Available online at www.pelagiaresearchlibrary.com

Pelagia Research Library

European Journal of Experimental Biology, 2014, 4(2):342-346

ISSN: 2248 –9215
CODEN (USA): EJEBAU

Effect of density on growth and production of *Litopenaeus vannamei* of brackish water culture in rainy season with artificial diet, India

Danya Babu Ravuru and Jagadish Naik Mude

Department of Zoology & Aquaculture, Acharya Nagarjuna University, Nagarjuna Nagar, Guntur, Andhra Pradesh, India

---

ABSTRACT

The Pacific white shrimp Litopenaeus vannamei (Boone, 1931) is an Ecological important tropical and euryhaline species. The culture of L. vannamei was taken from three ponds each one 0.6 ha for the study. Semi Intensive culture system was selected in Chinaganjam village (Prakasam District). The species L.vannamei (post larvae) stocking densities taken from three samples each one (3, 60,000) 60 species/m^2 and survival were 84, 86 and 88%. In rainy seasons in month of June to September, the water quality parameters were measured fortnightly in a month at 7a.m. The production was 6248, 6633 and 6945kg / 104, 110 and 112 days and FCR was 1.64, 1.51 and 1.71 for P1, P2 and P3, respectively. The artificial diet was provided 4times/day given made by Manamei feed pellets (Protein 35 and 34%). The final growth was 21.2, 22.20 and 22.70g/104,110 and 112 days, respectively.

Key words: *L. vannamei*, Salinity, Density, Growth and Production

---

INTRODUCTION

The white leg shrimp *Litopenaeus vannamei* is the most important penaeid shrimp species farmed worldwide (Alcivar – Warren et al., 2007). Because of the high demand for shrimps in Japan, the United States and Europe, shrimp aquaculture has expanded rapidly in all around the world, especially in tropical areas, such as Southeast Asia and Latin America (Lombardi *et al*., 2006). Among all species of shrimp, *L. vannamei*, which represent over 90% of shrimp culture in the Western hemisphere, is the most commonly cultured shrimp in Central and South American countries, China, and Thailand (Frias- Espericueta *et al*., 2001; McGraw *et al*., 2002; Saoud *et al*., 2003;). India rank second next to china in shrimp production. India has the one of the longest line of 8118 km. The shrimp culture commercially the most important forming as much as 90 percent of the total landings. *L. vannamei*, are presently being grown in low-salinity inland waters experimentally and commercially in Alabama, Arizona, Florida, Indiana, Illinois and Texas (Samocha et al., 2002;). Andhra Pradesh has one of the longest coast line 972 km widely distributed in India. The species *L.vannamei* has the great significance to grow as fast of *Penaeus monodon* (Tiger Shrimp). The recent trends in shrimp culture shows a considerable increase of farming of *L. vannamei* replacing *P. monodon* culture. An increase in farmed shrimp production can be achieved by increasing stocking density but this requires an increase in feed input which may degrade water quality. The optimal stocking density varies depending on the farm system and management practices. In India *L.vannamei* culture production of about 18247 MT from 2930 ha in 2010-11.

MATERIALS AND METHODS

The water taken from creek, stored in reservoir. The chlorination water pumped to all ponds by the pvc pipe (size 2½ inch). The pond shape is rectangular, the shrimp 15 days old post larvae *L.vannamei* at beginning the study. The (PL_{15}) of *L.vannamei* collected from BMR hatchery (Iscapalli village) situated approximately 20 km of Nellore, Andhra Pradesh. Cost of seed Rs. 50 paisa/species. Water depth maintained 7ft. The rainy season experiments the species *L.vannamei* (post larvae) stocking densities taken from three samples each one (3, 60000) 60 species/m^2 and survival were 84, 86 and 88% (3, 24000, 3, 09600 and 3, 16800) respectively. The temperature range up to 20 ^{0}C and adjusted by decreasing (or) increasing value by 2^{0}C/ day and salinity was 14 ppt adjusted by decreasing (or) increasing values by 2ppt/day. The artificial diet was given made by Manamei feed (protein% 35 (Feed No. 1, 2, 3 and 3S) and 34(Feed No. 3M)).The methodology includes standard techniques to measure the water quality parameters.

RESULTS AND DISCUSSION

In the experiment the stocking density influenced by the water quality parameters and indicated that the reduction in survival at higher densities. The species *L.vannamei* well grow up to 20 gm body weight increased 3.0g to 4.0g/15 days in Indian climate conditions, which is better than other countries. In the culture system the growth rate increased due to the artificial feed supplementation in the season. The oxygen consumption was higher in the large size groups than in the smaller shrimp. Given more feed to form the Ammonia and H_2S gas. When the electrical aerators and probiotics are used, the shrimp growth rate was increased due to lack of Dissolved Oxygen (DO). During the culture I observed, shrimp mortality caused by vibrio species. After the shrimp culture, the mean average weights of the shrimp were 21.2, 22.2 and 22.7g (Tables 1, 2 and 3), survival were 84, 86 and 88%. The production was 6248, 6633 and 6945 kg and giving feed 3806, 4372, 4058.6 kg / 104, 110 and 112 days and FCR were 1.64, 1.51 and 1.71 for P1,P2 and P3 (Table 1) respectively. Dead species are 162, 240, 246kg and Cost of the seed Rs71.84/kg and Cost of the species at harvesting time Rs 530, 560 and 630/kg for P1, P2 and P3.

Table: 1 Pond performance Details

Pond details	Area (ha)	DOC	Stocking date	PL stocking (days)	Density (m^2) & Initial stocking	Survival (%) & numbers	FCR
P1	0.6	104	5/06/2013	PL_{15}	60=3,60,000	84=3,24000	1.64
P2	0.6	110	5/06/2013	PL_{15}	60=3,60,000	86=3,09600	1.51
P3	0.6	112	5/06/2013	PL_{15}	60=3,60,000	88=3,16800	1.71

Table: 2 pond 1 Water parameters & Growth performance (g) in Rainy season

DOC	Temperature (^{0}C)	Salinity (ppt)	DO (ppm)	Giving feed (%)	Feeding/day (kg)	Total growth (g)	AVG growth (g)
15	17.0±2	11.0±2	3.4	—	120.00	2.00	2.00
30	17.5±2	11.5±2	3.5	6.5	73.10	5.00	3.00
45	18.5±2	12.5±2	3.7	4.5	54.40	8.00	3.00
60	19.0±2	13.0±2	3.8	4.0	48.30	11.00	3.00
75	20.0±2	14.0±2	4.0	3.5	42.30	14.50	3.50
90	19.5±2	13.5±2	3.9	3.3	39.90	18.00	3.50
104	18.0±2	12.0±2	3.6	3.0	36.20	21.20	3.20
			Mean	*18.4±2*	*13.9±2*	*3.7*	

Total production=6410kg; Dead shrimps=162kg; Final production=6248kg; Total feed=3806kg

Table: 3 pond 2 Water parameters & Growth performance (g) in Rainy season

DOC	Temperature (^{0}C)	Salinity (ppt)	DO (ppm)	Giving feed (%)	Feeding/day (kg)	Total growth (g)	AVG growth (g)
15	16.5±2	10.5±2	3.4	—	210.0	2.00	2.00
30	17.0±2	11.0±2	3.5	6.5	80.4	6.00	4.00
45	18.5±2	12.5±2	3.7	4.5	55.7	9.00	3.00
60	19.0±2	13.0±2	3.8	4.0	49.5	12.00	3.00
75	20.0±2	14.0±2	4.0	3.5	43.3	15.50	3.50
90	19.5±2	13.5±2	3.9	3.0	37.1	19.00	3.50
110	18.5±2	12.5±2	3.7	2.5	30.9	22.20	3.20
			Mean	*18.4±2*	*12.4±2*	*3.7*	

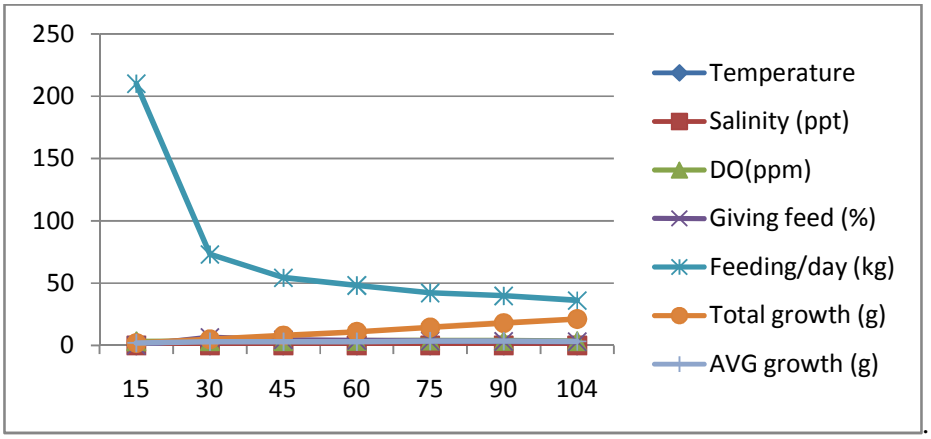
Total production=6873kg; Dead shrimps=240kg; Final production=6633kg; Total feed=4372kg

Table: 4 pond 3 Water parameters & Growth performance (g) in Rainy season

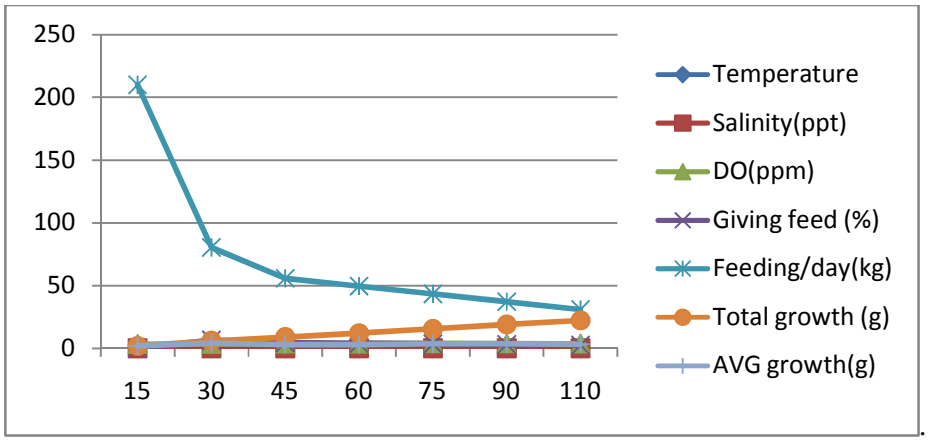
DOC	Temperature (^{0}C)	Salinity (ppt)	DO (ppm)	Giving feed (%)	Feeding/day (kg)	Total growth (g)	AVG growth (g)
15	16.5±2	10.5±2	3.4	—	210.0	2.00	2.00
30	17.5±2	11.5±2	3.5	5.0	63.3	6.50	4.50
45	18.5±2	12.5±2	3.7	4.5	57.0	9.50	3.00
60	19.0±2	13.0±2	3.8	4.0	50.0	12.50	3.00
75	20.0±2	14.0±2	4.0	3.5	44.3	15.50	3.00
90	19.5±2	13.5±2	3.9	3.0	38.0	19.50	4.00
112	18.0±2	12.0±2	3.6	2.5	31.6	22.70	3.20
	Mean	*18.4±2*	*12.4±2*	*3.7*			

Total production=7191kg; Dead shrimps=246kg; Final production=6945kg; Total feed=4058.6kg

Line Graph 1: pond 1 Water parameters & Growth performance (g) in Rainy season



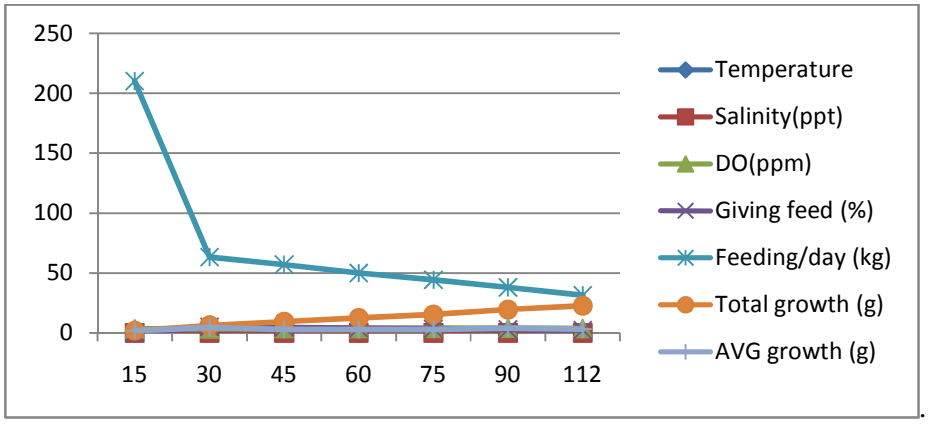
Line Graph 2: pond 2 Water parameters & Growth performance (g) in Rainy season



Line Graph 3: pond 3 Water parameters & Growth performance (g) in Rainy season

The statistical analysis method was applied "ANOVA" test, comparison of the survival, production, growth rate and FCR in P1, P2, and P3. The maintenance of good water quality is essential for optimum health, survival and growth of shrimp. The present study it was concluded that *L.vannamei* culture is successful in brackish water environment and the growth is directly related to stocking density. The shrimp at 20^{0}C were relatively inactive and exhibited low food consumption compared with at 35^{0}C. The shrimp maintained at 35^{0}C had the highest rate of food consumption Araneda *et al* .,2008) recorded the average growth rate of 0.38 g/wk in the 90 shrimp/m^2 and lowest in the 180 shrimp/m^2 (0.33 g/wk).Despite the variation observed, all value of the parameters meet the water quality requirements for shrimp production (Cawthorne, Beard, Devenport and Wickins1983; Allan and Maguire 1991;

Garcia and Brune 1991; Lee & Wickins 1992; Prado-Estepa, Llobrera,Villaluz & Saldes 1993); early morning Dissolved oxygen concentration was between 3 and 5 $mg1^{-1}$; salinity was above 15 % during the first week of grow out pond, which is preferable for post larvae (PL). The initial lower temperatures would have reduced metabolism and diet intake of the shrimp (Lester and Pante 1992), consequently slowing growth during the first weak. The optimum feeding rate and frequency of presentation must, therefore, be determined for individual feeds and farms by carefully monitoring feed consumption, growth and feed efficiency over several growing seasons (Tacon, 1993). Many studies have illustrated that artificial substrates could increase shrimp growth and survival (Moss and Moss, 2004; Arnold *et al*., 2009). As *L.vannamei*, is a euryhaline species, and Bray et al., (1994) reported optimum growth in 5-15ppt salinity, and Huang, (1983) at 20 ppt. Zu et al (2004). The growth rate of *L.vannamei* at higher salinities of 50ppt and more, showed the possibility of commercial production. As one of key factors for culture shrimp, water quality not only affects the shrimp growth and survival rate, but also affects the accuracy of the experiment result (Chim *et al*., 2008). During the course of the attachment, a large number of shrimp could be assembled on the aquaria bottom from the artificial substrates (Zhang *et al*., 2010). Protein requirement has been defined by Guillaume (1997) as the minimum or the maximum amount of protein needed per animal per day. Protein requirements change with respect to changes in biotic factors (e.g. species, physiological state, size) and dietary characteristics (e.g. protein quality, energy: protein ratio). Abiotic factors such as temperature and salinity may also affect the protein requirement (Guillaume, 1997). The protein requirement of a given species is often based on the response (e.g. weight gain, feed efficiency, protein conversion efficiency) of the animal to varying levels of dietary protein under a given set of circumstances. Probiotic is given to all ponds depending on biomass for i.e. "Back cheak" control the Bacteria. Minerals are given to all ponds depending on biomass for i.e. "Booster" for the development of the minerals in shrimp. "Ammo seize "for decrease of ammonia. "Gasonex' for lift of the gas (During the black soil will give after 70 days). Opti Oxygen controls the DO. "EDTA"3kg/0.7ha for molting of the species. "Burunt" lime to develop the Zooplankton. P1 the survival rate was decreased compared with P2, P3 and P2 Food Conversion Ratio was low compared with P1, P3 (Table1) and P3 the growth rate was increased compared with P1, P2 (Table 2, 3 and 4). The mean Temperature, Salinity and DO were 18.4±2^{0}C; 13.9±2 and 12.4±2 ppt; 3.7 ppm for P1, P2 and P3 (Table 2, 3 and 4).



***Note: P**=Pond, **DOC**=Days of culture, **PL**=Post Larvae, **FCR**=Food Conversion Ratio, **DO**=Dissolved Oxygen, **AVG**= Average growth*

CONCLUSION

In the present study, it has been observed, Temperature, Salinity, Dissolved oxygen, Density and Survival. The shrimp production and growth were increased with artificial Manamei feed when compared with control.

Acknowledgement
Authors are thankful to the Farmer and Owner of the culture ponds K. Ramana (Neeli Aqua Pvt, Ltd.) in Chinaganjam Village, Prakasakm District, for their encouragement and provided facilities up to harvest of the *L. vannamei culture*.

REFERENCES

[1] Allen G.L., & Maguire G.B**. (1991)**. *Aquaculture* 94, 2–37.
[2] Alcivar–Warren AD, Meehan–Meola S, Won Park, Xu Z, Delaney M, Zuniga G. **(2007)**. *Journal of Shellfish Research* 26(4): 1259–1277, http://dx.doi.org/10.2983/0730-8000(2007) 26[1259: SALMLM] 2.0.CO; 2
[3] Arenda. M., E.P. Perez, and E. Gasca-Leyva. **2008.** *Aquaculture* 283; 13–18.
[4] Arnold, S.J., Coman, F.E., Jackson, C.J. and Groves, S.A, **2009**. *Aquaculture*, 293.
[5] Bray, W.A., Lawrence, A.L., Leung-Trujillo, J.R., **1994**. *Aquaculture 122, 133–146.*
[6] Cawthorne, D.E., Beard T., Davenport, J and Wickins, J. **(1983)**. *Aquaculture* 32.165–174.
[7] Chim, L., M. Castex, D. Pham, P. Lemaire, P. Scmidely and M. Mariojouls, **2008**. *Aquaculture, 279: 63–69.*
[8] Huang, H.J., **1983**; Factors affecting the successful culture of *Penaeus stylirostries* and *Penaeus vannamei* at an estuarine power plant site: Temperature, Salinity, Inherent growth variability, damselfly, Nymph predation, Population density, Distribution and Poly Culture. Ph.D. dissertation, Texas A & M University, *221 P.*
[9] Frías-Espericueta, M.G, Voltolina, D. and Osuna-López, J.I, **2001**. *Bulletin of Environmental Contamination and Toxicology*, 67: 580–586.
[10] Garcia, A and Brune, D.E **(1991)**. *Aquaculture engineering* 10,269–279.
[11] Guillaume, J., D'Abramo, L.R., Conklin, D.E., Akiyama, D.M. (Eds.), **1997**. Protein and amino acids: Crustacean Nutrition. *World Aquaculture Society, Baton Rouge, LA, pp.* 26–50.
[12] Lee D.O.C. & Wickins J.E. **(1992)**. *Crustacean forming Black Well Scientific Publications. Oxford.*
[13] Lester, L. J. and M. J. Pante. **1992**. Penaeid temperature and salinity responses. Pages 515–534 in A. W. Fast and L. J. Lester, editors. Marine shrimp culture: principles and practices. *Elsevier Scientific Publishing Company*, Elsevier, New York, New York, USA.
[14]Lombardi, J.V., M.H .L. De Almeida, L.P.R. Toledo, B.O.J. Salee and E.J. De Paula, **2006**. *Aquaculture*, 258: 412–415.
[15] Mc Graw, W.J., Davis, D.A., Teichert-Coddington, D and Rouse, D.B, **2002**. *Journal of the World Aquaculture Society*, 33: 78–84.
[16] Moss, S.M, **2004**. *Journal of the World Aqua culture society*, 35: 537–542.
[17] Parado–Estpa E.E.D, Llobera A., Villaluz, A and Saldes, R. **(1993)**. *Israel Journal of Aquaculture* 45, 3–7.
[18] Saoud, I.P., Davis, D.A. and Rouse, D.B, **2003**. *Aquaculture*, 217: 373–383.
[19] Tacon, A.G.J. **1993**. Feed formulation and on-farm feed management. In M.B. New, A.G.J. Tacon and I. Csavas, eds. Farm-made aqua feeds, p. 61–74. *Proceedings of the FAO/AADCP Regional Expert Consultation on Farm-Made Aqua feeds. Bangkok*, FAO–RAPA/AADCP.
[20] Zhu, C.; Dong, S.; Wang, F and Huang, G, **2004**. *Aquaculture, Vol.* 234.pp.485–496.
[21] Zhang, B., W.H. Li, J.R. Huang, Y.J. W and R.L. Xu. **(2010)**. *Iran. J. Fish. Sci.*, 9: 293–304.20.