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Study on socio-economic analysis of white-leg shrimp, *Litopenaeus vannamei* nursery rearing in coastal districts of Tamil Nadu

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Abstract
Shrimp is one of the most traded seafood commodities, and aquaculture of shrimp is considered to be one of the success stories of modern aquaculture. The paper analyses the socio-economics of selected shrimp nursery farms in the coastal districts of Tamilnadu. The data were collected from the owners of the shrimp nursery farms for the period of 2019 and analysed with appropriate tools. The study revealed that 42.86 % shrimp nursery farmers belonged to old age group, 54.29 % were educated up to higher secondary level and 42.86 % had farming experience between 5-10 years. The economic analysis indicated that farmers have realized gross returns of Rs. 6,50,000 per 100 ton capacity and net returns of Rs. 1,15,500 with Benefit Cost Ratio of 1.22.

Keywords: Shrimp farming, shrimp nursery, socio-economics, coastal districts

Introduction
Aquaculture is the worlds' fastest growing food-producing sector, for the last three decade [1]. Worldwide, the aquaculture sector has grown at an average rate of 5.3 percent per year during 2001-2018, aquaculture production reaching up to 82.1 million tonnes in 2018 from a production of less than 1.0 million tonnes in the early 1950s [2]. India is the second largest aquaculture producer behind China [3].Development of shrimp farming from a traditional activity to a highly commercial farming enterprise in a span of about three decades is the main reason for this achievement. This was mainly possible due to the technological advancements in shrimp seed production and culture technologies. Indian brackish water aquaculture sector is synonymous with shrimp farming. Due to continued outbreak of WSSV in of *Penaeus monodon* culture leading to shattering of shrimp culture in India, Coastal Aquaculture Authority of India (CAA) introduced a new species, *Litopenaeus vannamei*, white-leg shrimp in India. The culturing system of shrimp comprises of hatchery, nursery and grow out system. Each stage plays an important role for the success in production. Nursery phase is defined as an intermediate step between hatchery-reared early post larvae and grow-out phase. The main aim of the nursery phase is to produce large size juveniles, which will probably have a better chance of survival and may achieve commercial size in a shorter time [4]. In order to achieve higher survival and reduce the grow-out period an intermediate nursery phase is essential. There are many benefits of the use of a nursery during the grow-out phase, including increased survival, improved feeding efficiencies, enhanced growth performance, more accurate stocking inventory, uniformity of shrimp size and reduction of cannibalism [4, 5, 6, 7]. This phase is usually characterized by high water renewal rates, high stocking densities, and the use of high quality artificial diets [8]. The integration of an intermediate nursery phase has also been found to improve efficiency of intensive limited discharge shrimp production systems [6, 9]. In past number of studies have been carried out to understand the socio-economic status of shrimp farming [10, 11, 12, 13]. However, studies pertaining to socio-economic status of shrimp nursery rearing is limited. Hence, the present study was undertaken to study the socio-economic status of shrimp nursery rearing in coastal districts of Tamil Nadu.

Materials and Methods
The study was carried out during March to August 2019 in the coastal districts of Tamilnadu predominantly undertaking shrimp farming *viz*., Thiruvallur, Kancheepuram, Villupuram, Cuddalore and Nagapattinam.These five districts play a very important role in brackish water farming in Tamilnadu, as they are situated in the coast of Bay of Bengal and have plenty of brackish water resources.

An expost-facto research design was employed in the present study. A total of 35 aqua farmers practicing shrimp nursery rearing were selected randomly. A well-structured and pre-tested interview schedule was used for data collection.

Results and Discussions

Socio-personal profile of farmers

The socio-economic profile of shrimp farmers in Tamil Nadu is presented in Table 1. Majority of the shrimp nursery grower respondents belonged to old age group (42.86 %), followed by middle (34.29 %) and young (22.86 %) age groups. Educational status of the shrimp nursery grower respondents revealed that all the farmers (100 %) were literate with more than half of the respondents (54.29 %) were educated up to higher secondary level followed by graduation and above level (28.57 %), middle school level (11.43 %), and primary school level (5.71%). Nearly three-fourth (74.29 %) of the shrimp nursery growers in the present study were engaged in aquaculture alone for their livelihood and rest (25.71 %) had other occupations as well in addition to aquaculture. It is very evident that shrimp aquaculture being a relatively risky farming activity, it requires the farmer's full time involvement and attention [13, 14, 15, 16].With respect to the experience of farmer in shrimp farming activity, majority of the respondents (42.86 %) had farming experience between 5-10 years and 34.29 % farmer respondents had more than 10 years of experience, while 22.86 % farmers were found to be with experience up to 5 years. It could be observed that farmers had considerable level of shrimp farming experience.

Table 1: Socio-personal profile of shrimp farmers

S. No.	Category	Frequency (N = 35)	Percentage
I	**Age**		
1	Young (up to 34 years)	8	22.86
2	Middle (35 to 44 years)	12	34.29
3	Old (45 years and above)	15	42.86
II	**Educational status**		
1	Illiterate	0	0.00
2	Primary education	2	5.71
3	Middle education	4	11.43
4	Higher secondary education	19	54.29
5	Collegiate and above	10	28.57
III	**Occupational status**		
1	Aquaculture as primary occupational activity	26	74.29
2	Aquaculture as secondary occupational activity	9	25.71
IV	**Farming experience**		
1	Up to 5 years	8	22.86
2	5 - 10 years	15	42.86
4	More than 10 years	12	34.29

Shrimp Nursery details

The distribution of farmers according to type of shrimp nursery rearing unit indicated that about 40.00 % of the respondents adopted concrete tanks (Table 2). About one-fourth of the respondents (25.71 %) adopted earthern ponds, followed by canvass plastic (22.86 %) and High density polyethylene (HDPE) tanks (11.43 %) for shrimp nursery rearing. With respect to size of shrimp nursery rearing units, results revealed that about three-fourth of the respondents were holding nursery rearing tanks upto 100 tons capacity with Concrete Square Tanks (22.86%), Canvass Plastic Tanks (22.86%), Concrete Circular Tanks (17.14%) and HDPE Tanks (11.43%). Earthern ponds with HDPE lining upto 1000 m^2 was held by 14.29 % respondents followed by Earthern ponds with Plastic sheet lining upto 600 m^2 by 11.43 % respondents.

Table 2: Details of shrimp nursery rearing units

S. No.	Category	Frequency (N = 35)	Percentage
I	**Type of nursery rearing unit**		
1	Earthern ponds	9	25.71
2	Concrete tanks	14	40.00
3	HDPE tanks	4	11.43
4	Canvass Plastic	8	22.86
II	**Size of nursery rearing unit**		
1	Earthern ponds with HDPE lining (upto1000 m^2)	5	14.29
2	Earthern ponds with Plastic sheet lining (upto 600 m^2)	4	11.43
3	Concrete Circular Tanks (upto100 tons)	6	17.14
4	Concrete Square Tanks (upto 100 tons)	8	22.86
5	HDPE Tanks (upto100 tons)	4	11.43
6	Canvass Plastic Tanks (upto100 tons)	8	22.86

Technical details and characteristics of shrimp nursery

Majority of the farmers (74.28 %) practicing shrimp nursery depend on creeks as water source for their farming activity. Water for shrimp nursery was treated by application of application of potassium permanganate (KMnO4), PAC (Poly Aluminium Chloride) and Bleaching powder @ 5 ppm and 10 ppm dosages. Nursery rearing of shrimp was carried out for an average culture period of 30 days for rearing the shrimp post larvae of 0.75 gm to attain 1.0 gm. Farmers stocked shrimp postlarvae of PL10 at average stocking density of 4-6 nos./lt and recorded survival rate of 82% on an average. All the farmers (100 %) used commercial shrimp nursery feed (Nursery type feed - N1, N2, N3) and also practiced administration of probiotics (100%). Water quality parameters

such as dissolved oxygen, Ph, ammonia and alkalinity level were checked periodically and water exchange in nursery unit was started from 5th day of culture onwards. In shrimp nursery units, farmers used root blowers with connected air grids for effective circulation. Shrimp at an average body weight (ABW) of 1.25 gram were shifted/ marketed for rearing to grow out ponds.

Component wise cost of shrimp nursery

The total cost of shrimp nursery in the sample farms was estimated to be Rs.6.855 lakh per 100 ton capacity, out of which 84.61 percent was accounted by variable cost and balance 15.39 percent was by fixed cost (Table 3). Component wise analysis of cost indicated that, cost of seed was the major component accounting more than one third of the total cost (37.42 %) which was closely followed by feed accounting for nearly one fourth of the total cost (23.39 %). Electricity charges (10.98 %) and fuel charges (6.55 %) were the next major cost component followed by cost towards minerals (5.61 %) and others. The results clearly indicate that seed, feed, electricity, fuel and minerals were the major costs accounting more than three fourth of the total cost in shrimp nursery rearing.

Table 3: Component wise cost of shrimp nursery rearing (per 100 Ton capacity)

S. No.	Particulars	Amount (in Rs.)	Share (%)
I	**Variable Cost**		
1	Seed Cost (Rs/ Kg)	200000	37.42
2	Feed Cost (Rs/ Kg)	125000	23.39
3	Mineral Cost (Rs/Kg)	30000	5.61
4	Probiotic Cost (Rs/Kg)	15000	2.81
5	Chemical Cost (Rs/Kg)	8000	1.50
6	Electrical Cost (Rs/Kg)	48000	8.98
7	Fuel Cost (Rs/Kg)	35000	6.55
8	Labour Cost (Rs/Kg)	10000	1.87
9	Miscellaneous	10000	1.87
	Total Variable cost	481000	89.99
II	**Fixed cost**		
1	Lease rent	30000	5.61
2	Depreciation	13500	2.53
3	Annual Repair and Maintenance	10000	1.87
	Total Fixed cost	53,500	10.01
	Total cost	534,500	100.00

Economics of shrimp farming

The economics of the shrimp farming per hectare in Tamil Nadu is illustrated in Table 4. The analysis revealed that average yield was 625 kg per 100 ton capacity with average of 5,00,000 post larvae (PL). The average expenditure i.e., total cost was Rs. 5,34,500 per 100 tons. The average cost of production worked out to be Rs. 1.07 / PL seed. The average gross income earned by the respondents was Rs. 6,50,000/ ha at average shrimp PL selling price of Rs.1.30 / PL seed. Benefit Cost Ratio (BCR) for the respondents was estimated to be more than unity (1.22) proving to be economically viable.

Table 4: Economics of shrimp nursery rearing (per 100 Tons)

S. No.	Particulars	Cost/ Return (Rs./ 100 tons)
1	Total cost	5,34,500
2	Yield (Kg/100 tons)	625
3	Average seed (in nos.)	5,00,000
4	Cost of Production (Rs./ PL seed)	1.07
5	Average Price (Rs./ PL seed)	1.3
6	Gross income (Rs.)	6,50,000
7	Net income (Rs.)	1,15,500
8	BCR	1.22

Conclusion and Recommendation

The present study conducted in the coastal districts of Tamil Nadu, aimed to analyse the socio economic structure of shrimp nursery systems. The component wise cost of shrimp nursery rearing was worked out. The economic analysis has showed that per PL seed cost worked out to Rs. 1.07. The shrimp nursery rearing was economically viable as evident from the economic measures of cash flow. Thus shrimp nursery rearing was found to be profitable venture drawing the attention of prospective entrepreneurial farmers to go for this and make fortunes.

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