oxygen (ppm)	4.0	3.5	4.4	3.4	6.0	5.1	3.4-6.0	4.4±0.914
pH	7.8	7.4	7.1	7.5	7.0	7.1	7.0-7.8	7.3±0.279
BOD (ppm)	11.0	13.0	12.0	13.0	13.0	12.0	11.0-13.0	12.3±0.745
Turbidity (FTU)	102.6	104.1	101.6	103.5	103.0	105.0	101.6-105.0	103.3±1.083
TSS (ppm)	127.3	133.2	115.9	132.1	130.0	135.0	115.9-135.0	128.9±6.307
Temperature (ºC)	28.6	28.5	27.5	26.5	24.4	27.4	24.4-28.6	27.15±1.411

S D: Standard Deviation

June and July. The lowest turbidity value was recorded in May to be 101.6 but peaked in August to 105.0. TSS ranged between 115.9 and 135.0 with a standard deviation of 6.30 and the highest temperature value was recorded in March with the lowest value recorded in July (Table 5).

DISCUSSION

One hundred and twenty-five fish belonging to five families and seven species were caught in both creeks during this study. All the species agreed to the work reported by Fagade and Olaniyan (1974), Solarin (1998), Emmanuel and Kusemiju (2005) and Emmanuel and Olojede (2010) of the Lagos Lagoon species diversity and this is because Lagos Lagoon has great influence on the species diversity, salinity and physico-chemistry of the creeks. Most of the species caught were juvenile and this is because the creeks serve as a nursery ground and the mangrove prop-roots create a special underwater habitat, especially during the breeding and juvenile stages as reported by Bennett (1989), Emmanuel and Kusemiju (2005) and Emmanuel and Olojede (2010). This also suggested that the creeks are stressed ecosystem due to unregulated fishing activities in the water bodies which resulted in the low species diversity that occurred in the study as noted by Emmanuel and Onyema (2007) and Emmanuel and Olojede (2010). The construction activities in the area might be another responsible factors for the low species as the disturbances could scare the fishes away (Emmanuel, 2009).

The most abundant of the species caught during the study was the Portunidae family represented by *Callinectes amnicola,* which was also reported by Emmanuel and Olojede (2010) in the same creek. This might have occurred due to the soak time of the trap that allowed the crab to use the finfishes in the traps as bait and also some of the decayed fishes smell that also attracted the crab to the trap as noted by Emmanuel (2008). Galvanized wire gauze trap baited with processed cassava (fufu) performed better and had more catches than the trap baited with coconut and this happened because processed cassava (fufu) attracts fish by releasing the strong smell into the water which makes the fish perceive the stimuli faster and stronger compared to coconut bait (Lokkeborg, 2014; Emmanuel and Awojide, 2016). The chemical stimulus released by processed cassava (fufu) is dispersed over a long distance in the water by the continuous movement of water current. It can be, therefore, agreed that processed cassava release strong and lasting chemical stimulus compared to coconut when used as bait in fishing gear (Emmanuel and Awojide, 2016).

The occurrence of S*arotherodon melanotheron, Hemichromis fasciatus* and *Callinectes amnicola* in both studied stations indicated that these species can tolerate a wide range of salinity, and that they migrate at a stage in their life cycle for the purpose of spawning, breeding, feeding, etc. A similar finding was reported by Albaret and Laë (2003) and Emmanuel (2008) for the Ebrie lagoon (West Africa) and Abule Agege creek (Lagos, Nigeria), respectively. The slight variation in the water temperature in the creeks could be linked with the shallowness of the creeks and regular tidal motions of water into the creeks which ensured the complete mixing of the water. This observation agreed with the report of Ajao (1990) and Emmanuel and Onyema (2007).

Since the optimum pH range for sustainable aquatic life is 6.5 – 8.2 (Murdock, 2001), the pH of the creeks was within optimum range all through the study period. The low level of dissolved oxygen could be attributed to high level of organic pollution which resulted in biodegradation by biotic microorganisms in the creeks (Nkwoji *et al*., 2010). The continuous rise and fall in the salinity levels of the creeks could be attributed to the inconsistent flow sea incursion, reduced flood, and water inflow from associated river, creeks and freshwater lagoons (Emmanuel and Onyema, 2007).

The catch composition of the trap may not be total representation of the fish species in the creek as the trap may be selective for some species as reported by Emmanuel and Akinniyi (2018) that wire gauze traps are highly selective fishing gears and are good for the sustainable development of fishery stocks. The CPUE was observed to be highest in both creeks in March due to the availability of food substances; while the least catch per trip was recorded in August in both creeks because of the depth at which the traps were operated (1.5-2.0m); the same depth where crabs' abundance had been recorded in previous studies (Emmanuel, 2008). Traps will help improve already damaged and stressed ecosystems by reducing the number of untargeted fish species compared to other active fishing gears. A very high number of shell fish compared to the number of fin fish was caught during the study. This agreed with the report of Emmanuel and Olojede (2010).

CONCLUSION

The findings of the study on the selectivity and effectiveness of galvanized wire traps will assist fish managers and environmentalists in making decisions to sustain ecosystem diversity restorations, appropriate fishing seasons, as well as water quality improvement. However, it is also important to note that the mesh size played an important role to determine the size of the species caught.

Conflict of interest: Authors indicate that there is no any actual or potential conflict of interest that could inappropriately or possibly influence this work after publication.

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