TARABA JOURNAL OF AGRICULTURAL RESEARCH
ISSN: 978-978-923-450-9
Email: tajar2011@yahoo.com, tajar2011@gmail.com

CATCH PER UNIT EFFORT AND COST-BENEFIT ANALYSIS OF TRADITIONAL AND MODIFIED MALIAN TRAPS IN TAGWAI DAM OF NIGER STATE

[1]Yusuf, J., [1]Lamai, S. L., [1]Ibrahim, A., [2]Abdullahi, M. M. and [3]Woru H. A
[1]Federal University of Technology Minna, Niger State
[2]Nigeria Institute for Oceanography and Marine Research (NIOMR) P.M.B. 12729, 3-Wilmot Point Road, Victoria Island, Lagos, Nigeria.
[3]National Institute for Freshwater Fisheries Research New-Bussa, Niger State
Corresponding Author's email address: **j.yusuf@futminna.edu.ng**
Received 11th December, 2020 Accepted 10th February, 2021

ABSTRACT

The decline in fish catch per unit effort and low return from ~~s~~ale has force many fisherfolks to abandoned fishing for other source of livelihood. This study seeks to find out the catch per unit effort and cost-benefit of traditional and modified Malian traps. The Traps were designed and constructed with Mimosa pigra sticks based on the specification. Traditional Malian Trap (TMT) has cone shaped, while the modified Malian traps were modified semi-circular Malian trap (MSCMT) and modified rectangular Malian trap (MRMT). The Traditional Malian Traps were enclosed in 3.75 cm mesh-size while modified Malian Traps were both enclosed in a netting material of 5 cm mesh-sizes (Standard). The Traps were set un-baited. Catches were Collected twice weekly for a period of six months (July to December). A total of 236 fishes were caught by both traps. The percentage of fish caught by the traps were 55.5 % for TMT comprising *Sarotherodon galilaeus, Coptodon zilii, Clarias gariepinus, Oreochromis niloticus* and *Synodontis membranaceus*, while MSCMT was 24.6 % of similar species and 19.9 % for MRMT also of similar species with *Hydrocynus forskahlii* inclusive. The total monthly catch per unit effort throughout the research period was 905.79 g for TMT and 1,047.48 g for the two different shape of modified Malian Traps. The value of the computed net profit (л)was ₦-4492.24, ₦-6966.64 and ₦6922.18 for TMT, MSCMT, and MRMT respectively. The low catch per unit effort and negative net profit values of the traps in the study revealed the low productivity of the dam. Hence, the need for sustainable management of the dam.

Keywords: Malian Trap, Cost- benefit, Tagwai dam, wooden frame, Monitoring visits

INTRODUCTION

Fish traps are stationary gear which are position in one place and6+ relies on the way the fish moves. Traps are usually confined structure fixed to the shore. In the past, traps were usually made from sticks and stone. Traps are often equipped with a device that prevents the fish from escaping once they have entered. The catch is often made by putting non-return valve in the trap that can closed up once the fish enters. The nomenclature of traps was done by (Brandt, 1984). Malian trap is copied by fishermen in Nigeria from their Malian counterpart (Reed *et al*., 1967). The traps have gained a remarkable adoption due to it indication of its efficiency than the other gears. However, most of the published works on the traps are just descriptive (Reed *et al.,* 1967); Holden and Reed, 1972). Although, Udolisa *et al.* (1994) reported the measurement of some of them. Malian trap was first brought to Kainji Lake by migrating Malian fishermen (Ipinjolu *et al*., 2004). The trap has been reported to be one of the most commonly used traps alongside with their traditional and modern fishing counterpart. In recent years, efforts have been made to modify fishing gears and their mode of operation to catch fish of various sizes and fish species of interest and other marine organisms more efficiently. Catch per unit effort is one of the most common pieces of information used in assessing the status of fish stock and relative abundance indices (Mauder *et al*., 2006). It is measure of fishing success of fishers (Agbelege and lpinjolu 2010). Assessment and management of fish stocks has had a long history, with many successes and failures. Failure to manage fishery effectively can have a disastrous effect on both social and economic condition.

Cost benefit analysis is an economic tool use to appraise the desirability of adapting an innovative technology. Brien (2005) stated that there is dearth of studies on economic studies of fisheries in the world and, as a result, management has dwell only on biological and technological perspective. In spite of the efforts done by researchers on the economic performance of capture fisheries at a global scale, data on fishing costs and benefit are poorly documented, and they vary according to the type of fishery (Lam *et al*., 2011). When costs and revenues are determined, a series of economic and social analysis can be performed, subsidizing valuable information for developing a more realistic fisheries management (Lucena & O´Brien, 2005; Dudley, 2008; Lam *et al*., 2011). Tagwai Dam Reservoir is water body established for the purpose of supplying domestic water to Minna metropolis. Local fisherfolks known as artisanal fishers' dwells within its vicinity. The productivity of the Dam constitutes part of the 85 % of total fish productions in Nigeria. In spite of its small size, it contributes meaningfully to sustainable livelihoods of the people in several ways among which includes provision of job, protein source, income, water for domestic and Agricultural activities. Only few studies have concentrated on catch per unit effort (CPUE) and cost benefit analysis (CBA) of the Malian traps. This study was designed to find out the catch per unit effort and cost-benefit of traditional and modified Malian traps with a view of recommending to the fisherfolks the most efficient and profitable ones and also to determine the status of fish stock in the dam.

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). The Dam was excavated in 1978 for the purpose of supplying domestic water to Minna metropolis. The catchment area of the dam is about 110 km^2 with a surface area of 5.5 Km^2(Alkali, 1994). Fishing in the area is dominated by artisanal fishermen that use manually operated wooden (dug-out) canoes, using mostly Malian traps, cast nets, gill nets, and driftnets. See figure1.

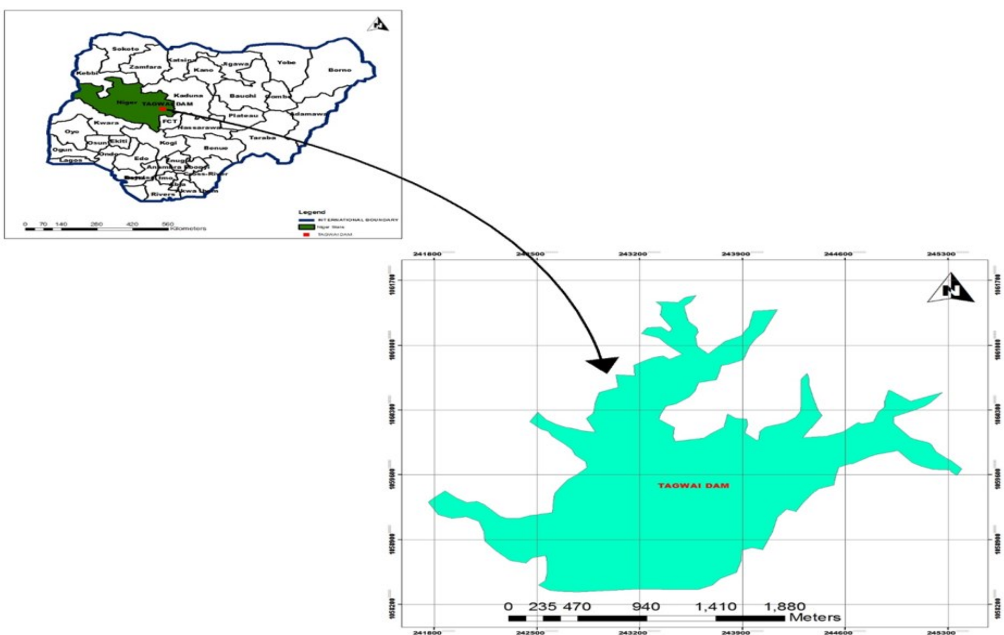

Figure 1. Nigeria and Niger State inset (Tagwai Dam) Source: (Abdullahi, 2015)

Traditional Malian Trap (TMT)

The design of the traps in this research was done with Computer (Paint software application). Wooden stick of giant sensitive plant (*Mimosa pigra*) were used as wooden frame for the construction. The diameters of the stick ranges from 3cm to 4cm respectively (Fig. 2). The sticks were then bent to form round shape of different diameters 130cm, 100 cm and 70cm respectively, and tied tightly with (rope size number 9) to avoid loosening. Wooden frames of 75cm 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 (3.75cm) mesh-size. 3 spaces for non-return valves were carved out and they were finally fixed. All in all, 6 traditional Malian Traps were constructed. (plate I).

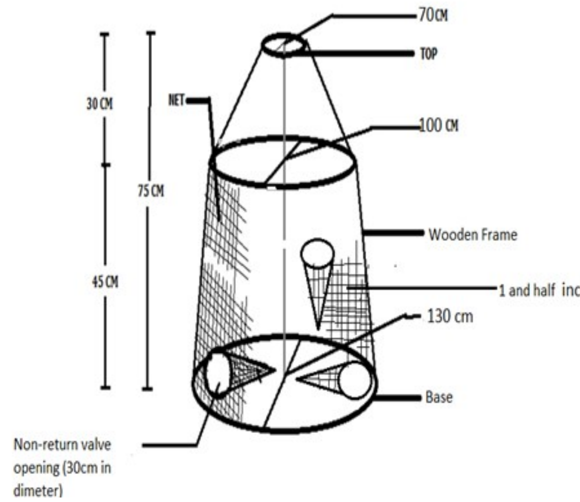

Figure 2: A sketch of a traditional Malian trap (TMT) Source: (Field Design, 2018)

Plate I: Traditional Malian Traps after construction. Source: (Field work, 2018)

Modified Semi-Circular Malian Trap (MSCMT)

Again, the giant sensitive plant (*Mimosa pigra*) was used for the construction of modified Malian Trap. 100cm length, and 50cm 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 50cm height. The frame was supported with straight wooden sticks strongly tied together as shown in Plate II. Thereafter, the structures were covered with polyamide netting material of 5cm 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 (Field work, 2018) (plate II).

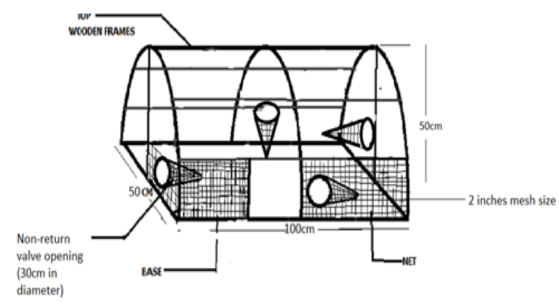

Figure 3: A sketch of a modified semi-circular Malian trap. Source: (Field design, 2018)

Plate II: Modified Semi-circular Malian Traps after construction. Source: (Field work, 2018)

Modified Rectangular Malian (MRMT)

Similarly, the giant sensitive plant (*Mimosa pigra*) was used for the construction of modified Malian trap. 100cm length, and 50cm width of the wooden stick were tied together to form rectangular shape (Fig.4). This was followed by the mounting of wooden frame of 50cm height. The frame was supported with straight wooden sticks strongly tied together as seen in (plate III). Thereafter, the structure was covered with polyamide netting material of 5cm or (2inches) (Recommended standard mesh-size). 4 spaces from different angle of the trap were carved out and the non-return valve were fixed. All in all, six modified rectangular Malian Traps were constructed (Field work, 2018) (Plate III).

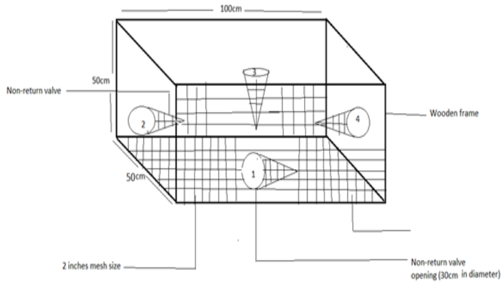

Fig. 4 Sketch of a Modified Rectangular Malian Trap. Source: (Field work, 2018)

Plate III: Modified Rectangular Malian Traps after construction. Source: (Field work, 2018

Traps Setting Process

After conveyance, the Traps were alternately set in row according to their shape with TMT set first, followed by MSCMT and the last was MRMT (Du Feu, 1993 and Udolisa *et al*., 1994). They were set 30 cm distance apart. The Traps were set un-baited with a stone and wet grasses placed at the top for stability of the traps. Sticks were used to mark the position of the set Traps.

Inspection, Monitoring and Collection of Catches

After setting the traps, they were 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. (FAO, 2001).

Data Collection of Trapped Fish

The collected from trapped fish were conveyed to the WAFT Department wet Laboratory for measurement of the following parameters:

Measurement of fish weight

The weight of the fish was measured 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 fish and those in the monograph and each species was identified in the process.

Determination of Monthly Catch Per Unit Effort of the Traps

The monthly catch per unit effort of the different traps shape (cone or traditional, rectangular, and semi-circular shape) were determined using the formula:

$$\text{Catch per unit effort (Visits/kj)} = \frac{\text{Total monthly fish caught by each shape of the trap}}{\text{Number of days of fishing visits in a month}}$$

(Lae and Bousquet 1996).

Determination of Cost and Return of Traditional and Modified Malian Traps

The cost and return technique of the traps were determined using the formulae below:

Specification of models:

$$\pi = TR - (TFC + TVC) \qquad \text{……….(1)}$$

(Shively and Galopin, 2015.)

Where:

π= Net profit

TR = Total Revenue

TFC = Total Fixed Cost

TVC = Total Variable Cost

π= Net profit
TC = Total Cost

Benefit cost ratio:

$$BCR = \frac{TR}{TC} \quad \ldots\ldots\ldots(2)$$

(Shively and Galopin, 2015.)

Where:
BCR = Benefit Cost Ratio
TR = Total Revenue
TC = Total Cost

Percentage of fish caught with traditional and modified Malian Traps

Figure5 revealed the total percentage of fish caught with Traditional and Modified Malian Traps. The highest percentage value of 55.51% was recorded for Traditional Malian Trap, this was followed with that of modified semi-circular Malian Traps of 24.57% and the least percentage value of 19.91% was recorded from modified rectangular Malian Traps (figure 5)

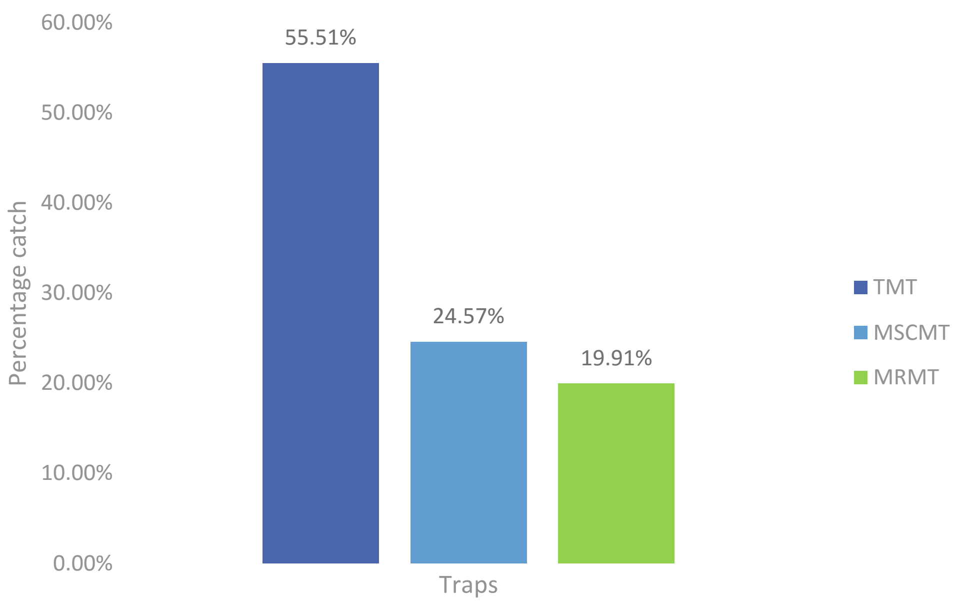

Figure 5: Percentage of fish caught with traditional and modified malian traps

Fish Species Diversity of Traditional and Modified Malian Traps

Table 1 expressed the family, species diversity and richness index of fish caught with Traditional and Modified Malian Traps. A total of four families, and six species were caught. The highest family of fish caught was *Cichlidae* accounting for 113 *Sarotherodon galilaeus,* 45 *Coptodon zillii*, and 5 *Oreochromis niloticus* amounting to total of 163, followed by *Mochokidae* with a value of 62 *Synodontis mambranaceous* recorded, next is *Claridae* accounting for the total of 6 *Clarias gariepinus* recorded and the lowest was *Characidae* accounting for 5 *Hydrocynus forskahlii* recorded. The highest number and species of 61 *Sarotherodon galilaeus* were caught with TMT. Followed by 39 *S. mambranaceous* also caught with TMT. And the lowest number and species of fish caught with TMT was *C. gariepinus.* No single *H.* forskahlii was caught with TMT. Also, the highest number and species of fish caught with MSCMT was 27 *S. galilaeus* followed by equal number of 13 S. *mambranaceous* and C. zillii respectively. The lowest was 2 *O. niloticus.* Also, no single *H. forskahlii* was caught with MSCMT. The highest number and species of fish caught with MRMT was 25 *S. galilaeus* followed by 10 *S. mambranaceous* , 6 *C. gariepinus* and 5 *H. forskahlii.* (table 1).

Table 1: Fish species diversity of traditional and modified malian traps

		Shape of Traps		
Family	Species	TMT (%)	MSCT (%)	MRT (%)
Claridae	*C.gariepinus*	0.7	5.2	4.3
Alestidae	*H.* forskahlii	0	0	10.6
Cichlidae	*O. niloticus*	2.3	3.4	0
Cichlidae	*S. galilaeus*	46.6	46.5	53.2
Mochokidae	*S. membranaceus*	29.8	22.4	21.3
Cichlidae	*C. zillii*	20.6	22.4	10.6

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

Monthly catch per unit effort of traditional and modified Malian Traps

Figure 6 depicts the monthly catch per unit effort of the Traps. The highest monthly catch per unit effort of 358.96g was recorded in the month of July from MSCMT, followed by 310.26g also recorded in the same month for MRMT while the lowest was 17.91g recorded in the month of September for MRMT. The monthly catch per unit effort of TMT ranges between 263.7g to 64.61g. For MSCMT, it ranges from 358.96g to 20.9g. While that of MRMT ranges from 310.26g to17.91g. The total monthly catch per unit effort were 905.79g, 528.2g and 519.28g for TMT, MSCMT and MRMT respectively. See figure 4.2. The total monthly catch per unit effort throughout the research period was 905.79g for TMT and 1,047.48g for the two different shape of modified Malian Traps. Figure 4.2

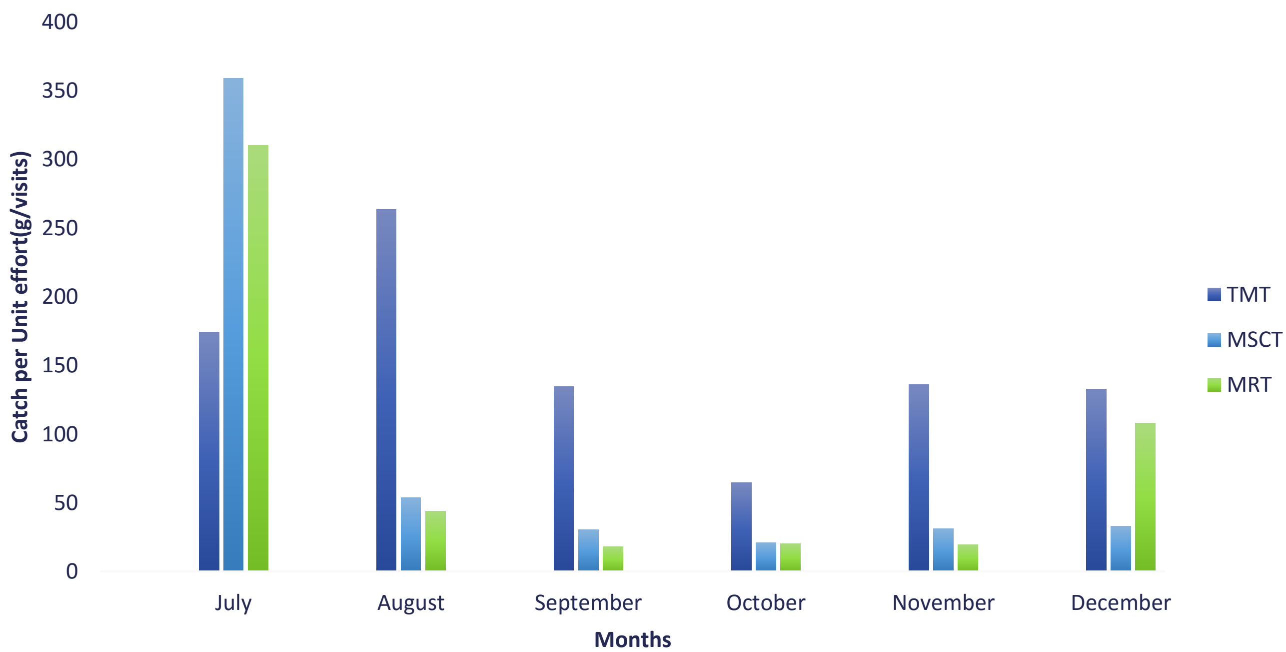

Figure 6: Monthly catch per unit effort (CPUE) of the traps

Cost and Return Analyses of Traditional and Modified Malian Traps

Table 2 revealed the cost and return analyses of the Traps. The amount expended in constructing 6 pieces of each shape of the trap was 10,290-naira. The trend of the weight recorded were 7,247.20 g, 4,154.20g, and 4,209.70g for TMT, MSCMT and MRMT respectively. The projected revenue base on the projected price was calculated at 800-naira per kg of fish. This gave computed return of 5,797.76-naira, 3323.36-naira and 3367.82 naira for TMT, MSCT and MRMT respectively. See Table 4.. The value of the computed net profit (л)was -4492.24-naira, -6966.64 naira, - 6922.18 naira for TMT, MSCMT, and MRMT respectively. The highest net profit value of -449.24 was recorded for TMT followed by 6,966.64 and 6,922.18 for MSCMT and MRMT respectively. The benefit cost ratio (BCR) calculated were 0.56, 0.32and 0.33 for TMT, MSCMT and MRMT respectively. See Table 4.

Table 2: Cost and return of traditional Malian traps

Variable	Cost	Total Revenue (#)	π
1 and half bundles of *Mimosa pigra* stick	750	5,798	-4492.24
1 and half inch's mesh size	2000		
18 pieces of no-return valve at	360		
Twine rope	100		
Workmanship	1000		
Transport	3000		
Cost for hiring a canoe	3000		
Total Variable Cost (TVC)	10,290		

Table 3: Cost and return of modified semi-circular Malian traps

Variable	Cost	Total Revenue (#)	π
1 and half bundles of *Mimosa pigra* stick	750	3,323.36	-6966.64
1 and half inch's mesh size	2000		
18 pieces of no-return valve at	360		
Twine rope	100		
Workmanship	1000		
Transport	3000		
Cost for hiring a canoe	3000		
Total Variable Cost (TVC)	10,290		

Table 4: Cost and return of modified rectangular Malian trap

Variable	Cost (#)	Total Revenue (#)	π
1 and half bundles of *Mimosa pigra* stick	750	3,323.36	-6966.64
1 and half inch's mesh size	2000		
18 pieces of no-return valve at	360		
Twine rope	100		
Workmanship	1000		
Transport	3000		
Cost for hiring a canoe	3000		
Total Variable Cost (TVC)	10,290		

Table 5: Summary of cost and return of traditional and modified Malian traps

Shape of Traps	Construction Cost (₦)	Total weight of fish caught (g)	Total Revenue of Fish Caught (₦)	Net profit (л)	BCR
TMT	10,290	7,247.20	5,797.76	-4492.24	0.56
MSCMT	10,290	4,154.20	3,323.36	-6,966.64	0.32
MRMT	10,290	4,209.78	3,367.82	-6,922.18	0.33

Where: **TMT**= traditional malian trap; **MSCMT**= modified semi-circular malian trap; **MRMT**= modified rectangular malian trap;**л** = net profit; **BCR**=benefit cost ratio

DISCUSSION

Catch per unit effort is expressed as estimated weight of fish caught per unit of fishing effort by fisherman. In this study, the entire catch per unit effort were below 1 kg. This result is contrary to Umar *et al.* (2014) who reported that majority of the respondents in their study indicated that their fish catch per unit effort before the establishment of Kanji Dam was more than 8 kilograms while the catch per unit effort after the establishment of the dam declined to less than 2kg. Ita (1982) reported that early fish yield after the impoundment is always very high after which the yield declined. This conforms with the finding of this research as Tagwai Dam was impounded for over 40 decades. The declined in catch per unit effort of this study could also be attributed to presumed increase in fishing pressure, use of undersized fishing gears, and absent of community-based management approach. Muoneke *et al.* (1993) reported that the variation in Catch Per Unit Effort (CPUE) stemmed from differences in the construction's materials, shape, design, gear volume, and area of the substrate covered by the trap. The finding of this study is in contrary to the report of Tuda *et al.* (2016) who reported highest catch per unit effort of above 2 kg with hook and line while basket trap, reef seine and beach seine had the lowest catch per unit of less than 2kg per fisher trip. The reason for the differences could be differences in gear used and location of study. Ago *et al.* (2012) reported comparatively higher catch per unit effort (CPUE) among the traps used with Malian pots being more efficient than the PVC pots. The result of catch per unit effort in this study does not correspond with Mshelia *et al.* (2015) who reported 3.5 kg of catch per unit effort of Malian traps used by the fisherfolk in lake Alau. In this study, the benefits calculated based on the projected price of 800 naira indicates lost for all the traps. The values of the computed net present value (NPV) were all below the cost price. This indicates financial loss. This shortfall, could be attributed to low productivity of fish in the Dam which translated to low catch per unit effort. Trisnani *et al. (*2016) studied the Technical and Economic Analysis of Modified *Payang* Fishing trap in the Fishing Port of Tawang Beach in Kendal District, Indonesia and discovered that the revenue from modified *Payang* fishing gear was less than the revenue from common *Payang* fishing gear. The cost benefit analysis is an economic tool use to appraise the desirability of adapting an innovative technology. The BCR for all the traps in this study were all below one. The reason behind these low values could also be link to low productivity of fish in the Dam. The (BCR) gives information on whether to adapt the use of the modified fishing gear. The BCR benchmark value is 1. Value below one is said to be discouraging. However, this does not mean another attempt of similar study cannot be made.

SUMMARY AND CONCLUSION

The study revealed that Modified Malian traps can compete favourably with its traditional counterpart in terms of catch per unit effort in Tagwai Dam. The entire catch per unit effort for all the traps were below one. Which implies declined in fish productivity of the dam occasioned by excessive exploitation. The computed low net present value (NPV) shows a financial loss. Also, the benefit cost ratios (BCR) for all the traps were all low due to low catch which is also attributed to low productivity of the dam. Hence, the calls for sustainable management of fisheries resources in the dam.

REFERENCES

Abiodun, J. A. and Niworu, A. M. (2004). Fisheries Statistical Bulletin Kainji Lake,Nigeria, 2004. Kainji Lake fisheries Management and Conservation Unit Technical Report Series *23*. 24.

Agbelege, O.O., Ipinjolu J.K. and Hassan W.A. (2005). Influence of number of valves on composition of a fishing pot trap (lege) in River Rima, North Western Nigeria. In: Araoye, P. A. (Ed.) *Proceeding of the 19th annual conference of Fisheries Society of Nigeria* (FISON) Ilorin, Nigeria. 365p

Ago, N.D., Balogun, 1. K., Auta, J., and Ogunfowora, O. O. (2012). Comparative performance of a newly developed fish trap and the Malian trap in Kainji Lake, Nigeria. *ARPN Journal of Agricultural and Biological Science.* 7(6): 474-483.

Alkali, A.L. (1994). Some water quality parameters and potential fisheries yield in Tagwai Dam, Minna, Nigeria. M. Tech Thesis, Fisheries Department, Federal University of Technology, Minna, Nigeria.

Ayanwale, A.V., Shokunbi, M.T., Olayemi, I.K., Chukwuemeka V.I., Falusi, F.M. and Erhabor, O.F. (2013). A study of the fish fauna of Tagwai lake Minna, Nigeria, in Relation to Gear Selectivity. *Pakistan Journal of Biological Sciences,*16: 731-734.

Brandt, A. V. (1984). *Classification of fishing gear*, In: Modern fishing gear of the world. Pp 134.

Du Feu, T.A. (1993). Fishing gear survey of Kainji Lake, NGKLEPP Technical Report.

Dudley, R.G. (2008). A basis for understanding fishery management dynamics. Syst. Dynam. Rev., 24(1): 129.

Holden, M. and Reed, W. (1972). *West African Freshwater Fishes.* London: London Group. Limited. 68.

FAO (2001). Modern fishing gear of the world, London, *Fishing News Books Limited*. 1-607.

Ibrahim, A., Lamai. S.L., and Yisa A.T (2015). Growth and Survival of *Sarotherodon galileus*and *Tilapia zillii* Obtained from Tagwai Dam into Federal University of Technology Research Farm facilities

Idodo-Umeh, G. (2003). *Freshwater Fishes of Nigeria* (taxonomy, ecological notes, diet and utilization). IdodoUmeh Publishers Limited, Benin City, Nigeria.

Ipinjolu, J. K., Agbelege, O. O. and Hassan, W. A. (2004). The performance of malian trap using four baits types in Lake Kainji, Nigeria,Proceeding of the 19th annual conference of Fisheries Society of Nigeria (FISON) Ilorin, Nigeria. 396p

Ita, E. O. (1982). Biological Indices of Overfishing in Kanji Lake and the Management Proposal for the lake Fishery. (New Bussa: KLRI Technical Report, Ser. No. 8)

Lam, V.W.Y., U.R. Sumaila, A. Dyck, D. Pauly and R. Watson. (2011). Construction and applications of a global cost of fishing database. ICES *Journal of Marine. Science* 68(9): 1996-2004.

La€e R. & Bousquet F. (1996) PECHART: Logiciel de saisie et de traitement des enqu^etes de p^eche artisanale. Orstom, Paris: Logorstom, pp. 70.

Lucena, F. and C.M. O'Brien. (2005). The consequences of different scenarios in the management of the gillnet and purse-seine fisheries targeting *Pomatomus saltatrix* and *Cynoscion guatucupa* in southern Brazil: a bio-economic approach. ICES *Journal of. Marine. Science* 62: 201213.

Maunder, M. N., Sibert, J. R. Fonteneau, A., Hampton, J., Kleiber, P., and Harley, S. J. (2006). Interpreting catch per unit effort data to assess the status of individual stocks and communities. *Journal of Marine Science*, 63: 1373-1385

Mshelia, M. B., Manneer, M. B., Garba, U. and Hassan M. (2015). A frame and catch assessment of fishes of lake Alau, *International Journal of Fisheries and Aquatic Studies* 2015; 2(45): 35-40

Muoneke, M. I., Maughan O. E. and Henry C. C. (1993). Comparative capture efficiencies of frame and hoop nets for white crappie (Pomoxisannularis Rafinesque). Fisheries Resources. 18: 231-240.

Olaosebikan, B. D. & Raji, A. (2013). *Guide to Nigeria Freshwater Fishes.* FCFFT Publication lst edition. Ilorin: Decency Printers. 106.

Reed, w., Barchard, T., Hopson, A. T., Jenness, I. and Yaro, I. (1967). *Fish and Fisheries of Northern Nigeria*. Ministry of Agriculture, Northern Nigeria, 226.

Shively. G and M. Galopin, (2015.) .An Overview of Benefit-Cost Analysis**.**Department of Agricultural Economics, Purdue University.9p. Retrieved from: http://www.agecon.purdue.edu/staff/shively/COURSES/AGEC406/reviews/bca.htm07 **M**arch, 2015

Trisnani, D. H. and Aristi D.P. (2016). *Technical and Economic Analysis of Products Processing and Health Aquatic Procedia* (7) 254 – 264

Tuda, P. M., Mathias W., and Annete, B. (2016). Size structure and gear selectivity of target species in the multispecies multi gear fishery of the Kenya South Coast. *Journal of Ocean and Coastal Management.* 130:(9) 95-106

Udolisa, R. E. K. & Lebo, P. (1994). Chemical narcosing of fish in Northern Cross River. In: E. O. Ita (ed.) *Proceedings of the 3rd Annual Conference of the Fisheries Society of Nigeria,1 Maiduguri,* 22 25th February 1983. 105-107.

Umar, S. and Illo, A. I (2014). Performance Assessment of artisanal fisheries in the Kainji Dam Area of Yauri Emirate Kebbi State. *Journal of Fish Biology, Agriculture and health care* ISSN 2224-3208. 4, 20