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Sustainable Culture method of Giant Black Tiger Shrimp, *Penaeus Monodon* (Fabricius) in Andhra Pradesh, India

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Abstract: *The culture of shrimp received maximum importance due to its unique taste, high nutritive value and persistent demand in world market. In the present study an attempt has been made to culture the giant tiger shrimp, P. monodon. The salinity of the culture pond was ranging between 26-30 ppt and pH was 7.8 to 8.2. Minimum 4.5 ppm dissolved oxygen and maximum 5.5 ppm was recorded during the culture period. The temperature was ranging between 28 to 30°C and the transparency was 38 to 55 cm. The culture was done for 140 days and the average body weight of the harvested animals is 40.2 g. The total production was 2,563 kg and the survival rate was 85%. The FCR was 1.25 and the net profit was calculated as Rs. 3, 25,037. So it is confirmed that 10 m^2 is an ideal stocking density for the culture of P. monodon as evidenced from the net profit Rs. 3, 25,0371. To get this profit, proper water quality management and feed management is essential.*
Key words: *Penaeus monodon; fertilizers; growth; survival; FCR; profit*

I. Introduction

In India, shrimp culture has grown by leaps and bounds and the industry generated huge revenue in terms of foreign exchange, lot of employment and uplifted the living standards of many people involved directly or indirectly with the industry and reduction of over exploitation of natural resources and food security in tropical and sub-tropical regions (Ramanathan *et al*., 2005). In general, the knowledge on suitable feeds which support on growth is lacking. It would be highly desirable to develop an efficient feed to improve the profitability. In India, at least 10 potential Penaeid species are available for the coastal aquaculture. However, *Penaeus monodon* is the only one best species cultured and it constitutes about 95 to 99% of total farmed shrimp production of the country. There is no doubt about the suitability of *P.monodon* for farming as a candidate species with highest growth rate and high market value. The culture of shrimp received maximum importance due to its unique taste, high nutritive value and persistent demand n world market. In India, aquaculture industry is growing at alarming rates surprising some major hurdles (disease outbreak and pollution) during its development. The higher stocking densities and poor water quality management might be the reasons for disease outbreak. So sustainable shrimp farming is need of the hour to overcome the above said problem. In the present study, sustainable shrimp farming was practiced in a pond at Kikaluru, Andhra Pradesh, India.

II. Material And Methods

The pond selected for the present study was located in Kikaluru, Andhra Pradesh, India. Initially the pond of the present study was allowed to dry and crack to increase the capacity of oxidation of hydrogen sulphide and to eliminate the fish eggs, crab larvae and other unwanted predators. Then pond bottom was scrapped 2-4 cm by using tractor blade to avoid topsoil. Subsequently the pond bottom was ploughed horizontally and vertically a depth of 30 cm to remove the obnoxiuous gases, oxygenate the bottom soil, discolouration of the black soil to remove the hydrogen sulphide odour and to increase the fertility. The soil pH was recorded in the pond with the help of cone type pH meter. The pH of the pond water was measured by using electronic pH pen manufactured by Hanna Instrumental Company, Japan. Water temperature was measured in the pond itself using a standard centigrade thermometer. The dissolved oxygen was estimated by dissolved oxygen meter. Transparency was measured in terms of light penetration using a secchi disc. During the first 3-4 weeks of culture, water exchange is not required. Water was exchanged five days once or depends upon the water and shrimp quality. The purpose of water exchange is to maintaining water quality and also to stimulate moulting of the shrimp, resulting in acceleration of growth and production. Feed management plays a major role in the shrimp culture. Godrej feed (Godrej Agro Vet feeds, Vijayawada) was used during the entire cycle, distributed manually by using of boat. During the first month after stocking, feeding rates were based on estimated survival and feeding tables and distributed four times per day. After 40^{th} DOC, daily rations were adjusted using feed trays and increased to five times per day thereafter. The use of feed trays is extremely important in the control of feeding. They provide information regarding the feed consumption, the health and

survival of the shrimp and also the condition of the pond bottom. It is also necessary to use a lift net to find out if the amount of feed is given properly. If the shrimp not consumed all the feed within the given time, we have to reduce the feed to prevent over feeding. Left over feed can cause the pond bottom to decay and water becomes deteriorated easily, the shrimp will be weak and stressed. They will also avoid feeding and easily get sick and eventually die. During sample time a cast net was used for capture and measures the growth rate of shrimps. The first sampling was taken after 40^{th} days of culture and number of individuals and the average body weights were recorded in each sampling. Five hauls were made in randomly selected areas of each pond. Healthiness, survival rate, Average Body weight (ABW) of the animals was estimated. Sampling was regularly performed every ten days until harvest. At the harvesting period a bag net was fitted on outlet canal with a 20 numbers mesh of width 1m and length of 4 m. The water level in the ponds was reduced from 1m to 60 cm and then out let was opened and shrimp were caught and collected. During the culture period four different typed of lime was applied for marinating the pH and algal bloom (Table.3)

III. Results

Water quality parameters are shown in Table 1. The salinity was ranged between 24-30 ppt during the culture period. The average pH was between 7.8 to 8.2 during the culture. The dissolved oxygen was recorded maximum 5.2 ppm and minimum 4.2 ppm. The temperature of the water was ranged between 26 to 30°C during entire culture period. It ranges from 38 to 55 cm during the culture period. The culture was done for 140 days and the average body weight of the harvested animals is 40.2 g (Table 4). The total production was 2,563 kg and the survival rate was 85%. The FCR was 1.25 and the net profit was calculated as Rs. 3, 25,037.00/ (Table 5).

Table 1: Water quality parameters in culture ponds (both low and high density stocking ponds)

Parameter	Range
Temperature (oC)	26 to 30
Salinity (ppt)	12 to 28
pH (ppm)	7.6 to 8.2
Dissolved oxygen (ppm)	4.5 to 5.5
Transparency (cm)	38 to 55
Ammonia	0.1 to 0.3

Table 2: Amount of organic and inorganic fertilizers applied during the culture pond

Type of fertilizer	Dosage (Kg/ha)
Organic fertilizers	
Rice bran	12
Ground nut oil cake	10
Cow dung (dry).	10
Yeast	0.3
Inorganic fertilizers	
Urea	8
Super Phosphate	5.5

Table 3: Different types of lime applied in the culture pond during the culture period

Type of lime	Dosage (Kg/ha)	Chemical formula
Calcium carbonate	160	$CaCo_3$ (Agricultural Lime)
Calcium Magnesium carbonate	160	Ca Mg $(Co_3)_2$- Dolomite
Calcium oxide	80	Ca O
Calcium hydroxide	80	$Ca(OH)_2$

Table 4: Average weight (g) of *P.monodon* in low and high density stocking ponds

Date of culture (DOC)	Average Weight (g)
40	7.5
50	11.5
60	13.2
70	15.6
80	19.2
90	22.4
100	28.5
110	31.4
120	32.6
130	37.5
140	40.5

Table 5: Economical aspects of *P.monodon* culture

Particulars	Harvest details
Stocking density/m^2	10
Age of the Post larvae (PL)	PL-20
Initial stocking density	**75,000**
Culture Period (days)	140
Average body weight (g)	40.2
Total Production (Kg)	**2,562.75**
Survival (%)	85
Feed intake (kg)	3,200
FCR	**1.25**
Total Chemical cost (Rs)	8,200
Total Operational cost (Rs)	2,45,000
Material cost (Rs)	5,75,000
Net Profit (Rs)	**3,25,037**

IV. Discussion

There has been a 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 the need of the hour. When a pond is ready for operation, the optimum stocking density of seeds in a pond determined in accordance with the production capacity of the pond and the culture system, which included the soil and water quality, food availability and seasonal variations, target production and farmers experience. The stocking density between 10-20 PLs/m^2 is ideal for successful shrimp farms [Ramanadhan *et al.,* 2005]. In the present study the seeds were stocked at the stocking density of 10/m^2. The maintenance 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 pond waters. The level of metabolites in pond water can have an adverse effect on the growth. Good water quality is characterized by adequate oxygen and limited level of metabolites. Excess feed, faecal matter and metabolites will exert tremendous influence on the water oxygen in all the culture ponds in the present study was quality of the shrimp ponds. Hence critical water quality parameters are to be monitored carefully as adverse conditions may be disastrous effect on the growing shrimps [Ramanadhan *et al.,* 2005]. Salinity is important parameters to control growth and survival of shrimps. Even though *P. monodon* is euryhaline animals it is comfortable when exposed to optimum salinity. 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 to diseases. The salinity of the present study was maintained 24-30 ppt in the culture pond. Muthu [1980] and Karthikeyan [1994] recommended a salinity range of 10-35 ppt was ideal for *P.*

monodon culture. While Chanratchakool *et al.* [1994] maintained the salinity of 10-30 ppt and 15-20 ppt respectively. Chen [1985] opined that salinity ranges of 15-20 ppt are optimal for culture of *P.monodon*. There are few reports [8-10], which stated that *P. monodon* adapted quite well in freshwater conditions also because of its wide range of salinity tolerance. pH is one of the vital environmental characteristics, which decides the survival and growth of shrimp under 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 [Ramanadhan *et al.*, 2005]. In the present study pH was ranging between 7.8 to 8.2 for the culture pond. Saha *et al*. [1999] noticed the pH of 8.11 to 8.67 in low saline ponds. Ramakrishnareddy [2000] was recommended pH of 7.5 to 8.5 for *P.monodon* culture. The pH of pond water is influenced by many factors, including pH of source waters and acidity of bottom soil and shrimp culture inputs and biological activity. The most common cause of low pH in water is acidic bottom soil, liming can be used to reduce soil acidity. In most common cause of high pH is high rate of photosynthesis by dense phytoplankton blooms. When pH is high water exchange will be better choice [Boyd, 2001]. 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 levels 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 shrimps 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 moulting and cause mortality [Gilles Le Molluae, 2001]. The dissolved ranging between 4.2 to 5.2 ppm. Water temperature is probably the most important environmental variables in shrimp cultures, because it directly affects metabolism, oxygen consumption, growth, moulting and survival. In general, a sudden change of temperature affects the shrimp immune system. The optimum range of temperature for the black tiger shrimp is between 28 to 30°C [Ramanadhan *et al.*, 2005]. The temperature in the present study was 26 to 30°C and the low temperature 25°C was observed due to cloudy weather. The optimum range of temperature of *P. monodon* was between 26 to 33°C [Ramanadhan *et al.*, 2005, Soundarapandian and Gunalan, 2008] and temperature range of 28 to 33°C supports normal growth [MPEDA, 2006] as observed in the present study. The transparency is mainly depends on the presence of phytoplankton. The secchi disc reading should be between 30-40 cm [MPEDA, 2006]. The optimum range of secchi disc reading is between 30 to 60 cm to the juvenile stage and between 25 to 40 cm to the sub adult and final stage. The transparency of the present study is 38 to 55 cm. Ramakrishnareddy [2000] also observed similar transparencies (35-50 cm) for his study. The reading less than 30 cm mean that the phytoplankton density is high. If it is more than 40 cm indicates, low population of phytoplankton. For the growth of phytoplankton adequate quality of sunlight is needed. Due to low intensity of light during the culture period, the plankton bloom was less. Hence, the transparency was more. Feed is one of the essential inputs in shrimp production and increase profits. Feed management is highly subjective, as feed consumption cannot be directly observed. The amount of feed was given to the culture pond was 3,200 Kg and the FCR was calculated as 1.25. Average Indian cultured food conversion ratios were varying between 1.5 to 1.75 [Paul raj, 1999]. Chekati [1995] observed the food conversion ranges were varying from 1.50 to 1.55 when microencapsulated diets are used. Saha *et al.* [1999] observed that the food conversion ratios of 1.31 to 1.58 in low saline ponds and 1.35 and 1.68 in high saline ponds. Ramakrishnareddy [2000] observed FCR of 1.58 for his study. In the present study, the survival rate was 85%. Krantz and Norris [1975] stated that survival rates of 60 to 80% are to be expected for *P. monodon* under suitable rearing conditions. It was achieved because the stocking density of 50,000 to 80,000 Pls/ha. In the present study also totally 75,000PLs were stocked for each pond. Ramakrishnareddy [2000] got 76% survival and average body weight of 35.22 g. According to him 70-80% survival is possible if the idle conditions are maintained for *P. monodon*. In the present study the average body weight of the shrimps were calculated as 40.2 g. The size of culture shrimps, market price and shrimp moulting percentage of shrimps plays vital role in fixing the harvesting. So timely harvest is very essential in aquaculture system. The total production for the present study was 2,563 kg. so it is confirmed that 10/m2 is an ideal stocking density for the culture of P.monodon as evidenced from the net profit Rs. 325 0.7. To get this profit, proper water quality management and feed is essential.

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References

[1] Boyd, C. E. 2001. Water quality standards: pH. The advocate, pp: 18.
[2] Chanratchkool, P., J.F. Turunbull and C. Limsunean,1994. Health management in Shrimp ponds. Aquatic Health Research Institute, Department of Fisheries, Kasetasart University, Bankok, pp: 91.
[3] Cheekait, N. G. 1995. Micro-encapsulation application in aquaculture. Aqua International, pp: 28-29.
[4] Chen, H.C., 1985. Water quality criteria for farming the grass shrimp, *Penaeus monodon* in: *Proceedings of the fist International conference on culture of Penaid prawns/ shrimps*, edited by Y, Take, J.H. Primavera and J.A. Liobrea, pp: 165.

[5] Collins, A. and B. Russell, 2003. Inland Prawn farming trail in Australia. Pond study tests *Penaeus monodon* performance in low salinity ground water. Global aquaculture advocate, pp: 74-75.
[6] Gilles Le Molluae, 2001. Enviromenatl factors affect immune response and resistance in Crustacesns. The advocate, pp: 99.
[7] Karthikean, J., 1994. Aquaculture (Shrimp farming) its influence on environment. Technical paper submitted pp: 28-29. to the seminar 'Our Environment-Its challenges to development projects'. 9-10 September 1994. American Society of Civil Engineers, Culcutta, India.
[8] Krantz, G. C. and J. Norris, 1975. Proceedings of 6th Annual World workshop, Maricualture Society, Seattle, Washington, 27-31, January, 6: 48-51.
[9] MPEDA, 2006. Media campaign on 'Welfare schemes of Central Government" Gopichettipalayam on 27 and 28 January.
[10] Muthu, M.S., 1980. Site selection and type of farms for coastal aquaculture of prawns. *Proceedings of the of Symposium on shrimp farming*, Bombay, 16-18. August, Marine Products Export Development Authority, pp: 97-106.
[11] Paul raj, B. B. 1999. Eco-friendly feed and management system for sustainable shrimp culture. Fisheries World, pp: 13-17.
[12] Ramakrishnareddy, 2000. Culture of the tiger shrimp *Penaeus monodon* (Fabricus) in low saline waters. M.Sc., dissertation, Annamalai University, pp: 31.
[13] Ramanathan, N., P. Padmavathy, T. Francis, S. Athithian and N. Selvaranjitham, 2005. Manual on polyculture of tiger shrimp and carps in freshwater. Tamil Nadu Veterinary and Animal Sciences University, Fisheries College and Research Institute, Thothukudi, pp: 1-161.
[14] Saha, S.B., C. Bhattacharyya and A. Choudhury, 1999. Preliminary observations on culture of Penaeus monodon in low saline waters. Naga. 22(10): 30-33.
[15] Shivappa, R.B. and J.B. Hamrey, 1997. Tiger shrimp culture in freshwater. *Ifo fish International* 4/97: 32-36.
[16] Soundarapandian, P. and B. Gunalan, 2008. Recent technology for the survival and production of giant tiger shrimp *Penaeus monodon* along South East Coast of India. Int. J. Zool. Res., 4 (1): 21-27.