ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 5, Issue, 02, pp.298-302, February, 2013

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

Comparison of Physico- chemical parameters from two different shrimp ponds (special reference with *Penaeus monodon* and *Litopenaeus vannamei*) along the south east coast of Tamilnadu

Karuppasamy A., *Mathivanan V. and Selvisabhanayakam

Department of Zoology, Annamalai University, Annamalai Nagar - 608 002, Tamil Nadu, India

ARTICLE INFO

Article History:
Received 16th November, 2012
Received in revised form
25th December, 2012
Accepted 30th January, 2013
Published online 14th February, 2013

Key words:
Shrimp, *P.monodon,*
L.vannamei, water quality,
Green colony,
Yellow colony.

ABSTRACT

Shrimp culture in ponds has been one of the major sources of livelihoods for the fish farmers whereas shrimp disease is the most serious problem that the farmers have been facing. Although shrimp farming has been quite successful and the technology has continually improved, it has caused some environmental damage such as eutrophication, sedimentation in coastal area, chemical bioaccumulation in waterborne and deleterious pond bottom soil. In the present study fluctuation of pH ratio was between 7.9 and 8.8 in the early morning, while fluctuation of pH value was between 8.0 and 8.4 in the station 1 and 7.5 to 8.2 in the station 2. In station 1 DO values fluctuated varied between 5.5 mg/l and 3.5 mg/l in the morning and between 5.5 mg/l to 6.5 mg/l in the evening and in the station 2 DO values vary from 2.7 to 5.5 in the morning and 5.0 to 7.0 mg/l in the evening. The high survival rate was recorded in station 2 (70%) and the low survival was recorded in station 1 (70%). Maximum production was station 1 and 2 was 31grm, 37grms respectively. The highest microbial load recorded in the station 1 was 150 and station 2 was 80. The present study confirming that, if we maintain the microbial population and water quality parameters in proper way, definitely famers can achieve their production and profit.

INTRODUCTION

Shrimp farming is one of the fastest growing components of the global aquaculture industry. Capture fisheries and aquaculture supplied the world with about 106 million tons of food fish in 2004. Of this total, aquaculture accounted for 43 percent. There is an increasing demand for seafood in international market and will continue to grow in future. In India, commercial shrimp farming started gaining roots only during the mid-eighties. It was a relatively late start in India; by this time, shrimp farming had reached peak in most of the neighboring Asian countries, especially China and Taiwan. It offers farmed shrimp amounted to about 712,000 metric ton in 1995, which accounted about 27% of total shrimp production from both wild-caught and farm-raised sources. Most of farmed shrimp production is in Asia (78%) with Black tiger shrimp (*Penaeus monodon*) was the most important culture species, accounting for 58% of cultured shrimp production, followed by western white shrimp (*Litopenaeus vannamei*) at 20% (Rosenberry, 1995).

Shrimp culture in ponds has been one of the major sources of livelihoods for the fish farmers whereas shrimp disease is the most serious problem that the farmers have been facing. Although shrimp farming has been quite successful and the technology has continually improved, it has caused some environmental damage such as eutrophication, sedimentation in coastal area, chemical bioaccumulation in waterborne and deleterious pond bottom soil. In recent year, misleading expansion and over exploitation environment resource has declined shrimp production due to disease's outbreak and pollution. Despite of severe problems rose in shrimp farming industry, the world demand relatively high which draw high attention the sustainable aquaculture system for recovering production. Sustainable aquaculture system requires consideration of environmental soundness, economic return that contributes the marginal rate for investment (Farok Afero, 2005). Pacific white shrimp (*Litopenaeus vannamei*) most interest species and intensively cultured in almost area, offers low production cost and high culture output. The species is stocked in higher density, fed by low protein content stuff and growth rate faster than species of *P. monodon*. In addition, Pacific white shrimp (*L. vannamei*) is more harvested in medium and smaller count due competitive price. On the other hand, the big size *P .monodon* has higher price but the smaller count bound to suffer as it prices are destined to be uncompetitive in market. These results indicated that *L. vannamei* most suitable alternative species would be selected to increase additional revenue in shrimp polyculture.

Therefore, the present study Comparing of Physico- chemical parameters from Black tiger shrimp (*P. monodon*) and Pacific white shrimp (*L. vannamei*) culture ponds. This study could evaluate the optimum water quality performance and better growth feasibility in the shrimp ponds. The information from this study will provide the insights for assessing the relative production efficiency and competitive advantage.

MATERIAL AND METHODS

The present study was undertaken at a shrimp farm in Karankadu (Station 1) and Uppoor (station 2), located in Ramnad district, Tamilnadu, India (Fig1&2). The study was conducted in two pond in both the stations. In both station one pond act as reserviour pond. The size of the reserviour pond is .8ha. The culture pond size is .6ha, 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 experimental ponds were 1.0 – 1.2m deep. The soil type was sandy clay. Ponds were initially prepared by drying, tilting (to remove the pests and predators and oxidize bottom

***Corresponding author:** veeramathiau@yahoo.co.in, suryabionutrients@yahoo.com

soil) and liming to correct the pH of the soil. Inorganic fertilizers such as urea and triple superphosphate were applied to enrich the natural food organisms in the water. For the station 1 & 2, all Biosecurity and precautionary measure was followed (Gunalan Balakrishnan *et al*., 2011). Before pumping filter bags were checked properly, which was fitted in the inlet and outlet pipe, then the pumping was done to the entire ponds. After filling water kept stand one day without any disturbance for sedimentation. Subsequently the water was chlorinated (60 ppm/ha) after that excess chlorine was neutralized by dechlorination process which took 72 hours. After dechlorination, the water enriched with probiotic for the good beneficial bacterial environment. The algal bloom was noticed slowly in the ponds (Gunalan *et a.,l* 2011).

The *L.vannamei and P.monodon* 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) and Taura syndrome virus(TSV) 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 25/ m², for station 1(*P.monodon* seeds) and station 2(*L.vannamei* seeds) respectively.

Irawan shrimp feed (station-1) and Blanca feed pellets(station-2) (CP Aquaculture India Pvt Ltd) were fed to the stocked post larvae for four times daily at 7am, 11am, 5pm and 10pm respectively. No water exchange was done for the entire culture period. 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.
Cast net was used to measure the growth rate of shrimp. The first sampling was taken after 40th day of culture and the number of individuals and the average body weight were recorded in each sampling. The sampling was done regularly for every ten days until harvest. 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. Temperature was measured using a standard centigrade thermometer and pH was measured using Elico pH meter (Model LC-120). Salinity was estimated with the help of a refractometer (Atago, Japan) and dissolved oxygen was estimated by the modified Winkler's method (Strickland and Parsons 1972) and is expressed as mg L-1. The ammonia and the nutrients of the water samples were estimated by adopting standard procedure as described by Strickland and Parson (1972).

Microbiological Analysis

For microbial analysis, the water and sediment samples were collected separately from different parts of the ponds in sterile conical flask and were mixed to make a single sample.

Fig.1. Station-1 Star aqua farm – karankadu (source: www.earthgoogle.com)

Fig:2 Station-2 Golden aqua farm – Uppoor (source: www.earthgoogle.com)

This procedure was repeated for every pond and the final samples were brought to the laboratory immediately and were analyzed for microbial counts.

Table: 1 Composition of Dobell marine agar medium

Composition	Amount (g)
Peptone	5.0
Yeast extract	1.0
K2 HPO4	0.5
Feso4	Trace
Agar	15
50% seawater	1000ml
pH	7.2

It was then transferred to a sterile conical flask (150-ml) containing 99ml of sterile diluents and serial dilution was performed to get 101, 102, 103, 104 and 105 suspension samples. For enumeration of Total Heterotrophic Bacteria (THB), Zobell marine agar medium (Hi-media, Mumbai) was used (Table 1). For enumeration of *Vibrio* spp TCBS media was obtained from Hi-media, Mumbai.

Isolation and Enumeration

Enumeration of the microbes was done by adopting spread plate method. In this method, sterile media were poured into Petri dishes aseptically and allowed to solidify. One milliliter of serially diluted sample was pipette out into sterile Petri dish. It was made spread in the plate first by rotating it in clockwise and then anticlockwise directions for three times and then spread with the help of a 'L'-rod. The plates were incubated in an inverted position at 28±2°C. After the incubation period of 2 to 3 days, the colonies were counted. The plates were examined and the number of colonies per plate. The microbial load in the given sample was calculated using the following formula and it is expressed as Colony Forming Units (CFU) per gram of the sample.

Total microbial load in the given sample (CFU/g) =

$$\frac{\text{Total number of colonies}}{\text{Samples of volume plated (0.1) X Dilution}}$$

RESULTS

Water quality analyses for the culture ponds are summarized in Tables 2&3. Pond water Temperature and DO readings are recorded in early mornings (AM) and late evenings (PM). For the both stations, fluctuation of pH reading was between 7.9 and 8.8 in the early morning, while fluctuation of pH value was between 8.0 and 8.4 in the station 1 and 7.5 to 8.2 in the station 2. In station 1 DO values fluctuated varied between 5.5 mg/l and 3.5 mg/l in the morning and between 5.5 mg/l to 6.5 mg/l in the evening and in the station 2 DO values vary from 2.7 to 5.5 in the morning and 5.0 to 7.0 mg/l in the evening (Table 2 & 3 ; Fig.4 & 5). In general, AM readings became lower as the cycle progressed and the standing crop increased. During the culture period the maximum salinity was recorded 40ppt in station 1 and 52ppt recorded in the station 2(Fig .3) The high survival rate was recorded in station 2 (70%) and the low survival was recorded in station 1 (70%). Maximum production was station 1 and 2 was 31grm, 37grms respectively. The highest microbial load recorded in the station 1 was 150 and station 2 was 80 (Table 2&3).

DISCUSSION

There has been considerable increase in the culture of brackish water shrimp due to its taste, market demand both national and international markets. In order to prevent many problems due to shrimp culture, sustainable shrimp farming is need of the hour. Even though shrimps are bottom dwelling organisms, the depth and volume of water in a pond has certain physical and biological consequences (Soundarapandian and Gunalan, 2008). The volume of water behaves like a buffer, which prevents weather fluctuations from influencing the environment in which shrimp lives. The ideal water depth is between 0.8 to 1.5 m depending upon the stage of culture. It is recommended that a minimum depth of 1 m will be maintained at operational level. In the present study 100 to 120 cm water level was maintained in both stations up to the end of the culture period. pH is one of the vital environmental characteristics, which decides the survival and growth of shrimp culture; it also affects the metabolism and other physiological process of shrimps. The optimum range of pH 6.8 to 8.7 should be maintained for maximum growth and production (Ramanathan *et al*., 2005, Liao and Murai, 1986, Chanratchakool *et al*., 1995).

Table 2. Water quality parameters of station 1 (*P.monodon*)

STOCKING DATE : 1/7/12 ; POND AREA .6ha ; DENSITY : 25/m^2 ; SURVIVAL : 70% HARVESTED BIOMASS : 3255 Kg							STAR AQUAFARM KARANKADU-RAMANATHAPURAM				
DOC	40	50	60	70	80	90	110	120	135	145	155
ABW	3.5	5.5	8	9.5	12	14	16.5	18.5	22	26	31
ADG		0.25	0.25	0.15	0.25	0.2	0.25	0.2	0.35	0.4	0.4
SALINITY	35	35	36	38	38	38	38	40	40	36	35
TEMPERATURE (AM)	28	28	25	30	30	30	30	28	28	28	30
TEMPERATURE (PM)	32	32	32	32	30	32	32	32	32	32	32
pH	8.2	8.2	8.4	8.4	8.4	8.3	8.3	8.2	8.2	8.2	8
NH3	0	0	0	0	0	0	0	0	0.1	0.1	0.1
DO (Early morning)	5.5	5.0	4.5	4.5	4.5	4.0	4.0	4.0	4.0	3.5	3.5
DO (Evening)	6.5	6.5	6.0	6.5	6.0	6.0	6.0	5.5	5.5	5.5	5.8
YELLOW COLONIES	150	150	150	140	120	160	150	110	100	120	100
GREEN COLONIES	65	100	60	80	80	60	20	60	80	60	150

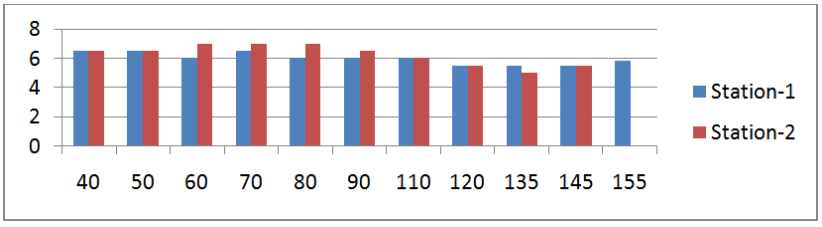

Fig.3. comparative salinity ratio in station1 and 2

Table 3. Water quality parameters of station 2 (*L.vannamei*)

STOCKING DATE : 1/7/12 ; POND AREA .6ha ; DENSITY : 25/m^2 ; SURVIVAL : 83% HARVESTED BIOMASS : 4606.50 Kg							GOLDEN AQUAFARM UPPOOR-RAMANATHAPURAM			
DOC	40	50	60	70	80	90	100	120	135	145
ABW	6.5	8	10	12.5	15	18	22	27	32	37
ADG		0.17	0.2	0.25	0.25	0.3	0.4	0.5	0.5	0.5
SALINITY	40	45	48	48	50	52	50	50	48	45
TEMPERATURE (AM)	28	28	25	30	30	30	30	28	28	30
TEMPERATURE(PM)	32	32	32	32	30	32	32	32	30	32
pH	8.2	8.2	8	8	8	7.8	7.8	7.8	7.5	7.5
NH3	0	0	0	0	0	0.15	0.25	0.2	0.1	0.12
DO (Early morning))	5.5	5.5	5.0	5.0	5.0	4.0	4.0	4.0	3.0	2.7
DO (Evening)	6.5	6.5	7.0	7.0	7.0	6.5	6.0	5.5	5.0	5.5
YELLOW COLONIES	140	160	140	140	120	110	160	170	120	120
GREEN COLONIES	80	80	60	60	60	40	40	40	60	60

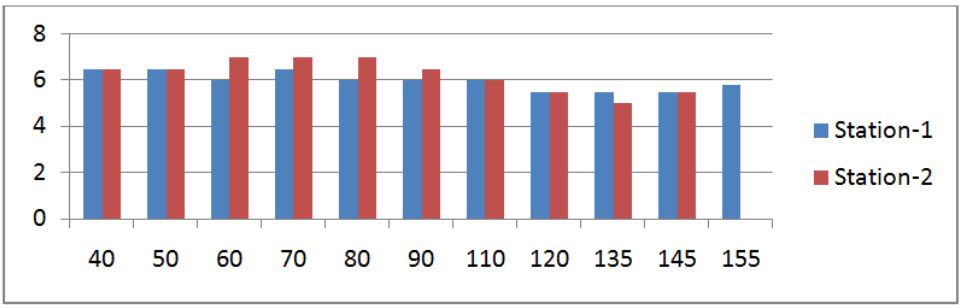

Fig.4. Comparative DO (early morning) ratio in station 1 and 2

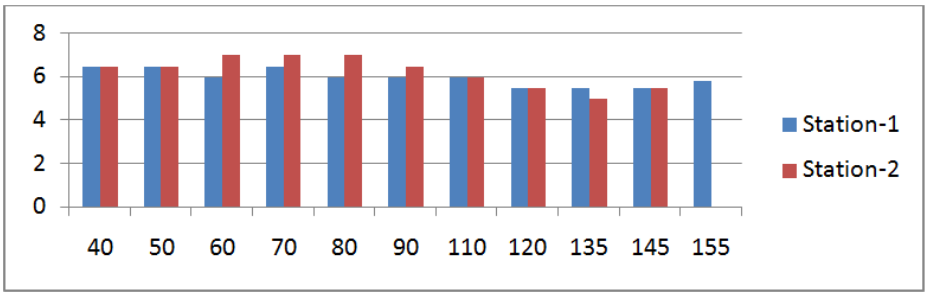

Fig.5. Comzparative DO (evening) ratio in station1 and 2

The pH recorded during the culture period from station 1 was 8 to 8.4 and station 2 it was 7.5 to 8.2. Dissolved oxygen plays an important role on growth and production through its direct effect on feed consumption and maturation. Oxygen affects the solubility and availability of many nutrients. Low level of dissolved oxygen can cause damages in oxidation state of substances from the oxidized to the reduced form. Lack of dissolved oxygen can be directly harmful to shrimp and cause a substantial increase in the level of toxic metabolites. Low level of oxygen tension hampers metabolic performances in shrimp and can reduce growth and molting and cause mortality (Gilles Le Moullac, 2000, Yung, 1990). The dissolved oxygen recorded during the culture period was ranging between station 1 was from 3.5 to 5.5 mg/l in the morning, 5.5 to 6.5 mg/l in the evening and station 2 it was from 2.7 to 5.5 mg/l in the morning 5.0 to 7.0 mg/l and in the evening from 3.1 to 4.2 mg/l . The microbial population was evident from the presence of higher load of green colony in the station 1. The occurrence of green colony in the ponds was concluded by presence of luminescence in the night time and occurrence of dead animals in the check tray. Maximum population of yellow colony was recorded in the station 2. Salinity is important parameters to control growth and survival of shrimps. At high salinity the shrimps will grow slowly but they are healthy and resistance to diseases. If the salinity is low the shell will be weak and prone diseases. The salinity of the present study in the station 1 was 35 to 40ppt and station 2 was showing high 40 to 52ppt. even through in high salinity the survival and growth is not affected the white leg shrimp growth in station 2. The present study confirming that, if we maintain the microbial population and water quality parameters in proper way, definitely famers can achieve their production and profit.

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