Case study

Economic assessment of *Litopenaeus vannamei* (Boone, 1931) culture with different stocking density in earthern pond during monsoon season along Saurashtra region of Gujarat coast.

ABSTRACT

Optimum use of coastal potential waste land into shrimp farming practice has given prosperity to coastal community of Rajula taluka of Amreli district. Shrimp farming in India has recorded remarkable growth in last three decades especially in coastal states. Economic assessment to shrimp farming experiment was conducted in commercial pond at Kavya Aqua Farm (Rajula) Amreli district of Saurashtra region, it's a peninsular and southernmost part of Gujarat covering 793 hector area under shrimp farming with higher input costs in *Litopenaeus vannamei* farming business. The production potential and performance of the species was evaluated in low (30pc/m^2) to high (80pc/m^2) stocking density for 120 Days of culture in earthen pond conditions. This case study revealed that aquaculture is risky business but farmers still ponder it as a profitable venture with high status. A primary survey using structured interview was conducted with 25 shrimp producer in order to observe the following attributes: social profile, fixed cost, variable cost, yield of production, gross income and net income. At higher stocking rates (80pc/m^2) has yielded better production with high count and FCR (feed conversion ratio). The present result indicates better economic return was recorded in low stocking density (30pc/m^2) with low count (no of pcs/kg) at harvest. An attempt has been made to assess an economic viability of *L.vannamei* farming and extent of contribution towards the uplift of their socio-economic status. This study will be of immense support to encourage the farmers of other in and around areas to invest in shrimp farming business to earn better livelihood. Present shrimp farming experiment with different stocking density along with survey study revealed that for small and marginal farmers, *L. vannamei* farming can be made profitable by adopting lower affordable stocking rates and shrimp farming significant contribution in employment generation and infrastructure development of the coastal community and overall development of the coastal areas.

Keywords: Economic, Shrimp, Yield, Production, Variable.

1. INTRODUCTION

Aquaculture solely covers cultivation of aquatic plants (seaweed) and culture, rearing and fattening of aquatic animals, especially fish, shellfish in natural confined marine or freshwater environmental condition for food production [1]. Aquaculture sector plays a vital role in the socio-economic condition of the coastal population of India by way of contributing to foreign exchange earnings and livelihood options. Modern

inland shrimp aquaculture has increased significantly during the last two decades and with a at faster pace after initiation of aquaculture projects in several developing countries under the FAO, UNDP and World Bank assistance [2]. In India, total 11.91 lakh ha. is considered to be the most potential and suitable area for shrimp farming, which has spreaded over 10 coastal state and a union territory viz. West Bengal, Orissa, Andhra Pradesh, Tamil Nadu, Pondicherry, Kerala, Karnataka, Maharashtra, Gujarat and Goa. Out of total, around 1.36 lakh ha area is currently under shrimp farming, which signifies that lot of scope exists for entrepreneurs to venture into this field of aquaculture sector. Gujarat state is bestowed with 1600 km coastline with vast stretches of water spread area of 3.76 lakh ha all along the coastline for aquaculture activity. In Gujarat shrimp farming, initiated with traditionally culture activity during 1980s, which rises at a phenomenal rate during 2014-2015. In Gujarat, the total Inland and marine fish production during 2018-19 was 1.42 and 6.99 lakh tonnes which rose to 1.58 and 7.01 lakh tonnes in 2019-20 respectively [3]. Gujarat is considered as a sunrise sector for supporting economic development. In the recent years, the local people living along coastal area have attracted considerably towards shrimp farming sector, as its food supply and became a major contributor towards foreign exchange earner. Because of this fact other countries have also given shrimp farming a industrial sector, a high priority in their fisheries programs. Increasing demand of shrimp and its value added products in international markets and it's over exploitation from coastal waters had out come with a wide gap between the supply and demand chains. This scenario has enhanced the possibility to explore other avenues for increasing shrimp production. Gujarat is the important maritime state and located in the northern part and on the west coast of India positioning between 20.6 and 24.42 degrees latitude and 68.10 and 74.28 degrees east longitude. Gujarat accounts for about one fifth of the length of coastline of our country and contributes approx. 1.80% of national shrimp production and stands second in brackish water area after West Bengal. The maximum potential area for shrimp farming is West Bengal followed by Gujarat state with 4.05 and 3.7 lakh ha. respectively Gujarat has one of the richest fishing grounds in India with most important commercial varieties of fish are captured and possesses a vast resource with favourable climates and environment condition for flourishing fish production through aquaculture. In developing countries, fishery exports are higher than those of other agricultural commodities [4]. For bulk export, there was an urgent need to tackle incidence of disease outbreak and good quality of SPF seed for shrimp farmers. Adoption of such measures can not only boost the shrimp industry but also enrich the livelihood of shrimp farmers and becomes the major contributor towards the commercial shrimp culture.
Saurashtra region has 11 coastal districts and a union territory of Diu but only five districts viz; Jamnagar, Porbandar, Gir Somnath, Amreli and Bhavnagar are the major contributors for state shrimp production. These districts contribute are having 73% of state fisher's population with potential area of 12,931 ha for shrimp production. With this background, an attempt has been made to assess an economic viability of *L.vannamei* culture done between the study periods 2018 to 2020 and determine the profitability ratio of shrimp farming.

2. MATERIAL AND METHODS

Shrimp culture experiment was taken up commercial shrimp farm, Datardi village, Taluka: Rajula, Dist: Amreli, Gujarat, India. (Latitude 20º 57'35.38" N and 71º 32'35.60" E and Longitude 20º 57'35.93" N and 71º 32'32.03" E) (Plate 1), additionally the survey information was collected from the actual shrimp farmer group, whoever were dealing with shrimp culture activity at five districts of Saurashtra region, the maximum numbers of shrimp farms are available at Amreli followed by Jamnagar, Bhavnagar, Gir Somnath, and Porbandar. Shrimp farms were divided into two division; Amreli and Bhavnagar, where Amreli districts comprises villages like Aktariya, Chanchh, Khera, Datardi, Bherai, Victor, Jafrabad, Sarkeshware and Siyalbet whereas in Bhavnagar districts villages like Jaswantpura, Kotda, Ganeshgadh, Sondari, Ghogha, Talaja and Mahuva. The shrimp farmers whoever have more than three years farming experience along with 2 to 5 ponds were randomly selected for pre tested questionnaire. Case study of pond performance was carried out on 15 shrimp farmers from different parts of Amreli. Economic assessment for shrimp farming was collected from single ponds that was carried out during the year. Shrimp ponds were filled with seawater by inlet pipes, all the culture ponds were (1.7-1.8 m deep). The soil type was sandy clay. The minimum water level in each pond was 1.5 m were around 3 to 5% of seawater was refilled against seepage and evaporation, the pond shape is rectangular.

The size of the shrimp culture pond was 0.50 ha, pond were constructed adjunction to creek, the availability of seawater was taken up through gravitational flow during high tide and wise versa. Two 10 HP Kirloskar motor pump, seawater was lifted from reservoir to feeder channel. Each pond is set with two inlet pipes (6" dia). Ponds were filled with seawater by inlet pipes, all the culture ponds were (1.7-1.8 m deep). The soil type was sandy clay. The minimum water level in each pond was 1.5 m were around 3 to 5% of seawater was refilled against seepage and evaporation, the pond shape is rectangular.

In all six ponds, *L. vannamei* post larvae were stocked @1.5, 2.0, 2.5, 3.0, 3.5 and 4.0 lakhs/ponds in T1, T2, T3, T4, T5, and T6 pond respectively. Blanca feed pellets (CP Aquaculture India Pvt Ltd) were fed to the stocked post larvae from 1st day onward with twice a day (for ten days), thrice a day (for fifteen days) and for four times daily at 7am,10am, 3pm and 9pm respectively till the end of crop.

The shrimp, *L.vannamei* post larvae (PL 09) were procured from commercial shrimp hatchery Blue Sea alliance Hatchery (Simar village). Post larvae were packed in oxygenated polythene bags and brought to Kavya Aqua Farm at Datardi. *L. vannamei* seeds were PCR tested. The PL were acclimatized in the farm with adequate aeration. The initial average weight (g) of Post larvae (n=22) was 0.06±0.01.

Detail economics and shrimp culture practices including pond preparation, stocking, feeding management, production and marketing and biosecurity concept on farm site were conducted on selected farms once in a month throughout the culture period. Measurements like pond area, stocking density, days of culture (DOC), harvested biomass, feed conversion ratio (FCR), average body weight, total feed consumption, seed survival rate, count, etc., were recorded from selected shrimp farms. For socio-economic component, educational status, age, occupation, farm size, farming experience, was recorded by interview method with the help of pre-tested questionnaire. During interview, impacts of shrimp farming on local area were interview with fisherman nearby coastal villages. To assess the socio-economic status of *L.vannamei* shrimp farmers, primary data was collected through interviewing with 25 shrimp farmers by using pretested structural questionnaire. Secondary data was also collected from DoF, MPEDA, CAA website etc. To estimate the capital investment as per [5], Total fixed cost as per [6], Total variable cost [7,8], Total costs include the total costs of all the resources used in the farming enterprise during a particular time period including stock adjustments and non-cash items. Total costs consist of fixed and variable costs [9] Anon., (2015), Depreciation [10], various cost and income [11] and to obtain profitability measures [12, 13] such as gross profit, net profit, pure profit, return to capital, output input ratio, rate of return and benefit cost ratio [14] for taking out shrimp farm business analysis.

Data analysis

General demographic characteristics of the respondents such as age, education, experience, family size, family type, source of income was analyzed by Descriptive Statistics whereas Tabular Analysis was followed to analyze the socio-personal characteristics, details of the cost components and the returns from shrimp farming. Economic analysis was also carried out to assess the profitability.

3. RESULTS AND DISCUSSION

The results of the analyses of the data gathered from the *L.vannamei* shrimp farmers in Amreli and Bhavnagar district and the inferences drawn are presented and discussed in this findings is as follows:

1. Present status and details of shrimp culture activities in the study area

2. Demographic characteristics of the shrimp farmers

3 Costs and returns of the shrimp farming practices.

3.1 Present status and details of shrimp culture activities in the study area:

For the details of the general shrimp farming performance, measurements like average culture period, average stocking seed size, shrimp seed resources, average survival rate, depth of pond, water source, feed brand and marketing channels were recorded from the shrimp farms. The shrimp farmers were

culturing two crops per year. Most of the shrimp farmers use to purchased *L. vannamei* seeds in the size of Post Larvae-10 at the average rate of Rs 0.72 paise per piece from commercial hatchery situated at Kotda village of Gujarat state. Majority of the shrimp farmers stocked at a density of 30-80 numbers/m2 in their ponds and followed the splashing method for shrimp seeds stocking. The Average culture period was 120 -150 days. The average survival rate of the stocked seeds was 80-85%. Majority of the shrimp farmers used to keep their pond depth at 1.5-1.75 meter. Creek was the main water source for all the shrimp farms.

The major shrimp feed utilized for shrimp farming are Avanti feed and Godrej Agrovet feeds, The cost of the feed varied within the price range of Rs 84 to 91/kg. Frequency of feeding varied from 2 to 4 times during the culture period (two times per day during 1st month followed by four times feeding. The average feed conversion ratio (FCR) for shrimp culturist should be between 1.2-1.5 along with all commercial application of products like vitamin C, minerals, binder and gut probiotics for better shrimp management practices and higher economic return. Majority of the shrimp farmers procured shrimp feeds and other culture inputs from the dealers on credit basis and store their input items in well-established store rooms. For the management of the pond, feed technician is generally employed by feed dealer, two labours per hectare are employed from the nearby villages and other state were paid Rs 8000/labour/month. Most of the shrimp farmers, regularly monitored soil and water quality conditions of the ponds manually, feed intake and health management of the shrimps by check tray observation. During final achievement of harvestable size (g) additional labours were being employed on daily wages. Shrimp sampling is done after 40 days of culture. The average shrimp harvest yielded 3722 kg to 6077 kg/ha/pond in 120 days. Price of the harvested shrimp varied due to the season, stage and time of harvesting. The process of shrimp transportation from pond to loading container is conducted by three wheeler rikshaw. The farmers directly fixed date and time with seafood processor from Mumbai, Chennai, and Veraval. On confirmation of date and time, the farmer on day before harvest start draining pond water through 6inch pipe installed in sluice gate. Majority of shrimp growers opt to supply to the feed dealers.

3.2 Social profile of shrimp farmers of Saurashtra region (n=25)

As per collected data, most of the shrimp farmers (70.00 %) were aged between 36 and 50 years followed by above 51 years old farmers (20%) and up to 35 years aged farmers accounting for 10% and this farming is taken up by 92% of males farmers followed by female (8%) whereas Kumar et al. (2016) stated that shrimp farming activity is predominately taken up by male farmers were males (86.68%) and females (13.33%) in valsad district of Gujarat. [15] Cyril et al. stated that 31-50 age group farmers were predominantly engaged in shrimp farming whereas 16% farmers was aged above 51 years

As per the survey record, family type status of shrimp farmers revealed that 84% (21 family) showed nuclear living habit followed by 16% joint family type, This finding was in contradiction to the findings of [15] Cyril et al. in which the percentage of shrimp farmers following nuclear type family was 68% and above 32% of the shrimp farmers followed joint family system. As per the survey record, most of the farmers have farm size below 2 ha were 12% (3 farmers) followed by farm size between 2-5 ha (84%) and above 5.0 ha farm size (04%) this report was similar to [17] Viswanatha et al. stated that the fish farmers having up to 2 ha was small farmers. Additionally, in the survey, shrimp farmers having above 5 year's experience 64% (16 farmers) whereas less than 4 years were 36% (9 farmers). As per occupation status, 44% (11 farmers) solely depends upon aquaculture business alone whereas 36% (09 farmers) has secondary business like fishing activity and 20% (05) had subsidiary business like stationary, general stores, shop keeping etc as a main source of income The literacy status (Table 1) of the shrimp farmers n=25 from illiterate, primary school level (standard 4-9), intermediately (standard 10+2), graduate and to PG (Post Graduate) shows that 12%, 8%, 20%, 48% and 12% respectively. [16] Jitendrakumar et al. observed that illiterate (3.70%) followed by primary school level (42.59%), up to SSLC (34.25%), graduate and above (19.44%) as educational status of shrimp farmers of valsad district in Gujarat. This socio-economic survey depict that majority of the shrimp farmers of the district are literate and significant contribution of shrimp farming in employment generation to the coastal villages men and women and in overall development of the coastal areas. All the respondents (96%) are living in their own houses whereas 4% was living in rented house [18] Vichare reported that majority of the fish workers (100%) were living in their owned houses. The total numbers of family members between 3-4 accounting for 32%

followed by family members 5-6 (44%) and above 7 members (24%) among the selected shrimp farmers. [6] Kumar et al. stated that the family size up to 4 members (30%) was less comparatively with family size with more than 5 members (70%) in Gujarat. Most of the selected shrimp farmers belonged to Hindu religion 84% followed by Muslim (16%) respectively [19] Jagadeesh stated that 80% of shrimp farmers belonged to Hindu religion in Prakasam district, Andhra Pradesh.

Table 1. Profile of Shrimp Farmer of Amreli and Bhavnagar District

Profile	**Group**	**Frequency**	**(%)**
Sex			
	Male	23	92
	Female	2	8
Age			
	< 30	1	4
	31-40	9	36
	41-50	11	44
	>51	4	16
Education			
	Illiterate	3	12
	Primary	2	8
	10-12	5	20
	Graduate	12	48
	PG	3	12
Farm size			
	Upto >2 ha.	3	12
	2-5 ha.	21	84
	Above 5 ha.	1	04
Occupation			
	Aquaculture+ Fisherman	09	36

	Aquaculture alone	11	44
	Aquaculture+ others	05	20
Religion			
	Hindu	21	84
	Muslim	4	16
Category			
	General	7	28
	Other Backward Classes (OBC)	15	60
	Schedule Caste (SC)	3	12
	Schedule Tribe (ST)	0	0
Residential status			
	Owned	24	96
	Rented	1	4
Family type			
	Nuclear	21	84
	Joint	4	16
Family size			
	3-4	8	32
	5-6	11	44
	Above 7	6	24
Farming experience			
	Upto 4 year	9	36
	Above 5	16	64

3.3 Costs and returns of the cultured shrimp farming practices.

The economic analysis of the shrimp farming practices was classified based on the stocking density carried out for one crop with a culture period of 4 months. The selected shrimp farms were stocked with 30, 40, 50, 60, 70 and 80 pcs/m^2.

3.3.1 Costs and returns of the cultured shrimp farm under experiment

In the case of small farmers stocking density of shrimp will be between 10-30 pc/m^2), the capital investment items such as aerators, pumps and motors and generators were worked out to 45.11% and the other items such as pond construction, reservoir and pipe lines, Farm electrification works, store rooms and other sheds and farm accessories were estimated to 43.31% respectively (Table 2) whereas other testing and communication instrument, net and craft, bio security and farm vehicles 11.58% These mean values were almost the half to the values of [5] Sahu et al. worked out the mean capital cost for shrimp farming per 0.5 ha with Rs. 3,71,000. The shrimp farmers, adopting the stocking density between 40 to 60 nos/m^2 is term as medium farmers, the capital investment items such as aerators, pumps and motors and generators were worked out to 45.32% and the other items such as pond construction, reservoir and pipe lines, Farm electrification works, store rooms and other sheds and farm accessories were estimated to 42.67% respectively whereas other testing and communication instrument, net and craft, bio security and farm vehicles 12.01% and in the case of big farmers adopting stocking density above 70 no/m^2, the average capital investment for aerators, pump etc was estimated to 46.27% and the other items such as pond construction and its related was estimated 39.94% whereas other testing and communication instrument, net and craft, bio security and farm vehicles 13.79%, In the present study, the mean capital cost for small, medium and big shrimp farmers per ha was worked out to Rs 6,26,386, Rs 6,79,547 and Rs 7,54,811 respectively (Table 2). These values are higher than the values (Rs 1,11,781.38) of [20] Brijesh et al. who estimated 4,62,165.93/ha/crop to Valsad district farmers, may be due to adoption of semi intensive to intensive culture technology who could earn 1.74 times more profit than reported by [21].

Table 2 Total Capital, Operational and Variable cost indicator for *L. vannamei* shrimp farming during monsoon crop in earthen grow out pond (Mean±SD)

CAPITAL INVESTMENT (A)	T1 (30 pc/m^2)	T2 (40 pc/m^2)	T3 (50 pc/m^2)	T4 (60 pc /m^2)	T5 (70 pc/m^2)	T6 (80 pc/m^2)
Pond construction	59402.6 ± 3478.2 (9.48%)	59402.67 ± 3478.26 (9.08%)	59402.67 ± 3478.26 (8.64%)	59402.67 ± 3478.26 (8.51%)	59402.67 ± 3478.26 (8.10%)	59402.67 ± 3478.26 (7.64%)
		(8.74%)			(7.87%)	
Reservoir	52166.6 ± 3013.8 (8.32%)	52166.67± 3013.86 (7.97%)	52166.67± 3013.86 (7.59%)	52166.67± 3013.86 (7.48%)	52166.67 ± 3013.86 (7.11%)	52166.67 ± 3013.86 (6.71%))
		(7.69%)			(6.91%)	
Inlet / Outlet / Feeder Channel	39188.3 ± 2673.2 (6.25%)	38673.33 ± 2800.38 (5.91%)	40240.00 ± 2710.87 (5.85%)	38496.67 ± 5169.72 (5.52%)	40883.33 ± 4190.02 (5.57%)	60350.00 ± 15203.37 (7.77%)
		(5.76%)			(6.67%)	
Pumps Motors (10 hP)	45306.6 ± 3091.2 (7.23%)	52833.33 ± 10417.45 (8.07%)	50000.00 ± 7175.65 (7.27%)	49766.67 ± 7769.38 (7.13%)	58333.33 ± 12291.60 (7.95%)	59566.67 ± 5122.82 (7.67%)
		(7.49%)			(7.81%)	
Bio Security Measures	4893.3 ± 586.2 (0.78%)	4893.33 ± 586.20 (0.74%)	4893.33 ± 586.20(0.71%)	4893.33 ± 586.20 (0.70%)	4893.33 ± 586.2 (0.66%)	4893.33 ± 586.2 (0.63%)
		(0.72%)			(0.64%)	
Generator	60833.3± 9291.5	63766.6± 18747.3	86583.33 ± 11478.4	100300.0 ± 17657.01	115333.3± 23750.4	124000.0 ± 24682.9

	(9.71%)	(9.74%)	(12.59%)	(14.38%)	(15.73%)	(15.96%)
		(12.23%)			(15.84%)	
Aerators	176433.3± 8328.4 (28.16%)	173666.67 ± 3617.09 (26.5%)	175833.33 ± 7023.7(25. 58%)	171286.67 ± 1954.1 (24.56%)	168386.67 ± 7441.9 (22.97%)	173000.0 ± 14673.7 (22.27%)
		(25.54%)			(22.62%)	
Electrification Works	46266.6 ± 5887.5 (7.38%)	65500.00 ± 8389.8 (10.01%)	67200.00 ± 7040.6 (9.77%)	62300.00 ± 6302.3(8.9 3%)	60683.33 ± 6171.7 (8.27%)	69433.33 ± 15571.23 (8.94%)
		(9.57%)			(8.61%)	
Soil and water Testing Kits	842.3 ± 69.8 (0.13%)	869.3±33.4 (0.13%)	886.6±122. 2 (0.12%)	953.3±100. 2 (0.13%)	971.3±11714 (0.13%)	1022.6±37.1 (0.13%)
		(0.14%)			(0.13%)	
Farm Vehicles	56933.3± 7466.14 (9.08%)	57966.6±361 9.8 (5.80%)	64966.6±70 03.8 (9.45%)	72333.3±25 16.6 (10.37%)	85500.0±926 0.1 (11.66%)	86766.6±911 3.9 (11.17%)
		(8.54%)			(11.42%)	
Nets and Craft	4686.6 ± 918.71 (0.74%)	4966.67±503 .3 (0.75%)	5600.00±60 0.0 (0.81%)	5966.67±45 0.9 (0.85%)	7066.67±378 .5 (0.96%)	6533.33±950 .4 (0.84%)
		(0.80%)			(0.90%)	
Communication instruments	5166.6 ± 763.7 (0.82%)	5166.67±763 .7 (0.78%)	5166.67±76 3.7 (0.75%)	5166.67±76 3.7 (0.74%)	5166.67±763 .7 (0.70%)	5166.67±763 .7 (0.66%)
		(0.75%)			(0.68%)	
Labors/ Store Rooms	43233.33 ± 5040.17 (6.90%)	43233.3 3±5040. 17 (6.60%)	43233.33±5040. 17 (6.29%)	43233.33± 5040.17 (6.20%)	43233.33± 5040.17 (5.89%)	43233.33±50 40.17 (5.56%)
		(6.37%)			(5.72%)	
Farm Accessories	31033.3 ± 3464.5 (4.95%)	31033.33± 3464.58 (4.74%)	31033.33± 3464.58 (4.51%)	31033.33±3 464.58 (4.45%)	31033.33±34 64.58 (4.23%)	31033.33±34 64.58 (3.99%)
		(4.57%)			(4.11%)	
Total	**626386.6 ±19918.7 (100%)**	**654138.6± 26201.6 (100%)**	**687206.0± 22368.6 (100%)**	**697299.3± 29206.4 (100%)**	**733054.0 ± 37431.4 (100%)**	**776568.6± 59312.7 (100%)**
		6,79,547.96 (100%)			**754811.3 (100%)**	

(The first row indicates mean and standard deviation with percentages in bracket whereas the next succeeding line is average of treatment T2,T3,T4 (in %) and T5, T6 (in %) respectively.

3.3.2 Items of fixed cost for the cultured shrimp farming under experiment

Fixed cost of the cultured shrimp pond are depicted in **Table 3**. Among the various fixed cost items mentioned, the lease or rental value for own land for small farmers category was accounted 11.11% followed by 10.42% and 9.65% for medium and big farmers respectively whereas for repair and maintenance for capital goods was accounted for 7.53%, 8.32% and 10.59% groups. The mean total fixed cost per/ha/annum for small, medium and big shrimp farmers was estimated as Rs. 3,23,759.8 and 3,41,831 and 3,72,571.25. These values are higher than the values of [21] Sathiadhas et al. the study taken up by the author were worked out before 10 years compare to the present study dealt with the gross returns for the shrimp species *L.vannami* culture which is characterized for fast growth rate. Among the various fixed cost items, the expenditure towards the repairs and maintenance for capital goods was accounted was lower may be due to good numbers of tractors availability. The expenses towards the own or lease land was costing lower expenses of fixed items in the culture practices.

Table 3 Items of fixed cost for the cultured shrimp farmer under experiment

Fixed Cost (B)	T1 (30 pc/m^2)	T2 (40 pc/m^2)	T3 (50 pc/m^2)	T4 (60 pc/m^2)	T5 (70 pc/m^2)	T6 (80 pc/m^2)
Own Land/ Lease Land	35966.67±6815.6 (11.11%)	35966.67±6815.6 (10.86%)	35966.67±6815.6 (10.42%)	35966.67±6815.6 (10.30%)	35966.67±6815.6 (9.83%)	35966.67±6815.6 (9.48%)
		(10.52%)			(9.65%)	
Interest on Capital Investment	70468.50±2240.86 (21.77%)	73590.60±2947.68 (22.23%)	77310.68±2516.48 (22.39%)	78446.18±3285.73 (22.47%)	82468.58±4211.03 (22.55%)	87363.98±6672.6 (23.03%)
		(22.36%)			(22.79%)	
Depreciation @15% on capital items	93958.00±2987.81 (29.02%)	98120.80±3930.24 (29.64%)	103080.90±3355.30 (29.86%)	104594.90±4380.97 (29.95%)	109958.10±5614.71 (30.06%)	116485.30±8896.9 (30.71%)
		(29.82%)			(30.38%)	
Repairs and Maintenance (per crop)	24366.67 ±6892.27 (7.53%)	24400.00±3195.31 (7.37%)	29883.33±1229.16 (8.66%)	31166.67±6110.10 (8.93%)	38400.00±2007.49 (10.50%)	40533.33±1950.21 (10.68%)
		(8.32%)			(10.59%)	
Consultancy Charges (per crop)	35000.00±0.00 (10.81%)	35000.00±0.00 (10.57%)	35000.00±0.00 (10.02%)	35000.00±0.00 (10.02%)	35000.00±0.00 (9.57%)	35000.00±0.00 (9.23%)
		(10.20%)			(9.40%)	
Farm Labors (2 labors/ pond for 24 hrs/ 4 months)	64000.00±0.00 (19.77%)	64000.00±0.00 (19.33)	64000.00±0.00 (18.33%)	64000.00±0.00 (18.33%)	6400.00±0.00 (17.50%)	64000.00±0.00 (16.87%)
		(18.66%)			(17.19%)	
TOTAL	323759.83±8648.96 (100%)	331078.07±9467.73 (100%)	345241.58 ± 5117.84 (100%)	349174.41±8508.36 (100%)	365793.34±2261.76 (100%)	379349.28±10756.45 (100%)
Total A + B	950146.5±12700.9	985216.73±35166.18	1032447.58 ±23132.92	1046473.74±35069.2	1098847.34±39379.5	1155917.94 ± 68929.5

(The first row indicates mean and standard deviation with percentages in bracket whereas the next succeeding line is average of treatment T2,T3,T4 (in %) and T5, T6 (in %) respectively.

3.3.3 Items of variable cost for the cultured shrimp farming under experiment

The variable cost for culture shrimp is presented in (Table 4) The variable cost incorporated the fertilization cost includes cost of fertilizers like potash, super phosphate, urea and others. The chemicals like calcium carbonate ($CaCO_3$), quick lime (CaO) are use for molt recovery, probiotics like *Lactobacillus lactis, Bacillus substilis, B. coagulans, B. lincheniformis, Saccharomyces cervisiae* and amylase for gut and growth enhancer, minerals like zinc, cobalt, manganese, magnesium, calcium, phosphorus, boran etc for shrimp body enzymatic action and for pond water and plankton bloomer. The Health management aspects cost includes cost of water quality kits, sampling, sanitation, water bleaching and drugs. Other variable cost items are electricity cost, fuel cost, labour cost, harvesting cost and miscellaneous cost. shrimp farmers, the pond preparation cost includes complete removal of organic wastes from the pond bottom, ploughing, levelling, checking of soil pH, liming, bleaching of water and inlet filter net. The cost of

shrimp seeds includes shrimp seed cost, PCR testing of seeds in the labs and transport cost for seeds. The shrimp supplementary feed cost includes cost of the supplementary feed and transport cost for feed. The mean total variable cost for the small shrimp farmers was Rs 8,89,097.4/ha/crop. Feed is the integral part of the culture system and hence 50 to 60% of the operational cost whereas shrimp seeds is another variable that comes next highest to operational cost. The shrimp seed and the supplementary feed cost account for major share in the variable cost items with average 15.68% and 55.88% respectively. The mean total variable cost for the medium shrimp farmers was recorded Rs 12,91,235.08 /ha/crop with major costing in the shrimp seeds and feed contribute 12.41% to 54.01% respectively whereas low variable cost was recorded n water treatment chemicals, transportation on charge and harvesting cost with 0.54%, 0.70% and 1.67% respectively. The mean total variable cost for the large shrimp farmers was recorded with costing Rs 16,04,448.81 as per [6] Kumar et al. stated that the mean total variable cost in the case of *L.vannamei* shrimp farming was worked out to Rs11,68,011/ha with the major share for supplementary feed representing 38.20% respectively. In the present study, the mean total variable cost per ha per crop for small, medium and large shrimp farmers was worked out to Rs 8,89,097.4, Rs 12,91,235.08 and Rs 16,04,448.81 respectively. In all the above stocking density of shrimp culture, in this case supplementary feed cost accounted for the major share in the total variable cost representing above 55.88%, the highest the stocking density, the higher is the total variable cost to be utilized for culture and wise-a-versa for the low stocking density.

Table 4 Items of variable cost for the cultured shrimp farmer under experiment

Variable parameter	T1 (30 pc/m^2)	T2 (40 pc/m^2)	T3 (50 pc/m^2)	T4 (60 pc/m^2)	T5 (70 pc/m^2)	T6 (80 pc/m^2)
Pond Preparation	33300 ± 2913.7 (3.74%)	33300 ± 2913.7 (2.80%)	33300 ± 2913.7 (2.26%)	33300 ± 2913.7 (2.00%)	33300 ± 2913.7 (1.88%)	33300 ± 2913.7 (1.83%)
		(2.35%)			(1.85%)	
Seeds Cost @ Rs 0.72/-	108000.00± 0.00 (12.41%)	144000.00± 0.00 (13.51%)	198000.00±0 .00 (14.99%)	237600.00±0 .00 (15.94%)	302400.00± 0.0 (19.13%)	334080.0± 0.00 (20.51%)
		(14.81%)			(19.82%)	
Feed cost	480264.1 ± 10288 (54.01%)	629439.18 ± 15326.8 (59.17%)	794355.3 ± 33136.2 (60.17%)	869858.8 ± 2922.2 (58.38%)	877704.4 ± 43503.4 (55.55%)	861651.8 ± 22259.3 (52.89%)
		(59.42%)			(54.22%)	
Salt / Minerals & Fertilizer Cost	30272.3±230 0.21 (3.40%)	19366.6± 1761.63 (1.82%)	22066.6±331 2.60 (1.67%)	27833.33±28 29.02 (1.86%)	27633.3±32 12.99 (1.74%)	31743.3±39 62.0 (1.94%)
		(1.78%)			(1.84%)	
Health Management Aspects Cost	32490.0±175 6.73 (3.65%)	29800.0±15 09.97 (2.80%)	34433.3±312 1.43 (2.60%)	45366.67±25 00.67 (3.04%)	40266.6± 6591.16 (2.54%)	49708.0±81 37.20 (3.05%)
		(2.81%)			(2.79%)	
Electricity Charges	91360 ± 5194.6 (10.27%)	100160 ± 4670.4 (9.41%)	107833.3 ± 4163.3 (8.16%)	116733.33 ± 5688.8 (7.83%)	128200 ± 4033.6 (8.11%)	137666.6± 4271.2 (8.45%)
		(8.46%)			(8.28%)	
Fuel Cost	20383.3 ± 2318.5 (2.29%)	21566.6 ± 1855.6 (2.02%)	28766.6 ± 2098.41 (2.17%)	31900 ± 3300 (2.14%)	34533.3 ± 4129.5 (2.18%)	34233.3 ± 2929.7 (2.10%)
		(2.11%)			(2.14%)	
Water Treatment Chemicals	4880.00±278 .75 (0.54%)	5200.00±30 0.00 (0.48%)	6066.67±416 .33 (0.45%)	7400.00±556 .78 (0.49%)	8933.33±55 0.76 (0.56%)	10333.33±1 258.31 (0.63%)
		(0.47%)			(0.59%)	

Transportation charges	6281.67±453.22 (0.70%)	6233.33±305.51 (0.58%)	6700.00±264.58 (0.5%)	7680.00±718.61 (0.51%)	8293.33±310.05 (0.52%)	10266.67±680.69 (0.63%)
		(0.53%)			(0.57%)	
Hire Labor Cost (during harvesting)	25233.33±975.16 (2.83%)	12500.00±0.00 (1.17%)	15000.00±0.00 (1.13%)	17500.00±0.00 (1.17%)	18000.00±0.00 (1.13%)	20000.00±0.00 (1.22%)
		(1.15%)			(1.175%)	
Harvesting Charges	14933.33±416.33 (1.67%)	8000.00±0.00 (0.75%)	8000.00±0.00 (0.60%)	9000.00±0.00 (0.60%)	10000.00±0.00 (0.63%)	10000.00±0.00 (0.61%)
		(0.65%)			(0.62%)	
Miscellaneous Cost	41699.3±3629.32 (4.69%)	57617.67±9697.59 (5.41%)	69023.67±9041.32 (5.2%)	89154.00±3998.41 (5.98%)	94216.67±9245.31 (5.96%)	99333.33±12980.88 (6.09%)
		(5.53%)			(6.02%)	
TOTAL	889097 ± 18320.4 (100%)	1063733.4 ± 19063.1 (100%)	1320095.6 ± 22119.2 (100%)	1489876.21 ± 6734.6 (100%)	1580031.08 ± 58842.02 (100%)	1628866.5 ± 6181.92 (100%)
		12,91,235.08 (100%)			**16,04448.81 (100%)**	

(The first row indicates mean and standard deviation with percentages in bracket whereas the next succeeding line is average of treatment T2,T3,T4 (in %) and T5, T6 (in %) respectively.

3.3.4 Total cost of the cultured shrimp farming under experiment

The cultured shrimp pond farmer respondents is presented in Table 5. In the case of small shrimp farmers, the mean total fixed cost and the mean total variable cost per ha per crop was worked out to Rs3,23,759.8 and Rs8,89,097.4 respectively. The mean total cost of shrimp farming per ha per crop came to Rs 12,12,857.3. For the medium shrimp farmers, the mean total fixed cost and the mean total variable cost per ha per crop was estimated as Rs 3,41,831.3 and Rs 12,91,235.08 respectively. The mean total cost per ha per crop was estimated as Rs16,33,066.47/ha/ crop. Similarly for the large shrimp farmers, the mean total fixed cost and the mean total variable cost per ha per crop was Rs 3,72,571.30 and Rs 16,04,448.81 respectively. The mean total cost came Rs 19,77,020.12/ha/crop. [5] Sahu et al. worked out the mean total cost of shrimp farming with Rs 11,52,840 per 0.5 ha, splitting into Rs1,94,840 and Rs 9,58,000 for the mean total fixed cost and the mean total variable cost, respectively. In the present study the mean total cost per ha per crop was Rs12,12,857.3, Rs16,33,066.47 and Rs 19,77,020.12 for the small, medium and large shrimp farmers respectively. These values are higher than the estimates calculated by [5] Sahu et al. may be due to adoption of old culture technologies.

Table 5 Total cost for the cultured shrimp farmer under experiment

Parameter	**T1 (30 pc/m^2)**	**T2 (40 pc/m^2)**	**T3 (50 pc/m^2)**	**T4 (60 pc/m^2)**	**T5 (70 pc/m^2)**	**T6 (80 pc/m^2)**
Fixed Cost	323759.8 ± 8648.9 (26.92%)	331078.1± 9467.7 (23.91%)	345241.5 ± 5117.8 (20.92%)	349174.4 ± 8508.3 (19.19%)	365793.3 ± 2261.76 (19.05%)	379349.2 ± 10756.4 (19.16%)
		(21.34%)			(19.10%)	
Variable Cost	8,89,097.8 ± 18320.4 (73.07%)	10,63,733.4 ± 19063.1 (76.09%)	13,20,0095.6 ± 22119.2 (79.08%)	14,89,876.2 ± 6734.6 (80.81%)	15,80,031.1 ± 58842.02 (80.95%)	16,28,866.5 ± 6181.92 (80.84%)
		(78.66%)			(80.89%)	
Total cost	1212857.31 ± 15896.	1394811.4 ± 27972.8	1665337.2 ± 26737.89	1839050.6± 14733.4	1945824.4 ± 61101.84	2008215.8 ± 16924.13

(The first row indicates mean and standard deviation with percentages in bracket whereas the next succeeding line is average of treatment T2,T3,T4 (in %) and T5, T6 (in %) respectively.

3.3.5 Mean production and the Mean Gross Returns of the cultured shrimp farming

The mean production and the gross returns of the cultured shrimp farming are furnished in Table 6. The mean shrimp production and the mean price received per kg, for small shrimp farmers was 5091.6kg/ha/crop and Rs 435/kg respectively. Similarly, the mean production and the mean price received per kg for the medium shrimp farmers was 7168.76 kg/ha/crop and Rs 404.44/kg respectively. The mean production and the mean price received per kg for the large shrimp farmers was estimated 7545.92 kg/ha/crop and Rs332.83 respectively. These estimates were higher than the estimates that [22] Jayaraman et al. he who calculated the economics of traditional shrimp farming of Indian state. There may be variation in farm production, it totally depend upon culture practices adopted [15].

Table 6 Mean production and the Mean Gross Returns for the cultured shrimp farmer under experiment

Return	T1 (30 pc/m^2)	T2 (40 pc/m^2)	T3 (50 pc/m^2)	T4 (60 pc/m^2)	T5 (70 pc/m^2)	T6 (80 pc/m^2)
Total yield	5091.68 ± 57.64	6143.64 ± 67.15	7457.60 ± 100.55	7905.05± 283.28	7799.2 ± 277.3	7292.6 ± 165.1
		7168.76			7545.92	
Price	435 ± 0	420 ± 0	405 ± 0	388.33 ± 2.88	365 ± 0	300.6± 2.30
		404.44			332.83	
Gross Returns	2214882.9 ± 25075.1	2580330.11 ± 28203.61	3020330.1 ± 40725.8	3070298.4± 130971.2	2846709.7± 101241.8	2192696.1 ± 54957.3
		28,90,319.56			25,19,702.94	

(The first row indicates mean and standard deviation with percentages in bracket whereas the next succeeding line is average of treatment T2,T3,T4 (in %) and T5, T6 (in %) respectively.

3.3.6 Economic Indicators of the farming practices of the cultured shrimp farming

The economic indicators of the farming practices of the cultured shrimp farming are furnished in Table 7. The total cost, gross returns and the net returns per ha per crop were estimated as Rs 1212857.3, Rs2214882.9 and Rs1336285.4 respectively for the small shrimp farmers. Similarly for the medium shrimp farmers, the corresponding values per crop Rs 16,33,066.4, Rs 28,90,319.5 and Rs15,99,084.4 respectively. On the other hand, the estimated total cost, gross returns and the net returns per crop for the large shrimp farmers were Rs 19,77,020.12, Rs 25,19,702.9 and Rs 9,15,254.13 respectively These estimates values were higher than the estimates of [23] Sathiadhas et al. where in the estimated total cost, and the net returns per ha per annum were Rs 9,64,000 and Rs 4,18,000 respectively which might be due to the adoption of culture practices for shrimp farming.

Table 7 Economic indicators for the cultured shrimp farmer under experiment

Parameter	T1 (30 pc/m^2)	T2 (40 pc/m^2)	T3 (50 pc/m^2)	T4 (60 pc/m^2)	T5 (70 pc/m^2)	T6 (80 pc/m^2)
Total Gross Returns	2214882.9 ± 25075.1	2580330.18 ± 28203.69	3020330.1 ± 40725.8	3070298.4± 130971.2	2846709.7± 101241.8	2192696.1± 54957.3
		2890319.56			2519702.9	
Total Fixed Cost	323759.83 ± 8648.96	331078.066 ± 9467.72	345241.5 ± 5117.813	349174.4± 8508.3	365793.3± 2261.7	379349.2± 10756.4

		341831.3			372571.30	
Total Variable Cost	889097 ± 18320.47	1063733.4± 19063.15	1320095.6 ± 22119.2	1489876.2± 6734.6	1580031.08± 58842.1	1628866.5± 6181.9
		1291235.08			1604448.81	
Total Cost	1212857.30 ± 15896.32	1394811.4 ± 27972.8	16665337.2 ± 26737.8	1839050.6± 14733.4	1945824.4 ± 61101.84	2008215.8± 16924.1
		1633066.43			1977020.12	
Net Returns ON TC (TGR - TC)	1336285.44 ± 10076.76	1516596.7 ± 12415.525	1700234.4 ± 45152.9	1580422.2 ± 130742.9	1266678.71 ± 126957.24	563829.55± 61130.2
		1599084.4			915254.13	
Net Returns ON TVC (TFC + TC)	1660045.28 ± 16141.75	1847674.8 ± 21154.99	2045476 ± 45657.7	1929596.6 ± 126775.70	1632472.05 ± 125483.15	943178.8± 50381.2
		1940915.8			1287825.44	
BCR ON TVC BASIS (TGR / TVC)	2.52 ± 0.02	2.42 ± 0.021	2.28 ± 0.04	2.06 ± 0.08	1.80 ± 0.10	1.34 ± 0.1
		2.25			1.57	
BCR ON TC BASIS (TGR / TC)	1.84± 0	1.86 ± 0.018	1.81 ± 0.03	1.66 ± 0.07	1.46 ± 0.07	1.09 ± 0.1
		1.77			1.27	
Rate of returns on capital investment TVCBASIS (%)	92.48 ± 2.5	108.01 ± 2.63	127.8± 2.09	142.46 ± 4.45	143.8 ± 2.89	141.21 ± 7.8
		126.12			142.5	
Rate of returns on capital investment TC BASIS (%)	140.6± 2.92	154.04 ± 4.23	164.79 ± 8.10	151.39 ± 17.10	115.63 ± 15.37	49.10 ± 8.32
		156.74			82.36	

(The first row indicates mean and standard deviation with percentages in bracket whereas the next succeeding line is average of treatment T2,T3,T4 (in %) and T5, T6 (in %) respectively.

3.3.7 The Average Cost Analysis for the cultured shrimp farming under experiment

In this farm economic section the various inputs cost contribution was calculated to produce one kg of shrimp in Amreli district and the details were furnished in Table 8. The total cost was calculated for small farmers was Rs 237.6/kg of which Rs 173/kg was variable cost and Rs 64.59/kg was total fixed cost for the small shrimp farmers to produce per kg of shrimp. The total production cost was calculated as Rs 227.6/kg of which Rs 179.5/kg was variable cost and Rs48.11/kg was total fixed cost for the medium shrimp farmers to produce per kg of shrimp. The total production cost was calculated as Rs262.4/kg of which Rs 212.97/kg was variable cost and Rs49.46/kg was total fixed cost for the large shrimp farmers to produce per kg of shrimp respectively. The feed cost was the major share in the production cost per kg with above Rs 93.21 to 115.3/ kg in all the categories of shrimp farmers representing above 60.00%. [6] Kumar et al. reported that the feed cost was high in the total variable cost representing 38.20% which coincides with the present study values. [24] Balakrishnan et al. also reported that feed cost was the major share in the production cost representing 50.39% and the net profit with costing Rs 78.56 / kg of shrimp. In the present study the net profit per kg was estimated as Rs 197.31, Rs 176.78 and Rs 70.4 for the small, medium, large shrimp farmers. These values coincide with the estimates of [24] Balakrishnan et al. for the net profit. From this it revealed that low stocking density (no of shrimp/m^2) will have higher survival%, low feed cost, high FCR, low fuel cost, total variable cost, low count (no of shrimp/kg), high price, higher net income and higher Net profit are all the parameters that shows that lower stocking density of shrimp ends with more net income compare with 40,50,60,70 and 80 (no of shrimp/m^2) of stocking density in pond.

Table 8 Average Cost Analysis for the sample shrimp culture under experiment						
Particular	**T1 (30 pc/m^2)**	**T2 (40 pc/m^2)**	**T3 (50 pc/m^2)**	**T4 (60 pc/m^2)**	**T5 (70 pc/m^2)**	**T6 (80 pc/m^2)**
area (ha)	0.5	0.5	0.55	0.55	0.60	0.58
density (no/m^2)	30	40	50	60	70	80
DOC	120	120	120	120	120	120
survival (%)	97.60	98.03	95.10	92.3	89.00	86.1
		95.14			87.55	
pond preparation cost Rs/kg	7.26	4.86	4.00	3.78	3.83	4.09
		4.21			3.96	
seed cost Rs/kg	11.06	9.69	8.41	7.74	6.43	6.01
		8.61			6.22	
Feed cost Rs/kg	93.21	102.45	106.52	110.04	112.54	118.15
		106.31			115.3	
fetilization cost Rs/kg	3.03	1.58	1.48	1.76	1.77	2.18
		1.60			1.97	
FCR	1.12	1.23	1.28	1.32	1.35	1.42
		1.27			1.38	
chemicals cost Rs/kg	3.03	1.58	1.48	1.76	1.77	2.18
		1.60			1.97	
health monitoring cost Rs/kg	6.48	4.85	4.62	5.74	5.16	6.82
		5.07			5.99	
electricity cost Rs/kg	17	16.30	14.46	14.77	16.44	18.88
		15.17			17.66	
Fuel cost Rs/kg	3.52	3.51	3.86	4.04	4.43	4.69
		3.80			4.56	
labour cost Rs/kg	12.73	10.42	8.58	8.10	8.21	8.78
		9.03			8.49	
harvesting cost Rs/kg	3.06	1.30	1.07	1.14	1.28	1.37
		1.17			1.32	
Miscellaneous cost Rs/kg	7.67	9.38	9.26	11.28	12.08	13.62
		9.97			12.85	
Total variable cost Rs/kg	173	173.14	177.01	188.47	202.59	223.35
		179.5			212.97	
Total fixed cost Rs/kg	64.59	53.89	46.29	44.17	46.90	52.02
		48.11			49.46	
Total Cost	237.6	227.03	223.31	232.64	249.50	275.36
		227.66			262.43	
Total production (kg)	5025	6144	7458	7905	7799	7293
		7169			7546	
Price Rs/kg	435	420.00	405.00	388.33	365.00	300.65
		404.4			332.83	
Gross Income	435	420.00	405.00	388.34	365.00	300.65
		404.4			332.83	
Net Income Rs/kg (Gross Income - Total cost)	197.31	192.97	181.68	155.69	115.51	25.29
		176.78			70.4	
Net Profit	197.31	192.97	181.68	155.69	115.51	25.29

		176.78	70.4

(The first row indicates mean and standard deviation with percentages in bracket whereas the next succeeding line is average of treatment T2,T3,T4 (in %) and T5, T6 (in %) respectively.

4. CONCLUSION

This study concludes that even though *L.vannamei* shrimp farmers are assumed to be just above poverty line but all of them could have their own pakka houses with necessary almost all facilities even they have their own four wheelers too. Shrimp farming business is a big risky venture brought a greater up-lift to their socio-economic status. The mean shrimp production and the mean price received per kg, for small shrimp farmers was 5091.6kg/ha/crop and Rs 435/kg respectively. Similarly for the medium shrimp farmers was 7168.76 kg/ha/crop and Rs 404.44/kg respectively and for the large shrimp farmers was estimated 7545.92 kg/ha/crop and Rs332.83 respectively. These estimates revealed that by stocking higher density (no of shrimp/m^2) culture end with higher biomass (tonnes) with low net profit returns, so my experiment state that, low stocking density (no of shrimp/m^2) give higher net income and low operational cost with minimum application of probiotics, chemicals and low headach during night times culture period. There may be variation in farm production, it totally depend upon culture practices adopted. Majority of the shrimp farmer after farming justify themselves to grow from semi intensive to intensive farming system to enhance productivity and profitability but the actual scenario is different, higher the stocking density low net profit return and wise a versa.

Consent

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

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FINANCE

I would like to share my financial hardship, I have taken my thesis entitled " EFFECT OF DIFFERENT STOCKING DENSITY ON GROWTH, SURVIVAL AND CARCASS COMPOSITION OF *Litopenaeus vannamei* (Boone, 1931) IN SUMMER AND MONSOON CROP as numbers of shrimp farmers were finding difficulty in what no. of stocking density should be adopted in purely saline water for operating their shrimp farms, so I took this topic and ultimately during shrimp farm operation, just for purchasing 51 lakhs shrimp seeds/ seasonal crop was costing around Rs 25 lakhs and all other expenses like feed, medicine, labors charges etc was really unmanageable, finally I have set with my friend who was a middle man in fish purchase business and due to his involvement, I could operate one crop, from this profit, second season crop was taken up.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use

these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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PLATE 1: Geographical location of Kavya Aqua Farm, Datardi, Tal: Rajula, Dist: Amreli