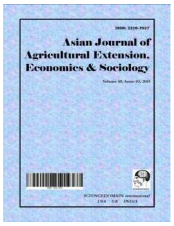

Asian Journal of Agricultural Extension, Economics & Sociology
10(3): 1-11, 2016; Article no.AJAEES.23881
ISSN: 2320-7027

SCIENCEDOMAIN *international*
www.sciencedomain.org

An Economic Analysis of Year Round Pangus Production and Social Impact in Some Selected Areas of Mymensingh District in Bangladesh

K. M. Mehedi Adnan[1*], Swati Anindita Sarker[2], Kaynath Akhi[3] and Md. Mostafizur Rahman[4]

[1]Department of Agricultural Finance and Banking, Sylhet Agricultural University, Sylhet, Bangladesh.
[2]Department of Agricultural Economics, EXIM Bank Agricultural University, Bangladesh.
[3]Department of Agricultural Economics and Business Studies, Sylhet Agricultural University, Sylhet, Bangladesh.
[4]Department of Agricultural Marketing and Business Management, Sylhet Agricultural University, Sylhet, Bangladesh.

Authors' contributions

This work was carried out in collaboration between all authors. Authors KMMA and SAS designed the study, wrote the protocol and supervised the work. Author KA managed all field work and helped to the statistical analysis. Authors KMMA and MMR managed the analyses of the study. Author KMMA wrote the first draft of the manuscript. Author SAS managed the literature searches and edited the manuscript. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJAEES/2016/23881
Editor(s):
(1) Rana Ozen Kutanis, Sakarya University, Esentepe Campus, Health Management Department, Turkey.
Reviewers:
(1) Ipinmoroti, Mabel Omowumi, Osun State University, Nigeria.
(2) Serguei Aily Franco de Camargo, Environmental Law, Universidade Estacio de Sa, Brazil.
(3) Renato Massaaki Honji, Universidade de Sao Paulo Rua do Matao, Brazil.
Complete Peer review History: http://sciencedomain.org/review-history/13974

Original Research Article

Received 27th December 2015
Accepted 17th March 2016
Published 1st April 2016

ABSTRACT

The study was designed to assess the costs, returns, profitability, and food security status of Pangus farm households. Samples were collected from two villages namely Baganbari and Konabari at Trishal Upazilla under Mymensingh district, Bangladesh in 2013. 100 sample farmers were selected randomly of which 27 were marginal farmers, 42 small farmers, 26 medium farmers

**Corresponding author: E-mail: mehedi_adnan.agfb@sau.ac.bd;*

and 5 were large farmers respectively. Tabular and statistical analysis was done to achieve the major objectives of the study. The average annual production of Pangus for all farms was 28860 kg which valued at Taka (Tk.) (1$=80 Tk.) 1010100 per hectare per year. The farmers earned the highest profit from the medium scale of Pangus farming. All the included variables such as human labour cost, fertilizer cost, and lime cost, and manure cost (except fingerlings and feed) had significant impact on yields and economic returns of it. Farmers changed land use patterns to increase farm income and food security. It's playing a significant role to develop road and communication, marketing system, social and economic institutions to improve overall economic condition and also have some adverse impact on environmental issues. As policy measures, it may be suggested that Pangus farmers should be provide fingerlings, credit, training and reasonable price for sustainable development of Pangus farming.

Keywords: Pangus production; food intake; social impact.

1. INTRODUCTION

According to the report of Bangladesh Bureau of Statistics [1], fisheries sector has been contributing 7.34% of the total export earning and 4.73% to the Gross Domestic Product (GDP). Pangus fish, scientific name *Pangasius sutchi* was initially imported into Bangladesh from Thailand in 1990 by the Ministry of Fisheries and Livestock (MOFL). Breeding of this species was first accomplished successfully in 1993 in the hatchery condition in Bangladesh. Then the artificial propagation was practiced all over the country. It is a temperature tolerant species and can survive in a wide range of temperature 22-300C and pH range 6.5-7.5 [2]. Pangus is one of the important species in aquaculture of Bangladesh. It occupies one of the top positions with respect to growth, production and nutritional composition and important for their fast growth, lucrative size, and good taste and high market demand. Over the last few years, spectacular development has been taken place in Pangus farming in Mymensingh district. Farmers are converting their rice fields into Pangus farming for high economic gain. Presently in Mymensingh districts, there are about 1364 Pangus farms. Covering an area 774 hectare and which produce 19203 MT fish per year 60% of total Pangus production [1]. There are so many factors for its vast cultivation. These are: it can be produced in fresh water and mild salty water, cultured even with high density, takes any kind of supplementary feed, grows quickly compared to any other fish, its production and profit is high, disease resistance power is high, be profitably cultivated in a short period of time, palatable and can be exported [3]. Labour employment in this sector has been increased approximately 3.5% annually and fish production in ponds lakes, borrow pits, floodplains, oxbow lakes and semi-closed water bodies are increasing day-by-day through transfer of modern technology [2]. Fish production has been increased to 24.41 lakhs MT in 2006-2007, which was 17.81 lakhs MT in 2000-2001 [4]. About 77% of total fish catch comes from inland fishery and of this about 27% is contributed by pond fishery [5]. Fish provides protein, essential nutrition for growth and good livings, Omega-3 fatty acids, control some arthritis, diabetic, etc [6]. Micronutrients like, Iron, Calcium and Phosphorus are responsible for blood and bone formation and Night blindness can be prevented by vitamin-A are also comes from fish [7]. People of developing countries spend a significant share of their incomes on food items. Like many other developing countries, the people of Bangladesh spend more than 50% of the income for food and the share of cost for food is more than 60% of the total cost [5]. Poverty, food insecurity and malnutrition are the usual phenomena for the people of Bangladesh. These three factors are interrelated, which cannot be isolated from each other. These three phenomena can be improved by increasing the domestic food production. So, research work needs to be undertaking on the management of Pangus farming which would be helpful in planning and setting up strategies for future development for the country and achieving food security.

A good number of studies on Pangus fish culture are available but no studies were conducted on Year round Pangus fish farming in relation to food security and social, environmental issues of respective farm households. The present study has, therefore, been designed to provide information about productivity and economic returns, food production, availability and utilization patterns, food consumption and nutritional status, factors affecting food security, and environmental impacts of year round Pangus fish culture. The finding from the study may also help the policy makers in making decisions on future of the Pangus fish culture. The information will also be useful to the extension workers.

Considering research proposal, following specific objectives are:

- To determine the costs and returns of Pangus fish production.
- To assess socioeconomic and environmental impact of Pangus farming on livelihood and food security of farm households.
- To suggest some policy implication for greater benefits on Pangus of farm households.

2. METHODOLOGY OF THE STUDY

2.1 Field Survey and Data Collection

The area in which a farm business survey is to be made depends on the particular purposes of the survey and possible cooperation from the farmers. Two villages from Mymensingh district under Trishal Upazila, Trishal Union (area 2827 hectors) namely Konabari and Baganbari were purposively selected for this study. Total sample size was 100. The data were collected randomly. The distribution of sample farmers is shown in Table 1 in details.

Firsthand information was collected by the researchers himself/herself from the study areas during the period from January to February in 2013.

Before preparing the final schedule, a draft schedule was developed by keeping in view the objectives of the study. The draft schedule was pretested in the study area by interviewing a few fish farmers by the researcher himself and then the final survey schedule was developed in logical sequence so that the fish farmer could answer chronologically. The information was collected through direct interview by the researcher himself. Several visits were made to this landing centre to collect correct and accurate information related to objectives of the study. After each visit, the collected information was checked for accuracy and clarity. Researcher was also involved in preparing data for analysis to avoid errors in interpretation, coding, computation and analysis. In the present study both the tabular and statistical techniques were used to know the effect of using inputs and other related factors of Pungus fishing.

2.2 Analytical Techniques of the Study

Mainly two types of techniques of analysis were used in this study a) Tabular Analysis and b) Statistical Analysis.

The Cobb-Douglas production function is often used to analyze the supply-side performance and measurement of a country's productive potential. This functional form, how-ever, includes the assumption of a constant share of labor in output, which may be too restrictive for a converging country.

The Cobb-Douglas production function used and estimated by Cobb and Douglas (1928), and in each of the subsequent time-series papers, takes the following form:

$$Q = A\,L^{\beta 1}\,K^{\beta 2} \tag{1}$$

Where Q, L and K are output, labour and capital respectively, and A, $\beta1$ and $\beta2$ are constants. They assumed constant returns to scale (CRS) with $\beta1 + \beta2 = 1$,. By imposing CRS, it was only necessary to estimate $\beta1$, effectively avoiding any potential problem of co-linearity in estimation. The imposition of the CRS restriction without testing is econometrically unsatisfactory and the restriction was subsequently relaxed by Douglas (1934), without any real impact on the estimated values of $\beta1$ and $\beta2$.

Table 1. Distribution of sample farmers

Categories of farms	Study areas of year round Pangus — Trishal Upazila under Mymensingh district			
	Villages		All farmers	Percentage (%)
	Konabari	Bagan		
	No. of farmers	No. of farmers		
Marginal farmers (<1.0 acre)	12	15	27	27
Small farmers (1.00 to 2.49 acre)	20	22	42	42
Medium farmers (2.5 to 7.49 acre)	14	12	26	26
Large farmers (>7.50 acre)	4	1	5	5
All farms	50	50	100	100

A more important problem with the original specification of the functional relationship is the omission of technical change. The need to take account of technical change in estimation was noted by Handsaker and Douglas (1937) and Williams (1945). Although Williams noted a method to proxy technical change, no effort was made in either of these studies to address this issue. Unless it is feasible to assume that over the entire data period there existed constant technology (i.e., *A* is constant) then there is a need to re-estimate the data with an additional explanatory variable. A standard procedure for introducing the possibility of technical change is to include a time trend (T). This captures observed changes in the technology although it is assumed exogenous to the estimated specification. Importantly the introduction of *T* de-trends the data without which it is likely that the regression estimates only capture historical growth rates in the data.

$$Q = A(t)\, L^{\beta 1}\, K^{\beta 2} \qquad (2)$$

Where $A(t) = Ae^{\delta t}$. *A* and δ are constants. δ is a measure of the proportionate change in output per time period when input levels are held constant (i.e. the proportionate change in *Q* that hap-pens as a result of technical progress). This specification incorporates neutral technical change - there is no impact on the marginal rate of substitution between capital and labour. This formulation implies that technical change is exogenous and disembodied.

Equation (3) is usually estimated as follows:

$$\ln Q = \alpha + \delta T + \beta_1 \ln L + \beta_2 \ln K + \varepsilon \qquad (3)$$

where ε is an error term. The log-linear specification means that the estimates of β_1 and β_2 are elasticity's and to assess CRS simply requires a hypothesis test on the sum of β_1 and β^2 [9].

Further, if

$$\alpha + \beta = 1,$$

the production function has constant returns to scale, meaning that doubling the usage of capital K and labor L will also double output Y. If

$$\alpha + \beta < 1,$$

returns to scale are decreasing, and if

$$\alpha + \beta > 1,$$

returns to scale are increasing. Assuming perfect competition and $\alpha + \beta = 1$, α and β can be shown to be capital's and labor's shares of output [10].

Cobb and Douglas were influenced by statistical evidence that appeared to show that labor and capital shares of total output were constant over time in developed countries; they explained this by statistical fitting least-squares regression of their production function [8].

The multiple regression function was specified as follows:

$$\mathbf{Y} = aX_1^{b1}\, X_2^{b2}\, X_3^{b3}\, X_4^{b4}\, X_5^{b5}\, X_6^{b6}\, e^u$$

The equation may be alternatively expressed as log-linear form.

$$\ln Y = \ln a + b_1 \ln X_{1i} + b_2 \ln X_{2i} + b_3 \ln X_{3i} + b_4 \ln X_{4i} + b_5 \ln X_5 i + b_6 \ln X_6 i + Ui$$

Where,

Y = Gross return (Tk/ha)
X_1 = Human labour cost (Tk./ha)
X_2 = Fingerling cost (Tk./ha)
X_3 = Feed cost (Tk./ha)
X_4 = Fertilizer cost (Tk./ha)
X_5 = Manure cost (Tk./ha)
X_6 = Lime cost (Tk./ha)
ln=Natural logarithm
a = Intercept
(b_1.....b_6)= Coefficients of respective variables
Ui = Error term

2.3 Measurement of Food Security

According, Food and Agriculture Organization of the United Nations (FAO) [11], five general types of methods/indicators were identified.

The first indicator can be labelled undernourishment, a measure commonly identified with the FAO. This FAO method begins with an estimate of the per capita dietary food energy supply, derived from aggregate food supply data.

A second group of indicators, which can be termed food intake, measures the amount of food actually consumed at the individual or household level. Indicators at the individual level can be obtained directly by measuring actual food intake through a number of techniques.

The third approach to the assessment of dietary deficiencies is to measure food utilization through nutritional status. Anthropometric measures of children are regularly collected in random sample surveys in many countries.

The fourth group of indicators revolves around the concept of access to food and can be peroxide by wealth status, measured by total consumption, expenditures or income. Access to food indicator, and in particular income, have served as the main food security indicator in many countries.

Finally, the last approach revolves around the concept that even if households are not currently undernourished, they may be at risk or vulnerable to future deprivation. Vulnerability is and inherently dynamic concept which expresses ex-ante vulnerability and ex-post outcomes.

2.4 Determining Parameters of Food Consumptions

For determining the factors that influence the food consumption and calorie intake, Cobb-Douglas type functions in double-log forms were employed. Normally functions in double-log forms give better results than other functional forms since transformation of variables ensures validity of normality assumptions. Separate models were fitted for food consumption and calorie intake in which food consumption and calorie intake were considered as dependent variables, and education of farm household head, respective land use patterns, main occupation of households head, farm size, family size, household's income and age group of family members were considered as independent variables. Along with the estimated parameters, standard errors of individual coefficients were estimated. Besides, F statistic was calculated to show the goodness of fit of data with different independent variables [12].

Theoretical model for food consumption, multiple regression function [7] is,

$$Y = aX_1^{b1}\, X_2^{b2}\, X_3^{b3}\, X_4^{b4}\, X_5^{b5}\, X_6^{b6}\, e^u$$

The equation may be alternatively expressed as log-linear form.

$$\ln Y = \ln a + b_1 \ln X_{1i} + b_2 \ln X_{2i} + b_3 \ln X_{3i} + b_4 \ln X_{4i} + b_5 \ln X_5 i + b_6 \ln X_6 i + b_7 \ln X_7 i + Ui$$

Where,

Y = Per capita consumption (Tk/year)
X_1 = Production of per capita (Tk/ year)
X_2 = Expenditure per capita (Tk/ year)
X_3 = Income per capita (Tk/ year)
X_4 = Cultivated land (decimal)
X_5 = Family size (No.)
X_6 = Cereal crop production (Tk/ year)
X_7 = Education of household head
ln=Natural logarithm
a = Intercept
$(b_1.....b_7)$= Coefficients of respective variables
Ui = Error term

3. RESULTS AND DISCUSSION

3.1 Cost of Small Scale Pangus Fish Production

It appears from the (Table 2) that per hectare average total costs of Pangus farming was about Tk. 66717.75. Out of total costs material input cost was the highest amount of the Pangus farming. In Pangus farming, out of the material inputs costs, share of feed, fertilizer, manure, lime, chemical electricity and fingerlings were 78.02, 0.31, 0.45, 0.49, 0.78, 0.20 and 8.24 per cent respectively of the total cost of production.

3.2 Gross Return

It appears from the Table 2 that the average production was 28860 kg per hectare per year and its estimated value Tk. 1010100. Gross return was the highest in medium farms (Tk. 1031415) followed by large farms (Tk 10, 30085), small farms (Tk. 1024100), and marginal farms (Tk 976500) respectively.

3.3 Net Returns

Per hectare per year average net return for all sizes of Pangus fish were Tk. 342928.25. The net return, according to farm size was the highest in medium farms (Tk 360639) followed by large farms (Tk 357291), small farms (Tk 339804) and marginal farms (Tk. 313979) respectively Table 2.

Table 2. Per hectare costs and economic returns of Pangus production

Items	Farm categories				
	Marginal	Small	Medium	Large	All farms
Yield Kg	27900	28640	29469	29431	28860
Gross returns (GR) Tk.	976500	1002400	1031415	1030085	1010100
Total variable cost (TVC), Tk.	604441	604173	610637	612759	608002.5
Total fixed cost (TFC) Tk.	58080	58423	60139	60035	59169.25
Total cost TC= (TVC+TFC), Tk.	662521	662596	670776	672794	667171.75
Gross margin (GM = GR-TVC),Tk.	372059	398227	420778	417326	402097.5
Net returns (NR= GR-TC), Tk.	313979	339804	360639	357291	342928.25
Return over Tk. investment (NR/TC)	0.47	0.51	0.54	0.53	0.51
BCR (GR/TC)	1.47	1.51	1.54	1.53	1.51

3.4 BCR

Benefit Cost Ratio (BCR) for Pangus fish production was determined as a ratio of gross return to gross cost. Table 2 reveals that BCR (undiscounted) of Pangus farming is 1.51 indicating that production of Pangus farming was profitable. The BCR is highest is obtained from medium farms (1.54) which is more profitable than marginal (1.47), small for (1.51) land large farms (1.53).

3.5 Interpretation of Econometric Analysis

The results of the econometric analysis are illustrated in terms of the estimated co-efficient and related statistics. The most important features are noted below.

3.5.1 Human labour cost (X_1)

The regression co-efficient of human labour were negative for Pangus fish farming. Co-efficient of human labour for Pangus was -0.2184 which was statistically significant at 5 percent level. It indicates that keeping other factors constant, 1 percent increase in additional expenditure on human labour would decrease the returns of Pangus production by 0.2184 percent (Table 3).

3.5.2 Fertilizer cost (X_4)

The regression co-efficient of fertilizer cost was positive 0.9184 which was highly statistically significant at 1% level. It reveal that 1 percent increase in the fertilizer costs keeping other factor constant would increased gross returns by 0.9184 percent (Table 3).

3.5.3 Manures cost (X_5)

The production coefficient of Manure cost which 0.4034 (Table 3) with positive significant implies that keeping other things remain same one percent increase in manure would lead to an increase in the gross return by 0.4034 percent. This coefficient was statistically significant at 1 percent level.

3.5.4 Lime cost (X_6)

The regression co-efficient of lime cost (X6) was negative (-0.2170) (Table 3) in Pangus fish farming and statistically significant at 5 percent level indicating that 1 percent increase in the cost of lime keeping other factor hold constant would in decreased gross returns of Pangus fish production.

3.5.5 Value $\bar{R}^2$ and F

F-value of the equation is 27.53 which were highly significant implying that all the included explanatory variables were important for explaining the variation in Pangus fish production (Table 3). Therefore, the inclusion of independent variables was reasonable. The value of R^2 is 0.74 From the table 4 the value of adjusted $\bar{R}^2$ is 0.717 indicates that 72 percent of the variation in the dependent variable explained by the chosen six explanatory variables which were included the model and the other 28 percent of the variation in the dependent variable explained by the other explanatory variables which were not included. The high value of $\bar{R}^2$ indicates that the model fit the data well. The value of $\bar{R}^2$ is the corrected coefficient which explains the explanatory variables.

Table 3. Estimated values coefficients and related statistics of Cobb Douglas production function for Pangus gross returns

Factors	Co-efficient	Std. Error	t-value	Significant
Constant	6.0147	0.6705	8.97	0.000
Human lab. Cost (Tk./ha)	-0.2184	0.1238	-1.76	0.81**
Fingerlings Cost (Tk/ha)	-0.0976	0.1672	-0.58	0.561 NS
Feed cost (Tk/ha)	-0.0440	0.1468	-0.30	0.765 NS
Fertilizer cost (Tk/ha)	0.9184	0.2116	4.34	0.000*
Manure cost (Tk/ha)	0.4034	0.1454	2.77	0.007*
Lime cost (Tk/ha)	-0.2170	0.1330	-1.63	0.106**
F-Value	27.53			
R^2	0.74			
Adjusted $\bar{R}^2$	0.717			

Note: = 1, ** = 5, NS = Non-significant*

3.6 Interaction of Results of Factor Affecting Households Food Consumption

Food consumption of farm households differs from house to house. Different types of factors such as volume of production per capita, expenditure per capita, income per capita, cultivable land per capita, Family size cereal crop production and education of household head may influence the household food consumption. The regression co-efficient standard error, t-values and significant level and assumed factors of Cobb-Douglas production model is placed in Table 4.

3.6.1 Income per capita (X_3)

The co-efficient of income shows that income consumption of farm households. The co-efficient of income was 0.059 which was positive and indicates that household consumption might increase 0.059 per cent if income was increased by 1 percent in the study area (Table 4).

3.6.2 Cultivated land per capita (X_4)

The estimated regression co-efficient of cultivated land was 0.828 which is significant at 1 percent level (Table 4). It indicates that keeping other variables constant one percent increase of cultivated land of farm households would result to increase the per capita consumption by 0.828 percent. Large area of cultivable land may encourage the farmers to produce more crops which may help increase per capita consumption.

3.6.3 Production of cereal per capita (X_6)

The estimated regression co-efficient for production per capita of cereal crops in the Pangus farm households was 0.412, which significant at 5 percent level (Table 4). It indicates that keeping other variables constant, 1 percent increase of cereal crop production would help 0.412 percent of household income. Household increase produced more crops had higher households income in the study areas. By producing more cereal crops farmers increased their household income.

3.6.4 Value $\bar{R}^2$ and F

From the table 4 the value of $\bar{R}^2$ 0.79 indicates that 79 percent of the variation in the dependent variables explained by the chosen explanatory variables which were included in the model. And the other 21 percent of the variation in the dependent variables explained by the other explanatory variables which were not included. The high value of $\bar{R}^2$ indicates that the model fit the data well. The value of $\bar{R}^2$ is the corrected co-efficient which explained the explanatory variable.

The F-value is 27.617 which is statistically highly significant which means that all included variable is important for the regression model (Table 4).

3.7 Impact on Food Consumption of Pangus Farm Households

Food utilization is one of the important components of food security. Usually food is consumed to maintain our health and to revive strength. Food is consumed by individual as essential item of living. Every food item has its own calorie, protein and other nutrients which are essential for health. Nutritional values vary from

Table 4. Estimated values of co-efficient and related statistics of food consumption of farm households

Factors	Co-efficient	Std. error	t-value	Significant
Constant (a)	1.275	1.350	1.25	0.297
Expenditure per capita (Tk/yr)	0.040	0.018	2.172	0.035
Income per capita (Tk/yr)	0.059	0.008	5.86	0.000*
Cultivated land/decimal (X_4)	0.828	0.432	2.45	0.005*
Family size (No.) (X5)	-0.896	328.730	-0.287	0.860NS
Cereal crop production (×6)	0.412	0.108	0.218	0.024**
Education of HH (X_7)	-0.122	0.020	-0.121	0.890NS
R	0.899			
R-Square	0.809			
$\bar{R}^2$	0.792			
F value	27.617			
Significant level	0.000			

Note: = 1, ** = 5, NS = Non-significant*

food item to food item. That is why; people would like to take different food items to balance their calorie, protein and other nutritional need. But in Bangladesh, a large segment of the people cannot consume required amount of different necessary food items for various reasons and they are malnourished. Poverty and malnutrition in Bangladesh are characterized by regional variation. Factors such as proneness to natural disasters, distribution and quality of land, access to education and health facilities, level of infrastructure development, employment opportunities, and dietary and hygiene practices provide possible explanations for the variation of food and calorie intake, poverty and malnutrition. Poverty hinders and influences the consumption of essential and quality food. However, this section chapter is designed to discuss about food utilization such as food intake and nutritional Pangus farm households.

Table 5. Daily per capita food intake (gms)

Farm groups	Food intake (grams)
Marginal	1062
Small	1100
Medium	1189
Large	1446
All	1155

3.7.1 Intake of food

It appears from the table 5 that daily per capita food intake for the number of large farm households was higher than those of the marginal, small and medium farm households. Poverty Monitoring Survey (PMS) [13] reported that average per capita per day food consumption was 966.0 gms where as it was 947.8 gms in Household Income and Expenditure Survey (HIES) [14]. The average per capita per day food intake is 1155 gms for all farm households. This average per capita per day food intake is relatively higher than that of national average reported in PMS, (2004) and HIES (2006).

3.7.2 Intake of food by food items

Intakes of food according to food items by the households per capita per day have been presented in Table 6. It reveals the detailed explanation of food consumption by households considering major food items. Rice is the main item of foods for human consumption in the rural areas. Average per capita per day intake of rice was 534 gm, which was relatively higher than the national average (439.6 gm) [13,14]. The second important food item was observed to be fish and the consumption rate was about 126 gm. per capita per day at the aggregate level. The next important food item was potato followed by leafy vegetables and milk, respectively. The various food items consumed by the farm households were similar and consistent with PMS, 2004 and HIES, 2006 with a few exceptions.

3.8 Impact of Small Scale Pangus Fish Production

Pungus fish farming is profitable with some positive and negative impacts both social-economical and environmental issue.

3.8.1 Positive socioeconomic impacts of pangus farming

It is reported that among all other development factors, expansion of Pangus farming playing a significant role to develop road and communication, marketing system, social and economic institutions and to improve overall economic condition in the study areas. Benefit may be either directly to the households that is income from Pangus and the creation of employment opportunity in the Pangus farming. However, for determining the socioeconomic and environmental benefits of year round Pangus farming issues raised in discussion with the selected Pangus farmers in the study areas and their views and comments are summarized in Table 7.

Table 6. Food intake of farm households (gm/day/cap)

Food itmes	Marginal	Small	Medium	Large	All farm
Rice	563	502	525	656	534
Wheat	0	2	0	0	1
Maize	0	0	0	0	0
Potato	69	70	65	43	66
Leafy vegetables	53	69	69	42	64
Cabbage/califlower	36	59	54	107	57
Cucumber	34	39	34	36	36
Brinjal, bean, kachu, patal, kakrol, okra, etc.	33	22	25	7	24
Lentil	16	11	13	25	14
Maskalai/khesari	2	4	5	6	4
Mustard oil	9	11	12	25	12
Soyabean oil	12	10	14	26	13
Beef/mutton	8	16	17	73	20
Poultry meat	16	19	22	17	19
Egg	6	5	7	5	6
Fish	106	121	131	165	126
Onion	26	24	34	32	29
Garlic	6	7	6	11	7
Chilli	7	5	6	9	6
Fruits	4	7	12	37	11
Sugar	14	15	16	24	16
Milk	42	82	121	99	90
Total	1062	1100	1189	1446	1155

Table 7. Positive socioeconomic impacts of Pangus farming

Positive Impact	Percent (%)
Increasing purchasing capacity	81
Increase saving	78
Developed households health and sanitation	77
Developed socioeconomic infrastructure	92
Increase investment to other business	74
Increased employment opportunity	68
Developed marketing facilities	65
Increased children education	77
Extended electricity facilities	59
Increased knowledge about small commercial Pangus farming	72
Improved life style	88
Increased quality and choices of food items	90
Home supplied fruits and vegetables decreased	77
Increased nutritional status	90
Supply of food grain increased	74
Increased food security	**82**
Developed transportation and communication facilities	**74**

Table 8. Adverse effects of small scale commercial Pangus farming

Negative impacts	Percent (%)
A. Socioeconomic impact	
Decreased land for rice production	77
Scarcity of grazing land and declining livestock production	92
Loss of common property right	74
Unequal distribution of income	77
B. Environmental Impact	
Destroys plant and tress	74
Damaged the households vegetation	77
Damaging adjacent rice fields	69
Long term leasing arrangement	82
Inbred species problems	95
Low quality feed produced and supplied	92
Slow growing (stunted) of Pangus	85
Increased ill health of soil	56
Sedimentation problem (to soils)	74

3.8.2 Negative impacts small scale pangus farming

Thus, in recent years, the massive and unplanned Pangus farming has come under close scrutiny based on a number of socioeconomic and environmental issues. Some issues are summarized in Table 8.

4. CONCLUSION AND POLICY RECOMMENDATION

4.1 Conclusion

The findings of this study suggest without doubt that Pangus fish farming. In spite of its high profitability all farmers were not presently interested in Pangus due to its high production cost other component of agriculture cultivation. Moreover, the price of Pangus is decreasing day by day because of its low demand for the consumers. Considering food security average daily per capita consumption was higher for the member of large farm household than those of other categories of farmers. Production of cereal crops, cultivated land, income per capita, expenditure per capita and production per capita were the significant factors to increase per capita consumption for the members of farm households.

4.2 Policy Recommendations

The findings of this study suggest without doubt that Pangus fish culture under year round was profitable. The present study has revealed some valuable information regarding Pangus fish production. Pond fish production can be increased by improving the production technology in existing ponds. In views of the scarcity of land in this country, fish production should be increased through intensification, rather than increasing farm size or constructing new ponds.

Following policy recommendations have been made for increasing the production and financial returns of Pangus fish production.

i) Application of scientific fish culture and management should be ensured. For this, government and other agencies should play their assigned role to train up the Pangus farmers.
ii) Government and other agencies should ensure adequate supplies of quality fingerlings in proper time.
iii) Bank loan and other institutional credit should be made available on easy terms and conditions to the farmers.
iv) Immediate attention should be given to develop good marketing facilities both for inputs and outputs so that the fish farmers can have fair price round the year.
v) The fish farmers should be given loans on easy terms and condition, so that they can use it in lean period.
vi) Market demand and market price of different species should be monitored throughout the year so that the farmers can sell fish with higher price when demand is high.
vii) Fisheries extension service should be strengthened to estimate the prospective farmers and circulate booklets and

pamphlets about new technologies of Pangus production under year round production.

viii) Effective linkage requires to be set up between Upazila Fishery Officer and farmers.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. BBS. Statistical Year Book of Bangladesh. Bangladesh Bureau of Statistics. Ministry of Planning. Government of the People's Republic of Bangladesh: Dhaka; 2010.
2. Mazid MA, Hossain. Rice-fish farming technology a popular practice in Bangladesh. Biological Science and Living Resources. 1997;27(9).
3. Amin. A socio economic analysis of pond fish culture under BRAC supervision in some selected areas of Mymensingh District. M.S. Ag. Econ. Thesis. Department of Agricultural Economics. Bangladesh Agricultural University: Mymensingh; 1998.
4. DOF (Department of Fisheries). Annual Report. Department of Fisheries: Dhaka; 2007.
5. Bhattacharjee L, Saha SK, Nandi BK. Food basket nutrition strategies in Bangladesh. Department of Agricultural Extension (DAE), GoB and FAO: Bankok; 2007.
6. Wahed MA, Roy AK. Food composition data in Bangladesh. Special Publication No. 128 ICDDR, Bangladesh. Centre for Health and Population Research: Mohakhali, Dhaka; 2008.
7. Coates, Jennifer PW, Robert H. Measuring food insecurity: Going beyond indicators of income and anthropometry. Washington DC. Food and Nutrition Technical Assistance Project. Academy for Educational Development: 1825 Connecticut Avenue, N W; 2003.
8. Wikipedia. Cobb–Douglas production function.
   Available:https://en.wikipedia.org/wiki/Cobb%E2%80%93Douglas_production_function
9. Fraser I. The Cobb-Douglas production function: An antipodean defense. Economic Issues, Vol.7, Part 1, March 2002.
   Available:http://www2.econ.iastate.edu/tesfatsi/ProductionCobbDouglasFct.EmpValid.Fraser.pdf
10. Beattie BR, Taylor CR. The economics of production. Montana State University. John Wiley & Sons: New York; 2008.
11. FAO. Food and Agricultural Organization. Gateway to Land and Water Information. Food and Agriculture Organization Bangladesh national report; 2003.
    Available:http://www.fao.org/ag/AGL/swlwpnr/reports/y_sa/z_bd/bd.htm
12. James Stewart. Calculus: Early transcendental. 6th Edition. Thomson Brooks/Cole; 2008.
13. PMS. Report of the Poverty Monitoring Survey, 2004. Bangladesh Bureau of Statistics. Ministry of Planning. Government of the People’s Republic of Bangladesh; 2004.
14. HIES. Preliminary Report on Household Income and Expenditure Survey-2005 Bangladesh Bureau of statistics (BBS). Planning Division. Ministry of Planning Government of the People Republic of Bangladesh; 2006.

Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/13974