Profitability Analysis of Concrete and Earthen Ponds Catfish Production Systems in Rivers State, Nigeria

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Abstract
This study analyzed comparatively catfish production systems for concrete and earthen ponds in Rivers, Nigeria. Specifically, the study was designed to describe the type of fish farming practices and characteristics of fish farmers in the study areas, estimate costs and returns relationship of concrete and earthen ponds catfish production systems and compare the profitability. Many fish farmers would opt for concrete or any other enclosure rather than earthen based on space manageability and not because it is essentially more profitable. The data were gotten from primary data sources. Primary data was collected through well-structured copies of questionnaire. Descriptive statistics (frequency, percentage and mean scores) and inferential statistics (T-test) analysis were used for the analysis of collected data. The results showed that the Gross Marginal Index (GMI) was N110,003,016 for concrete and N49,454,029 for earthen pond with a profitability ratio of 0.32 and 0.38 respectively. Rate of Return on investment 24.2% and 27.5% respectively which implies the difference in cost and returns for concrete and earthen pond production systems. The t-test results showed no significant difference in the output level of catfish in concrete and earthen pond systems (t-calculated = 0.835 < t-critical = 0.96). The study concluded that there is no much difference in the production of catfish when using either a concrete or an earthen pond. The study recommends that catfish farmers should be trained on how to manage hatchery in order to be able to provide their own fingerlings for production. Also good water facilities should be made available to catfish farmers by the government and private bodies.

Keywords: *Catfish, Concrete tanks, Earthen pond, Production system*

I. Introduction

Aquaculture incorporates all types of nurturing of aquatic creatures and plants in brackish, marine and fresh waters. The practice of aquaculture has its principle reason which is expanding the production of fish nourishment over the intensity that would be normally delivered. Aquaculture is as of now in charge of a consistently expanding offer of worldwide aquatic food generation, which expanded from 3.9 percent in 1970 to 31.9 percent in 2003 (Food and Agricultural Organization, 2006). The major financial objective of aquaculture is to create furthest load of attractive fish or some other aquatic creatures and plants from a given volume of water in the most limited conceivable time at any rate cost (Ogundari and Ojo 2009). While, the demonstration of fish cultivating is limited to the purposeful supporting of fish under controlled (concrete tanks, GP tanks, tanks, and so forth) or semi controlled (earthen ponds) conditions for monetary and social advantages. (Anthonio and Akinwumi, 2002). In a similar vein, Veliu, Gessese, Ragasa and Okali, (2009) bore witness to the fact that fish cultivating is a corresponding part of agribusiness which furnishes an undeniable supply of protein gotten from animal food and expanded sustenance which aids the prosperity in Nigeria's populace as regards to wellbeing.

Olagunju, Adesiyan and Ezekiel (2007) also opined that the most likely fish products popular amongst the Nigerian populace are smoked, iced and fresh fish. The cultivable species of fish food products that are cultivated in Nigeria incorporate common carp, tilapia and catfish. Notwithstanding, many agriculturists who are fish farmers center around catfish since it commands a decent business venture in the Nigerian markets (Samson, 1997).
Catfish has characteristics which makes it ideal when contrasted with different species, for example, it adjusts well to culture condition, can without much of a stretch be sold while fish is still active and breathing in the water and it is of top value. Without much stress, catfish can be appropriately stocked in ponds reasons been that they endure truncated supply of oxygen in the pond, superior to tilapia and the rest.

Osawe (2004) also listed other attributes such as; high fertility rate, and the rate of fry survival is also high and easily adjust to complementary fish feed. Thus, catfish cultivating is essential to the maintainability of the aquaculture business in the nation. In addition, catfish has wide worthiness as nourishment in Nigeria. In spite of these extensively high possibilities, local fish production has not been able to fulfill the nation's demand which had created supply gap (FAO, 1998). Expanded catfish generation in the nation, according to FAO (2007), can help diminish this troubling fish supply deficiency in the country.
Fish cultivating creates work and venture, open doors for individuals who are both straightforwardly and by implication associated with the production of angling yield and other unified organizations (Olagunjun et al., 2007).

Aquaculture is frequently simpler to oversee than catch fisheries, as aquaculture exercises for the most part falls inside national administration systems and do not confront similar challenges in asset the executives that later do (FAO, 2006).
Aquaculture in Africa has been confronting extraordinarily difficulties which had hindered its development, while much development in fish creation as of late had experienced quick extension of fish farming in Asia, but its growth in Africa is slow when compared to Asia. The Pacific and Asia represented 91.5% of the world’s aquaculture creation by 80.5% by incentive in 2004, while sub-Saharan Africa represented just 0.16% by amount and 0.36 percent by value. By far, most African fish farming happens at an exceptionally little scale, with more than 90 percent of African fish farming originating from fish farms with only a small number of earthen ponds, developed and operated utilizing household effort. These ponds should be mostly under 500 m2 in size, producing 300– 1,000 kg/ha yearly (World Bank, 2006). These ponds stands for a critical supply of nourishment and salary for the owners, but have not been practiced in intensities equipped for shutting that "fish supply gap" which exist in the in sub-Saharan regions of Africa.

Concrete ponds have dependably picked up conspicuousness among fish farmers with contrast to earthen pond. This is on the grounds that fish is raised nearer to home and requires less space when contrasted with earthen pond development. The fish cultivating business is one in which the farmer's sole aim is benefit amplification. To accomplish this objective, the agriculturist sorts out required factors of production. It is basic for the fish farmer to know the feasibility of the concrete and earthen ponds production frameworks in other to limit misfortunes. Many fish farmers normally decide on the Concrete pond fish cultivating framework when contrasted with the earthen pond fish cultivating framework. Does it essentially imply that it is all the more financially suitable?

Objectives of the study

The objective of this study was to investigate the profitability of concrete and earthen ponds catfish production systems. Specifically the objectives are to;

i. Examine the kind of fish cultivating practices in the study areas

ii. Compare the expenses and returns of concrete and earthen pond catfish production frameworks and therefore analyze their productivity

Methodology

This study was conducted in Rivers State of Nigeria. The state is bordered on the North by Imo and Abia states, on the South by Atlantic Ocean, on the East by Akwa Ibom state and the West by Bayelsa and Delta states. Rivers State is in the Niger Delta (South South) region of Nigeria. These incorporate new Calabar, Orashi, Bonny, Somber and Bartholomew Rivers. Rivers State lies between Latitude five (5°N') North and mid-path between longitude five (5°S') South of the Greenwich Meridian (Rivers State Government, 2010).

Research Design

A proportional sampling techniques was used in the selection of the sample size. In district I, 3 local government areas were selected; they include Obio/Akpor, Ikwerre, and Emohua. In district II, 3 local government areas were also selected, and they include Eleme, Andoni, Tai. In district III Ahoada East, Ahoada West Ogba/Egbema/Ndoni were selected also. In this 9 local government areas were selected, 20 fish farmers were selected based on availability from each local government making a total of 180 fish farmers were selected.

Data Collection Method and Sources

Primary data was used for the study. Structured questionnaire and interview schedule was used to obtain data from the respondents.

Data Analysis Techniques

Descriptive statistics was used to determine the type of fish farming practices and characteristics of the fish farmers. The budgetary technique (economic indicators) was used to determine costs, returns and profitability indices of fish farming in concrete and earthen pond. T test analysis was used to compare the compare concrete and earthen pond.

Results and Discussions

Table 1: Fish Farming Practices and Characteristics

Practices	Frequency	Percentage
Reasons for going into fish farming		
to earn a living	100	74.07
to supplement income	27	20.00
hobby	6	4.44
social status	2	1.48
Total	**135**	**100**
source of water supply		
Borehole	41	30.37
deep well	51	37.78
stream or river	16	11.85
public tap	27	20.00
Total	**135**	**100**
type of production system		
Concrete pond	83	60.74
Earthen pond	32	22.96
Re-circulatory system	3	2.96
Earthen and Concrete pond	20	13.33
Total	**135**	**100**
Source of fingerlings		
Own hatchery/farm	33	24.44
commercial fish hatchery	89	65.93
Government fish farms	10	7.41
from the wild	3	2.22
Total	**135**	**100**
culture period		
Two months	7	5.19
four months	49	36.30
six months and above	79	58.52
Total	**135**	**100**
Nature of Harvesting		
Total pond harvest	36	26.67
partial pond harvest	72	53.33
Both	27	20.00
Total	**135**	**100**

Source: Field Survey 2018.

Fish Farming Practices and Characteristics

Reasons for going into fish farming 100 (74.07%) of the respondents went into it to earn a living, 27 (20%) engage fish farming to supplement income whereas 6 (4.44%) and 2 (1.48%) went into fish farming as a hobby and social status respectively. The implication of the results is that farmers in the study area engage in fish farming as a major source of livelihood. It sustains families and creates employment for the people.

Source of water supply: 41 (30.37%) got their water from borehole 51 (37.78%) from deep well 16 (11.85%) from stream or river and 27 (20%) were from public tap. Water supply is essential in aquaculture, majority getting their water from well is an indication that their operational efficiency is low.

Type of Production System: From table 1, 83 respondents (60.74%) used concrete pond, 32 respondents (22.96%) used earthen pond 3 respondents (2.96%) used re-circulatory system, and 20 (13.33%) used both concrete and earthen pond. The results show that concrete ponds are preferable owing to the fact that land to construct earthen ponds is limited. Re-circulatory system use is low, most farmers can't afford it.

Source of fingerlings: Table 1 showed that 33 respondents (24.44%) own hatchery farm, 89 respondents (65.93%) got their fish fingerlings from commercial fish hatchery 10 respondents (7.41%) got theirs from government fish farms and only 3 respondents (2.22%) got theirs from the wild. This means that the majority of farmers buy fingerlings, they are not capable of running a hatchery on their own.

Culture Period: The table 1 showed that 7 respondents (5.19%) practiced a culture period of two (2) months, 49 respondents (36.30%) four (4) months and 79 respondents (58.52%) kept the fish up to six (6) months and above. This means majority of the raise their fish to table size before selling them.

Nature of Harvesting: Table 1 showed that 36 respondents (26.67%) of the respondents do total pond harvest, 72 respondents (53.33%) do partial pond harvest and 27respondents (20%) do both.

Table 2: Cost and Return Structures of Concrete and Earthen Pond Fish Production System for one Production Period

Cost Structure	Concrete Pond (n=93) Amount (₦)	Earthen Pond (n=42) Amount (₦)
Variable cost		
Feed	26,316,000	**6,106,000**
Fingerlings	5,071,000	**2,497,000**
Labour	2,905,000	**1,598,000**
Medication	2,081,926	**970,903**
Fuel	2,468,000	**1,141,000**
Transportation	515,000	**239,000**
water treatment	1,220,000	**544,000**
Electricity	1,045,000	**516,000**
Maintenance	394,058	**193,068**
TVC	**42,015,984**	**13,804,971**
AVC	**451,784**	**328690**
Fixed Cost		
Land (Acquisition/Rent)	7,985,000	**4,260,000**
Pond Construction (including plumbing and drainage)	107,100,000	**49,700,000**
Borehole	13,615,000	**6,085,000**
Generator	7,671,000	**3,351,000**
Tank	6,458,000	**2,932,000**
Tank stand	13,480,000	**6,133,000**
Scoopnet/dragnet, Mosquito net, and weighing scale	484,500	**214,500**
Wheel Barrow/shovel/head pan/Bowl	1,703,000	**769,000**
Total Fixed Costs	**158,496,500**	**73,444,500**
AFC	**1,704,263**	**1,796,024**
Total costs (TC)	**200,512,484**	**87,249,471**
ATC	**2,156,048**	**2,077,368**
% TVC to TC	**21%**	**16%**
% TFC to TC	**79%**	**84%**
Revenue Structure		
Output (kg)	**223,500**	**96,150**
TR	**152,049,000**	**63,259,000**
AR	**1,634,935**	**1,506,167**
Profit (TR-TC)	**-48,463,484**	**-23990471**
GMI (TR-TVC)	**110,033,016**	**49,454,029**

Source: Field Survey 2018.

Cost and Return Structure of Concrete and Earthen Pond Fish Production System for one Production Period

From the result table 2, the Gross Margin Index (GMI) of concrete pond production was N110,033,016 while that of Earthen pond was N49,454,029. The profitability ratios were 0.32 & 0.38, a Benefit Cost Ratio (BCR) of 0.76 and 0.73 for concrete and earthen ponds respectively. The Net Farm Income was N48,463,484 for concrete and N23,990,471 for Earthen pond. Rate of Return on investment showed 24.2% for concrete and 27.5% for earthen pond. Rate of return on Variable Cost (%) (RVC) was 15.3% for concrete, while that of earthen was 73.8%. Expense Structure Ratio (ESR) was 0.79 for concrete and 0.84 for earthen pond.

The result is an indication that there is no much difference in the production of catfish when using either a concrete or an earthen pond.

Difference in the Output Levels of Catfish in Concrete and Earthen Pond Fish Production Systems

Table 3: Mean Standard Deviation and t-test showing the output levels of catfish in concrete and earthen pond fish production systems.

Production system	N	Mean $\bar{x}$ Output	SD	Df	t_{cal}	t_{crit} (0.05,133)	Sig. t	Level of significance	Dec.
Concrete Pond	93	223500	782.7	133	0.835	0.96	0.405	0.05	Accept
Earthen Pons	42	96150	611.7						

Source: Field survey 2018, detail in appendix 12

The summary of t-test result on the difference in the in the output levels of catfish in concrete and earthen pond fish production systems in table 3 shows that the mean output of catfish is 223,500kg from concrete pond and 9,6150kg from the earthen pond with a standard deviation of 782.7 and 611.7 respectively. The t-test results showed no significant difference in the output level of catfish in concrete and earthen pond systems (t-calculated = 0.835 < t-critical = 0.96).

Conclusion

Majority, 100 respondents (74.07%) went into catfish farming to earn a living; the implication of the results is that farmers in the study area engage in fish farming as a major source of livelihood. Majority, 51 respondents (37.78%) get water from deep well. Indicating low operational efficiency. Majority, 83 respondents (60.74%) used concrete pond, the results show that concrete ponds are preferable. Majority, 89 respondents (65.93%) got their fish fingerlings from commercial fish hatchery. Majority 79 respondents (58.52%) kept the fish up to six (6) months and above. Majority, 72 respondents (53.33%) do partial pond harvest. The result of Cost and Return Structure of Concrete and Earthen Pond Fish Production System for one Production Period showed that there is no much difference in the production of catfish when using either a concrete or an earthen pond. The t-test results showed no significant difference in the output level of catfish in concrete and earthen pond systems (t-calculated = 0.835 < t-critical = 0.96). The study recommends that catfish farmers should be trained on how to manage hatchery in order to be able to provide their own fingerlings for production. Also good water facilities should be made available to catfish farmers by the government and private bodies.

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