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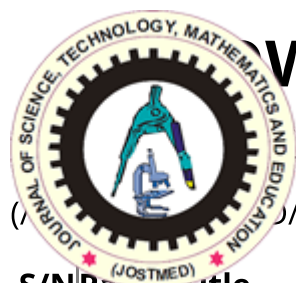
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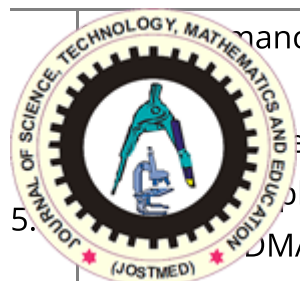


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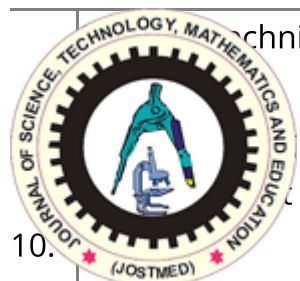
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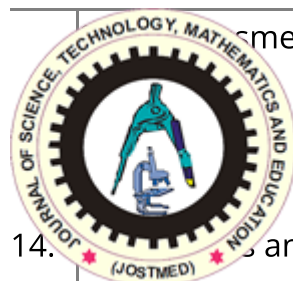


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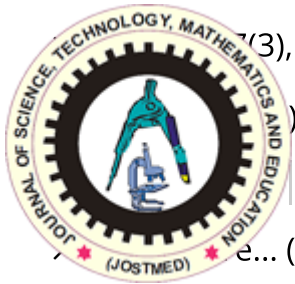
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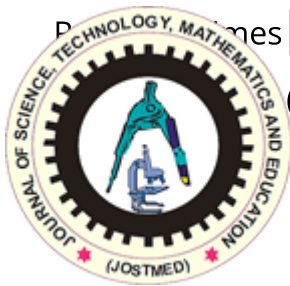
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## DEMOGRAPHIC AND SOCIO-ECONOMIC ASSESSMENT OF FISHING IN TAGWAI DAM RESERVOIR, NIGER STATE, NIGERIA

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### Abstract

*Fishing is an important livelihood for communities around Taggwai Dam Reservoir; hence, adequate data is required for the proper management and conservation considerations. This study utilised randomised data from 15 fishers for socio-economic assessments. The study discovered that the Tagwai Dam fishery consisted of all-male fishers, fishing full-time (53%), married (87%), and in the age brackets— 21 - 50 (60%), and 46 and 50 years (40%). Three in four completed primary education, and roughly six in seven attended Quranic schools. All fishers had active involvement in Fadama Cooperative. Gears (gillnets, cast nets, and Malian traps) in Tagwai Dam Reservoir (TDR) mainly were rented (80%) or owned (20%). Each crew owned a craft and a blend of gears (mesh sizes: 0.5-1.5in). The fisheries consisted of Cichlidae (68.21%), Alestidae (21.79%), Clarteidae (10.24), and Clariidae (0.15). The predominantly Cichlidae catches were neither preserved nor processed on-site. Per fisher monthly average catches include June 118.47kg, July 112.27kg, and Aug. 94.62kg), Catch Per Unit Effort (CPUE)—June 0.51kg/boat/day, July 0.50kg/boat/day, and Aug. 0.41kg/boat/day, and Benefit-Cost Ratio (BCR)—June 4.57, July 3.65 and August 3.62 declined progressively along the months. TDR represents a typical small-scale fishery systematically "fishing down the food web" for profits at the expense of fisheries regulatory ethics.*

**Keywords:** Catch per unit effort, Cost-benefit ratio, Demographic and fishing characteristics, fishing gears

### Introduction

In Nigeria, nearly 338 fishes reportedly inhabit the freshwater aquatic space, making it the fish-richest in West Africa. Fisheries have brought significant social and economic benefits to riparian communities regarding food security, employment, and income (Dienye, 2020). The global fisheries organisation—WorldFish (2018) estimates that several hundred thousand people (over 8.6 million) are employed directly and another 19.6 million (70% of whom are women) indirectly in the Nigeria fisheries sector. Regrettably, inland captures have contracted considerably in recent times due to the off-the-cuff resource exploitation and management choices of the artisanal fishing industry across the country and putting the livelihood of millions on the precipice (Bawa *et al.*, 2019b). Underproductivity of fisheries can hurt rural riparian communities as they are sources of employment, income, and protein for the population.

Niger state has nearly 72,234 ha of Nigeria's wetlands (Ayanwale *et al.*, 2013). Wetland ecosystems constitute a critical asset for riparian communities' economy and social well-being across the state (Amalu & Ajake, 2019). In these communities, fishing activities are hardly regulated, and methods that violate the UN's code of responsible fishing are sometimes used. Catches are often poor, rarely commensurate with efforts, and yield little economic rent (Igejongbo, 2021). Consequently, fishing is concentrated on more compact species closer to the food web and pushes fragile ecosystems to low daily margins (Pauly & Palomares, 2005). The scenario appears to present a warning signal of depleting stock.

Recent studies have provided new insight into the extensive effects of fisheries well beyond the collapse of exploited stocks (fish). Environmental conditions and fishing exploitation have been suggested to significantly impact the transfer efficiency of food webs and the effectiveness of aquatic ecosystems. Pieces of evidence suggest that even minor changes can significantly impact food availability and the efficiency of the aquatic ecosystem (Eddy *et al.*, 2021).

Putting the results of this study into context will further enhance understanding of the forces behind resource variability and increase consciousness of the lurking dangers of fish overexploitation in TDR. Knowledge of the demographic, socio-c and the bio-economic ins and outs of fishing will make accurate performance valuation of the fishery possible and assist both the managers and local fishers in reaching rational decisions regarding profitability and sustainability of exploitation.

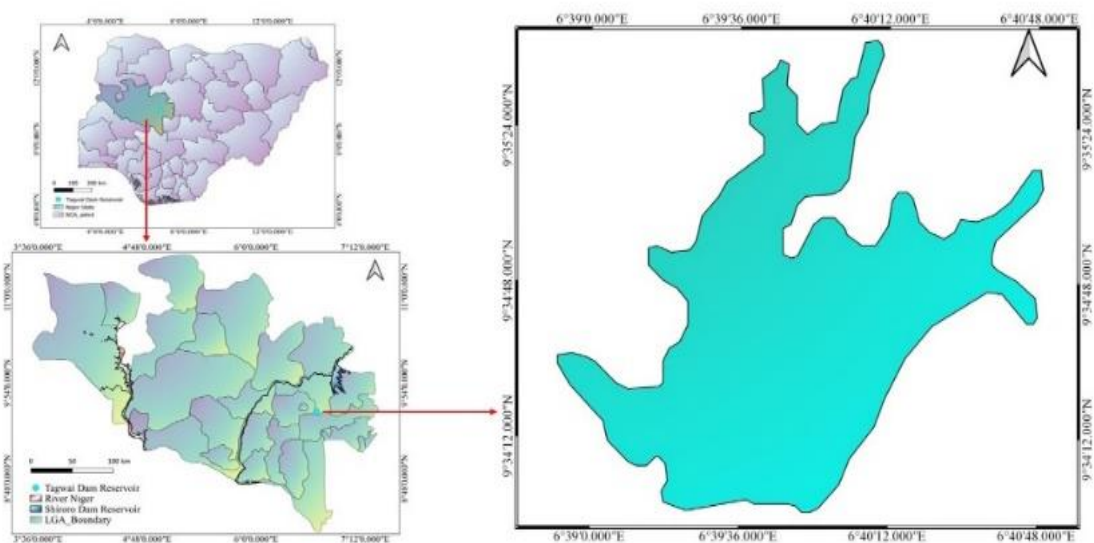
The objective of this study is to evaluate the socio-economic and demographic characteristics of fishing in the TDR for data generation and a better understanding of the socio-economic and ecological aspects of fishing in the TDR by:

- (i) A study of the socio-economic and demographic characteristics of the fishermen
- (ii) Analysis of the profitability of fishing
- (iii) Survey of the gear, fish, and fishing characteristics

## Materials and Methods

### Study location

Tagwai Dam reservoir (Figure 1) is 10 km from Minna (lat. 9°33'N and 9°37'N; long. 6°39'E and 6°42'E). It has a total area of 5.5 sq. Km (Alabi, 2011), with a capacity of 28.3 x 10<sup>6</sup> m<sup>3</sup> (NSWB, 1978) and a 110 sq. km catchment. Rainfall averages 60" per year (Oladosu *et al.*, 2019). Vegetation is varied; the water, from rocky hills, descend to the valley marked by scanty trees, shrubs, and tall grasses reminiscent of savanna woodland altered by cultivated areas. Fishing is chiefly artisanal, using plank canoes as crafts and gears of cast nets, gill nets and traps (Chukwuemeka *et al.*, 2020).



**Figure 1: Geographical location of the study area: TDR (right), TDR inset Niger state (lower left), and Niger state inset Nigeria (upper left)**

### Sampling and Data Collection

Two surveys were conducted each month (at the beginning and end) from June to August 2018 to gather information on fishers' socio-economic and demographic characteristics. A total of ninety (90) questionnaires were randomly administered throughout the survey, with an average of fifteen fishers/fishing groups during every sampling visit to TDR, where data were generated for the study.

### Data Analysis

The catch data were analysed using catch per unit effort and Cost-Benefit Ratio (CBR).

#### Catch per unit effort

Catch per unit effort was calculated as  $CPUE = C / E$ .

Where: C= Total catch;

E= Effort ( $BAC \times F \times A$ )

where: **BAC**: is the Boat Activity Coefficient, expressing the probability that any fishing unit will be active on any day during the month.

**F**: is a [raising factor](#): number of fishing units that are potentially operating at all fishing sites)

**A** is a [raising time factor](#): the number of days with fishing activities during the month

Total Fishing effort (E) was estimated using Stamatopoulos's (2002) sampling in space and time approach.

#### Benefit-Cost Ratio

The Cost-benefit ratio was determined using the formula:  $NPV = PV(B) - PV(C)$

Where: NPV = Net present value of the fisherman; B= Benefit derived from the sale of fish;

C= Cost expended or input

$CBR = PV(B)/PV(C)$

If the benefit is  $>1$ , the approach is even, i. e. profitable.

### Statistical Analysis

Data on demographics, socioeconomics, and fish species abundance were subjected to descriptive statistics using IBM SPSS Statistics V21 x86.

### Results

Located 10 kilometres southeast of Minna, Niger State, TDR is an artificial water supply dam intended for municipal use and provides a small-scale fisheries platform to surrounding communities (Ibrahim & Sternberg, 2021). The fisheries activities are typical of small-scale fisheries in northern Nigeria and sub-Saharan Africa as a venture for sustenance and family support (Bawa *et al.*, 2019a).

The socioeconomics, bio-economics, and fishing characteristics of fishers and fishing activities in TDR are shown in Table 1. All fishers in TDR were male, most of whom worked full time (53%), 87% married with ages ranging between 21 - 50 years (100%), and their family sizes include— Single (13.3%), 1-5 (20%), 6-10 (20%) and 11-15 (46.7%). The fishers' population was approximately three-quarters educated, and roughly six-sevenths attended Quranic schools. All the folks sampled were subscribed to Fadama Cooperative for various fishing incentives. Each fisher or group owned single (40%) or a collection of (self-made (66.7%) or factory-made (33.3%)) fishing gears with Mesh sizes— Cast net 1.5 - 2.0in (40%), gillnets: 0.5 - 1.0in (33%), and Malian trap: 0.5 - 1.0in (27%), were either rented (80%) or owned (20%) as presented in Figure 2. In Table 3, the Cichlidae (*T. Zillii* and *O. niloticus*), Alestidae (*A. nurse*), Clariidae (*C. gariepinus*), and Claroteidae (*A. occidentalis*) constituted the fish

fauna with a majority (68.29%) of the catches being Cichlids. Catches meant for sale were fresh, with no form of processing. Table 2 showed a successive decline in total catches (June- 118.47kg, July-112.27kg, and Aug.- 94.62kg), CPUE (June- 0.51kg/boat/day, July- 0.50kg/boat/day and Aug.- 0.41kg/boat/day), and BCR (June- 4.57, July- 3.65, and Aug.- 3.62) of monthly catches.

**Table I: Demographic, gear and fishing characteristics of TDR**

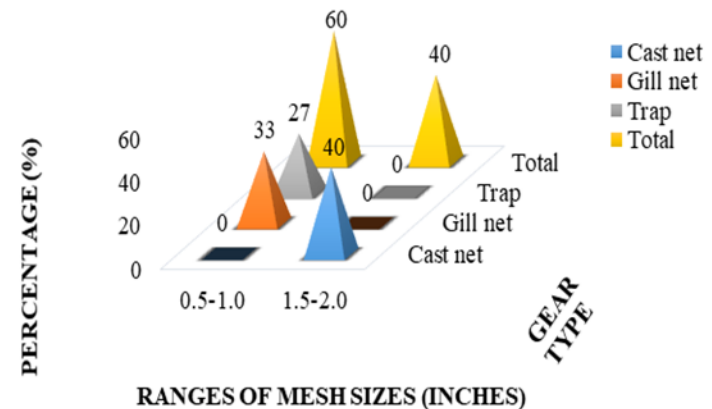
Question	Response	Frequency	Percentage (%)
<b>Gender</b>	Male	15	100
	Female	-	-
<b>Age</b>	21-45	9	60
	46 and 50	6	40
<b>Marital Status</b>	Single	2	13.3
	Married	13	86.7
<b>Household size</b>	No dependant	2	13.3
	1-5	3	20
	6-10	3	20
	11-15	7	46.7
<b>Level of education</b>	Primary certificate	5	33.3
	Quranic education	10	66.7
<b>Engagement in fishing</b>	Full time	8	53.3
	Part-time	7	46.7
<b>Cooperative society</b>	Member	15	100
<b>Type of craft</b>	Motorised canoe	15	100
	<b>Mode of Acquisition</b>	Purchased	3
	Rented	12	80
<b>Cost of craft</b>	₦1000-5000	12	80
	₦15000-20000	3	20
<b>No. of craft</b>	1	15	100
	2	-	-
<b>Source of gear</b>	Self-fabricated	10	66.7
	Factory-made	5	33.3
<b>No. of fishing gear owned</b>	1	6	40
	2	5	33.3
	3	4	26.7
	<b>Handling of bycatch</b>	Returned to the water	2
	Sold	13	86.7
<b>Form of marketing catches</b>	Fresh	15	100

**Table II. Per fisher monthly catch, CPUE and BCR of fishing in TDR**

Month	Catch (kg)	CPUE (kg)	BCR
<b>June</b>	118.45 kg	0.51 kg/boat/day	4.57
<b>July</b>	112.1 kg	0.50 kg/boat/day	3.65
<b>August</b>	94.62 kg	0.41 kg/boat/day	3.62

**Table III. Fish species/family relative abundance and in TDR**

Family	Taxa	Frequency	% Relative abundance
<b>Cichlidae</b>	2		
<i>T. zillii</i>		1234	38
<i>O. niloticus</i>		997	30.30
<b>Alestidae</b>	1		
<i>Alerts nurse</i>		717	21.79
<b>Clariidae</b>	1		
<i>C. gariepinus</i>		5	0.15
Claroteidae	1		
<i>A. occidentalis</i>		337	10.24



**Figure II. Mesh sizes (in) of fishing gears in TDR**



## Discussion

Like other small-scale fisheries in Nigeria and Africa, TDR is an "artisanal fishery" resort. As a dual utility Dam supplying water to the Minna metropolis, it also provides the platform for fisheries activities by inhabitants of adjacent riparian communities (Ibrahim & Sternberg, 2021). The fishers are middle-aged, all-male, typical of many fisheries in northern Nigeria and sub-Saharan Africa (Bawa *et al.*, 2019a). Tagwai fishers (over 86%) primarily fished for sustenance and support for the family, as reported in other small scale fisheries in Nigeria (Bawa *et al.*, 2019a) and other parts of the world (Islam *et al.*, 2016; Ezeh *et al.*, 2019). Men in the Tagwai fishery are primarily fishing, while women are primarily responsible for processing fish. There may have been a significant impact of cultural affiliation on how fishers embraced fishing activities based on their gender. This characteristic is not different from what Bawa *et al.* (2019a) reported as typical of fishing communities in northern Nigeria and sub-Saharan Africa. The preceding proposition validates the WorlFish (2018) report, which indicated over 70 % indirect engagement of women in fisheries activities in Nigeria.

Essentially, the three gear types (gill nets, cast nets and traps) recorded in TDR shared similarities with many local inland fisheries in the country, as reported in Ogundiwin (2014), Bawa *et al.* (2019b) and Ibrahim *et al.* (2020) in Kainji, Kebbi and Niger respectively. A significant percentage of fishers in TDR engaged in fishing as a sole occupation (53%). In comparison, 47% took fishing as an alternative career. A similar scenario was reported by Ogunsola (2019) about fishers in the Lagos lagoon, though in contrast to what obtains in the Degema region of Rivers State (Agbugba & Christian, 2019).

Daily income levels of fishers in TDR were above the poverty level defined by the United Nations (above \$1.00/day). Bawa *et al.* (2019a) reported similar findings on fishers in Kebbi State. The BCR values (4.57, 3.65 and 3.62) above 1 indicated good returns and profitability. The situation has given the fishers a false sense of security and profitability of fishing in TDR (in the short run) at the expense of sustainability due to the absence, weakness and ineffectiveness of regulatory policies on fishing activities that characterised Nigeria's inland capture fisheries arena (Olopade *et al.*, 2017). Ultimately, the profitability of this nature is often short-lived and will wither sooner or later. Conversely, Christy *et al.* (2021) posited that fishing motivation might be intrinsic rather than the cost-benefit consideration indicated in TDR.

## Conclusion

TDR represents the typical free access fisheries in Nigeria. In general, all performance metrics (Catches, CPUE and BCR) assessed have shown decreasing values over time due to the systematic exploitation of the fish resource to serve the users' self-interest over the common good of the communities. Unless drastic management approaches and policies are implemented, It is unlikely that the current trends of pseudoeconomic rent with its threat to the aquatic ecosystem and users' livelihood can be sustained.

## Recommendation

Undoubtedly, fishing activities facilitate the livelihood of fishers and communities around TDR. It is expedient to suggest that the state's fisheries regulatory policy needs to be amended to foster community-based fisheries management options that integrate the management of the resource and capacity building of fishers and their communities. Such an approach will enhance the fishers' capacity to rationalise and juxtapose resource exploitation, profitability, and sustainability for the greater good of all.

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