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Socio-economic condition of the *Litopenaeus vannamei* farmers with implementation of better management practices (BMP's) in Andhra Pradesh, India

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Abstract
Litopenaeus vannamei (shrimp) farming is playing a pivotal role in the socio-economic development of India. India is exporting 4.4 lakh tones of shrimp products (2016-17) of which vannamei share is 3.30 lakh tonnes. The Andhra Pradesh state is the largest vannamei producer amongst the shrimp farming states of India contributing 2.31 lakh tonnes (70% of total Indian exports). The present study was conducted to evaluate socio economic status of the vannamei shrimp farmers in Andhra Pradesh. This study was conducted during the year 2014-15, in various districts of reorganized Andhra Pradesh state. The socio economic status of vannamei shrimp farmers were studied in terms of age education, family size and type, occupation status, caste, housing condition, income, experience, land holding, social participation and economic motivation. A three stage selection was adopted to finalize the respondents. Out of nine districts of Andhra Pradesh state, three districts *viz.* Prakasam, Guntur and Krishna were purposively selected for the present study. *Ex-post-facto* research design was used in the present investigation. The technique of proportionate and simple random sampling was adopted to select the required number of respondents. A sample size of 180 respondents was selected from the identified mandals of the three districts. Primary data was obtained through interview schedule from180 respondents selected for the specific purpose aided with well-structured questionnaire. It was found that most of the vannamei shrimp farmers in Andhra Pradesh were belonged to the age groups of 31-45 years (53.03%), majority (27.70%) growers had education of secondary school level (6th -10th class), Most (63.30%) of the respondents belonged to nuclear family type, majority (66.10%) of the respondents belonged to small family (possess up to 5 members), majority (61.60%) of the respondents had occupation of *vannamei* farming only, most (26.60%) of the respondents were involved in agriculture as subsidiary occupation, majority (47.22%) of the *vannamei* farmers belong to backward communities (BC), majority (54.44%) of respondents were holding 2.51-5.00 acres of land, majority (54.40%) of the *vannamei* farmers had RCC type of houses, 34.44 percent of respondents had annual income of Rs.1-2 lakh, majority (43.33%) of the respondents had low level of social participation and majority (55%) of *vannamei* farmers had medium level of economic motivation. The study concluded that the implementation of BMP's in *L. vannamei* culture of the study area had shown socio-economic benefits.

Keywords: *Litopenaeus vannamei*, better management practices (BMP's), socio- economic status and Andhra Pradesh

1. Introduction
Aquaculture is the fastest- growing form of food production in the world and shrimp dominates the aquaculture production by value. Shrimp aquaculture is the fastest growing food area and its economic importance is increasing concurrently. It is an important sector in the majority of the countries of the world from the viewpoint of income and employment generation. Indian fisheries and aquaculture is an important sector of food production, providing nutritional security to the food basket, contributing to the agricultural exports besides engaging more than 14 million people in different activities. Constituting about 6.3% of the global fish production, the sector contributes to 1.1% of the GDP and 5.15% of the agricultural GDP. In India, shrimp farming areas are mostly located in the coastal states of Gujarat, Maharashtra, Karnataka, Goa, Kerala, Tamil Nadu, Andhra Pradesh, Orissa and West Bengal.

The Andhra Pradesh state is contributing half of the total shrimp production of India. It has a coast line of 974 KM and about 175,000 Ha of area is under shrimp culture. *Peaneous monodon* was the leading shrimp culture during 1990's.

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Due to the outbreak of WSSV and other associated problems, the *Litopenaeus vannamei* (Pacific white legged shrimp), an exotic species was introduced during 2009 as an alternative species to *P. monodon*. *Litopenaeus vannamei (*shrimp) farming playing a vital role in the socio-economic development of India. Aquaculture technology is continuously getting improved to cope up with the emerging scenario. Better Management Practices (BMP's) is one such technology adopted by organized farming community for better yields and sustainable environment. In short, the implementation of the BMPs has provided benefits to the farmers, environment, and society (Mohan *et al.* 2008) [10]. The culture vannamei had increased rapidly in all the maritime states of India. The Andhra Pradesh state has become hub of shrimp aquaculture and it has been cultured on commercial scale in 9 coastal districts. India is exporting 4.4 lakh tones of shrimp products (2016-17) of which vannamei share is 3.30 lakh tonnes. The Andhra Pradesh state is the largest vannamei producer amongst the shrimp farming states of India contributing 2.31 lakh tonnes (70% of total Indian exports). In recent times, the vannamei culture also receiving severe setback due to several reasons and lead to crop losses.

2. Methodology

The present study was conducted to assess the socio-economic status of the vannamei shrimp farmers in Andhra Pradesh. This study was conducted during the year 2014-15, in various districts of reorganized Andhra Pradesh state, aimed to analyze the socio-economic benefits of BMP's in *Litopenaeus vannamei* culture. A three stage selection was adopted to finalize the respondents. Out of nine districts of Andhra Pradesh state, three districts *viz.* Prakasam, Guntur and Krishna were purposively selected for the present study. *Ex-post-facto* research design was used in the present investigation. The technique of proportionate and simple random sampling was adopted to select the required number of respondents. A sample size of 180 respondents was selected from the identified mandals of the three districts. Primary data was obtained through interview schedule from180 respondents selected for the specific purpose aided with well-structured questionnaire. The study was conducted in *Litopenaeus vannamei* farmers (licensed and permitted by the Department of Fisheries, Govt. of Andhra Pradesh) which were implementing BMP's. All the listed variables were empirically measured using various scheduled developed for the study. The final questionnaire included the questions on the socio-demographic condition, age, education, occupation, income, family size, family type, experience, etc. All the collected information were accumulated and analyzed by MS-Excel and then presented in textual, tabular and graphical forms to understand the present status of the socio-economic status of the vannamei shrimp farmers in the studied area.

3. Results and Discussion

The aim of this study was to determine the socio-economic status of vannamei shrimp farmers. Especially, emphasized was given on such variable namely age, religion, education, family size, education, annual income, family type, and other socio economic issues.

3.1 Age

The results showed (Fig.1) that majority (53.30%) of the *L. vannamei* farmers were within the middle age category (between 31 - 45 years), whereas 31.66 percent were old (above 46 years) and 15 percent of them were young (between 15-30 years). The average (mean) age of respondents was 41.30 years and standard deviation was ± 9.58. A critical observation from the above findings indicated that a considerable percentage of the *vannamei* farmers were of middle age. The plausible reason for the above trend might be, the middle aged farmers comparatively have free hand in financial affairs and more responsibility than younger ones. They can take up independent decisions to implement their ideas. Further, the middle aged farmers are enthusiastic, possess more physical vigor & have more work efficiency than older and younger farmers. Thus, it might be the reason for majority of respondents falling under the middle age group category.

Age was found to be positively influencing the adoption of BMP's in *vannamei* farming. This revelation of young people being involved in the management of the aquaculture industry is an advantage to the industry as their technology implementation behaviors are crucial to improvement in aquaculture productivity. Young and middle-aged farmers were aggressive and energetic people who were more willing to adopt new technology like BMP's than older farmers. Older farmers were conservative, risk averse and unlikely to try new ideas, which were similar to the finding reported by Kanokwan Tammaroopa *et al.,* (2016) [5] and were mostly s half of shrimp farmers had an age rank between 41-55 years old.

Similar findings were reported by Ogunmefun, and Achike (2017) [12], that the majority (39%) of the farmers falls within the age of 35-40years, followed by respondents within age 41-44years with 22 percent. Vadher and Kapila Manoj (2014) [20] reported that the 56 percent of the farmers were of the age of 40 years of age and 44 percent were above 40 years of age. Swathi lekshmi *et al.* (2005) [18] reported that 47.50 percent of the shrimp farmers were between 45-55 years old.
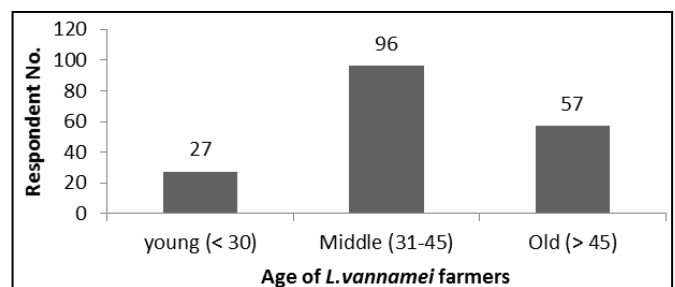

Fig 1: Age of *L. vannamei* farmers

3.2 Education

The results showed (Fig. 2) that majority (27.70%) growers had education of above primary level (6th -10th class), 20 percent had 1-5th class level, 13.8 percent had intermediate level, 17.2 percentages had graduate level and 12.2 percent were above graduate level of education. It is interesting to note that 8.8 percent of the respondents were illiterates and involved in *vannamei* farming and implementing BMP's. The average education of respondents (3.47%) was 6th -10th class level and standard deviation was ± 1.507

The *vannamei* culture system is a recently introduced exotic species which has been undergoing scientific updating at regular intervals. Therefore, the *vannamei* culturists need to gather knowledge on improved culture techniques of grow out pond culture. If the farmers have some institutional educational background they can easily understand the system. Literacy rate of pond shrimp farmers can play a vital

role in efficient management and operation as well as in successful production of shrimp. Education and farming efficiency are closely related and education generally has a positive effect on farm productivity. An educated farmer is more likely to adopt new technology than an uneducated one (Meena *et al*., 2002) [9].

The probable reason for majority of *vannamei* farmers educated (up to middle school / primary school) might be due to their low annual family income and lack of awareness among elders in the family and village about education and lack of encouragement from their family members for further continuance of their education and also non-availability of educational facilities in the villages. Therefore, the efforts are needed to promote adult education and functional literacy programmes in order to increase their level of education.

The present results are similar to that of Dona *et al*., (2016) [4] and reported that the education level of shrimp farmers indicated that no one was illiterate. Similar results was found in Srinivas and Venkatrayalu (2016) [16], who also reported that the 54.8 percent of shrimp farmers had education level of below 10th class (SSC), 41.7 percent were SSC, 0.9 percent were Intermediate, 2.2 percent were graduate and 0.4 percent was above graduation level. Swathi lekshmi *et al*., (2005) [18] reported that 40.00 percent had collegiate level of education in shrimp farmers and 30 percent of shrimp farmers had primary education in Andhra Pradesh. The findings of the present study were differed with that of Kumaran *et al*., (2003) [7], who reported that half of the tiger shrimp farmers (53.3 %) had degree or higher level of education. Kanokwan Tammaroopa, (2016) [5] reported the educational background of *vannamei* farmers of his study area were of mostly completed primary school. Ogunmefun and Achike (2017) [12] reported that the majority (60%) of the respondents possessing secondary education and 44 respondents (37%) were found to possess tertiary education with only very few (3%) respondents indicating to have only completed primary education.
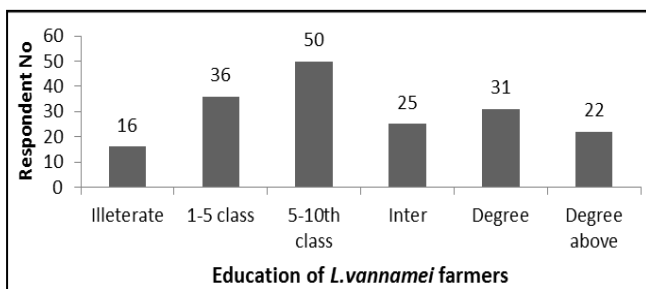

Fig 2: Education of *L. vannamei* farmers

3.3 Family type

Most (63.30%) of the respondents (Fig. 3) belonged to nuclear family type, whereas 1/4th of the respondents (36.60%) were of joint family. The average (1.37) family type of respondents was nuclear family type and standard deviation was ± 0.48.

The results showed the general inclination among the sampled farmers towards having nuclear family where decision making would be quick and easier compared to joint family Cyril *et al*. (2013) [2] reported that 68 percent of the shrimp farmers had nuclear family. Similar findings were reported by Kanokwan Tammaroopa *et al*., (2016) [5], and also Srinivas and Venkatrayalu (2016) [16]. The family size has considerable influence on the income and expenditure of the family (Pandey and Upadhayay, 2012) [13].
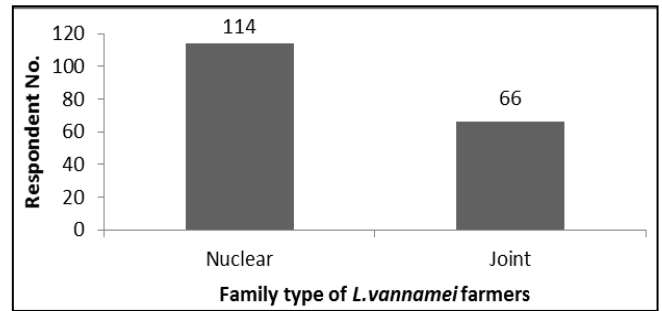

Fig 3: Family types of *L. vannamei* farmers

3.4 Family size

The results showed (Fig. 4) that majority (66.10%) of the respondents belonged to small family (possess up to 5 members) where as 33.80 percent of respondents were large family (possess above 5 members) category. The average (mean) family size of respondents was 1.33 family and standard deviation of ± 0.4.

The size of the family has a direct influence on the expenditure and income patterns of the family and thereby influences production. Similar findings were reported by Kanokwan Tammaroopa *et al*., (2016) [5], Srinivas and Venkatrayalu (2016) [16], Tapashi Gupta and Mithra Dey, (2014) [19], and Pandey and Upadhayay (2012) [13]. Manus Peter and Singas Susan (2014) [8] reported that 82.5 percent of the farmers had small to medium family sizes, implying that most of the farmers were young and active. It is evident from these results, that majority of the respondents were having small family size (possess up to 5 members).
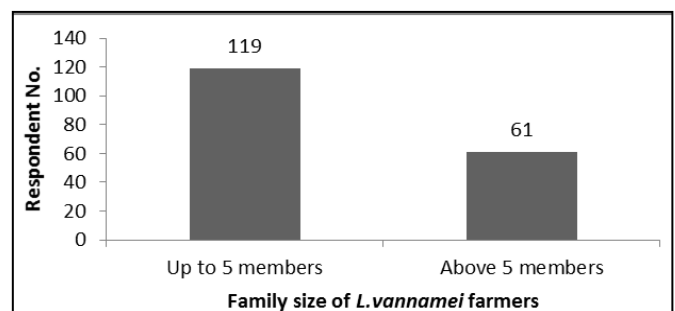

Fig 4: Family sizes of *L. vannamei* farmers

3.5 Farming Experience

The results (Fig. 5) illustrated that the all the respondents were experienced and majority (53.33) respondents acquired zero to 2 years of farming experience, followed by 46.66 percent of respondents with 3-6 years of experience. The results also showed that none (0 %) of the respondents had more than 7 years experience. The average (mean) farming experience of respondents was 1.4 years and standard deviation was ± 0.05.

Age, economic condition and interest over farming contribute to the years of vannamei farming experience. The high experience of *vannamei* farmers was a result of involvement of farmers in tiger prawn aquaculture occupation since ages and is the main occupation and livelihood for the farmers and hence this trend might be noticed.

Kumaran *et al*., (2003) [7] found similar results that the *P. monodon* shrimp farmers of surveyed had more than five years of farming experience. Kanokwan Tammaroopa, (2016) [5] of Thailand reported similar findings that the white shrimp farmers possess an average experience in shrimp farming about 5-15 years.
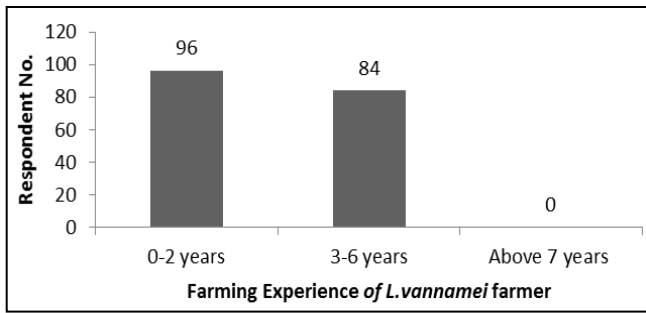
Fig 5: Farming Experience of *L .vannamei* farmer

3.6 Occupational status
The results pertaining to occupational status of *vannamei* farmers showed that (Fig. 6) majority (61.60%) of the respondents had occupation of *vannamei* farming only where as 20.50 percent were involved in both *vannamei* culture as well as agriculture and remaining 12.20 percent were involved in both shrimp and fish farming as their occupation. It is also observed that none (0%) of the respondents were involved in both *vannamei* cultures as well as tiger prawn (shrimp) culture. The average (mean) occupational status of respondents was 1.95 (*vannamei* farming only) and standard deviation was ± 1.38.
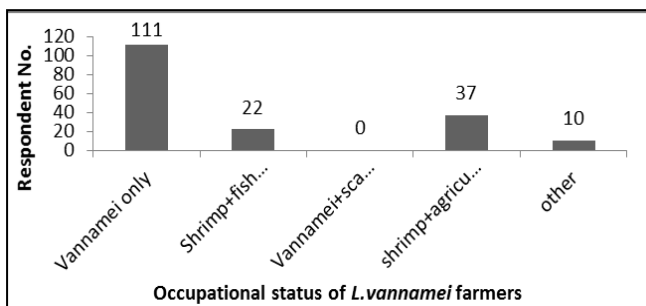

Fig 6: Occupational statuses of *L. vannamei* farmers

3.7 Subsidiary occupation
The results pertaining to subsidiary occupation of *vannamei* farmers revealed (Fig. 7) that most (26.60%) of the respondents were involved in agriculture as subsidiary occupation, where as 23.80 percent were depending on dairy, 19.40 percent were on fish culture, 9 percent were on fishing and fish marketing, 7.70 percent were working as agriculture labor, 5.50 percent were on petty business, 3.30 percent were on rural enterprises and 1 percent were involved in sericulture farming as their subsidiary occupation. The average subsidiary occupation of respondents was agriculture & dairy (mean 3.28) and standard deviation was ± 2.13.

This is quite possible because unemployed youths from agriculture and non – agriculture families were trained and promoted to take *vannamei* culture as alternate to tiger prawn culture to generate additional income since they possess more lands for cultivation. The results showed that none (0%) of the respondents of present study were involved in both *vannamei* cultures as well as tiger prawn (shrimp) culture. This could be attributed that the *vannamei* culture had replaced the tiger prawn culture in the study area. Similar finding were reported by Kanokwan Tammaroopa *et al.,* (2016) [5]. Dona *et al.,* (2016) [4] reported that the 40 percent of farmers were involved in shrimp farming along with agriculture and 30 percent in shrimp farming with fishing, only 12.5 per cent were involved shrimp farming alone as shrimp farming is more risky.

Srinivas and Venkatrayalu (2016) [16] reported that the more than three fourths of the farmers (92 %) had other occupations (agriculture and business sectors) in addition to shrimp farming and only 8 % have aquaculture as only occupation. Vadher and Kapila Manoj (2014) [20] reported that the 65.7 percent of the farmers had other occupations in addition to shrimp farming, where as 34.3 percent of shrimp farmers had only aquaculture occupation. Kumaran *et al.,* (2003) [7] reported that the shrimp farmers surveyed (73.3%) had other occupations (agriculture, business) in addition to shrimp farming.
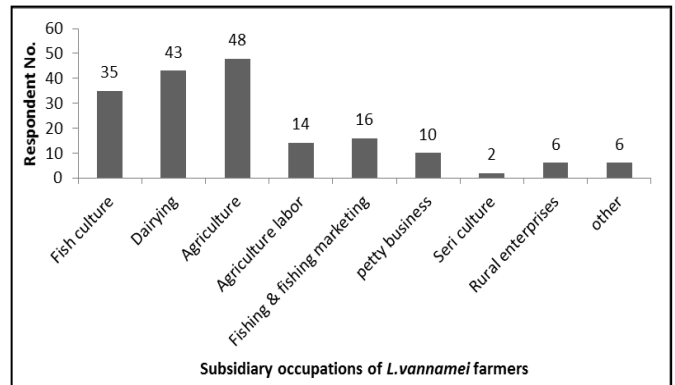

Fig 7: Subsidiary occupations of *L. vannamei* farmers

3.8 Caste
The results of the present study showed (Fig. 8) that majority (47.22%) of the *vannamei* farmers belong to backward communities (BC), followed by forward community (OC-37.77%) and only 15 percent of respondents belong to SC/ST category. The average (mean 2.22) surveyed respondents belongs to backward communities (BC) and standard deviation was ± 0.691.

With the above findings, it can be conclude that shrimp farming activity is mostly carried out by forward and backward communities and this information could be utilized by Govt. extension personnel for popularization of *vannamei* farming enterprise among Scheduled Caste/ Scheduled Tribe communities. The involvement of SC/ST communities in *vannamei* culture was low in the present study area as it might be due to poor financial resources as well as lack of awareness about beneficial aspects of *L. vannamei* culture.

Mukunda Goswami *et al.,* (2002) [11] found similar results that caste pattern of respondents showed that the majority (48.00 %) of Darrang were from general castes followed by 20.00 percent of scheduled tribes (ST), 17 percent of other backward communities (OBC) and 15 percent of scheduled castes (SC). In Nagaon, majority of the respondents belonged to general castes (43.33%) followed by OBC (33.33%), SC (13.33%) and ST (10.00%).
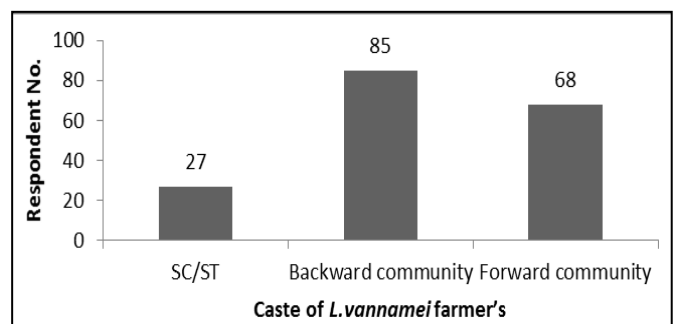

Fig 8: Caste of *L. vannamei* farmers

3.9 Land holding

The results (Fig. 9) indicated that majority (54.44%) of respondents were holding 2.51-5.00 acres of land, where as 45.55 percent of the respondents were holding up to 2.50 acres. The average (mean 1.54) land holding of respondents possessing 2.51 to5.00 acres of land and standard deviation was ± 0.499.

From the present study, it is very clear that majority of the *vannamei* farmers belonged to both small-scale (< 2.5 acres) as well as marginal / medium scale farmer's category. The involvement of small-scale as well marginal scale farmers (holding the lands of up to 2 ha) is once again confirming that the *vannamei* culture is practiced by more number of small/marginal scale farmers of rural areas. Kumaran *et al.,* (2003) [7] found similar results that the shrimp farmers surveyed most were small farmers having a farm size of less than *5* ha of farm and Swathi lekshmi *et al.* (2005) [18] reported 63.33 percent had big farm size in shrimp farmers. Srinivas and Venkatrayalu (2016) [16] reported that the most of the farmers are small farmers, having a farm size of less than 2 ha (86%) and about 14 percent of them were large farmers with more than 2 ha farming area. Vadher and Kapila Manoj (2014) [20] reported that the most of the farmers had farm size in between 2-5 ha (43.4%), 33 percent of farmers had farm size of less than 2 ha and 23.6 percent of shrimp farmers had above 5 ha of farm size. Sahu *et al.,* (2013) [15] found that the majority of farms were of small sizes (65%) ranging from 0.1 ha to 0.3 ha. 23 percent of the farms were less than 0.3 acre and 12 percent of the farm surveyed had farming area more than 2 acre.
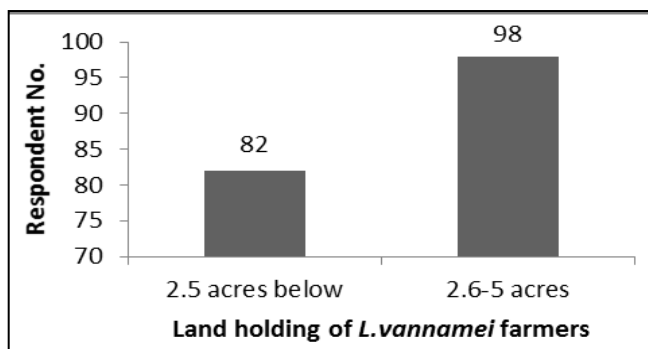

Fig 9: Land holding of *L. vannamei* farmers

3.10 House type

The results pertaining to type of house possessed by the *vannamei* farmers were presented in Fig. 10. It showed that majority (54.40%) of the *vannamei* farmers had RCC type of houses, 32.20 percent were having tile roofed houses and only 13.3 percent of respondents were living in hut/shed type of houses. The average (mean 2.41) house type of respondents was RCC type of houses and standard deviation was ± 0.711.

Housing pattern is one of the most important indicators used to assess the economic well-being of any community. The results could be attributed to the socio-economic condition as well as the richness of *vannamei* cultivators. It is a general opinion that the aquaculture farmers belong to high income group due to the profits incurred out of cultivation of shrimp culture. The present study was also confirming that most of the respondents of the study area were having RCC built-in houses indicating the economic status of the respondents.
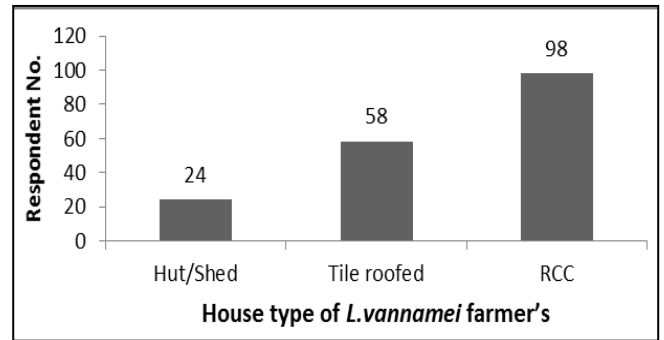

Fig 10: Types house of *L. vannamei* farmers

3.11 Annual income

The results pertained to annual income of *vannamei* farmers showed (Fig. 11) that 34.44 percent of respondents had annual income of Rs.1-2 lakh whereas 32.20 percent of respondents had annual income of Rs 50, 001- Rs 1 lakh. The results also revealed that 20 percent of the *vannamei* farmers had annual income of above Rs. 2 lakh and only 13.30 per cent of *vannamei* farmers had income less than Rs.50, 000/-. The average (mean 2.61) annual income of respondents was Rs. 1-2 lakh and standard deviation was± 0.95.

It is interesting to note that majority farmers had informed that they were earning between Rs.1 to 2 lakh only. These were contrast to their economic status. It is presumed that most of the respondents might have not revealed reliable information out of fear of payment of income tax. These results can also be inferred to involvement of low/marginal – income group of farmers.

Dona *et al.,* (2016) [4] reported that majority (35%) of the shrimp farmers annual income was up to Rs.2, 00,000/-, 32.5 percent had between Rs 2,00,000 to Rs.3,00,000/-, and only 27.5 per cent farmers were earning above three lakh. This might be due to that majority of them were practicing extensive type of shrimp farming. Swathi lekshmi *et al.* (2005) [18] reported that 36.67 percent of their study involved medium level of annual income in shrimp farmers.
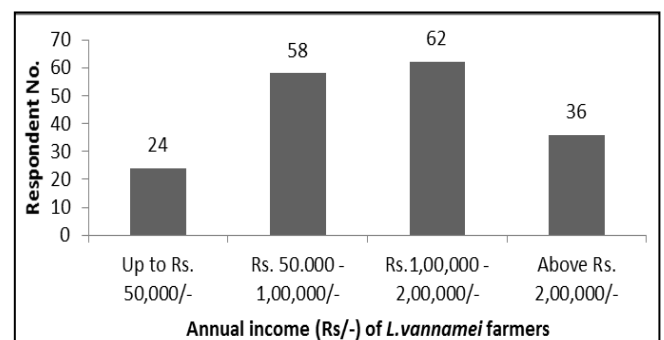

Fig 11: Annual income (Rs/-) of *L.vannamei* farmers

3.12 Social participation

The results showed (Fig. 12) that majority (43.33%) of the respondents had low level of social participation, where as 38.33 percent of respondents belonged to medium level of social participation and 18.33 percent respondents had high level of social participation. The Mean± SD of scores of the statements of social participation showed that 1.45 ± 1.56, which confirms the medium category of social participation of respondents.

The results indicated that the social participation of farmers of *vannamei* farmers is low. The plausible reason for this trend might be due to the fact that lack of interest and time, non-attractiveness of work undertaken by the organization, lack of perceived benefits, lack of awareness about various social organization and their activities and local political hindrances to participate actively in different social organizations. It can also be attribute to lack of time due to *vannamei* culture activities and could not find appropriate space for the same. Deshmukh *et al.,* (2007) [3] reported medium to high level of social participation of farmers in Marathwada. Swathi lekshmi *et al.* (2005) [18] found 56.67 percent had low level of social participation by shrimp farmers. The studies of Subash Chandra, (1986) [17], Baruwa, *et al.,* (2012) [1], and Krishnaiah, (1989) [6] reported medium to low levels of social participation of aqua farmers in the state of Andhra Pradesh.
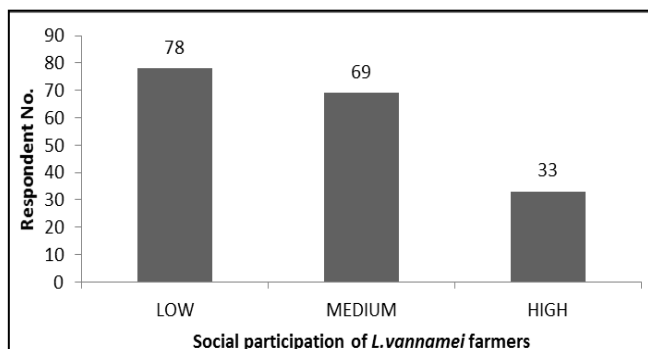

Fig 12: Social participation of *L. vannamei* farmers

3.13 Economic Motivation
The results (Fig. 13) pertained to economic motivation showed that majority (55%) of *vannamei* farmers had medium level of economic motivation in terms of profit making and relative value placed on economic ends where as 31.11 percent had high and 13.88 percent had low economic motivation. The Mean± SD of scores of the statements of economic motivation showed that 18.26 ± 2.49, which confirms the medium category of economic motivation of respondents.

Better exposure and close interaction with extension personnel about economically sound production technologies might have helped the *vannamei* farmers to orient towards medium and high economic motivation. Unless one is not exactly motivated, one cannot make sincere efforts and exalt interest in their profession. The reason for above fact might be due to majority of farmers had moderate land holding with middle school education. Farmers having high economic motivation were willing to take calculated risk for their field operations and were dare enough to invert huge capital on farming, whereas, poor economic motivation (13%) was also found and it might be due to poor credit orientation and less exposure to modern aquaculture technologies. The reasons for this might be due to the fact that respondents are properly guided, appraised and provided with information on economic viability of shrimp farming enterprise by extension officials and they have been convinced of the fact that is encouraging. Swathi lekshmi *et al.* (2005) [18] reported that 55.83 per cent had medium level of economic motivation in shrimp farmers and several others such as Baruwa, *et al.,* (2012) [1], Riski *et al.,* (2012) [14] reported similar type of results.
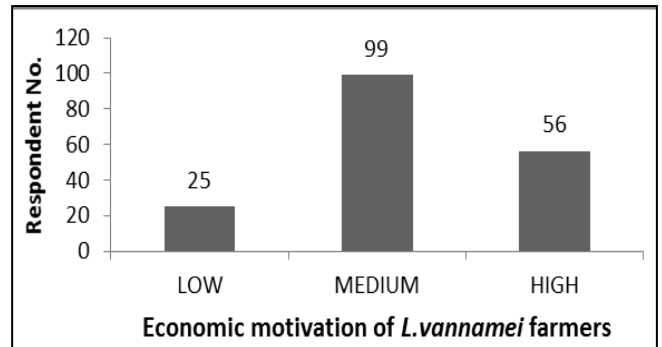

Fig 13: Economic motivation of *L. vannamei* farmers

4. Conclusion
Socio-economic condition of the vannamei shrimp farmers in Andhra Pradesh was presented in terms of age structure, religion, family type, family size, housing condition etc. The vannamei shrimp farmers were implementing the BMP's in *L. vannamei* culture would improve socio economic status of the farmers due to increase of yield", has been evidently proved.

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