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Fish Weight and Species Diversity of Traditional and Modified Malian Traps in Tagwai Dam of Niger State, Nigeria

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Abstract
Over the last century riverine ecosystem have suffered from intense fishing, resulting to over exploitation and extinction of several species of fish. This study seeks to determine fish weight and species diversity of Tagwai Dam using traditional and modified Malian traps. The traps were designed using computer paint application and constructed with *Mimosa pigra* wooden frame. Traditional Malian trap (TMT) has cone shape, while the modified Malian traps has semi-circular (MSCMT) and rectangular shape (MRMT) respectively. The traditional Malian traps were enclosed in 3.75 cm mesh-size while the modified Malian traps were both enclosed in a netting material of 5 cm mesh-sizes (Standard). A total of 236 fishes were caught by both traps. traditional Malian trap caught fishes comprising of *Sarotherodon galileus. Tilapia zilii, Clarias gariepinus, Oreochromis niloticus* and *Synodontis membraneceous*. While modified semi-circular Malian trap caught fishes of similar species and modified rectangular Malian traps caught fishes which were similar species with addition of *Hydrocynus forskalii.* The total weight of the fish caught were 7,247.20 g, 4,154.20 g and 4,209.78 g for (TMT), (MSCMT), and (MRMT) respectively. There was no significant difference ($p>0.05$) in the biomass and species of fish caught with the Traps. This shows that despite the large netting mesh size of the modified Malian traps and low number of catches, it has the potential of competing favourably with its traditional counterpart. Therefore, modified Malian traps of this nature are recommended as tools in the study of ichthyofaunal composition and sustainable management of fishery resources.

Keywords: Mesh size, Cone shaped Malian trap, Semi-circular shaped Malian trap, Rectangular shaped Malian trap, Tagwai Dam.

Introduction
Nigeria is blessed with abundant natural water bodies with diverse fish resources. Most Nigeria's populations dwelling near water bodies such as lakes, lagoons, reservoirs, rivers, swamps and coastal lagoons depend heavily on the resources of such water bodies for their main source of livelihood (Abubakar *et al.,* 2006). The fish productivity of most Nigeria inland waters is generally on the decline (Jamu and Ayinla 2003). The decline of these fishes has been attributed to several causes ranging from environmental degradation of the water bodies to inadequate management of the fisheries resources. For sustainable exploitation of these resources, a crucial management tool is to have a comprehensive understanding of the ichthyofaunal composition of the water bodies. Lawson and Olusanya (2010) reported that species diversity is the number of different species in a given area. They are commonly used in conservation studies to determine the balance of ecosystem and their species. Information generally on fish abundance studies of natural water bodies is helpful in the sustainable management of the aquatic resources. Lawson and Olusanya (2010) further noted that for the sustainability of fish resources to be attained, it is pertinent to have adequate knowledge of species diversity, composition and relative abundance of the water bodies. Also, the avoidable decline of fisheries resources in an area occasioned by overexploitation and inadequate management of inland waters could be unraveled through the availability of relevant information of various parameters of species in the river. According to Suter (2007), species diversity and relative abundance studies have been advocated for ecological risk assessment in the aquatic system. Fish abundance studies could also help identify the presence of species of importance and economic value to the livelihood of the people living in an area. However, Jamu and Ayinla (2003) reported that the yields of most inland waters are generally on the decline as result of improper management of fisheries resources, environmental degradation such as water pollution. This study is aim at determine the fish species diversity and weight of Tagwai dam reservoir with a view of providing information on the ichthyofaunal composition of the dam and the potential of modified alian traps in relation to its traditional counterpart.

Materials and methods

Study Area

The research was carried out at Tagwai Dam located in Minna, Niger State. The geographical co-ordinates of the Dam are Latitude 6°39' to 6°44' East and Longitude 9°34' to 9°37' North to South East of Minna-Suleja Road (Fig. 1). (Alkali, 1994).

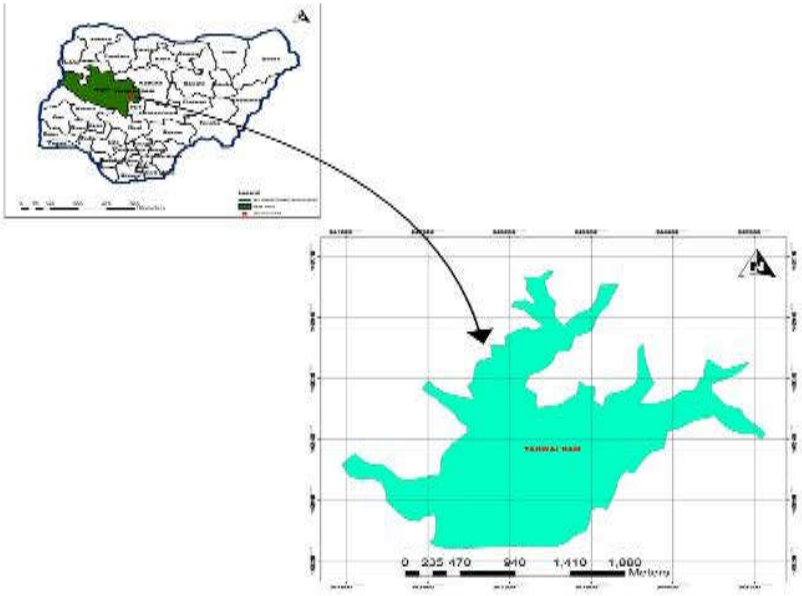

Figure 1. Nigeria and Niger State inset (Tagwai Dam)
Source: (Abdullahi, 2015)

Traditional Malian trap

Wooden stick of giant sensitive plant (*Mimosa pigra*) were used as wooden frame for the construction. The diameters of the stick ranges from 3 cm to 4 cm respectively (Fig. 2). The sticks were then bent to form round shape of different diameters 130 cm, 100 cm and 70 cm respectively, and tied tightly with (rope size number 9) to avoid loosening. Wooden frames of 75 cm height were mounted and tied on the round bottom. The same procedure was repeated for the middle and the tops. Thereafter, the structures were covered with polyamide netting material (3.75 cm) mesh-size. 3 spaces for non-return valves were carved out and they were finally fixed. 6 traditional Malian Traps were constructed (plate I)

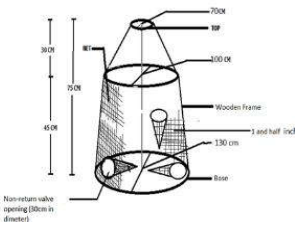

Figure 2: A sketch of a traditional Malian (TMT) Source: (Field Design, 2018)

Plate I: Traditional Malian traps after construction trap
Source: (Field work, 2018)

Modified semi-circular Malian trap

Again, the giant sensitive plant (*Mimosa pigra*) was used for the construction of modified Malian trap. 100 cm length, and 50 cm width of the wooden stick were tied together to form rectangular base. See (Fig. 3). This was followed by the mounting of bent wooden frame of 50 cm height. The frame was supported with straight wooden sticks strongly tied together as shown in Plate III. Thereafter, the structures were covered with polyamide netting material of 5 cm or (2 inches) mesh-size (Recommended standard mesh-size). 4 spaces from different angle of the trap were carved out and the non-return valves were fixed. Six modified semi-circular Malian Traps were constructed (Plate II).

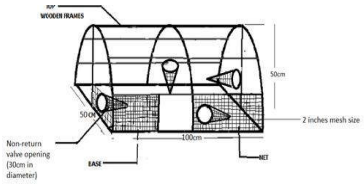

Figure 3: A sketch of a modified semi-circular Malian trap Source: (Field work, 2018)

Plate II: Modified semi-circular Malian trap after construction. Source: (Field design, 2018)

Modified Rectangular Malian Trap

The construction process was similar to figure 2, only the shape was rectangular (plate III).

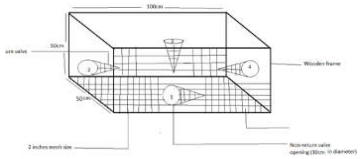

Figure 4: A sketch of modified rectangular Malian trap Source: (Field work, 2018)

Plate III: Modified rectangular Malian trap Source: (Field work, 2018)

Traps Setting, Inspection, Monitoring and Collection of Catches

After conveyance, the traps were set and monitored twice in a week for a period of 26 weeks (6 Months) making the total of 48 fishing visits conducted in different locations of the Dam. At each monitoring visits, the traps were lifted out of water and the weaved top opening was loosed to collects the trapped fish into a cooler jug. Thereafter, the loosed top opening was weaved back and the traps were set again for subsequent monitoring. Both the traditional and modified traps were moved backward to the littoral part as the water volume increases to prevent their vulnerability to flood.

Determination of fish weight

The weight of the fish was determined by placing the fish on the top tray of the weighing balance (Citizen model) and the reading was observed and recorded for each of the trapped fish.

Identification of species

Monograph of Olaosebikan and Raji (2013) was used to observe the similarity in the morphological features of the trapped fishes and those in the monograph and each species was identified in the process.

Results

Number and weight of fish caught with traditional and modified Malian traps

Table 1. depicts the monthly number and weights of fish caught with traditional and modified Malian traps. The total weight of the fish caught were 7,247.20 g, 4,154.20 g and 4,209.78 g for (TMT), (MSCMT), and (MRMT) respectively. There was significant difference ($p>0.05$) in the biomass of fish caught with the traps

Table 1: Number and Weight of the fish Caught with Traditional and Modified Malian Traps

Months	TMT	MSCT	MRT	TMT (g)	MSCMT (g)	MRMT (g)
July	29	27	25	232.25 ± 73.13^{a}	413.68 ± 137.5^{a}	478.61 ± 160^{a}
August	33	7	5	351.62 ± 115.5^{a}	58.3 ± 8.66^{b}	69.05 ± 18.92^{b}
September	19	6	2	179.32 ± 54.2^{a}	23.9 ± 8.42^{b}	40.37 ± 6.2^{c}
October	12	3	4	86.15 ± 20.3^{b}	26.75 ± 8.43^{b}	27.9 ± 8.3^{d}
November	20	7	4	181.2 ± 54.93^{a}	25.72 ± 8.46^{b}	41.6 ± 5.77^{c}
December	18	9	7	177.33 ± 53.54^{a}	144.03 ± 41.58^{a}	44.12 ± 4.62^{c}
TOTAL	131	58	47			

Data on the same column carrying different superscript are significantly different from each other ($P<0.05$).

Where: ±**SDM**= standard deviation of the mean; **TMT**= traditional malian trap; **MSCMT**= modified semi-circular malian trap; **MRMT**= modified rectangular malian trap

Fish Species Diversity of Traditional and Modified Malian Traps

Table 2 expressed the family, species and number of fish caught with traditional and modified Malian traps. A total of four family, and six species were caught. The highest family of fish caught was *Cichlidae* accounting for 113 *S. galileus,* 45 *T. zillii*, and 5 *O. niloticus* amounting to total of 163, followed by *Mochokidae* with a value of 62 *S. membranaceous* recorded, next is *Claridae* accounting for the total of 6 *Clarias gariepinus* recorded and the lowest was *Characidae* accounting for 5 *H. forskalii* recorded.

Table 2: Fish species diversity of traditional and modified malian traps

		Shape of Traps		
Family	Species	TMT	MSCT	MRT
Claridae	*C.gariepinus*	1	3	2
Alestidae	*H. forskali*	0	0	5
Cichlidae	*O. niloticus*	3	2	0
Cichlidae	*S. galileus*	61	27	25
Mochokidae	*S. mebraneceous*	39	13	10
Cichlidae	*T. zilli*	27	13	5
Total		131	58	47

Where: **TMT**= Traditional Malian trap; **MSCMT**= Modified semi-circular Malian trap; **MRMT**= Modified Rectangular Malian trap

Discussion

The study on fish weight and species diversity of traditional and modified Malian traps revealed the potential of the traps in catching different species of fishes with their corresponding weight. A total of 236 fishes weighing 15, 611.18 g of different size and species were caught. Ayanwale *et al.* (2013) reported that variation in mesh- size of gears influenced number of catches. This conform with the result of this study in which there was a variation in mesh size used for traditional and modified Malian traps. Akinnigbagbe and Osibona (2017) reported 47.7 g as the highest mean fish weight in their study of Fish weight and species diversity of traditional and modified traps in selected fishing communities in Lagos lagoon. The reason for the differences could be as a result of differences in study location. There was no significant different ($p>0.05$) observed in weight of fish caught among the three different shapes of the traps in this study. This agreed with the report of Ago *et al.* (2012) who observed no significant difference ($p>0.05$) in the catch (number and weight) of the two gear types used in their study. Agbelege *et al.* (2004) also reported 37.68 kg as the total biomass of fish caught with no significance difference in the biomass of fish caught in the 4-v and 6-v traps. This also tally with the result of this study. Trisnani *et al.* (2016) reported (18 kg) of fish using common *Payang* fishing trap while modified *Payang* fishing trap caught (15 kg) of fish with no significant difference ($p>0.05$) observed in the two weights. This also conform with the result of this study.

In this research, a total of four family comprising of six species were caught. The highest family of fish discovered was *Cichlidae*.This finding is in line with Ayanwale *et al*. (2013) who reported *Cichlidae* as the Preponderance fish family comprising of *S. galileus* and *T. zillii* in Tagwai dam. Thus, they further reported *Mormyridae* as one of the abundant species in the Dam also. This contradicts the finding of this research in which *S. mebraneceous* was the next in abundant after *Cichlidae*. This could be as a result of differences in gear used, time of the study, over exploitation or migration of this aforementioned species. The finding of this study does not conform with that of Ipinjolu *et al.* (2004) who reported *O. niloticus* as the most abundant species in their study. The variation in their species result with this study could be attributed to location of the study. Mshelia *et al.* (2015) reported *Cichlids* as the dominant species in Lake Alau. Similar reports were observed by Balogun *et al.* (2000) in Zaria reservoir; Kangimi lake (Balogun and Auta, 2001) and Ero reservoir (kester *et al*, 2007). The finding of Trisnani *et al. (*2016) where trevally fish sp. was reported to be the dominant fish species using traditional and modified Payang fishing traps were used also disagreed with the finding of this study.

Conclusion

The study revealed that Modified Malian traps can compete favourably with its traditional counterpart in trapping different species, size and weight of fish in Tagwai Dam. The species of fish caught with the traps shows an extinction of few valuable species such as *Mormyrus* and *Alestes* species which were hitherto reported to be among the dominant species in the Dam. Therefore, information obtained on the ichthyofaunal composition in this study can be use in sustainable management of the dam.

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