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Research Article

ALLOCATIVE EFFICIENCY OF RESOURCE UTILIZATION IN FISH FARMING IN OWO LOCAL GOVERNMENT AREA OF ONDO STATE, NIGERIA

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ABSTRACT

The study assessed resource use efficiency among fish farmers in Owo Local Government Area of Ondo State, Nigeria. A multistage sampling technique was used to select 50 fish farmers for the study. Data obtained were analyzed using multiple regression analysis. Significant determinants of the quantity of fish harvested at the end of the production cycle were fish seeds (0.647) and the quantity of feeds used (0.339). The two productive resources were significant at 0.01 probability level. The values of allocative efficiency of all the inputs used indicated that pond size (7.041) and fish seeds (11.500) were underutilized while labor (0.705) was overutilized; only feeds (1.032) were optimally utilized during fish production process. Underutilized resources should be optimally used to obtain the best possible output. Excessive use of labor should be reduced so as to cut cost of production and increase profit margin. It is also recommended that fish farmer's capacity should be developed through regular training on how to allocate productive resources efficiently.

Keywords: Fish, Resource, Marginal, Utilization, Farming, Efficiency, Feeds, Allocation.

INTRODUCTION

Fish are a major source of animal protein for people worldwide, especially for those in the lowest stratum of the society in developing countries who live on less than a dollar per day [1]. reported that fish accounted for about 17% of the global population's animal protein intake and 6.7% of all protein consumed in 2013. Moreover, fish provided more than 3.1 billion people with almost 20% of their average per capita intake of animal protein. In addition to being a rich source of easily digested, high-quality protein containing all essential amino acids, fish provide essential fats (e.g., long chain omega-3 fatty acids), vitamins (D, A, and B), and minerals (including calcium, iodine, zinc, iron, and selenium), particularly if eaten whole [1]. Even modicum quantities of fish can have an essential positive nutritional impact on plant-based diets such as maize, wheat, cassava, sorghum, and yam, and this is the case in many developing countries like Nigeria.

Fish farming as an agricultural business has great capability or potential to raise family income, provide employment opportunities, and reduce the problem of food insecurity among rural, peri-urban, and urban dwellers [2]. An estimated 56.6 million people were engaged in the primary sector of capture fisheries and aquaculture in 2014, of whom 36% were engaged full time, 23% part time, and the remainder were either occasional fishers or of unspecified status. Following a long upward trend, numbers have remained relatively stable since 2010, while the proportion of these workers who engaged in aquaculture increased from 17% in 1990 to 33% in 2014 [1].

Nigeria needs about 2.66 million metric tons of fish annually to meet the dietary requirement of her citizens. Regrettably, the total aggregate domestic fish supply from all sources (capture and culture fisheries) is <0.7 million metric tons per annum [3]. Nigeria has to import about 1.96 million metric tons of fish valued at about $500 million annually to augment the shortfall. This colossal importation of frozen fish into the country has ranked Nigeria the largest importer of frozen fish in Africa [3]. It has been observed that Nigeria can be self-sufficient in fish production if domestic capacity is greatly enhanced so as to transform the country from being a net importer of fish into a net exporter of fish. To reverse this negative trend of huge fish importation with its attendant drains of the nation's economic reserve, it is pertinent to ensure that resources being used in fish farming are allocated efficiently to produce fish that will not only reach market weight within the shortest period of time but meet local demand, and also ensures that fish farmers can make quick returns from their investment of money, time, energy, and resources.

Allocative efficiency defines a point whereby a business enterprise or organization is able to achieve maximum result (i.e., realize the highest possible output) at least-cost combination of resources or inputs. Although some studies exist on fish farming in Ondo State, only limited studies exist on allocative efficiency of resources used in fish farming in the state, particularly in Owo Local Government Area (LGA) of the state and that is why a study like this is essential to serve as a guide on how limited or scarce resources can be utilized efficiently so as to obtain maximum output in fish production.

METHODS

Description of the study area

Owo LGA is one of the 18 LGAs in Ondo State. Owo traced its origin to the scenic and ancient city of Ile-Ife, the cradle of Yoruba culture. The coordinates of the LGA are 7°11'N and 5°35'E. The LGA is blessed with tropical rainforest climate and high humidity with a temperature that ranges between 21°C and 28°C [4]. Owo as at 2006 had a total population of 222,262, with males accounting for 112,056 and females accounting for 110,206 [5]. With an annual growth rate of 2.87%, the projected population of Owo in 2017 is put at 292,430. The present-day Owo is an agrarian society that is involved in fish farming, growing, and trading of yams, cassava, maize, peppers, okra, cocoa, etc.

Sampling method

A multistage sampling procedure was adopted for this study. In the first stage, Owo LGA was purposively selected out of the 18 LGAs in Ondo State for this study because of its high profile aquaculture status in the state. This prominent aquaculture status was attested to by Ondo State Fisheries Department of 2013 in which Owo LGA was listed as having 97 registered fish farmers. Simple random sampling technique was then used to select 50 fish farmers from the LGA.

Method of data collection

Primary data were collected through the use of interview schedule and questionnaires distributed to fish farmers. The information gathered through the use of questionnaires and interview schedule include inputs used (fish seeds, feed, water, and labor) and the output of the farming exercise (the quantity of table size fish harvested in kilogram).

Analytical technique

Data obtained from the study were analyzed using regression method. Equation (2) was used to determine the effect of certain variables on the quantity of fish harvested at the end of the production cycle:

$$Y = a_0(x_1^{a1}x_2^{a2}x_3^{a3}x_4^{a4}e^u) \quad (1)$$

Using logarithm to transform Equation 1

$$LogY = loga_0+a_1logx_1+a_2logx_2+a_3logx_3+a_4logx_4+e \quad (2)$$

Marginal physical product (MPP) = a.y/x

Where,

Y = Quantity of fish in kg

x_1 = Pond size (meter square)

x_2 = Fish seeds (unit)

x_3 = Feeds (kg)

x_4 = Labor (man days)

e = Error term, i.e., random variable which captures factors outside farmer's control

a_0 = Constant term

a_1-a_4 = Regression coefficients

MPP = Marginal physical product

Allocative efficiency in fish farming can be determined using certain physical parameters such as MPP, unit cost of each input used, and the unit price of table size fish harvested at the end of production cycle. Therefore, the allocative efficiency of resources or inputs used in production process like fish farming is given as follows:

$$AL_{eff} = \frac{MPP_{xi} * P_y}{P_{xi}} \quad (3)$$

$MPP_{xi} * P_y$ = Marginal value product (MVP) while P_{xi} = Marginal factor cost (MFC). Therefore, allocative efficiency can also be written as follows:

$$AL_{eff} = \frac{MVP}{MFC} \quad (4)$$

Where,

AL_{eff} = Allocative efficiency

MPP_{xi} = MPP of the i[st] input. It is the change in output as a result of a unit change in a particular input.

P_y = Unit price of table size fish and it is obtained by dividing total revenue by the quantity of table size fish produced.

P_{xi} = Unit cost of i[th] resource used in raising fish. It is obtained by dividing the total cost of that particular input by the quantity of such input used.

MVP = MVP, which is the change in the total value of product due to a unit change in the amount of variable input used in production.

MFC = MFC, which is the addition to total cost of production as a result of using an extra unit of input.

Allocative efficiency of pond size, for instance, can be determined as follows:

$$AL_{eff} = \frac{MPP_{x1} * P_y}{P_{x1}}$$

To determine the efficiency of resources used in production process, the following decision criteria were established [6,7].

(a) $\frac{MVP_{xi}}{MFC_{xi}}$ > 1, indicates underutilization of resources.

(b) $\frac{MVP_{xi}}{MFC_{xi}}$ < 1, indicates overutilization of resources.

(c) $\frac{MVP_{xi}}{MFC_{xi}}$ = 1, indicates optimal utilization of resources.

RESULTS AND DISCUSSION

Results of regression analysis

To determine the effect of factors such as pond size, fish seeds (fingerlings or juveniles), feeds, and labor on the quantity of fish harvested at the end of the production cycle, a regression analysis was conducted and the double log form specified in equation (2) was used. The results are shown in Table 1.

The results indicated that variables such as fish seeds and feeds were positive and significant while pond size and labor were not significant but positive.

In line with a priori expectation, the regression coefficient of the number of fingerlings or juveniles stocked was positive and significant at 1% level of probability. This indicates that a unit increase in the number of fish seeds stocked will lead to an increase in fish output. This result is in consonance with the findings of the study by Nwosu and Onyeneke [8] in their work on the effect of productive factors of pond fish on fish output in Owerri, Imo State that farmers who stocked more fingerlings or juveniles recorded higher output than their counterparts who stocked less.

The amount of feeds administered in raising fish was positive and significant at 1% level of probability. This implies that feeds are very essential in raising fish to reach marketable size within the shortest period of time. This is in tandem with the work of the study by Ele *et al*. [9] that an increase in the amount of quality feeds applied in raising fingerlings or juveniles will definitely lead to an increase in the quantity of table size fish that will be cropped at the end of the production cycle.

The coefficients of pond size were positive but not significant implying that a lot of the farmers in the study area were small-scale fish farmers with small ponds while labor was also positive but not significant.

Estimates of allocative efficiency of resources utilized in fish farming

The calculation of allocative efficiency of resources used in fish farming involves the estimation of physical parameters such as MVP, MPP, and MFC. The results are presented in Table 2.

The results show that productive resources such as pond size and fish seeds were underutilized; labor was overutilized while there was optimal use of feeds. It must be noted that pond is a fixed input, and it was depreciated using the straight-line method shown below:

$$D = \frac{P - S}{N}$$

Where,

D = Depreciation

Table 1: Regression estimates of variables determining the quantity of harvested fish

Variables	Coefficients	Standard error	t-statistic	p
Constant	−0.091	0.211	−0.433	0.667
Pond size	0.014	0.600	0.235	0.816
Fish seeds	0.647	0.089	7.289**	0.000
Feeds	0.339	0.055	6.136**	0.000
Labor	0.021	0.079	0.264	0.793
R^2	0.940			
Adjusted R^2	0.935			
F-statistic	177.55**			0.000
Durbin-Watson	1.718			

**p<0.01