IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 12, Issue 4 Ser. I (April 2019), PP 69-77
www.iosrjournals.org

Drum Trap Fishery: An Innovation in the Fisheries of the Nun River, Bayelsa State, Nigeria

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Abstract: *Drum fishing trap was studied in the Nun River, Bayelsa state between January and June, 2018 to determine the mode of construction, fish species composition, most preferred bait and most dominant fish species caught by the Drum trap. Three sampling stations were selected based on the fishing activities of the fishers. A Completely Randomized Design was adopted with three traps in each station resulting to 9 traps. The 9 traps were set baited with life-fish, groundnut cake and a control set of traps without bait. Traps were set and retrieved after 120 hours thereafter fish caught were sorted, counted and identified into their respective families and species levels using standard identification keys. 14 fish species belonging to 9 families were recorded including Claroteidae as the most abundant family (41.8%) and Polypteridae least abundant (0.8%) family. Clarotiedae and Mochokidae families constituted the most dominant fish families in the drum trap. The most abundant species caught were Chrysichthys nigrodigitatus (38.5%) followed by Heterobranchus bidorsalis (10.7%) and Synodontis clarias (9.8%) while the least caught species was Polypterus senegalus (0.8%). Station 2 (110) recorded the highest number of fish caught and station 1 (61) the least. The monthly catch of fish was highest (60) in June and least number (23) was caught in January. The drum trap baited with life-fish (Chrysichthys nigrodigitatus) caught the highest number of fish species (151) with relative species diversity index (RSDI) of 10.79 and drum trap without bait (empty) caught the least number of fish species (22) with RSDI of 1.57. The study therefore suggest that the drum trap may be an excellent fishing trap for Chrysichthys nigrodigitatus fisheries in the Nun River. However, more studies are needed to ascertain its suitability and environmental friendliness.*

Keywords: Drum Trap, Fisheries and Nun River.

Date of Submission: 07-04-2019 Date of acceptance: 23-04-2019

I. Introduction

Fishing is the practice of harvesting aquatic organisms such as finfish, shellfish, squid, octopus, turtles, frogs and some edible marine invertebrates with the fundamental principles of filtering the water, luring and outwitting the prey by hunting (Gray *et al.,* 2007). This practice is often carried out with specific but various fishing gear such as lift nest, drift nets, cast nets, traps etc. which are referred to as fishing gear (Tagago and Ahmed, 2011; Kwen *et al*., 2013). Traps are simple passive gear which allows fish to enter and make escape difficult by means of chambers and non-return valves (Davies and Kwen, 2012, Kingdom and Ogbulagha, 2013). Due to advancement in technology, it has led to the invention of different and more effective fishing gear (Tagago and Ahmed, 2011; NIFFR, 2012). Seasonal changes in species diversity and abundance have stimulated the design of varieties of fishing gear (Bankole *et al*., 2003). One such trap that has under gone numerous design specifications is the Drum trap which is popular in the inland waters of Nigeria. However, its use as fishing gear is relatively new as observed in the Nun River by Kwen *et al.* (2013) studies. The term fisheries denote a number of different types of fishery viewed together in a given area or country (NIFFR, 2012). It could denote an area with its associated fish or aquatic population which is harvested for its commercial value (Gray *et al*., 2007). Sanni*et al.* (2011) noted that a fishery could be typically defined in terms of the people involved, species or type of fish, area of water or seabed, method of fishing, class of boats, purpose of the activities or a combination of the foregoing features. A fishery may involve the capture of wild fish, or raising fish through fish farming or aquaculture (Sanni*et al.,* 2011). Sanni*et al.* (2011) reported that over 500 million people are depending either directly or indirectly on fisheries and aquaculture for their livelihood in Nigeria. The drum trap is relatively a new trap been introduced into the Upper Nun River, by migratory Benin fishers from Ovia South West Local Government Area of Edo state in collaboration with Malian fishers. The trap is one of the commonest and efficient types of gear used among the various fishing methods in the Nun River (Kwen *etal*.,

2013). Drum trap fishery commenced between 2006 and 2007 in the study area, which is made up of a normal metal drum with one funnel-shaped non-return valve with an opening by the side which can be open to permit removal of fish with a nylon rope for hauling the trap. The trap is usually set along the littoral zone of rivers or creeks, baited with live post fingerlings of *Chrysichthysnigrodigitatus*. The trap's catch often includes various species of fishes such as *Chrysichtys,Bagrus, Clarotes, Heterobranchus, Synodontis* and *Malapterurus* (Kwen *etal*., 2013).

Justification of the study

The drum trap fishery is indeed a new type of fisheries that is being introduced into the Nun River mostly around the Polaku community and its environs. The drum trap is gradually spreading rapidly to neighbouring areas within the vicinity due to its efficiency (Kwen *et al*., 2013). Despite the increasing popularity of drum trap fisheries, only little scientific work has been carried out on the trap in the Niger Delta area. The result of this study shall therefore contribute basic information about the drum trap fishery especially the mode of construction, catch composition and the most dominant species caught in the Nun River.

General objective of the study

The general objective is to evaluate the drum trap in the Nun River, in respect to the mode of construction, catch composition and most dominant fish species caught in the trap.

Specific objectives of the study

The specific objectives of the study are:

1. To determine the mode of construction of the drum trap.
2. To examine the fish species composition caught by the drum trap.
3. To ascertain the monthly fish species caught during the study.
4. To determine the most dominant fish species caught by the trap.
5. To examine the size distribution of fish caught by drum trap.
6. To identify the most preferred bait for drum trap fishery in the study area.
7. To examine the seasonal catch of fish during the study.

II. Materials and Methods

Study Area

The study was carried out at the Upper Nun River around Polaku Town in Yenagoa Local Government Area of Bayelsa State. The Nun River is one of the numerous low land rivers in the Niger Delta. The river is seasonal, usually over flooding its bank during the rainy season in the months of August and September, and even up to October at times. The area lies between longitudes 6^{o} 17'E and 6^{o} 18'E, and latitudes 5^{o} 01' N and 5^{o} 02'N along Nun River and is the stretch of the river with wild meandering. The outer concave bank is deep with a moderately steepy and muddy bottom. The inner convex bank is relatively shallow with a sandy point bar. Polaku Town where the study was carried out is at a point on the River Nun where the Taylor Creek empties and is subjected to mild tidal influences in the dry season. Water flows rapidly in one direction during the flood period. At the peak of the dry season the direction of flow is slightly reversed during the rising tide and at full tide the flow almost stagnates.

Selection of stations

The stations used for the study were carefully chosen based on the fishing activities on-going in the stations along the Nun River around Polaku Town. The stations were labeled ST1 (Station 1), ST2 (Station 2) and ST3 (Station 3). The stations are 1 – 2 kilometers apart and are the major fishing sites along the Nun River around Polaku Town.

Materials for construction

The materials used for the construction of the experimental Drum Trap are: metal drum, synthetic twine (210d/9), netting material of mesh sizes three inches (3"), Liane canes (*calamus spp*.), nylon rope of 15 mm, chisel, hammer, knife, razor blade and needle.

Pre-treatment of the Drum trap

The Drum traps used for the study were kept in water for two weeks before they were used for the experiment. This was done in order to reduce or remove the substance and smell of the content that was contained in the drums not to scare away fish from entering the Drum traps. Thereafter, the Drums were taken to the fishing stations for the experiment.

Experimental design

The design for the experiment was a Complete Randomized Design (CRD) with bait type as the factor of comparism. Nine traps comprising three each of the Drum trap was used at each station. The traps were baited with life-fish (LFH) such as *Chrysichthys nigrodigitatus*as shown in Plate 1, groundnut cake (GNC) and without bait (NBT) as control separately. They were set at the littoral zone of the Nun River at the designated stations on the same day between 6:30 am and 7:30 am in the morning and haul after 5 days in the morning between 8:00am and 9:00am maintaining a soaking time of 120 hours for six months.

Plate 1: Photograph showing life-fish (*Chrysichthysnigrodigitatus*) used as bait in the drum trap

Sampling Procedures

The study was carried out for six months from January – June 2018, using nine drum traps to obtain fish samples twice monthly at 14 days' intervals at three stations labeled ST 1, ST 2 and ST 3 along the bank of Nun River around Polaku Town. Traps were set in the morning between 6:30am and 7:30am and, were hauled after 5 days in the morning between 8:00am and 9:00am maintaining a soaking time of 120 hours. The fish species caught, were sorted and counted based on the number caught according to the bait type. Thereafter were separated into their respective families and species using fish identification keys byIdodo-Umeh (2003), Olaosebikan and Raji (2013). The total length (cm) of each fish species caught was measured using a measuring board having a calibrated metric ruler while the total weight (g) was obtained using a top load weighing Mettler balance Model 2000.

Description of drum trap

Drum trap is relatively a new type of trap used at the Nun River around Polaku Town in Gbarain Kingdom in Yenagoa Local Government Area and its environs. The trap was and constructed with normal metal drum with dimensions (Plate 2): height 895mm, diameter 585mm, an opening for fish collection of 200mm and entrance (non-return) valve of 220mm.

Plate 2: Drum trap before and after construction

Mode of construction

The construction was done using a chisel to cut along the marks drawn on the drum, starting with the entrance valve, followed by an opening for fish collection and boring of holes at the posterior part. After which an entrance valve made of cane and netting material was installed using twine (Plates 3a-3h). Nylon rope was fastened to the drum which was used for hauling the fish trap (Drum trap). The drum trap was constructed in multi-stage process in the following sequence.

Plate 3.3a: Cutting out non return valve position

Plate 3.3b: Completion of non-return valve position

Plate 3.3c: Cutting-out position for fish collection

Plate 3.3d: Completion of position for fish collection

Plate 3.3e: About installing the non-return valve

Plate 3.2f: Installing of non-return valve in progress

Plate 3.2g: Complete installation of non-return valve

Plate 3.3h: Construction of Drum Trap completed

Data Analysis

The data collected on fish number, weight and total length of each fish species were subjected to descriptive Statistics and Analysis of Variance (ANOVA) using the Statistical Package for the Social Sciences (SPSS, 1999). Where there is significant difference the mean values were separated using Duncan Multiple Range Test (Ahmed *et al*., 2005). The relative abundance in terms of number and weight of fish species of the various traps used were determined in percentages. The Relative Species Diversity Index (RSDI) for each trap was calculated using the modified version of the formula described by Adimula (2003) and Ahmed *et al.* (2005):

RSDI= Number of species caught by each trap type
Total number of species caught by all traps

III. Results

Total number of fish caught

The total number of fish caught from the various months is shown in Table 1. The results revealed that a total of 244 fish were caught with the highest (118) number in station 2 (ST2), followed by station 3 (ST3) (76) and the lowest quantity (50) was in station 1 (STI). In terms of monthly catches, the total number of fish caught in station 1 ranged from 3-15 fish, station 2 was 8-31 fish and the number in station 3 ranged between 7and 20 fish.

Table 1: Total number of fish caught in the various months from the various stations by drum traps during the study

Month	ST1		ST2		ST3		Total fish caught
	No. of fish Caught	% of total catch	No. of fish Caught	% of total catch	No. of fish Caught	% of total catch	
January	3	13.0	13	56.6	7	30.4	23
February	9	34.6	8	30.8	9	34.6	26
March	6	17.6	18	52.9	10	29.4	34
April	13	27.1	23	47.9	12	25.0	48
May	4	7.5	31	58.5	18	34.0	53
June	15	25.0	25	41.7	20	33.3	60
Total	50		118		76		244

Source: Field survey, 2018.

Families and species of fish caught

The composition of fish species caught by the drum fishing trap is presented in Table 2. Fourteen (14) fish species belonging to nine (9) families were caught in the study of the Nun River. The family Claroteidae ((Plates 1 and 4.2)) had the highest (102) number of fish with 41.8% of the total catch, followed by Mochokidae with 18.0%, Clariidae 14.8% Bagridae 10.7%, Malapteruridae 4.9%, Mormyridae 4.3.7%, Alestidae 3.3%, Hepsetidae 2.0%. The lowest (2) number of fish caught was Polypteridae with 0.8%. The families Clariidae, Mochokidae, Bagridae, Claroteidae and Alestidae were represented by two species each and the other four families (Mormyridae, Malapteruridae, Hepsetidae and Polypteridae) were represented by one species each (Table 2). The number of the species caught in the drum fishing traps varied greatly whereby *Chrysichthysnigrodigitatus* accounted for the highest (38.5%), followed by *Heterobranchusbidorsalis* (10.7%), *Synodontisclarias* (9.8%), *Synodontissorex* (8.2%), *Bagrusbayad* (7.4%), *Malapteruruselectricus* (4.9%), *Heterobranchuslongifilis* (4.1%), *Mormyropsdelicious* (3.7%), *Bagrusfilamentosus* (3.3%), *Claroteslaticeps* (3.3%), *Hydrocynus forskalii* (2.0%), *Hepsetus odoe* (2.0%), *Hydrocynus brevis* (1.2%), and *Polypterus senegalus* (0.8%), the lowest (Table 2).

Table 2: Catch composition of the drum trap during the study

Family	No. of fish caught	% of total catch	Species identified	No. of fish caught	% of total catch
Alestiedae	8	3.3	*Hydrocynus brevis*	3	1.2
			Hydrocynus forskalii	5	2.0
Bagridae	26	10.7	*Bagrus bayad*	18	7.4
			Bagrus filamentosus	8	3.3
Clariidae	36	14.8	*Heterobranchus bidorsalis*	26	10.7
			Heterobranchus longifilis	10	4.1
Claroteidae	102	41.8	*Chrysichthys nigrodigitatus*	94	38.5
			Clarotes laticeps	8	3.3
Hepsetidae	5	2.0	*Hepsetus odoe*	5	2.0
Malapteruridae	12	4.9	*Malapterurus electricus*	12	4.9
Mochokidae	44	18.0	*Synodontis clarias*	24	9.8
			Synodontis sorex	20	8.2
Mormyridae	9	3.7	*Mormyrops deliciosus*	9	3.7
Polypteridae	2	0.8	*Polypterus senegalus*	2	0.8

Source: Field survey, 2018.

Table 3 shows the monthly catch composition of fish species during the study. The highest number (60) was caught in June, followed by May (53), April (48), March (34), February (26) and the least number (23) of fish was caught in January. However, there was significant difference between the catches ($P<0.05$).

The catch composition of fish species based on the different stations is shown in Table 4. The results revealed that the highest fish catch was obtained in station 2 (110), followed by station 3 (73) and the least catch was obtained in station 1 (61) ($P<0.05$).

Table 3: Monthly catch composition of fish species during the study

Species	Jan.	Feb.	Mar	Apr.	May	Jun.	Total No. of fish caught	% of total catch
Bagrus bayad	3	3	5	7	0	0	18	7.4
Bagrus filamentosus	0	0	2	0	0	6	8	3.3
Chrysichthys nigrodigitatus	9	12	12	18	20	23	94	38.5
Clarotes laticeps	1	0	0	0	0	7	8	3.3
Heterobranchus bidorsalis	2	3	5	0	5	11	26	10.7
Heterobranchus longifilis	1	1	0	8	0	0	10	4.1
Hepsetus odoe	0	0	0	0	3	2	5	2.0
Hydrocynus brevis	0	0	0	3	0	0	3	1.2
Hydrocynus forskalii	0	1	0	0	0	4	5	2.0
Malapterurus electricus	2	0	0	3	7	0	12	4.9

Mormyropsdeliciosus	1	0	0	4	4	0	9	3.7
Synodontis clarias	2	6	0	5	6	5	24	9.3
Synodontis sorex	2	0	10	0	8	0	20	8.2
Polypterussenegalus	0	0	0	0	0	2	2	0.8
Total	23	26	34	48	53	60	244	
Ranking	6	5	4	3	2	1		

Source: Field survey, 2018.

Table 4: Catch composition of fish species based on stations during the study

	Stations				
Species identified	ST1	ST2	ST3	No. of fish caught	% of total catch
Bagrus bayad	3	9	6	18	7.4
Bagrus filamentosus	4	2	2	8	3.3
Chrysichthys nigrodigitatus	20	50	24	94	38.5
Clarotes laticeps	3	2	3	8	3.3
Heterobranchus bidorsalis	6	12	8	26	10.7
Heterobranchus longifilis	5	2	3	10	4.1
Hepsetus odoe	1	0	4	5	2.0
Hydrocynus brevis	0	3	0	3	1.2
Hydrocynus forskalii	0	4	1	5	2.0
Malapterurus electricus	6	2	4	12	4.9
Mormyropsdeliciosus	2	5	2	9	3.7
Synodontis clarias	5	12	7	24	9.3
Synodontis sorex	6	6	8	20	8.2
Polypterussenegalus	0	1	1	2	0.8
Total	61	110	73	244	
Ranking	3	1	2		

Source: Field survey, 2018.

Fish caught based on bait type

The number of fish caught based on the bait types is presented in Table 5. The results show that the drum trap baited with live-fish (LFH) (*Chrysichthysnigrodigitatus*) caught the highest number of fish species (151) with relative species diversity index (RSDI) of 10.79, followed by drum trap baited with groundnut cake (GNC) (71) with RSDI of 5.07 and the drum trap without bait (NBT) caught the least number of fish species (22) with RSDI of 1.57. The dominant species of fish caught by the drum traps baited with live-fish were *Chrysichthysnigrodigitatus* (64), *Heterobranchusbidorsalis* (19), and *Bagrusbayad* (12), trap baited with groundnut cake *Chrysichthysnigrodigitatus* (20), *Synodontisclarias* (14), *Synodontis sorex* (13) and drum trap without bait *Chrysichthysnigrodigitatus* (10) and *Heterobranchuslongifilis* (3) were dominant.

Fish caught in the two seasons

Figure 1 shows the total number of fish caught in between January and March (dry season) and April and June (wet season). The dry season caught 102 fishes with 41.8% contributing to the total catch and the wet season caught 142 fishes with 58.2% resulting to the total catch. There was significant difference ($P<0.05$) in the number of fish caught in the two seasons.

Table 5: Number of fish species caught based on the bait type

	Bait Type						
Species	L. Fish	% of total catch	GNC	% of total catch	NBT	% of total catch	Total
B. bayad	12	66.7	4	22.2	2	11.1	18
B. filamentosus	4	50.0	3	37.5	1	12.5	8
C. nigrodigitatus	64	68.1	20	21.3	10	10.6	94
C. laticeps	4	50.0	3	37.5	1	12.5	8
H. bidorsalis	19	73.1	5	19.2	2	7.7	26
H. longifilis	7	70.0	0	0.0	3	30.0	10
H. odoe	4	80.0	1	20.0	0	0.0	5
H. brevis	3	100.0	0	0.0	0	0.0	3
H. forskalii	5	100.0	0	0.0	0	0.0	5
M. electricus	11	91.7	1	8.3	0	0.0	12
M. deliciosus	1	11.1	7	77.8	1	11.1	9
S. clarias	10	41.7	14	58.3	0	0.0	24
S. sorex	5	25.0	13	65.0	2	10.0	20
P. senegalus	2	100.0	0	0.0	0	0.0	2
Total	151		71		22		244
RSDI	10.79		5.07		1.57		

Source: Field survey, 2015.
RSDI = Relative species diversity index

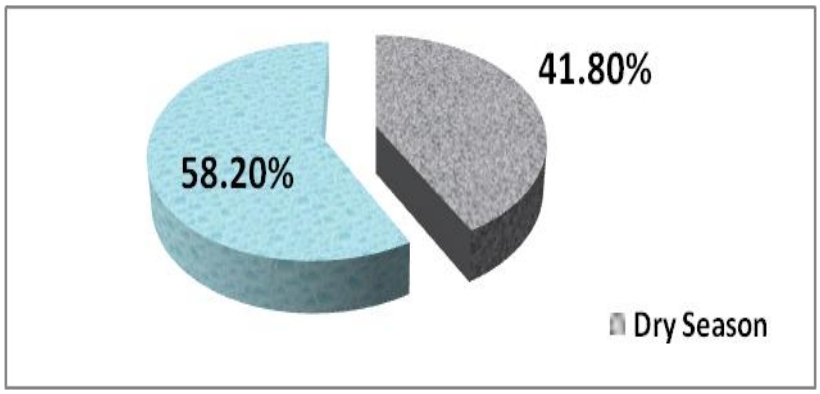

Figure 1: Total number of fish caught from the dry and wet seasons by drum trap during the study

IV. Discussion

Mode of drum trap construction

The drum traps used for this study were constructed with normal metal drum, synthetic twine (210d/9), netting material of three inches (3") mesh sizes, Liane canes (*calamus spp*.), nylon rope of 15 mm, chisel, hammer, knife, razor blade, needle. This was similar to drum traps used by Anwa-Udondiah*etal*. (2013) in Ifiayong River, AkwaIbom State with dimensions; height 895mm, diameter 585mm, an opening for fish collection of 200mm and entrance (non-return) valve of 220mm.

Catch composition of fish.

The diversity of fish species recorded in this study indicated that the fishing in the Nun River is multi-species. The 9 families and 14 species recorded in the drum traps were similar to those reported by Anwa-Udondiah*etal*. (2013) on the efficiency of drum traps for silver catfish fishery in the face of climate change in Ifiayong River, AkwaIbom State, Nigeria and Kwen *etal*. (2013) on the fishing trials of metal drum traps in the Upper Nun-River, Bayelsa State. However, the number and size of fish species caught in this study were higher and larger than those of Anwa-Udondiah*et* al. (2013) in Ifiayong River in Akwa-Ibom State and Kwen et *al*. (2013) producing fishing traps using a drum trap in the Upper Nun River Bayelsa State.These variations in terms of number of fish caught and sizes could be attributed to the time frame of the study (Davies and Kwen, 2012), soaking time (Davies and Kwen, 2012), variation in sampling methods, difference in locations (Okorie, 2005), seasonal change (Sonyinka and Kazeem, 2008) and water bodies the studies were been carried out (Nguyen *et al*., 2008). The high number of species of Claroteids, Mochokids and Clariids caught in the Nun River is in consonance with the report of Davies and Kwen (2012) and Kwen *et al.* (2013) in the Upper Nun River, Bayelsa State, who stated that freshwater fish families of commercial importance in species diversity included Mochokiadae, Clariidae, Mormyridae, Cyprindae, and Cichlidae. The size distribution of the fishes caught revealed that the drum traps were capable of capturing larger sized fish than juveniles. Earlier investigation (Kwen *etal*., 2013) in freshwaters in Nigeria showed that drum trap with small mesh sizes used in the construction of the non-return values exploited juvenile fishes. However, the size range of fish (13.10-72.10 cm) caught in this study were larger than those reported by Anwa-Udondiah*et al.* (2013) (10.50-48.10 cm) in Ifiayong River in Akwa-Ibom State. Traps baited with live-fish (*Chrysichthysnigrodigitatus*) caught the highest number of species and species diversity indices indicating the attractiveness of life-fish to more of the catfish especially *chrysichthysnigrodigitatus*. This could be due to the fact that these fish species have the ability to perceive their fellow odour more than their vision to detect colour. This is in line with the observation of Balogun (2006) who reported that stimuli perceived by the senses like small taste, sight and lateral line system control the regulatory feeding act of fish.

Dominant Fish Species

The drum traps generally were dominated by Claroteids, Mochokids and Clariids. This view was also observed by Kwen *etal*. (2013) indicating that the drum traps are more selective for mainly the catfishes. The dominance of *Chrysichthysnigrodigitatus*, *Claroteslaticeps* and *Heterobranchusbidorsalis* was also reported by Anwa-Udoncliah*etal*. (2013) in Ifiayong River in Akwa-Ibom State. The drum fishing trap in this study caught more of *Chrysichthys nigrodigitatus* than any other species. The reason why it caught more *Chrysichthys nigrodigitatus* could be due to the following factors: that the trap is selective of *Chrysichthys nigrodigitatus*, the life-fish of *Chrysichthysnigrodigitatus* being used as baits, darkness and hollow nature of the trap. The number of families and species recorded in the drum fishing trap was similar with those recorded in the fishing pot trap in River Rima, Northwestern Nigeria (Agbelege and Ipinjolu, 2001) and that of Davies and Kwen (2012) in the

Upper Nun River, Niger Delta, Nigeria using the Malian and Ikara traps. The highest catch from the stations were in the months of June (60) May (53) and April (48) while the lowest catches were in the months of January (23), February (26) and March (34). This could be due to the flooding of the watershed. The results show that the highest catches were obtained in station 2 (110) and station 3 (73). This could be as a result of their closeness to Igbedi and Taylor Creeks, which are feeder systems bringing additional nutrients in to the Nun River.

V. Conclusion

The Results of this study showed that;

1. The Nun River area offers a variety of fish species for fishers which include *Bagrus bayad, Bagrus filamentosus, Chrysichthys nigrodigitatus, Clarotes laticeps, Heterobranchus bidorsalis, Heterobranchus longifilis, Hepsetus odoe, Hydrocynus brevis, Hydrocynus forskalii, Malapterurus electricus, Mormyrops deliciosus, Synodontis clarias, Synodontis sorex* and *Polypterus senegalus.*
2. The most abundant family in the catch was Claroteidae and least was Polypteridae.
3. The drum trap fishery is multi-species but specific to Claroteids.
4. Drum trap baited with life-fish is more effective in Claroteids/Mochokids/Clariids fisheries
5. Life-fish bait is more effective than groundnut cake as baits in drum traps for capturing Claroteids in the Nun River.

VI. Recommendations

Based on the results the following recommendations are suggested to enhance drum trap fisheries:

1. The use of drum as a fishing gear is recommended for capturing Claroteids such as *Chrysichthys nigrodigitatus* in the Nun River.
2. Further studies should be carried out in order to look at different soaking time in relation to catch.
3. Further studies should be conducted on the drum traps, to ascertain their suitability and environmental friendliness.

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