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An Economic Analysis of Shrimp (*Litopenaeus vannamei*) in Nagapattinam District of Tamil Nadu

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Shrimp has become a popular seafood delicacy across the world. Shrimp is one of the widely traded seafood items and shrimp farming has created huge employment opportunities and gives foreign exchange to developing Nations. Shrimp exports have grown substantially with the introduction of *Litopenaeus vannamei* in India. The study analyses the economics of shrimp production and the constraints faced by the shrimp farmers in Nagapattinam district of Tamil Nadu. The economic analysis indicated that shrimp farmers have realized average gross returns of Rs.24,48,000 per hectare and average net return of Rs.8,71,038.58 per hectare. Disease problem and high feed cost were the major constraints faced by the farmers in the shrimp production.The results would help the policy makers in formulating suitable programs and devising strategies for increasing production of shrimp in Tamil Nadu.

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1. INTRODUCTION

Aquaculture has emerged as one of the fastest growing food-farming systems at global level with enormous potential for further development [1-7]. Worldwide, the aquaculture sector has grown at an average rate of 5.3 percent per year during 2001-2018 [8]. India is the second largest aquaculture producer next to China. India is endowed with a long coastline of 8129 km, offering vast scope for development and diversification of coastal aquaculture [9].

Shrimp is an important farmed aquatic crustacean species in the world and plays a great role in human nutritional needs due to its high protein, balanced amino acids profile, unsaturated fatty acid, vitamins and minerals [10]. Consumers are flocking to shrimp because of its high nutritional value and therapeutic characteristics. China is the largest shrimp producer with 13,50,622 MT followed by India with 4,94,959 MT in the year 2017. Countries like China, India, and Southeast Asia represents more than 78 per cent of total shrimp production.

India is the second largest producer and exporter of shrimp. The total shrimp production in India was 851,664 MT in the year 2020-21. The share of *Litopenaeus vannamei* is high when compared to tiger shrimp and scampi with 3.24 per cent and 0.97 per cent respectively. In India, Andhra Pradesh accounts for major share of shrimp (*Litopenaeus vannamei*) production with 77.80 per cent, followed by Gujarat and Tamil Nadu with 6.18 per cent and 5.48 per cent respectively (MPEDA, 2020).

Tamil Nadu has the second longest coastline in the country with shrimp farming growing considerably over an area of 5075 ha. Totally 1,859 shrimp farms (3,712.02 ha.) and 63 shrimp hatcheries have been registered under the Coastal Aquaculture Authority (Department of Fisheries, Tamil Nadu, 2019) [5]. The total shrimp production of Tamil Nadu in the year 2020-21 was 44735 MT. Nagapattinam district is the leading shrimp producer of the State with 9873 tonnes in the year 2020 followed by Thanjavur district and Thiruvarur district with 25 per cent and 12 per cent respectively (MPEDA, 2020). The objective of this research is to estimate the cost and return of shrimp production and also to identify the constraints faced by the shrimp farmers.

2. REVIEW OF LITERATURE

Sayad et al. [11] conducted an economic study of shrimp farming in Andhra Pradesh district of Nellore. The result showed that the entire investment cost per hectare was around Rs.1, 44,900. The total cost of production was Rs.1,54,950 per hectare, with total fixed costs of Rs.50,580 per hectare and total variable costs of Rs.1,04,370 per hectare, respectively. The estimated gross returns and net return were Rs.4, 42,680 and Rs.2, 87,730 per ha. Shravan et al., (2018) conducted a study on production and marketing of shrimp in East and West Godavari district of Andhra Pradesh revealed that the average gross return and net return from shrimp cultivation per acre were Rs.8,20,000 and Rs.5,88,320. The study on socio-economic analysis of white-leg shrimp nursery rearing in coastal districts of Tamil Nadu by Durai and Alagappan [1] revealed that the farmers have realized gross returns of Rs.6,50,000 per 100 ton and net returns of Rs.1,15,500 with Benefit Cost Ratio of 1.22.

Black tiger shrimp farmers earned a net profit of Rs.19.63 lakh per hectare per crop and white legged shrimp farmers earned a net profit of Rs.5.57 lakh per hectare per crop. The white legged shrimp was more profitable than the black tiger shrimp. Finally, the study indicated that, while both shrimp farming methods were profitable, white legged shrimp farming was more profitable owing to its two culture crops each year and higher productivity than black tiger shrimp farming [2].

Srinivas and Venkatrayalu [3] found that the major constraints faced by the shrimp farmers in West Godavari district were lack of quality seed and high feed cost. It was suggested that, the Aquatic Quarantine Facilities (AQF) and brood stock multiplication center in Godavari district should be increased and also government should take strict measures to close unregistered hatcheries. In a study by Shravan et al., (2018) at East and West Godavari district of Andhra Pradesh also revealed that the major constraints faced by the shrimp farmers were disease problem and lack of availability of quality seed.

3. METHODOLOGY

Nagapattinam district of Tamil Nadu was purposively selected for the study as this district

was the leading shrimp producer in the state. From Nagapattinam district 3 blocks viz., Vedarnayam, Nagapattinam and Kizhvelur were selected for the study. Simple random sampling technique was used to collect data from sample farmers. A total of 60 shrimp farmers at the rate of 20 farmers from each blocks of Nagapattinam district were randomly selected. The primary data was collected with the help of a well-structured and pre-tested interview schedule. Cost of cultivation to estimate the cost and return of shrimp and Garrett ranking to analyze the constraints faced by the farmers in shrimp production were the tools used for the interpretation of data.

4. RESULTS AND DISCUSSIONS

4.1 Socio-economic Characteristics of Shrimp Farmers

The socio-economic characteristics of sample farmers in Nagapattinam district of Tamil Nadu is presented in Table 1. Majority of shrimp farmers belonged to middle age group. The educational status of the shrimp farmers revealed that the majority of shrimp farmers were educated upto secondary education level (35 per cent), followed by primary education level (21.67 per cent). Majority of farmer's occupation was only shrimp farming (51.67 per cent), followed by shrimp farming and agriculture (33.33 per cent). With respect to family size, majority of shrimp farmers had more than 6 family members (48.33 per cent), followed by 4 to 6 family members (35 per cent).

4.2 Shrimp Farm Details

Shrimp farm details of the sample farmers of Nagapattinam district of Tamil Nadu is presented in the Table 2. Majority of shrimp farmers had less than 2 ha of farm pond (60.00 per cent), followed by 2 to 4 ha of farm pond (23.33 per cent) and more than 4 ha of farm pond (16.67 per cent). Ownership of the shrimp farmers revealed that the majority of farmers had owned ponds (55.00 per cent), followed by leased ponds (25.00 per cent) and both owned and leased ponds (20.00 per cent). With respect to experience of shrimp farming activity, majority of the farmers had farming experience between 20 to 30 years (38.33 per cent), followed by experience above 30 years (28.33 per cent), experienced between 11 to 20 years (20.00 percent) and experienced between 0 to 10 years (13.34 per cent).

Table 1. Socio-economic characteristics of shrimp farmers

S. No	Category	Frequency (N=60)	Percentage
I	**Age**		
1	Upto 30	8	13.33
2	31 to 40	14	23.33
3	41 to 50	26	43.34
4	> 50	12	20.00
II	**Educational status**		
1	Illiterate	7	11.66
2	Primary education	13	21.67
3	Secondary education	21	35.00
4	Higher secondary	10	16.67
5	Graduate	9	15.00
III	**Occupation status**		
1	Shrimp farming	31	51.67
2	Shrimp + Agriculture	20	33.33
3	Shrimp +others	9	15.00
IV	**Size of family**		
1	Less than 4	10	16.67
2	4 – 6	21	35.00
3	Above 6	29	48.33

Table 2. Shrimp farm details

S. No	Category	Frequency (N=60)	Percentage
I	**Size of farm pond**		
	Upto 2 ha	36	60.00
	2-4 ha	14	23.33
	Above 4 ha	10	16.67
II	**Ownership**		
	Owned	33	55.00
	Leased	15	25.00
	Owned + leased	12	20.00
III	**Farming experience**		
	0 to10 years	8	13.34
	11 to20 years	12	20.00
	20 to 30 years	23	38.33
	Above 30 years	17	28.33

Table 3. Cost and Returns of shrimp farms (in Rs/hectare)

S. No	Particulars	Amount (in rupees)	Percentage to total
A. Fixed cost			
1	Depreciation	37029.39	2.35
2	Salaries to permanent labour	58750.00	3.73
3	Interest on fixed cost	86010.43	5.44
4	Lease rent	91375.00	5.79
5	Others	17935.83	1.14
	Total fixed cost	**291100.65**	**18.45**
B. Variable cost			
5	Pond preparation	34130.00	2.15
6	Cost of seed	113350.00	7.19
7	Cost of feed	581033.30	36.85
8	Fertilizers	26585.00	1.69
9	Medicines/Probiotics	127735.00	8.10
10	Water quality monitoring	1845.00	0.12
11	Electricity/Fuel charges	166500.00	10.56
12	Harvesting charges	33267.50	2.11
13	Labour charges	45104.17	2.86
14	Miscellaneous expenses	18540.00	1.18
15	Interest on working capital	137770.80	8.74
	Total variable cost	**1285860.77**	**81.55**
	Total cost/crop/season	**1576961.42**	**100**
	Cost of cultivation for 2 crops/annum	**3153922.84**	
Returns			
16	Yield of shrimp/season(in Kg)	6800	
17	Total value of shrimp @ average price of Rs.360/Kg	2448000	
18	Income for two crops per annum	4896000	
19	Production cost per kg of shrimp	**232**	
20	**Net income**	**871038.58**	
21	**BC ratio**	**1.55**	

Table 4. Constraints faced by the shrimp farmers

S. No	Constraints	Garrette's score	Rank
1	Disease problem	73	I
2	High feed cost	71	II
3	High cost of electricity	54	III
4	Lack of availability of quality seed	52	IV
5	Feed quality and availability	43	V
6	Lack of government support	30	VI
7	Lack of credit and insurance	27	VII

4.3 Cost and Return of Shrimp Farms

The cost and return of shrimp farm per hectare were analyzed and presented in the Table 3. The total cost of shrimp farming was estimated to be over Rs.15.76 lakh per hectare per crop out of which 81.55 per cent was accounted by variable cost and 18.45 per cent was by fixed cost. The cost of feed (36.85 per cent) was the major component of the total cost incurred by the shrimp farming followed by electricity/fuel charges (10.56 per cent). The result clearly indicated that feed cost, electricity charges, interest on working capital, medicines/probiotics and seed cost were the major cost incurred in shrimp farming.

The average yield of shrimp farming was 6500 kg per hectare per crop. The average gross income per hectare per crop was Rs.24,48,000 from shrimp farming considering the average price of Rs.360 per Kg of shrimp. The gross income of the present study were higher than the estimates of Kumar et al., [4] where in the estimated gross income per ha per crop was Rs.15,88,725. The net income per hectare per crop of shrimp farming was Rs.8.71,038.58. Shrimp farming in Nagapattinam district of Tamil Nadu was observed to be economically profitable as the Benefit Cost Ratio (BCR) was more than one (1.55).

4.4 Constraints Faced by Shrimp Farmers

The constraints faced by the sample farmers in shrimp production were ranked using Garrett's ranking technique and furnished in Table 4. It was inferred from the Table 4. that problem of disease attack and high feed cost were the major constraints faced by the shrimp farmers followed by high cost of electricity , lack of availability of quality seed , feed quality and availability, lack of government support and lack of credit and insurance respectively. Government owned hatcheries might tackle the problem of disease outbreaks by producing and supplying high-quality shrimp seeds and also government has to take efforts to produce and supply supplementary feed to shrimp farmers at a subsidized rate.

5. CONCLUSION

Shrimp farming has created huge employment opportunities and gives foreign exchange to developing Nations. Shrimp aquaculture in India has a long history of successes and setbacks, illustrating the industry's potential as well as its obstacle. The total cost of shrimp farming was estimated to be over Rs.15.76 lakh per hectare per crop out of which 81.55 per cent was accounted by variable cost and 18.45 per cent was by fixed cost. The result clearly indicated that feed cost, electricity charges, interest on working capital, medicines/probiotics and seed cost were the major cost incurred in shrimp farming. The average yield of shrimp farming was 6500 kg per hectare. The average gross income per hectare per crop was Rs.2448000 from shrimp farming considering the average price of Rs.360 per Kg of shrimp. The net income per hectare per crop of shrimp farming was Rs.871038.58. Shrimp farming in Nagapattinam district of Tamil Nadu was observed to be economically profitable as the Benefit Cost Ratio (BCR) was more than 1 (1.55). Disease problem and high feed cost were the major constraints faced by farmers in shrimp production. Government owned hatcheries might tackle the problem of disease outbreaks by producing and supplying high- quality shrimp seeds and also government has to take efforts to produce and supply supplementary feed to shrimp farmers at a subsidized rate.

6. LIMITATION

1. The study was based on primary data where the sample farmers provided information based on their memories.

2. The study was limited to Nagapattinam district of Tamil Nadu which will not predict for all over the state.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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