International Journal of Fisheries and Aquatic Studies 2013; 1(2):40-44

ISSN: 2347-5129
IJFAS 2013; 1(2):40-44

www.fisheriesjournal.com
Received: 25-10-2013
Accepted: 13-11-2013

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Comparative Growth Analysis of *Litopenaeus Vannamei* in Different Stocking Density at Different Farms of the Kottakudi Estuary, South East Coast of India

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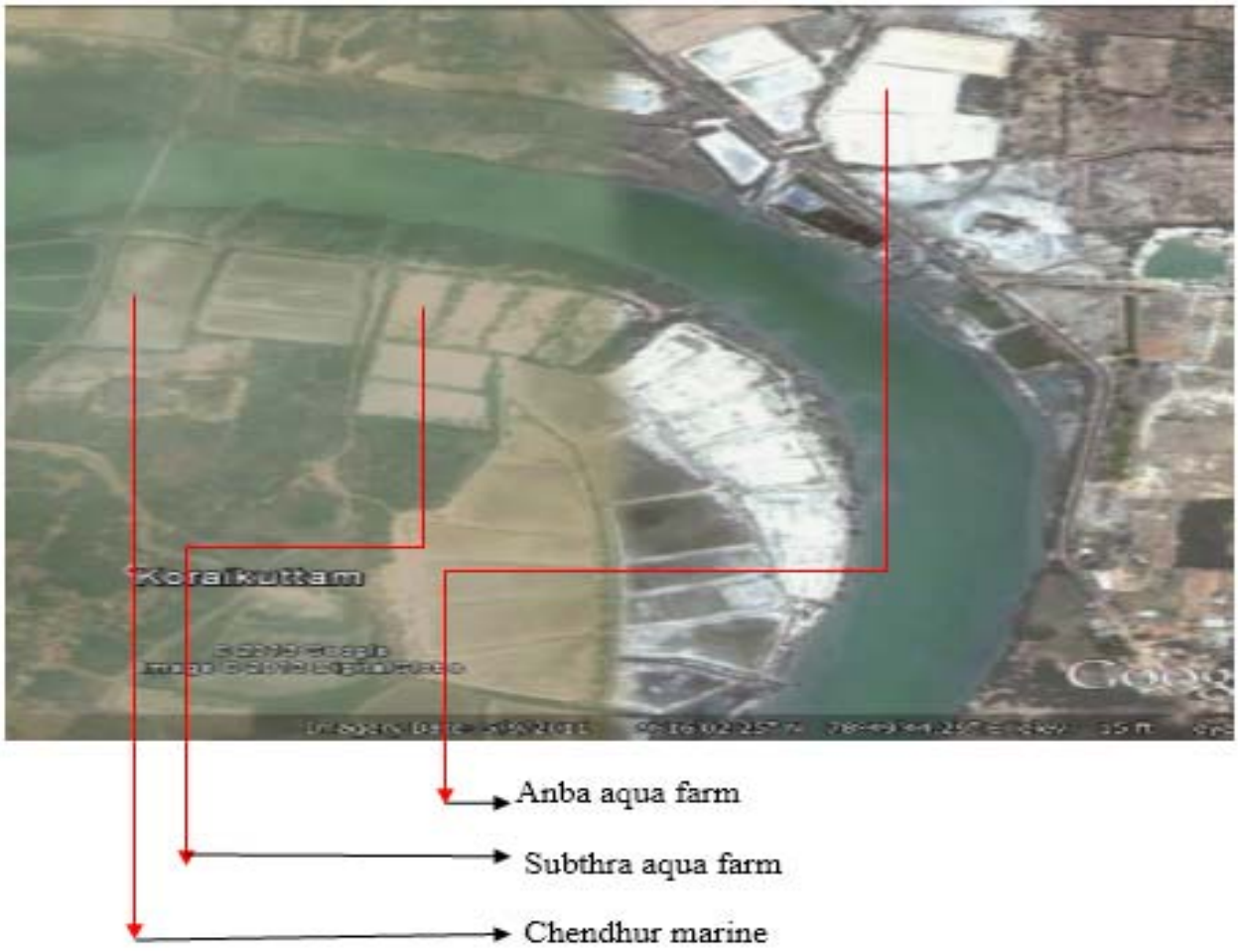
Abstract
Several shrimp species are being cultured in ponds, and one particular species that is gaining popularity in tropical countries is the white shrimp, *Litopenaeus vannamei*. The present study carried out in the Ramanathapuram district, south east coast of India. In the present study average pH recorded during the culture period was from 7.2 to 8.2 in the morning, 7.4 to 8.5 in the evening and the average dissolved oxygen was ranging between 2.3 to 7.0 in the morning and 6.0 to 8.0 ppm recorded in the evening. The temperature was ranged between 28 to 30 ^{0}C in all culture ponds maximum dissolved oxygen level in the evening. The final average body weights gained from the chendhur marine, anba aqua and subathra (35, 24.5 and 19.5 grms) respectively. In these cases, from the three different stocking density 10 m^2 and 35 m^2 shows the better growth.

Keywords: *Litopenaeus vannamei*, Shrimp, Stocking Density, Culture, Farming.

1. Introduction
Aquaculture production has grown tremendously in the past years and is expected to continue during the next few years. Crustacean aquaculture followed the same trend in which its annual production reached almost 5 million tons in 2006 [1]. Penaeid shrimps account for the bulk of production in terms of volume and value of production. Penaeid shrimps are among the preferred crustaceans in aquaculture and proof of this is the vast expanse of land area devoted to shrimp farming [2]. Due to intensive shrimp aquaculture in most parts of the world, this activity has resulted in several problems including higher incidence of disease outbreaks [2], environmental pollution of the waterways [3], over-dependence on the use of fish meal in commercial feeds [4] and low prices due to oversupply in the market [5].Several shrimp species are being cultured in ponds, and one particular species that is gaining popularity in tropical countries is the white shrimp, *Litopenaeus vannamei*. This penaeid shrimp has fast growth rate, thus, its culture period is significantly reduced. It is now evident that *L. vannamei* is farmed and established in several countries in East, Southeast and South Asia and is playing a major significant role in shrimp aquaculture production. There is very limited research works were done on the culture and growth performance of *L. vannamei* with different stocking densities in brackish water ponds in India. So the present study was attempted to evaluate the water quality parameters, survival, and growth of *L. vannamei* culture in the different culture farms with different stocking densities.

2. Materials and methods
The present study was undertaken at a three different shrimp farm (Anba aqua farm, chendhur marine and subthra aqua farm) in Kottakudi estuary, thirupulani, Ramanathapuram, south east coast of India (Fig : 1). The study was conducted in each farm one culture ponds. Three ponds (anba aqua, chendhur marine, subthra aqua) were 0.5 ha in area. A sedimentation pond and a chlorination pond are in the size of 0.6 ha. Water recirculation method followed to avoid cross contamination during the culture period. All the culture ponds were 1.2 – 1.5 m deep. The soil type was sandy clay.

Pond preparation, biosecured method and water culture techniques followed as per [6]. The *L.vannamei* seeds (post larval stage 14, that had been acclimated to a salinity level of 35 ppt and confirmed negative for the white spot syndrome virus (WSSV) by the polymerase chain reaction (PCR assay), were purchased from CP Aquaculture India Private Ltd , hatchery Gudur. The seeds were transported in oxygenated double-layered polythene bags with crushed ice packs between inner and outer covers of the bag to maintain optimum temperature in turn to keep less stress to the shrimps and the entire set up was packed in a carton. The seeds were brought to the farm site and bags were kept in the pond water for some time to adjust the temperature. Then the pond water was added slowly into the seed bag to adjust the salinity and pH. Subsequently the seeds were released slowly in to the ponds. The stocking densities were 35/m², 10/m² and 7/m² for ponds anba aqua, chendhur marine and subthra aqua respectively. Blanca feed pellets (CP Aquaculture India Pvt Ltd) were fed to the stocked post larvae for four times daily at 7am, 10am, 3pm and 9pm respectively. No water exchange was done for the entire culture. But some water from the reservoir was added at regular intervals to compensate water loss due to evaporation or soil seepage.



During harvest all the water from culture ponds drained to sedimentation pond and ultimately reached to reservoir pond. At any account of time the pond water was not pumped out side of the farm as a bio secure measures. From the 30th days of culture (DOC) onwards cast net (sampling) was used every ten days for monitoring shrimp health and growth. The water level was measured by using a standard scale with cm marking. The water quality parameters like salinity, pH, temperature, dissolved oxygen and light transparency were measured by using hand Refractometer, pH pen, thermometer, and dissolved oxygen meter and secchi disc, respectively. Aeration was given to the entire culture period for all ponds. Totally 16 hp aerator was fixed for each culture pond. The aerators were placed in such a way that it could dissolve maximum dissolved oxygen (DO) into the pond water and makes the culture environment friendly.

3. Results

The average pH recorded during the culture period was from 7.2 to 8.2 in the morning, 7.4 to 8.5 in the evening and the average dissolved oxygen was ranging between 2.3 to 7.0 in the morning and 6.0 to 8.0ppm recorded in the evening. The temperature was ranged between 28 to 30 ^{0}C in all culture ponds maximum dissolved oxygen level in the evening. The ammonia level maximum was .3 and minimum .1 was noticed in all culture ponds (Table 1, 2&3).

Table 1: Dissolved oxygen results during the culture period

DOC	Anba (35m2)		Chendhur marine (10m2)		Subthra (7m2)	
	DO		DO		DO	
	AM	PM	AM	PM	AM	PM
10	6.5	7.5	7.0	7.5	6.5	7.5
20	6.5	8.0	7.0	7.5	6.0	7.5
30	6.2	7.2	6.5	7.5	6.0	7.5
40	6.0	7.0	6.2	7.5	5.5	7.0
50	6.0	7.2	6.0	7.0	5.5	6.5
60	5.5	6.8	6.0	7.5	5.0	6.5
70	5.0	6.5	5.5	7.5	4.0	7.0
80	4.8	6.5	5.5	7.5	3.5	6.5
90	4.5	6.3	5.0	7.0	3.0	6.0
100	4.2	6.0	4.8	7.0	2.3	6.0

Table 2: pH results during the culture period

DOC	Anba (35 m^2)		Chendhur marine (10 m^2)		Subthra (7 m^2)	
	pH		pH		pH	
	AM	PM	AM		AM	PM
10	8.0	8.2	8.2	10	8.0	8.2
20	8.0	8.4	8.2	20	8.0	8.4
30	7.8	8.5	8.0	30	7.8	8.5
40	7.7	8.2	8.0	40	7.7	8.2
50	7.6	8.0	8.0	50	7.6	8.0
60	7.5	7.8	7.8	60	7.5	7.8
70	7.2	7.5	7.7	70	7.2	7.5
80	7.2	7.4	7.5	80	7.2	7.4
90	7.3	7.4	7.3	90	7.3	7.4
100	7.4	7.5	7.3	100	7.4	7.5

Table 3: Ammonia results during the culture period

DOC	Anba (35 m^2)	Chendhur marine (10 m^2)	Subthra (7 m^2)
	NH_3	NH_3	NH_3
10	0	0	0
20	0	0	0
30	0	0.1	0.1
40	0.1	0.1	0.2
50	0	0.2	0.2
60	0.12	0.2	0.3
70	0.15	0.1	0.2
80	0.12	0.2	0.1
90	0.25	0.3	0.3
100	0.3	0.2	0.3

The average growth was calculated from 30th doc onwards. The average body weight in anba aqua farm (35m^2) on 30th days of culture 4.5 grms, chendhur marine (10m^2) 6.5 grms and 5.5 grms in subthra aqua farm (7 m^2). The maximum growth was recorded in chendhur marine 35 grms and the minimum growth was recorded 19.5 grams in subthra aqua farm (Fig: 2). The average salinity was recorded in all culture ponds from 35 to 40 ppt. the maximum survival 87% was calculated in the subthra aqua farm and minimum 81% was calculated in the chendhur marine farm. In anba aqua farm 84 % survival was recorded (Fig: 3).

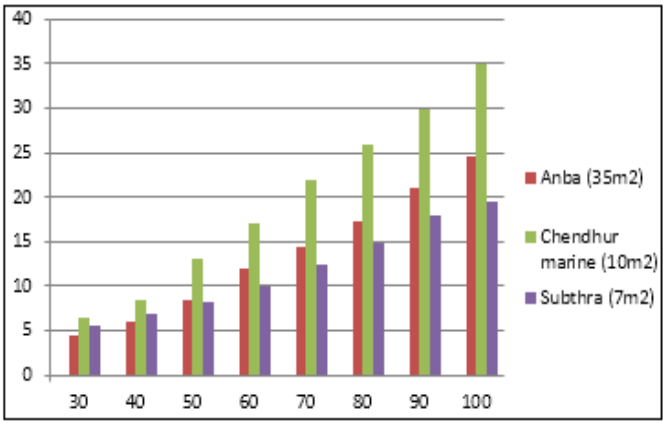


Fig 2: Average body weight during the sampling

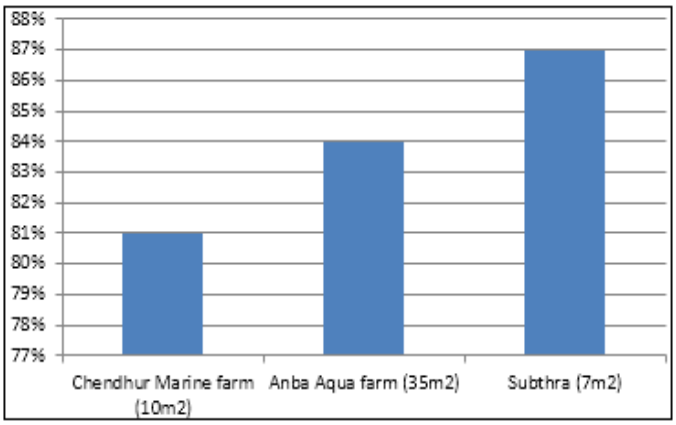


Fig 3: Survival during end of the culture

4. Discussion

This study shows that different stocking density influencing the growth and survival of *L. vannamei* in the brackish water shrimp farm located in the Kottakudi estuary in Thirupulani, Ramanathapuram, south east coast of India. Several authors have reported on the growth and survival of *L. vannamei* stocked in different salinities and densities in culture ponds [7, 8, 9]. In the present study three different farms at three ponds culture was carried out. In all the culture ponds water quality parameters were checked and maintained properly. The maintaining of good water quality is essential for optimum growth and survival of shrimps. The levels of physical, chemical and biological parameters control the quality of culture waters. The level of metabolites in culture water can have an adverse effect on the growth. Good water quality is characterized by adequate oxygen and limited level of metabolities. Excess feed, feacal matter and metabolites will exert tremendous influence on the water quality of the shrimp culture. Hence critical water quality parameters should be monitored carefully as adverse conditions may be disastrous effect on the growing shrimps [10, 11, 12].

The DO content in the water indicates the production capacity of the pond. The initial DO increased over the total duration of nurturing in the range 6.5 – 7.0 mg/l the oxygen production rate by water and the oxygen consumption rate by water decreased in the 3th and 4th months of culture. Sunshine could not penetrate through the depth of water in the pond which might have affected the growth of phytoplankton [13, 14]. The rate of oxygen consumption by shrimps in the pond was related to the body weight of the shrimp and the number of shrimps. When the body weight increased, the rate of oxygen consumption of the shrimps increased. The DO budget of Pacific white shrimp culture in an earthen pond could be a wise way of predicting estimates of the amount of oxygen in an aquaculture system as it is essential, basic knowledge for the successful management of an intensive aquaculture system. Moreover, farmers could apply this technique to improve and manage their aquaculture systems in order to increase production [14].

pH and ammonia values remained below the respective safety levels for shrimp culture (7.2 to 8.5, 0.13 respectively) [15,16,17]. This confirms the importance of the micro biota adhered to the submerged surfaces, which used the dissolved and particulate nutrients present in the water column and in the sediments for their growth and development.

The best final average body weights gained from the chendhur marine, anba aqua and subathra (35,24.5 and 19.5 grms) respectively. In these cases, from the three different stocking density 10 and 35 m^2 shows the better growth result. So always minimum or optimum stocking density plays a major role the better growth of *L. vannamei* (Gunalan et al., 2011). For better growth and culture promote nutrient recycling, provided sufficient food for the cultured organisms, eliminated the cost of formulated feed and water exchanges and was, at the same time, environmentally friendly because it minimized the environmental impact of nutrient-loaded effluents.

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