Econometrics of Scampi (Macrobrachium Rosenbergii) Polyculture in Selected Ponds at Sandeshkhali - I Development Block in North 24 Parganas District of Coastal West Bengal over the Year 2014

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Abstract: **For a social and economic standpoint prawn farming will remain an important part of the rural economy. From an environmental standpoint impacts of intensive prawn culture will only become exacerbated if the discharge of untreated effluent continues. This could have severe consequences for the industry in the future. Alternative systems, such as nutrient recycling systems, or alternative water treatment strategies are necessary to mitigate negative impacts in the future. The potential for higher farm income through remediation of currently idle ponds will provide a significant incentive for farmers to make them back on scampi farming. Factors encouraging prawn farming expansion are compatibility with agriculture, small farmers can practice in their own land, opportunities for women's involvement, no interference with mangrove or environment. Revive the scampi industry can made it a major contributor in earning foreign exchange for our country and at the same time play a crucial role to the employment generation and socio-economic upliftment of a major portion of coastal rural fisher folk.**

Key words: ***Economic standpoint, intensive culture, quality measures, mitigate, sustainable development, potential***

I. INTRODUCTION

Aquaculture is widely used as an important weapon in the global fight against poverty and malnutrition, particularly within developing countries. The giant river prawn *Macrobrachium rosenbergii* is native to Southeast Asia, South Pacific countries, northern Oceania, and western Pacific islands [1]. Modern aquaculture of the species began in the late 1960s with the discovery that larval survival required brackishwater conditions [2]. Commercial development was possible due to research conducted by Takuji Fujimura which allowed for the ready availability of postlarvae [3]. Adults are found in most inland freshwater areas, preferring turbid conditions [3]. Due to aggressive behavior and competition, freshwater prawns exhibit differential growth rates. According to Ministry of Water Resources, Govt. of India the total water bodies cover about 7.0 million ha in which tanks and ponds are about 2.9 million ha followed by reservoirs (2.1 million ha), brackish water areas (1.19 million ha). These resources are still underutilized or neglected in terms of production, and can be converted into successful farming ventures. Freshwater prawn farming can be conducted by unskilled rural people on small establishments and prawns are consumed domestically by all social classes. This differs considerably from marine shrimp farming, which is controlled by a small number of individuals and is primarily for export [4]. Semi-intensive culture has been the most common production system for *M. rosenbergii* in Southeast Asia [5]. While environmental impacts of individual prawn farms are less than marine shrimp farms, high concentrations of farmers practicing semi-intensive to intensive culture can quickly degrade water quality within an area. Semi intensive is defined by stocking densities of 4-20 pcs/m^2, incorporation of fertilization and feeding, and production of 500-5,000 kg $ha^{-1}year^{-1}$ [6]. In that regard the purpose of this survey was to address the following aspects of prawn culture: determine the types of production systems and management strategies utilized for freshwater prawns in North 24 Parganas, and the level of production and net profits and go through the input and output variables associated with polyculture of *Macrobrachium rosenbergii.*

II. MATERIALS AND METHOD

The present study is based on traditional Macrobrachium rosenbergii polyculture with IMCs conducted in Sandeshkhali I blocks of North 24 pgs district, West Bengal during the months of February 2014 to July 2014. Before the commencement of fieldwork, a pilot study was conducted during the month of January 2014. Based on that pilot study, Sandeshkhali I blocks of North 24 pgs district is selected for final study. Purposive sampling method was used while selecting the study area. West Bengal ranks first in total area utilized in scampi farming and ranks second in production with respect to all the states of India. The bulk of the culture of giant freshwater (*Macrobrachium rosenbergii*) is mainly cantered in North 24 pgs.

North 24 Parganas has 25,26,486 ha area are suitable for both brackishwater and inland water farming.(Government of West Bengal, Directorate of Fisheries Annual Report, 2000). In that case the culture practices of Macrobrachium rosenbergii was mainly consisting in domestic ponds. The development plans for West Bengals's fisheries sectors were aimed at increasing the fishery production, improving the welfare of fishermen and providing food security in

North 24 Parganas. In recent decades, prawn polyculture in the household ponds of North 24 Parganas has become economically attractive as a result of the growing market demand and high price. All above reasons lead to the consideration of North 24 Parganas district for its purposive selection at Stage- 1 of the sampling frame. The primary and secondary data collection was conducted in Bashirhat sub-division in North 24 Parganas at Stage- 2 level of the sampling frame. These sub-divisions are exists mostly direct and indirect effects of environmental and natural parameter, which are reasons for better economic profitability for both monoculture and polyculture of Macrobrachium rosenbergii. Sandeshkhali- I block is chosen between ten blocks of Bashirhat sub-division for giant fresh water prawn polyculture and better transportation facilities from my campus (Sandeshkhali and Dhamakhali bus stand are nearer to Sandeshkhali- I block). The next step of this work is associated with selection of study villages of selected stations. In Sandeshkhali-I block, the study sites are situated about 5-6 Km from Sandeshkhali bus stand. In Station- 2, there are two villages are selected for study site. The names of the villages are Khaksardha, Boyarmari. These villages have vast water areas for scampi polyculture. In this stage an equal number i.e. five number of farmers

III. RESULT & DISCUSSION

Concise Analytical Discussion for Average Economics (unit 1 bigha) in connection with Capital Cost for Scampi Farming considering all the involved parameters during 2014.

The linear regression equation (Table 1) taking capital cost as dependent variable and other variables viz. lease amount, construction of pond, inlet and outlet structure, pump house cum workshop, watchman shed, pumps, electric installation, land and farm equipments, miscellaneous and capital cost as independent variables. The equation revealed as below:

Total Capital Cost (TCC) (Rs.) = 8266.360 + (1.853 x Pumps) + (40.177x Electric installation with electrification) + (.621 x Land and farm equipments) + (-1.610 x Miscellaneous)

The equation clearly indicates that the most important variables (average value calculated for 1 bigha area, in all the cases) are Electric installation with electrification and Pumps. Both of them have positive impact upon Total Capital Cost (TCC) (Rs.). All the other independent variables except Miscellaneous have positive impact upon Total Capital Cost (TCC) (Rs.). The 95% Confidence Interval i.e. the lower and the Upper boundaries are depicted as: Pumps (1.853, 1.853), Land and farm equipments (0.621, 0.621), Electric installation with electrification 40.177, 40.177), Miscellaneous (-1.610, -1.610).

Concise Analytical Discussion for Average Economics (unit 1 bigha) in connection with Variable Cost for Scampi Farming considering all the involved parameters during 2014.

The linear regression equation (Table 2) taking Total Variable Cost (TVC) (Rs.) as dependent variable and other variables of Total Variable Cost (TVC) (Rs.), viz. cost of chemicals and manure, cost of seeds, Cost of IMC (fingerling/table size), cost of feed, fuel charges, electricity charges, labour charges, medicines, annual maintenance and repairing cost, miscellaneous expenditure as independent variables. The equation revealed as below:

Total Variable Cost (TVC) (Rs.) = 30480.139 + (0.481x Cost of prawn seeds) + (1.066 x Labour charges) + (1.269 x Annual maintenance and repairing cost) + (4.405 x Miscellaneous)

The equation clearly indicates the most important variables (average value calculated for 1 bigha area, in all the cases) are Miscellaneous and Annual maintenance and repairing cost. Both of them have positive impact upon Total Variable Cost (TVC) (Rs.). All the other independent variables viz. labour charge and Cost of IMC (fingerling/table size) have positive impact Total Variable Cost (TVC) (Rs.). The 95% Confidence Interval i.e. the lower and the Upper boundaries are depicted as: Cost of prawn seeds (.481, .481), Labour charges (1.066, 1.066), Annual maintenance and repairing cost (1.269, 1.269), Miscellaneous (4.405, 4.405).

Concise Analytical Discussion for Average Economics (unit 1 bigha) in connection with Fixed Cost for Scampi Farming considering all the involved parameters during 2014.

The linear regression equation (Table 3) taking Total Fixed Cost (TFC) (Rs.) as dependent variable and other variables of Total Fixed Cost (TFC) (Rs.), viz. Depreciation on capital cost @ 7%, Interest on capital cost @ 13.2%, Interest on variable cost @ 13.2% as independent variables. The equation revealed as below:

Total Fixed Cost (TFC) (Rs.) = -0.148 + (2.886 x Depreciation on capital cost @ 7%) + (1.000 x Interest on variable cost @ 13.2%)

The equation clearly indicates the most important variables (average value calculated for 1 bigha area, in all the cases) are Depreciation on capital cost @ 7% and Interest on variable cost @ 13.2%. Both of them have positive impact upon Total Fixed Cost (TFC) (Rs.). The 95% Confidence Interval i.e. the lower and the Upper boundaries are depicted as: Interest on capital cost @ 13.2% (2.886, 2.886) Interest on variable cost @ 13.2% (1.000, 1.000).

Concise Analytical Discussion for Average Economics (unit 1 bigha) in connection Profit of Scampi Farming considering all the involved parameters during 2014.

The linear regression equation (Table 4) taking Profit (Total Income - Total Expenditure) as dependent variable and other variables of viz. lease amount, construction of pond, inlet and outlet structure, pump house cum workshop, watchman shed, pumps, electric installation, land and farm equipments, miscellaneous, capital cost, cost of chemicals and manure, cost of seeds, Cost of IMC (fingerling/table

size), cost of feed, fuel charges, electricity charges, labour charges, medicines, annual maintenance and repairing cost, miscellaneous, Depreciation on capital cost @ 7%, Interest on capital cost @ 13.2%, Interest on variable cost @ 13.2%, Total Expenditure, Contribution of Prawn in Profit, Contribution of IMC in Profit as independent variables. The equation revealed as below:

Profit (Total Income - Total Expenditure) = 43527.531+ (1.747 x Cost of feed) + (-97.775 x Electricity charges) + (-34.533 x Medicines) + (3.592 x Contribution of IMC in Profit)

The equation clearly indicates the most important variables (average value calculated for 1 bigha area, in all the cases) are Electricity charges and Medicines. Both have negative impact upon Profit (Total Income - Total Expenditure). All the other independent variables viz. Land and farm equipments and Contribution of IMC in Profit, the former have negative impact Profit (Total Income - Total Expenditure). The 95% Confidence Interval i.e. the lower and the Upper boundaries are depicted as: Cost of feed (1.747, 1.747), Electricity charges (-97.775, -97.775), Medicines (-34.533, -34.533), Contribution of IMC in Profit (3.953, 3.953).

Concise Analytical Discussion for Average Economics (unit 1 bigha) in connection with Contribution of Prawn in Profit and Contribution of IMC in Profit of Prawn polyculture considering total profit during 2014.

The linear regression equation (Table 4) taking Profit (Total Income - Total Expenditure) as dependent variable and other two variables viz. Contribution of Prawn in Profit and Contribution of IMC in Profit as independent variables. The equation revealed as below:

Profit (Total Income - Total Expenditure) = 0 .008 + (1.000 x Contribution of Prawn in Profit) + (1.000 x Contribution of IMC in Profit)

The equation clearly indicates the most important variables (average value calculated for 1 bigha area, in all the cases) are *Contribution of Prawn in Profit* and Contribution of IMC in Profit. Both of them have positive impact upon *Profit (Total Income - Total Expenditure).* The 95% Confidence Interval i.e. the lower and the Upper boundaries are depicted as: Contribution of Prawn in Profit (1.000, 1.000), Contribution of IMC in Profit (1.000, 1.000).

IV. CONCLUSION

From an environmental standpoint impacts of intensive prawn culture will only become exacerbated if the discharge of untreated effluent continues. This could have severe consequences for the industry in the future. Alternative systems, such as nutrient recycling systems, or alternative water treatment strategies are necessary to mitigate negative impacts in the future. Recently due to the sudden introduction of white shrimp in costal belt of West Bengal the farmers look slightly reluctant in prawn poly culture as white shrimp gives greater economic return in very short period of time. SEMBV/WSSV disease or frequent tidal bores as in marine shrimp, can be normally grown in salinity up to 10 ppt, large potential areas all over the districts, increased demand in urban domestic market, subsidies from state and central agencies, higher market price & existing export demand. Technical constraints are related to the inability of scampi farmers to apply appropriate technology that determines the quantity and quality of scampi. When prawn farmers open a farm or pond, they do not consider the area selection, design and layout of the farm or pond, irrigation canals and carrying capacity of environment. If the problem occurs during the production process, they have to solve the problems by themselves or by exchanging information and technology among themselves to find out a solution.

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APPENDIX

Table 1 : Correlations Matrix of Scampi polyculture at (Station- 2), South 24 Parganas during 2014: Schedule Depicted on Pond Size of 1333.33 m^2 (1 Bigha)

	Lease	Construction	Inlet	Pump house	Watch-man shed	Pumps	Land	Miscellaneous	(TCC) (Rs.)
Lease amount	.(a)								
Construction of ponds	.(a)	1							
Inlet and outlet structure of pond	.(a)	.349	1						
Pump house cum worksh op	.(a)	.077	.735	1					
Watch man shed	.(a)	.747	-.076	-.330	1				
Pumps	.(a)	-.293	-.276	-.772	.035	1			

Electric installation with electrification	.(a)	.915(*)	.322	.335	.596	-.647			
Land and farm equipments	.(a)	-.591	-.441	-.100	-.781	-.001	1		
Miscellaneous	.(a)	-.257	-.886(*)	-.900(*)	.326	.586	.083	1	
Total Capital Cost (TCC) (Rs.)	.(a)	.836	.141	-.368	.653	.224	-.393	.036	1

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Table 2 : Correlations Matrix of Scampi polyculture at North 24 Parganas during 2014: Schedule Depicted on Pond Size of 1333.33 m^2 (1 Bigha)

	Chemicals	seeds	fingerling/table size	maintenance	Miscellaneous	TVC (Rs.)
Chemicals	1					
Cost of prawn seeds	.901(*)	1				
Cost of IMC (fingerling/table size)	.200	-.100	1			
Cost of feed	-.917(*)	-.773	-.541			
Fuel charges	-.457	-.651	-.241			
Electricity charges	.507	.411	-.459			
Labour charges	.711	.357	.699			
Medicines	.072	-.148	.455			
Annual maintenance and repairing cost	-.410	-.511	-.473	1		
Miscellaneous	-.726	-.661	.242	-.012	1	
Total Variable Cost (TVC) (Rs.)	.964(**)	.874	.312	-.492	-.520	1

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Table 4: Average Economics of Scampi polyculture at Sandeshkhali- I Block North 24 Parganas during 2014: Schedule Depicted on Pond Size of 1333.33 m^2 (1 Bigha)

A	Capital Cost (C.C.)	
	Lease amount	10000
	Construction of ponds	6191.43
	Inlet and outlet structure of pond	185.29
	Pump house cum workshop	225.71
	Watchman shed	302.14
	Pumps	3086
	Electric installation with electrification	191.14
	Land and farm equipments (including maintenance charge for all machineries)	1988.57
	Miscellaneous	279.14
	Total Capital Cost (TCC) (Rs.)	22449.43
B	Variable Cost (V.C.)	
	Chemicals and manure	866.57
	Cost of prawn seeds	12272.86
	Cost of IMC (fingerling/table size)	5440
	Cost of feed	18142.86
	Fuel charges	463.14
	Electricity charges	635.71
	Labour charges	1965.71
	Medicines	568.29
	Annual maintenance and repairing cost	1206.57
	Miscellaneous	457.71
	Total Variable Cost (TVC) (Rs.)	42019.43
C	Fixed Cost (F.C.)	
	Depreciation on capital cost @ 7%	1571.46
	Interest on capital cost @ 13.2%	2963.32
	Interest on variable cost @ 13.2%	5546.56
	Total Fixed Cost (TFC) (Rs.)	10081.35
D	Income	
	A. Prawn	
	Average stocking density (no/m2)	1.67
	Average survibility @	0.84
	Total number of species survive	1851.29
	Average body weight (gm)	95
	Total biomass (Kg)	173.01
	Average selling price (Rs.)	565
	Income (Rs.)	98054.17
	B. IMC and Exotic carps	
	Average stocking density (no/m2)	1.155
	Average survibility @	0.76
	Total number of species survive	1187.26
	Average body weight (gm)	312.93
	Total biomass (Kg)	367.55
	Average selling price (Rs.)	116
	Income (Rs.)	42017.85
E	Total Income (A+B)	140072.02

F	Total Expenditure (TVC+TFC) (Rs.)	52100.78
G	Profit (Total Income - Total Expenditure)	87971.24
	Ratio of Income (Prawn : IMC)	2.34

	Contribution of Prawn in Profit	61657.78
	Contribution of IMC in Profit	26313.46

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