A STUDY ON GROWTH PERFORMANCE OF LIPOPENEUS VANNAMEI IN ZERO SALINITY WATER IN ADDANKI AREA, AP

By

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DECLARATION

We declare that this thesis entitled "A Study On Growth Performance Of Lipopeneus Vannamei In Zero Salinity Water In Addanki Area, Ap" is composed by us and has not been published or submitted in part or in full for award of any degree.

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CONTENTS

A study on the growth performance of *L.vannamei* in zero salinity water in Addanki area, A.P

Introduction:

Shrimp aquaculture sector occupies very important role in the socio-economic development of the country and also provide protinacious food for the poor people. The aqua industry has expected to account progressively for the insufficient aquatic food supply that would occur for the population increase expected until 2030 and it is the fastest growing food production sector in the world increasing with an average rate of 9.2% over the past 30 years (FAO 2005) which makes aqua industry one of the promising industry to meet future food demand.

In the recent years aquaculture intensification has become a common practice throughout the world. Farmers are reporting with higher stocking densities, artificial fertilization of the ponds and supplementary feeding using artificial feeds to get the maximum profit from a unit area. There is always a chance of stress to the growing organism with the over intensification. Under stress the pathogens present in the pond may enter and cause disease resulting in severe mortality. During the last few years Asian countries were severely affected with many viral diseases and faced massive economic losses particularly due to continuous outbreak of White Spot Disease (WSD). In India outbreak of WSSV to tiger shrimp *Penaeus monodon* has spread and caused large scale mortalities and severe damage to shrimp aquaculture industry. The pacific white shrimp *Litopenaeus vannamei* has become the main crustacean species produced through culture, with production exceeding that of tiger shrimp *Penaeus monodon* since 2003. The production of this species has been increased from 186,113 tons in 1999 to over 2.3 mmt in 2007.

Many studies have aimed to increase the shrimp production through manipulating of stocking density, fertilization, artificial feeding and opening of new lands for culture and combination of different species into culture system (Varghese et al., 1975; Chakraborti et al., 1985; Krishna, 2006). In practice, the densities at which farmers keep their stock are based on the experience and institution with codes of practice and hand books being used as guide. Information regarding effect of stocking density of the shrimp performance during intensive culture is limited, inconsistent and some time controversial.

Pacific white shrimp, *Litopenaeus vannamei*, is one of the most intensively cultivated shrimps all over the world (Perez Farfante and Kensley 1997) because of the reduced risk of catastrophic diseases and favorable environmental conditions (Boyd 2002; Zhu et al., 2006). Several authors described about the growth in shrimp culture systems based on stocking density (Cailout et al., 1976; Sedgwick 1979; Maguire and Leedow 1983) and some authors have reported an inverse relationship between growth and stocking density (Lee et al., 1986; Sandier et al., 1987; Whay-Ming and Yew-Hu, 1992; Daniels et al., 1995). No proper research has yet been done on the effect of stocking density in long term survival and growth performance of *L.vannamei.* Hence it was aimed to evaluate the effect of different stocking densities on the survival and growth of *L.vannamei* for the present study.

Success of aquaculture depends on providing animals with a satisfactory environment (Boyd and Tucker, 2009). Over the past few decades, shrimp farming in India has expanded rapidly to a vibrant export industry with the export production of 3, 57,505 MT worth USD 3.7 Billion (MPEDA, 2015) for 2014-15. The corresponding figures for 2015-16 in USD are 3.1 Billion (MPEDA, 2016). Given the ever-increasing consumer demand, high foreign exchange earning potential and stagnation in the wild catch, the shrimp farming has been expanding at phenomenal proportions. . The world needs an extra 40-60x106 tons of food fish by 2020. Therefore culture is transforming rapidly into an intensive type of semi-

intensive mode. Growth and development of aquaculture should be sustainable. The growing aquaculture industry is haunted by a number of environmental and social issues.

Indian Aquaculture Scenario:

- As per GLOBEFISH, India is the fourth largest exporter of seafood in 2017
- Largest supplier of frozen shrimp to USA
- 2nd largest supplier of shrimp to European union
- Second largest supplier of frozen shrimp to Japan
- Largest supplier of cephalopods to EU
- Statutory body under the Ministry of Commerce & Industry, Govt. of India; set up in 1972 by an act of parliament.
- Nodal agency for promotion of the export of marine products
- Entrusted with the overall development (including infrastructure), regulation, and promotion for the export of marine products.
- Capture fisheries contribute about 45.18% of seafood export of India value and about 68.51% in quantity.
- The rest is contributed by coastal aquaculture, especially shrimps.

MARINE PRODUCTS EXPORT FROM INDIA

Fig. 1. Export Performance: 2017-18 (in USD value)

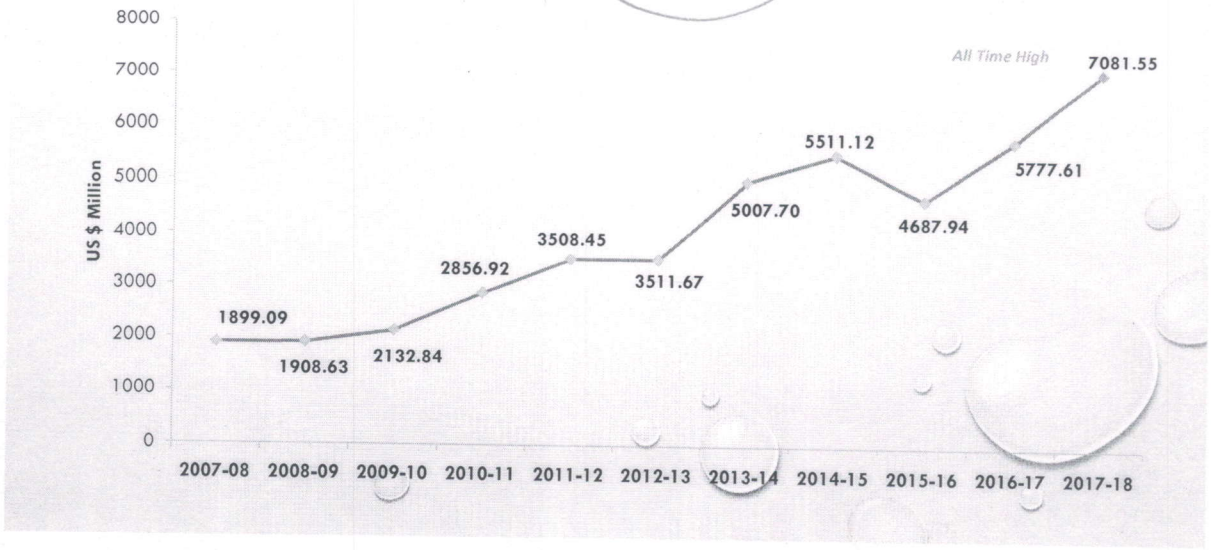


Fig. 1. Trends in progress of aquaculture production of export oriented species

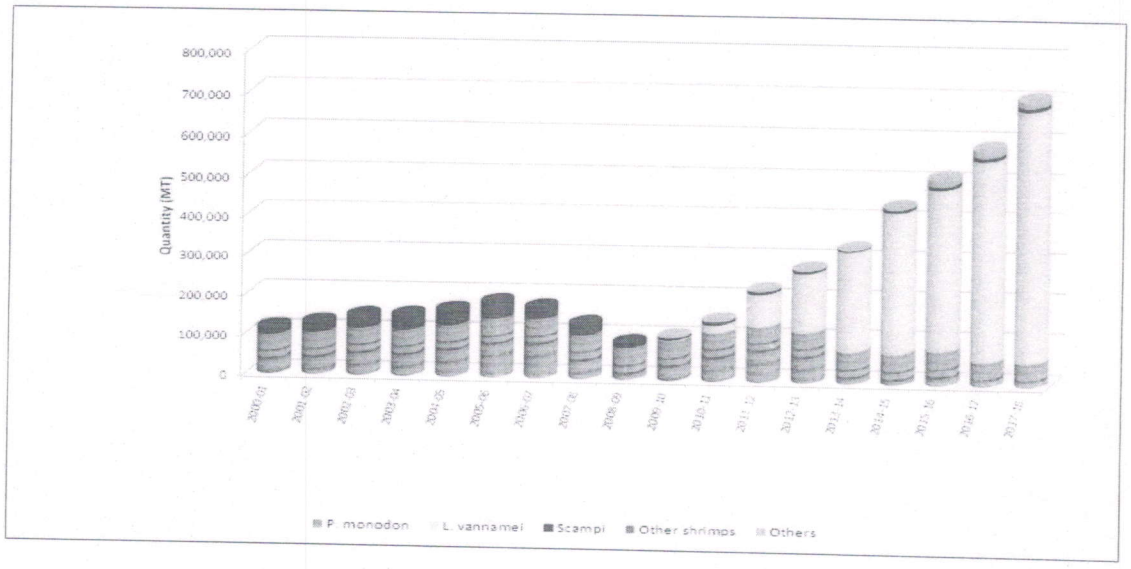
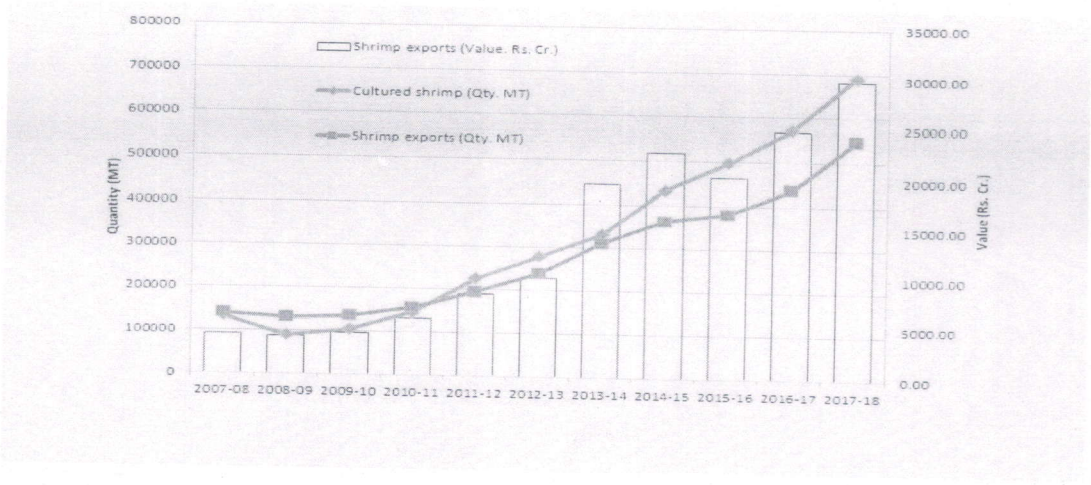


Fig. 2. Trends in progress of cultured shrimp production and shrimp exports



Shrimp Production in species-wise during 2017-18

Species	Production (in MT)
	Country Total
P. monodon	58,163
L. vannamei	5,01,297
F. Indicus /other shrimp	1,675

Total Shrimp Production in the Country during 2017-18

Sl. No.	State	Area Utilised(ha)	Production (Mt)	Productivity (Mt/ha/year)
1	West Bengal	52,131	71,051	1.36
2	Odisha	8,574	29,296	3.42
3	Andhra Pradesh	64,266	3,55,956	5.54
4	Tamil Nadu	8,751	49,054	5.60
5	Kerala	4,452	*3,987	0.90
6	Karnataka & Goa	1,154	*2,197	1.90
7	Maharashtra	1,652	6,842	4.14
8	Gujarat	5,656	42,755	7.56
	Total	1,46,636	5,61,138	3.83

**including the production of F. indicus*

Litopenaeus vannamei (white leg shrimp) species, which have been introduced to many coastal states of India, now account for 90 percent of the country's total shrimp culture. The species exhibits a fast growth rate and its culture period is significantly shorter than that of *Penaeus monodon* (tiger prawn), making it an attractive alternative to tiger prawn production in several countries.

Specific pathogen free (SPF)

Aquatic animals that have been produced and are tested and held under rigorous conditions of bio-security that provide assurances that they are free of certain specified pathogens.

- First SPF shrimp was developed on the big island of Hawaii, in Kona, in 1990.
- SPF animals offer an advantage to a country introducing a species for the first time as it offers some assurance that the imported animals will not introduce the listed pathogens to native species.

- Use of SPF shrimp has greatly reduced disease incidence and thus enhanced the shrimp production at global level.

- Use of SPF broodstock has reduced the spread of shrimp diseases worldwide and eliminated the industry's practice of capturing shrimps from the wild for seed production.

Aquaculture in Andhra Pradesh:

Andhra Pradesh is achieving rapid progress in aquaculture with vast potential for the development of fish and prawn cultivation and sea food production. The fish and prawn production has 6.4 per cent share in the Gross State Domestic Production (GSDP) and providing livelihood to 14.5 lakh population. Up to December 2017, the fish and prawn production achieved 27.49 lakh tonnes with GVA of Rs.34,041 crore (constant prices). During the year 2017-18, the State government had set the target of producing 33.84 lakh tonnes of fish and prawns with GVA of Rs.42,110 crore with growth rate of 22.35 per cent on production and 35.65 per cent on GVA.

Andhra Pradesh has a coast line of 970 km with vast scope for production of fish, prawn and other sea products. Keeping in view of huge demand for sea food in the international market, the state government is promoting the best practices like simplifying the procedures for registration of aqua farms through Mee-seva, permitting aquaculture in DKT lands, cluster approach and continuous awareness campaign at the primary producer level in the existing 181 aqua clusters covering 1.27 lakh hectares areas.

Andhra Pradesh has lion's share in the sea food exports from our country with 45 per cent share in the year 2016-17. Sea food worth Rs.17, 000 crore was exported from the state in the year 2016-17 against the total exports of worth Rs.37, 871 crore from India.

The present study was conducted to see if the stocking densities were having any impact on the growth performance of the shrimp grown in fresh water earthen ponds in an area where the culture of brackish water shrimp is new.

Objectives of the study:

1. To assess the influence of Stocking Density on Average Daily Gain and Specific Growth Rate
2. To measure the FCR at different Stocking Densities

Review of Literature

Shrimp farming plays a pivotal role in the socio-economic condition of the coastal population of India by way of contributing to foreign exchange earnings and livelihood options. The farmers are going for gradual intensification with more than the CAA prescribed Stocking Densities. Optimum stocking density at which sustainable growth is achieved is to be investigated. The optimum density varies with the culture water. The present study carried out in fresh water tried to assess the optimum stocking density for the fresh water shrimp culture.

Most of the researchers conducted research on shrimp economic performance at various stocking densities. They are Allan. G.L. and G.B. Maguire et al., (1992), Daniels, W.H., D'Abramo, L.R. Fonden., Durant.M.D.(1995), Apud F.D., K. Gonzalez and N. Deatras (1981), Maguire, G. B. and M. I. Leedow.(1983), Tidwell.J.H. Coyle, S., Weibel, C. and Evans, J.(1999) Whay-Ming, R. and C. Yew-Hu.(1992).

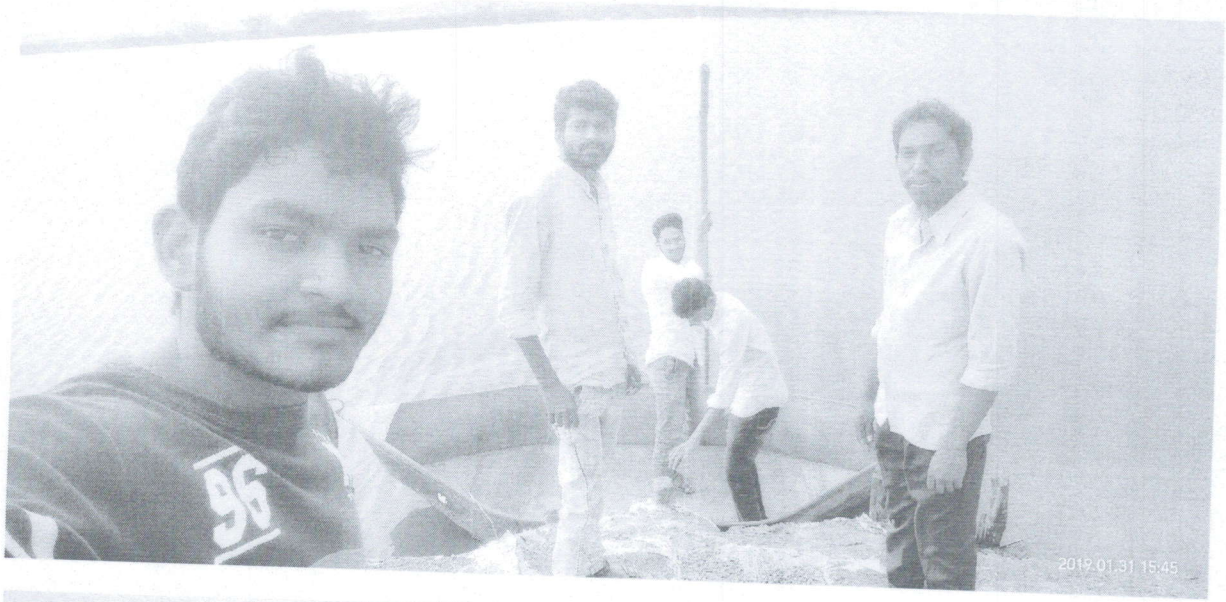
Materials & Methods

For the present study, commercial fresh water ponds located near Addanki, Prakasam district, Andhra Pradesh, India were chosen. They were treated as Pond1 (P1), Pond2 (P2). These ponds belonged to two farmers. They were stocked at a density of 60/m^2 in pond1 and 70/m^2in Pond 2. Both the experimental ponds were of the size of 1 acre. All the ponds were

dried, tilled and limed before stocking (Pre-stocking Management). Water is pumped from the local natural lake, Bhavanasi, which is just a throw away distance from our college. Following biosecurity measures, the water was pumped with the help of motors and provided with filter bags. Crab fencing and bird netting were made. Application of organic and inorganic fertilizers and chlorination process were done before stocking the post larvae (PL) Healthy and disease free post larvae collected from Gayathri Hatcheries, Bapatla, were stocked at a size of 0.80g at PL 14 stage. They were confirmed negative for the White Spot Syndrome Virus (WSSV) and Taura Syndrome Virus (TSV) through Polymerase Chain Reaction (PCR Assay) before packing. After the completion of acclimatization post larvae were released.

Total culture period was 120 days. Pond aeration was maintained through paddle wheel aerators. Supplemented feed of Awanti was used four times daily and check trays were used to maintain proper feeding management. Feed was adjusted based on the expected survival and biomass. To monitor the shrimp growth, sampling was carried fortnightly by Seine net at first fifteen days and through cast net for the remaining culture period. Analyses of physico-chemical parameters for all the ponds were carried using standard methods (APHA, 1989). Field test instruments were used to analyze water pH (Digital mini-pH meter, model 55), Temperature & Dissolved Oxygen (YSI-58), Transparency (Sacchi disc, Boyd, 1990), Total ammonia (APHA, 1989), and Phosphorous (model 21D).

At each sampling weights for growth increments were recorded. Average Daily Gain (ADG), Specific Growth Rate (SGR), and Feed conversion ratio (FCR) were calculated from the sampling data. Total Yield (Kg) and Total feed fed (Kg) were recorded at the end of experiment. All the results were statistically analyzed by two way analysis of variance (ANOVA). According to Steel and Torrie (1980) the significant differences between treatments (60, 70/m^2) were performed at a level of $P<0.05$ significance.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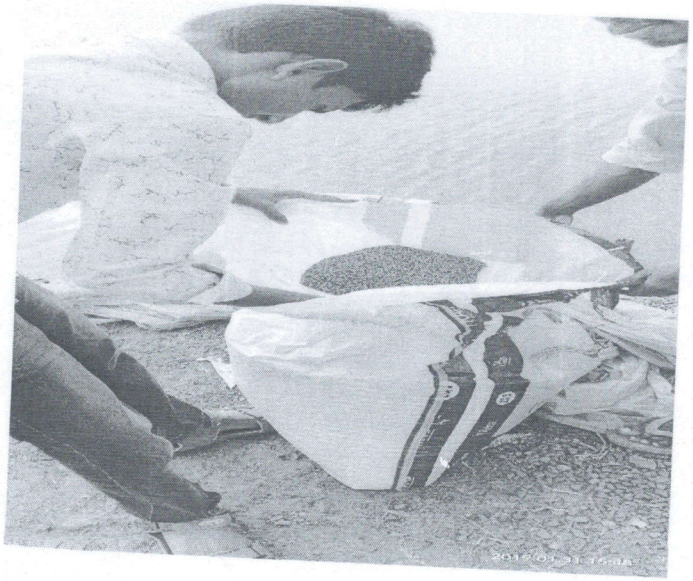


Growth Parameters to Be Assessed:

$$\text{Specific Growth Rate (SGR)} = \frac{ln\,(Final\,Weight) - ln(Initial\,Weight)}{Duration\,of\,Culture} \text{ X } 100$$

$$\text{Average Daily Gain (ADG)} = = \frac{Final\,Weight(g)}{Duration\,of\,Culture}$$

$$\text{Feed Conversion Ratio (FCR)} = \frac{Total\,Feed\,Fed(Kg)}{Total\,Yield(Kg)}$$

Results & Discussion:

Growth Parameters at two different stocking densities

Parameter	Pond 1 S.D=60/m^2	Pond 2 S.D=70/m^2
Initial Weigh(g)	0.80	0.80
Final Weight(g)	10.2	9.4
ADG(g)	0.085	0.0783
SGR	1.749	1.681
FCR	2.11	2.30

Fig: Comparison of Final Weight Values at two different Stocking Densities

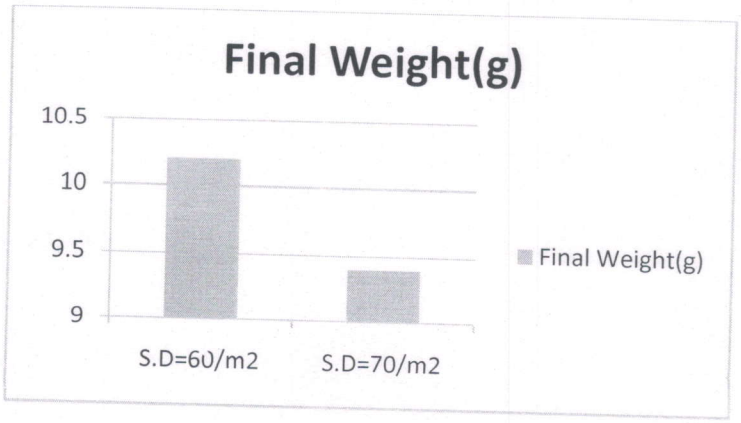
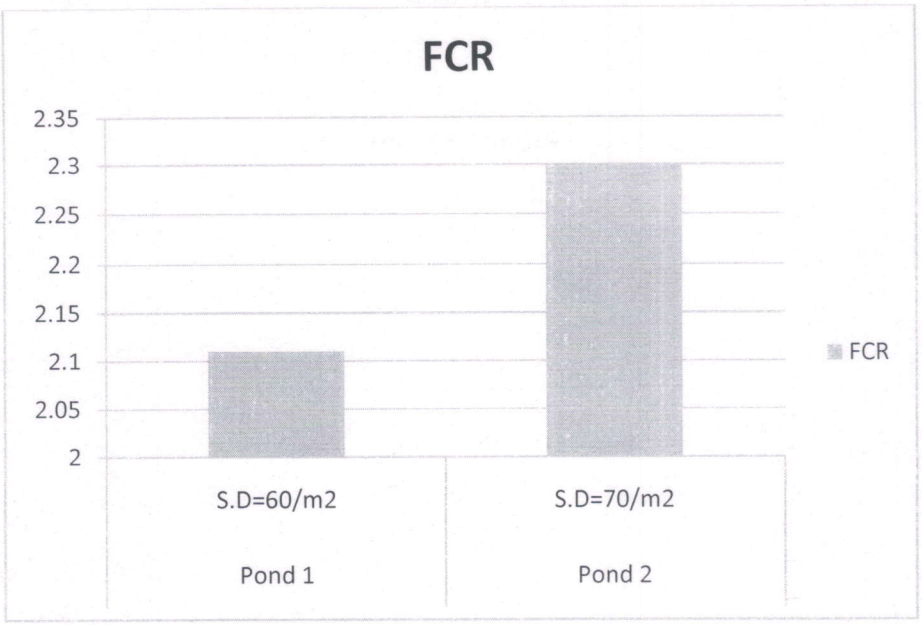


Fig 2: Comparison of FCR Values at two different Stocking Densities



The result of growth calculation was relatively varied between the two treatments. The three parameters taken for investigation showed better in the case of stocking density 60/m^2 when compared with those of stocking density 70/m^2. Wyban *et al.,* (1987) also reported the declined growth and increased yield with increased density in penaeid shrimps. Hanson and Goodwin (1977); Maguire and Leedow (1983) and Allan and Maguire (1992) reported that the growth reduction in shrimp at higher densities attributed to reduction in grazing activity of a pond. Kungvankij and Chua, (1986) and Tidwell *et al.,* (1999) also stated that best economic results were possible at optimum stocking density and that may depend upon the area of the pond, the required harvesting size of the shrimp and the number of crops per year. They also stated that in culture system different stocking densities will be used for different shrimp species. Similar results were observed by Apud *et al.,(*1981); Maguire and Leedow (1983); Sandifer *et al.,* (1987).

Williams et al. (1996) and Davis and Arnold (1998) reported rates of 0.50 to 0.95 g week−1 in seawater. In trials with brackish water and stocking densities of 107 and 100

shrimp m−2, respectively, Samocha et al. (2004) and Sowers and Tomasso (2006) reported very high growth rates (1.17 and 1.23 g week−1, respectively). The weight gain per week obtained in the study is 0.60g/wk and 0.56g/wk. In a study using low salinity, (0.5 ppt) water, VanWyk et al. (1999) reported growth rates of 0.57 and 0.40 g week−1, which are near those observed here. Lower growth rates and higher mortality are to be expected as culture system salinity decreases.

Cultured white shrimp. Van Wyk et al. (1999) reported that salinities less than 0.5 ppt put this species at its physiological limit and cause a large proportion of its energy to be used in osmoregulation, therefore limiting growth and preventing it from reaching commercial sizes. Other studies indicate that growth may depend more on certain required water quality parameters, such as specific concentrations of the main anions and cations: bicarbonate; sulphates; chlorides; calcium; magnesium; potassium; and sodium (Van Wyk et al., 1999; Boyd et al., 2002; Balbi et al., 2005).

Optimum stocking density of quality seed in tune with the infrastructure and carrying capacity of the pond were the critical factors determine the success of shrimp farming. Stocking density and duration of culture determine the production and shrimp size at production (Suresh babu et al., 2014). Stocking at higher densities than the pond carrying capacity would certainly lead to production risks in vannamei shrimp farming.

Conclusion:

Inland culture of marine shrimp will likely continue to expand worldwide, particularly where viable inland low salinity waters are available. Water modification and dietary modification approaches have been explored by researchers and farmers to improve the growth and survival of marine shrimp in low salinity waters as remediation techniques are further refined, better survival, growth and production. There are some dietary additions that

have shown promise in laboratory studies, and future studies should seek to verify these findings in actual pond production trials in low salinity waters.

In conclusion, white shrimp can grow and survive in freshwater (0 ppt) at intensive densities. In this study, at lowest density of 60/m^2, final average weigh of 10.2g could be achieved.

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