-African Journal of Basic & Applied Sciences 2 (3-4): 124-127, 2010
ISSN 2079-2034

Determine the Economic Feasibility of the Polyculture System (Giant Tiger Shrimp and Mullet)

[1]S. Kotiya Anil, [2]B. Gunalan, [3]K.L. Jetani, [4]G. Kuldeep Trivedi and [5]P. Soundarapandian

[1]Asst Research Scientist, Fisheries Research Station, J.A.U. Okha
[2,5]Faculty of Marine Science, Centre of Advanced Study in Marine Biology,
Annamalai University, Parangiettai-608 502 TamilNadu, India
[3]Research officer, Fisheries Research Station, J.A.U. Okha
[4]S.R.F. Fisheries Research Station, J.A.U. Okha

Abstract: Aquatic plants and commercial species such as rabbit fish, mullet, grass carp and clam are good candidates for polyculture. Mullet is a filter feeder, which usually swims near the top of the water in school and eats the scum of the water surface. Mullet can thrive in both fresh and saltwater. The present experiment was carried in the month of 24th May 2009 to 18th Oct 2009 in shrimp grow out ponds. The stocking density of *P. monodon* was 5 no/ m^2 in mono as well as polyculture ponds but additionally mullet were stocked in polyculture @0.33 no /m^2. There were no significant differences in pH, dissolved oxygen and nutrient concentrations among the mono and polyculture ponds throughout the experiment. The aim of present investigation is stocking with *P. monodon* with *Mugil tade* is a viable approach in terms of profit. Tiger shrimp and mullet is quite suitable for polyculture. Growth rate of shrimp in polyculture pond is higher compared to the growth rate of shrimp in monoculture pond.

Key words:

INTRODUCTION

Aquaculture is one of the fastest growing industries around the world. Capture fisheries and aquaculture supplied the world with about 106 million tones 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. 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. The idea of polyculture is based on the principle that each species stocked has its own feeding niche that of other species. Therefore, a more complete use is made of the food resources and space available in polyculture than in monoculture. In some cases, one species enhances the food availability for other species and thus increases the total fish yield per unit area [1-3]. Since polyculture ponds are complex and not fully understood, we investigated the economic feasibility for the combinations of *P. monodon* with *M. tade.*

MATERIALS AND METHODS

Experiments were carried out in shrimp grow out ponds situated at North latitudes 22° 44’ and 22° 41’ and East longitudes 71° 00’ and 70° 52’ Patelwadi village of Diu region, Saurashtra. Experiment was conducted in the month of 24th May 2009 to 18th Oct 2009 in ponds No. 1 & 2 of 0.8 hector WSA (water spread area) and one pond used as a reservoir. Water was pumped by 10 HP motor. Pond preparation, addition of fertilizer and supplementary feeds were applied as per the standard. Seeds of *P. monodon* were purchased from commercial hatchery whereas *M. tade* were collected from sea shore weighing 3.78 ± 12.58 g. *M. tade* were collected and acclimatized for a period of 10 days in a cement tank and

Corresponding Author: B. Gunalan, Faculty of Marine Science, Center of Advanced Study in Marine Biology, Annamalai University, Parangipettai-608 502, Tamil Nadu, India, Tel: +04144-243223.

were fed by rice bran, groundnut oil cake and fish meal mixed powder (1:0.2:0.5). *M. tade* were stocked @ 2653 numbers in 0.8 ha grow out pond on 07 May 2009 without feeding had avg. wt 6.16 ± 0.49 g whereas *P. monodon* seeds were stocked @ 40000 no per ha of initial wt 0.05 ± 0.0 g in mono as well as polyculture ponds. *P. monodon* was fed by pelleted feed as per the standardized technique.

The *P. monodon* seeds (PL 15) were procured from a commercial hatchery and transported in oxygenated polythene bags (1500 no/bag) of initial wt of 0.005 ± 0.0. They were acclimatized to FRP tank of 1000 l capacity, after 1 to 2 hrs of acclimatization, the seeds were released into mono & polyculture experimental ponds by 2" diameter hose pipe. Immediately after introduction the seeds were fed with commercial starter feed twice in a day whereas no feed was given to *M. tade* fish. Growths in term of weight (g) were assessed every fortnight with Shimazu electro – balance (model AEL200) as per Ching Shan and Lo- Chai [4]. Average daily growth (ADG) and biomass was calculated as per Chanratchakool *et al.* [6] whereas *M. tade* growth assessment was once in a month. Water quality parameters such as temperature (°C), pH and dissolved oxygen (mg/l) were measured as per Trivedy and Goel [6] whereas salinity (‰) as per Katznelson [7]. Estimation of nitrate nitrogen (NO_3-N) ((mg/l) and total phosphate (PO_4) ((mg/l) were as per Trivedy and Goel [6] and Gupta [8] respectively. Ammonia was determined as described by Allan, *et al.* [9].

RESULTS AND DISCUSSION

Prawns, crabs, milkfish and mullets are commonly cultured together in combinations of two, three or four species [10]. In India, milkfish (*C. chanos*) and mullets have been cultured experimentally in salt water ponds [11]. Polyculture of *C. chanos*, *Valamugil seheli* (mullets), *Liza macrolepis* and white prawn *P. indicus* gave a production of 1364 – 1864 kg/ha. Mixed culture of *V. seheli* and *Chanos* yielded 1422-1600 kg/ha. At Tuticorin (south eastern coast of India) an estimated production of 499-739 kg/ha/hr of milkfish, mullets and shrimps was obtained in polyculture [11].

The maintenance of good water quality is essential for optimum growth and survival of shrimp and fish. The values of water quality parameters reveal that all these are in the acceptable range for shrimp culture without any variation. The variation in water temperature of 29.2 ± 1.55°C in the shrimp ponds during the study period was associated with normal climatic change of the experimental area [12]. The temperature was found quite suitable for *P. monodon* growth as described by Chiu [13] and Nakra [14]. The salinity of the present study was maintained 24-31% in all ponds (Fig. 1). Gunalan, *et al.*[15]

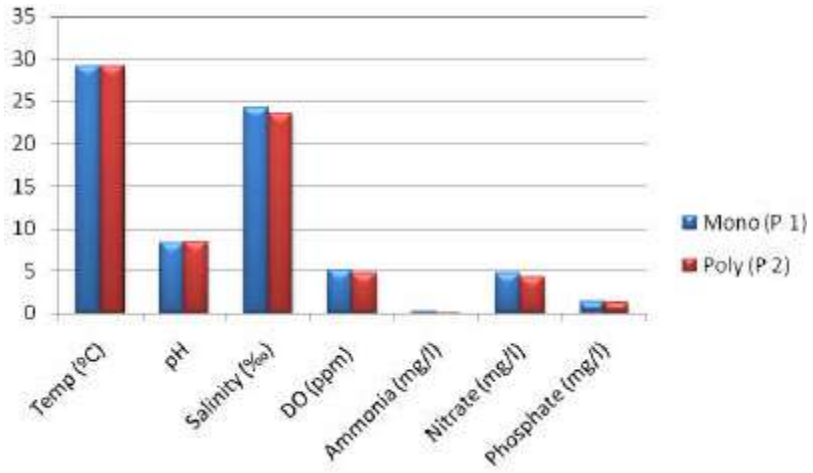

Fig. 1: Average water quality parameters in mono (P1) and polyculture (P2) ponds

Table 1: Average water quality parameters in mono (P1) and polyculture (P2) ponds

Parameters	Mono (P 1)	Poly (P 2)	Mono (P 1)	Poly (P 2)
Temp (°C)	29.2	29.2	29.2 ± 1.55	29.2 ± 1.55
pH	8.32	8.33	8.32 ± 0.33	8.33 ± 0.31
Salinity (‰)	24.27	23.54	24.27 ± 7.9	23.54 ± 7.82
DO (ppm)	5.01	4.7	5.01 ± 0.61	4.7 ± 0.54
Ammonia (mg/l)	0.18	0.01	0.18 ± 0.14	0.019 ± 0.01
Nitrate (mg/l)	4.70	4.25	4.7 ± 2.8	4.25 ± 2.11
Phosphate (mg/l)	1.29	1.25	1.29 ± 0.27	1.25 ± 0.19

Table 2: Economics of mono and poly culture ponds

	Monoculture	Polyculture	
	P.monodon	*P.monodon*	*M.tade*
Ponds	P1	P2	
Pond Area	8000	8000	
Stocking Density	5	5	0.33
Initial Stocking	40000	40000	2653
Stocking Date	24.5.09	24.5.09	24.5.09
Average Daily gain	0.25	0.16	0.13
Days of Culture	142	148	148
Average Body Weight	33.8 g	38.27 g	203.24 g
Survival %	82.60	72	78.40
Total Production (kg)	1116.7 kg	1071	422.4 kg
Production kg / ha	2233.4	2142	844.8
Total Feed Used	1371.9 kg	1792.6 kg	No feed
Feed Conversing ratio	1.2 : 1	1.6: 1	NA
Seed cost	0.40 paise/ seed	0.40 paise/ seed	Natural collection
Feed cost (Rs / kg)	Avg Rs 53.5	Avg Rs 53.5	No feed cost
Total Seed Cost	16,000	16,000	Natural collection
Total Feed cost	73,397	95,904	No feed cost
Selling rate	290 per 30 count	290 per 30 count	Rs 40 per kg
Income	326,635	332,010	16,896
Other Expense			
(Labour,probiotic,pond Preparation and diesel)	51,860	58,269	nil
Net profit	274,775	290,637	

recommended 18-25% salinity was ideal for shrimp growth. The optimal range of pH 6.8 to 8.7 should be maintained for maximum growth and production of shrimp [16]. In the present study pH was ranging between 8.3 to 8.4 for all culture ponds. Ramakrishna Reddy [17] was recommended pH of 7.5 to 8.5 for *P. monodon* culture. Dissolved oxygen plays a major role and its affect the feed consumption and maturation. Lack of dissolved oxygen can be directly harmful to shrimp and cause a substantial increase in the level of toxic metabolites. The dissolved oxygen in all the culture ponds in the present study was ranging between 4.7 to 5.01 mg/l. Ammonia, nitrate and phosphates were recorded in optimum level during the present study (Table 1).

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. In present study CP feeds was used for both poly and monoculture ponds. The maximum feed conversion ratio was observed1.6 in polyculture pond (P2) and minimum (1.2) was recorded in monoculture (P1) pond. Soundarapandian and Gunalan [18] observed FCR of 1.36 for their study (Table 2). Periodic sampling is very important for successful shrimp culture. Its help to know the average weight and this would help to estimate the total biomass in the pond for better – feed management. In the present study the sampling was done from 40th DOC onwards (every fortnight). Higher survival (82.6%) was

recorded in monoculture pond and lower survival (*P.monodon* 72% and *M. tade* 78.4%) was in the polyculture pond. In the present study 40000 thousand *P.monodon* seeds were stocked in each pond. But in the P2 pond along with *P.monodon* 2653 thousand mullet seeds also stocked. Maximum growth was obtained from pond P2 (38.27grms) and that was followed by pond P1 (33.8grms). In polyculture pond, in addition to shrimp 422.4Kg of mullets also harvested at the size of 203.24grms. So the production increased the profit in pond P2,at the same time its clean the pond bottom ,reducing the organic load of the pond. So this investigation conforming that polyculture is better than monoculture. This is due to better management of water quality and feed.

REFERENCES

1. Herper, B., A. Milstein, H. Leventer and B. Teltsch, 1989. The effect of fish density and species combination on growth and utilization of natural food in ponds. Aquaculture Fish. Manag., 20: 59-71.
2. Miah, M.S., M.S. Uddin and M.S. Shah, 1993. Effects of artificial feed in carps polyculture system. Bangladesh J. Agric. Sci., 20: 359-364.
3. Azad, M.A.K., M.R. Rahman, Z. Rahman, M.A. Kader M. A. Haque and M.J. Alam, 2004. Polyculture of carp, tilapia and pangas using low cost inputs. Pakistan J. Biol. Sci., 7: 1918-1926.
4. Ching Shan Cheng and Lo- Chai Chen, 1990. Growth characteristics and relationships among body length, body weight and tail weight of *Penaeus monodon* from a culture environment in Taiwan. Aquaculture, 91: 253-263.
5. Chanratchakool, P., J.F. Turnbull, S.J. Funge- Smith, I.H. Mac Rae and C. Limsuwan, 1998. Health Management in Shrimp Ponds. Aquatic Animal Health research Institute, Department of Fisheries, Katsetsart University Campus, Jatujak, Bangkok, Thailand.
6. Trivedy, R.K. and P.K. Goel, 1986. Chemical and Biological methods for Water Pollution Studies, pp: 1-52.
7. Katznelson, R., 2004. Conductivity/ Salinity/ Measurement principles and methods, DQM information Paper, pp: 1-9.
8. Gupta, P.K., 1999. Soil plants water and fertilizer analysis. Agrobiols, pp: 137-340.
9. Allan, G.L., G.B. Maguire and S.J. Hopkins, 1990. Acute and chronic toxicity of ammonia to juveniles *Metapenaeus macleayi* and *Penaeus monodon* and the influence of low dissolved- oxygen levels. Aquaculture, 91: 265-280.
10. Cowan, L., 1984. Crab farming in Japan, Taiwan and the Phillipines. Queensland Department of Primary Industries, Brisbane, Qld. Australia Information series Q 184009.
11. James, P.S.B.R., 1996. Technologies and Potential for sea farming in India part II. Aquaculture Magazine. Asheville NC; 22(3): 30-43.
12. Roy, A.K., 1992. Semi-intensive culture of tiger shrimp *Penaeus monodon* with artificial diet. M.Sc. Thesis, Bangladesh Agriculture University, Mymensingh, pp: 63.
13. Chiu, Y.N., 1988. Considerations for Planning Prawn Farm Projects. In: Technical Consideration for the Management and Operation of Intensive Prawn Farms Leds. Y.N. Chiv, L.M. Santos and R.O Juliano, (eds.), U.P. Aquaculture Society, lloilo City, Philippines, pp: 25.
14. Nakra, M., 1994. Praw n farming M anual. Waterbase Ltd, Anathapuram, Nellore 52344, India, pp: 63.
15. Gunalan, B., P. Soundarapandian and G.K. Dinakaran, 2010. Effect of Different Stocking Densities on the MBV Infected Seeds of Black Tiger Shrimp, *Penaeus monodon* (Fabricius). Asian. J. Agric. Sci., 2(1): 5-8.
16. 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.
17. Ramakrishna, R., 2000. Culture of the tiger shrimp *Penaeus monodon* (Fabricus) in low saline waters. M.Sc. Thesis, Annamalai University, pp: 31. M. Nakra, 1994. Praw n farming M anual. Waterbase Ltd, Anathapuram, Nellore 52344, India, pp: 63.
18. 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.