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An Assessment of Constraints and Potential Benefits of Using Burrow Pits for Fish Farming. A case study of Kano State, Nigeria

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Abstract: The study was conducted between January 2021 and March 2022 in 2 local governments of Kano State, Nigeria (namely: Sallarin, {Tarauni LG} and Kofan Dan Agundi, {Municipal LG}). The objective of the study are to examine the socioeconomic characteristics of fish farmers, estimate the opportunities of the burrow pits fish production systems and identify the problems facing fish farmers in the study areas. Primary data was collected through well-structured copies of questionnaire. Descriptive statistics (frequency, percentage and mean scores), table, narrative and pictorial formats and results discussed. Specifically, the results showed that majority of the respondents (53.8%) and (23.1%) were within the active age range of 20 – 30 and 31 – 40 years, in addition, =N=12,900 contributions from single harvest makes burrow pits production systems profitability entity. The main opportunities of burrow pits are availability of water, simple management techniques, presences of fish markets, and availability of land suitable for aquaculture. On the other hand, the main constraints identified are lack of quality fry, water quality maintenance and burrow – pit ownership, the mode of operation of the fish farmers has remained rudimentary for several decades. The study concludes on an optimistic note for a better development of aquaculture in the State with positive professional policy measures for production and marketing.

Keywords: Burrow pits; Constraints; Fish Farming; potential; Kano State, Nigeria.

INTRODUCTION

The promotion of environmental management is vital to ensure good management of natural resources (water, oceans, forests) which led to the adoption of other means for improving food production such as aquaculture. Burrow pit is environmentally friendly and prominent as fish production system in Kano State, Nigeria. Burrow pits are unconventional excavations or depressions that can be utilized for water holdings in agriculture (Amos, 2000). Other unconventional depressions are ponds, swamp lands, bore hole-outflow, stagnant pools and mining paddocks which can be utilized for fish farming. The pits can either be 'Natural' **t**his includes natural depressions like stagnant pools, rock crevices, or 'Constructed 'through excavation (Mining Pits, Road construction pits etcetera). Burrow pits are most near-natural type of pond good for raising fish. In addition, fishes tend to eat food like earthworms which is readily available in burrow pits for sustainability and faster growth which is lacking in other types of ponds (water recirculation and concrete). This is inconsistent with the finding of (Abbas *et al.*, 2010), that fish grow faster in an earthen pond, because it contains all the essential amino acids and minerals in desirable concentrations.

Broadly, Earthen Ponds are synthetic dams, reservoir, or lake constructed to upscale various species of fishes as a way to retaining some options of the pure aquatic setting. Earthen ponds can be constructed manually or mechanically with water retention potential or supported with other water source. Amos (2000) asserted that some burrow-pits in Northern Nigeria are abandoned and seasonal in their water holding capacities as they retain water for not more than 3-5 months. Depending on soil structure and the environment, some burrow-pits are rich in humus deposit, retain water throughout the year and can be fertile. Thus, some burrow pits are unsuitable for fish farming especially those in high clay – area, whereas species like

Oreochromis niloticus, Synodontis ouemeensis and *Heterobranchus* grow well in burrow pits. It is important to note that burrow pits culture species are predominately lower trophic level than marine aquaculture species, relying upon more sustainably sourced feed (algae {wild}, compounded feeds, food remnants etc). More sustainable burrow pits fish culture can be featured in integrated food systems such as rice field. Suloma, (2006), reported that fish culture in China produces almost one million tons of fish and almost 10 million tons of rice with more environmentally friendly management practices.

In any case, fisheries enhancement involves activities designed to increase the quantity, quality and sizes of fish availability, the aim is to provide backup to the dwindling fish supply from the wild and particularly where more fish are in high demand. In addition, the dependence on fisheries by millions of people around the world, coupled with increased consumer demand for aquatic food and the depletion of global fisheries has created an impetus to expand fish production through fish farming (Adeogun *et al.*, 2014). Burrow pit is large and has the potential for fisheries enhancements, which can be achieved through stocking of fingerlings/juveniles to a body of water which increases supplies of fish food and means of livelihood. The Raw Materials Research and Development Council (2007) pointed out that over 10 million people are directly or indirectly engaged in fishery in Nigeria.

Aquaculture consistently expands global fish supply through intensive control, while Nigeria annual fish demand is 3.25million metric tons, its domestic production stands at 1.027million metric tons, leaving a huge deficit of 2.223million metric tons (FDF 2015). The difference between Nigeria fish demand and consumption posed enormous strain on Nigeria's foreign reserve as government attempted to augment fish supply by relying heavily on importation (frozen and smoked fishes), making Nigeria the largest importer of fish in Africa. (FDF, 2015) estimated fish importation both frozen and smoked caused Nigeria of about USD$1,126,428,414.41 and exports valued at about USD$56,067,915.00. The variance between production and consumption implies high market potentials in the fishing industry (Alhaji, 2020). However, the limited capacity of the Nigeria fisheries sector to meet the domestic demand has raised questions in policy circle that needed socio-economic transformation which should empowers the people and redeems them from the clutches of poverty. This study has shown that constrains and potential for burrow pits as fish farming system are important factors which can determine the level of output such that could maximize returns Oriakhi, (2011). Consequently, Profit from the system and adequate returns on investment are important considerations, influencing behaviour to harness and channel resources positively that would ensure the workability of the production system. Therefore, this paper focuses on achieving a sustainable fish farming production through estimation of profitability in burrow pits production systems. Specifically, to measure the efficiency of the system and provide technical suggestions for enhancing productivity, profitability and sustainability of fish farming practices, (FAO, 2012).

MATERIALS AND METHODS

Study areas: Two Burrow pits were selected (Sallarin and Kofan Dan-Agundi) of Tarauni and Municipal Local Government respectively, all in Kano State, Nigeria. Three research surveys were carried out in each of the burrow pit from January, 2021 to March 2022. Based on the objective of study, a convenience sampling procedures were adopted in selecting 39 correspondents from the two burrow pits. Leaders of the two burrow pits provided further information on their rules of membership and mode of operation. Quantitative information gathering technique of Focal Group Discussion (FGD) (NIOMR, 2006) was employed for structured questionnaire. Ocular and physical inspection coupled with Semi Structure Interviews (SSI) were the methods used to obtain information on harvesting, fish farmer personal data, income generations, constrains, craft, gear, and catch.

Figure 1: (Plate A, and B) below shows one of the Burrow pit in Kano State, it is located at Sallari in Tarauni Local Government, Kano State, Nigeria. Different species of fishes are cultured together and harvested twice in a week or otherwise. Plate 'B' shows fish species harvested and processed for smoking. Calabash (Go'ora), hooks, hand nets and traps are some of the fishing gear used in this Burrow pit.

Figure A: *Burrow pit at Sallari, Tarauni Local Government, Kano State, Nigeria.*

Source: *Field survey 2021.*

Figure B: *Burrow pit at Sallari, Tarauni Local Government, Kano State, Nigeria.*

Source: *Field survey 2021.*

Model specification: There are Two variables for assessment; fish production system (burrow pits) and crafts/gear. The fish production system is the dependent variable, crafts/gear independent variable. The data collected from the study was subjected to Marginal Costs Analysis (Habib, 2004), to determine the economic profits accruable to the fish farmer in the study areas. Hence; $S = Vc + Fc \pm \pi/L$ or $S - Vc = Fc \pm \pi/L$.

Where;

S = sales

Vc = variable cost

Fc = fixed cost

π = profit

L = loss

Marginal cost Equation

Variable cost + fixed expenses ± Profit/loss

Or Sales = Variable cost = fixed expenses ± Profit/loss

Hence, margin per harvest is;

TC = FC+VC

Annual Profit; annual sales- total cost

π =S-TC

Break Even Point/Harvests

At BEP therefore,

$$\frac{\text{fixed cost}}{\text{Selling price/ harvest -variable cost/ harvest}}$$

Break Even Point = Units of harvests x Selling price/ harvests

(In terms of sales) = harvest x Selling/harvest

Depreciation

A straight line method is adopted in the depreciation calculation; the result is as follows;

Craft (calabash)	5%
Fishing Gear & spare parts	50%
Store/mats	25%

Introduction of depreciation will change both interest and BEP to;

Total investment + Interest@10%

Annual sales (Selling/harvest × harvests)

Since, π = TR-TC, then,

The average annual profit will be sales of total harvests, depreciation at 10% interest.

Burrow pits are large and there capacities to hold water throughout the year is guaranteed, simple crafts and gears were used for harvesting and fish was availability for or sale in a particular time/season. Total Revenue (TR) is the total amount made from sale of harvest. Total Variable cost (TVC) is the total cost incurred from the period of stocking fish to maturity/cost of crafts/gear. Total Gross Margin (TGM) is the gross profit that is obtainable from fish harvest. Therefore, cost and return was used to assess the margin value of crafts/gear from annual harvest. It is assumed all fixed expenses depreciated in value at a 5%, 50%, 25%, craft, gear/spare parts, per annul was tested during the surveys (2021-2022), (to further prove its potential viability). The basic assumption made in this study is that harvest is twice per weeks represents 104 harvest in a year, all things been equal. The work is presented using descriptive, narrative and pictorial formats and results explicitly discussed.

RESULTS

Results of the socio-economic characteristics of fish farmers is presented in Table 1 which indicates that majority of the respondents (53.8% and 23.1%) are within the economically active age group (20-30 and 31- 40) years respectively. The distribution shows that aquaculture has a seemingly positive relationship in the future. Retirees and other members of the society form the most experienced burrow pits users. Aquaculture industry in Kano is dominated by male, probably (culture, religion). It is important to note that all the respondents from the two burrow pits were married. The result further revealed an impressive educational status of fish farmers in the study area with only 12.8% without formal education (but had Islamic education), 7.7% had tertiary education, 41.03% primary education while 23.7% secondary and 15.4% had vocational knowledge. In any case, the educational level of the respondents is sufficient to support adoption of new technology and information sharing. Table 1 further reveals that despite they are engaged in other jobs all the respondents are full time fish farmers (100%). While table 2 below presents the average sale, fixed and variable cost incurred from a particular harvest (burrow pits). The major constraint of burrow pits is ownership of the farm, 100% of the fish farmers are squatting probably the sizes and locations of burrow pits.

Table 1: Socio – Economic Characteristics of Respondents

Variable	Frequency	Percentage
Age		
20-30	21	53.8
31-40	9	23.1
41-50	7	17.9
51-60	2	5.2
>60	0	0
Total	**39**	**100**
Marital Status		
Married	39	100
Single	0	0
Widow	-0	0
Separated	0	0
Total	**39**	**100**
Educational Status		
No formal education	5	12.8
Primary	16	41.03
Secondary	9	23.07
Tertiary	3	7.7
Vocational	6	15.4
Total	**39**	**100**
Status 1		
Full time fish farmer	39	100
Temporary	0	5
Leisure	0	0
Total	**39**	**100**
Resource Issues		
Own land	0	0
Rent land	0	0
Family land	0	0
Government	0	0
Squatting	39	100
Total	**39**	**100**

***Sources**: Field survey Jan. 2021 to March 2022.*

Cost Analysis

Table 2: Investment cost.

	Details	=N=
a.	Sales/harvests	18,000

Fixed expenses	**=N=**
Gear (calabash)	13,000
Building (store, zinc)	80,000
Membership (registration)	1,500
Hand Nets (sinkers, wood)	5,000
Stainless Ring Hook (200pcs)	100,000
Security Lights (2pcs)	2,500
Miscellaneous	2,500
Sub-Total	**204,500**
Variable Cost (on harvest per day)	
Baits/food remnants	400
Mats (made from bamboo)	1,200
Feeding	1,500
Precautionary	2,000
Sub-Total	**5,100**
Grand Total	**209, 600**

Sources: *Field survey Jan, 2021 to March 2022*

Marginal cost Equation

Elements of costs can be written as follows;

Variable cost + fixed expenses ± Profit/loss

Or Sales = Variable cost = fixed expenses ± Profit/loss

Hence, margin per harvest is;

=N=

Sales	18,000.00
Variable cost	5,100.00
Contribution	12,900.00

The annual contribution will then be unit of contribution/harvest × total harvests, hence, 12,900 × 104 harvests =N= 1,341,600. And the expected annual profit (π) will be TR - TC. Therefore; TR = unit sales × harvesting/year

=18,000 × 104 = 1,872,000 (annual sales).

TC = FC+VC

TC = 204,500 + 5,100 = 209,600.

Annual Profit; annual sales- total cost

π =S-TC

1,872,000 - 209,600 = 1,662,400.

Break Even Point/Harvests

(In harvest)

Fixed cost	204,500.00
Variable cost/ harvest	5,100.00
Selling/harvest	18,000.00

At BEP therefore, $\frac{\text{fixed cost}}{\text{Selling price/ harvest -variable cost/ harvest}}$

Substituting the value, such as,

$= 204500 = \frac{204500}{18000-5100} = \frac{204500}{12900}$

= 15.9 harvests

Break Even Point = Units of harvests x Selling price/ harvests

(In terms of sales) = 15.9 x 18000 = =N= 286,200.

Depreciation

A straight line method is adopted in the depreciation calculation; the result is as follows;

Craft (calabash)	5%
Fishing Gear & spare parts	50%
Store/mats	25%

Total cumulative cost of depreciation for the 1st phase is estimated as =N= 23,200.00. The cost of depreciation, remaining value of capital items was estimated as follows;

			=N=
=N=			
Craft (calabash)	13,000	@ 5%	650
Fishing Gear & spare parts	5,100	@ 50%	2,550
Store (zinc)	80,000	@ 25%	20,000
Total			**98,100**
23,200			

Break Even Point

Introduction of depreciation will change both interest and BEP to;

	=N=
Total investment	209,600.00
Interest@10%	20,960.00
Depreciation	98,100.00
Total cost	**328,660.00**

Annual sales (18,000 ×104 harvests) = 1,872,000.00

Since, π = TR-TC, then, 1,872,000 -209,600 = 1,662,400.

Sensitivity analysis

	=N=
Sales	18,000.00
Variable cost	5,100.00
Margin	12,900.00

Breakeven point/landing

	=N=
Sales	18,000.00
Fixed cost	204,500.00
Variable cost	5,100.00

Total cost = 209,600

Annual sales (18,000 ×104 harvests) = 1,872,000.00

Since, π = TR-TC, then, 1,872,000.00 - 209,600 = 1,662,400.

At BEP therefore, $= \frac{204,500}{18,000} = 11.4$ harvests

=18,000×11.4 = 204,500,000.

	=N=
Total investment	204,600, .00
Interest@10%	20,460.00

Depreciation	23,200.00
Total cost	**248,260.00**

Annual profit (18,000 ×104 harvests) = 1,872,000.00

Since, π = TR-TC then, 1,872,000 - 248,260 = 1,623,740.

The average annual profit made from sales of 104 harvests, depreciation =N=23,200 and at 10% interest was =N= 1,872,000.00.

DISCUSSION

The study shows positive relationship between burrow pits and increased cultured fish species due to availability of large market in Kano State, Nigeria. Religion and culture of Kano State made fish farming particularly burrow pits a male dominated industry who are in their economic active years. This is in consistent with the findings of Oloruntoba & Fakoya, (2002) opined that fishing activities are the exclusive preservation of people in their active age. In Kano fish farmers' converts to useful purposes land otherwise not suitable for other form of agriculture (burrow pits). It reduces pressure on fishing in natural waters. It restocks semi natural water bodies with fingerlings and minimized cost procedure, as reported by (Onyemauwa, 2010), knowledge plays important role in adopting technology and new fish farming skills.

Generally, the estimates revealed burrow pits has exhibited high profit potentials, under *ceteris paribus* the investment will be able to payback in short period of time. In this context, investment on burrow pits would facilitate unhindered flow and increased level of fish production and animal protein intake in Nigeria. It will increase the income generation capacity of the fish farmer and reduces the level of poverty among users in lines with the findings of Omitoyin (2012) in Lagos State, Nigeria. Inland fisheries provide food for billions and livelihood for millions of people worldwide (FAO 2014*b*). There are several ways to enhance a fishery. Stocking fingerlings/juvenile to a burrow pit can be done to increase supplies of fish in Kano. Burrow pits can be stocked to encourage the growth of favoured species. Thus, burrow pits in Kano improved through traditional knowledge and practices (artisanal fisherman turned to open space fish farmers).

RECOMMENDATION

The utilization of vast available untapped or abandoned land and water resources to useful aquaculture purposes that will reduces pressure on fishing in natural waters. For competitiveness and resilience, the burrow pits fish farmers' needs improved seed and management practices, facilitating financial access and market linkage, lower-cost quality feeds through policies and stakeholders' cooperation. In addition a holistic approach to aquaculture may positively transformed Nigerian's fish demand deficit or at least reduces it as well as contributes towards economic development from the availability of abundance resources.

REFERENCES

Abbas, S. I., Ahmed, M. S., and Khalil –Ur- Rehiman (2010). Comparative effects of fertilization and supplementary feed on the growth performance of three fish species. Int. J. Agric. Biol. 12:276-280.

Adeogun, O., Alimi, T. and Adeyemo, R. (2014). Comparative analysis of profitability and technical efficiency of fish farming using different rearing techniques in Nigeria. Asian Journal of Agricultural Extension, Economics and Sociology, 3(5):405-418.

Alhaji Tanko Abdallah (2007): Determinant of Fluctuation in the Prices of Smoked Fishes from Bornu State. A Case Study of Selected Fish markets in Lagos State. *Unpublished Msc. Thesis submitted to Department of Economics. University of Lagos, Nigeria.*

Amos Taiwo Timothy (2000): Sustainable Poly-culture Fish Practices in Kano State of Nigeria: An Economic Analysis. *An unpublished PhD. Thesis submitted to the Department of Agricultural Economics and Rural Sociology. Ahmadu Bello University Zaria, Nigeria.*

FAO, (2012). The State of world fisheries and aquaculture 2012. Rome 209 Pp.

FAO 2014*b*. The State of World Fisheries and Aquaculture – 2014 (SOFIA). Rome, Italy.

Federal Department of Fisheries (FDF) (2008-2015): Fisheries Statistics of Nigeria. Federal Department of Fisheries Area 11, Garki, Abuja, FCT, Nigeria. Fifth Edition.

Habib, S. (2004). Costing Methods and Techniques. Vol. II Poly Communication Limited. 1st Published in 2004. Nagwamatse House, Bank of the North Building. First Floor, suit IV left wing. Pp. 46-55

Nigerian Institute for Oceanography and Marine Research (NIOMR), (2006). Market Development, Fish and Fish products Marketing in Urban and Peri-urban Zones of Lagos. Technical Report , 35p.

Oloruntoba, A. & Fakoya, E.O. (2002). Constraints to the Increased Fishing Productivity of Women in Rural peri-urban setting of Lagos State, Nigeria. *Journal of Extension Systems*, 19(2), 60-71. Retrieved from: http://jesoline.org.

Omitoyin, S. A., Tosan, F. B. (2012): Potential impacts of climate change on livelihood food security of artisanal fisher folks in Lagos River State, Nigeria. Journal of Agricultural Science, 4, 9, 20, 30.

Onyemauwa, C., S. (2010). Marketing Margin and efficiency of Watermelon Marketing in Niger Delta Area of Nigeria. Agricultural Tropical et Subtropical , 43(3), 196 – 201.

Oriakhi H. O. and Onemolease E. A. (2011). Prospects and Constraints of Artisanal Fishing in Selected Communities in Delta State, Nigeria. Advances in Applied Science Research 2(6): 55-61.

Suloma, A., Ogata, H.Y., (2006). Future of rice-fish culture, desert aquaculture and feed development in Africa: The case of Egypt as the leading country in Africa. Japan Agricultural Research Quarterly: Japan Agricultural Research Quarterly, 40 (4) (2006), pp. 351-360