Bangladesh J. Fish. Res., 7(1), 2003: 77-82

Effect of farm made feeds on polyculture of shrimp (*Penaeus monodon)* and three brackishwater finfish species

A.F.M. Shofiquzzoha*, M.L. Islam and S. U. Ahmed[1]
Bangladesh Fisheries Research Institute, Brackishwater Station, Paikgacha, Khulna 9280, Bangladesh
[1]Present address: Bangladesh Fisheries Research Institute, Riverine Station, Chandpur
*Corresponding author

Abstract
A study was conducted to evaluate the effects of feed made from locally available ingredients on polyculture of shrimp and three brackishwater finfish species. Hatchery produced post-larvae (PL) of shrimp *Penaeus monodon* (0.005g) were stocked at the rate of 15,000 PLs/ha. Brackishwater finfish species *Liza parsia*, *Mugil cephalus* and *Rhinomugil corsula* of 0.63-1.41g collected from local rivers were stocked at the rate 8,000, 1,000 and 2,000/ha, respectively in four treatments. Shrimp and finfishes were fed four different experimental diets composed of fish meal, mustard oil cake, rice bran, oyster shell power and vitamin premixes at the rate of 3-5% estimated crop/day for 195 days. Among four treatments, *P. monodon* showed comparative better growth in T_4 and T_3. Finfish *L. parsia* showed its better performance in treatment T_2. Species *M. cephalus* and *R. corsula* showed insignificant production. *P. monodon* showed better growth with diet of fish meal and mustard oil cake @ 28.84 and 33.65%, respectively in T_3, and 19.22 and 43.27%, respectively in treatment T_4.

Key words: *P. monodon*, *L. parsia*, *M. cephalus*, *R. corsula*, Feed, Polyculture

Introduction

Brackishwater aquaculture in the south-west part of Bangladesh at the present time is absolutely directed to farming the penaeid shrimp and some cases practiced as polyculture with accidental intruded finfishes. Now- a- days, trend being changing with the farmers to care about polyculture of penaeid shrimp with some selective fish species (Shofiquzzoha *et al.* 2001). Culture practices are extensive in nature and rely on natural productivity of water body (Hoq *et al.* 1994) with little or without management. Traditionally farmers do not use supplemental feed and/or not aware of using any feed to their *gher* (a traditional shrimp farm). In polyculture system, finfish may contribute to the shrimp *ghers* a higher rate of production with shrimp, if a low-cost effective feed from locally available ingredients can be supplement to the stocked animal.

To obtain a sustainable higher production the present experiment was undertaken to observed the effect of feed prepared from locally available ingredients on shrimp *Penaeus monodon* and three non-carnivore brackishwater finfish species in polyculture practice.

Materials and methods

The experiment was carried out during May to October in 12 earthen ponds as four treatments *viz.* T_1, T_2, T_3 and T_4 with three replications each.

Preparation of the pond

The ponds (0.2 ha each) were drained and dried. Soil pH was measured and lime was applied at the rate of 270-300 kg/ha depending on the pH levels of the soil. The water pH was also maintained in the same way. Mustard oil cake as an organic fertilizer was applied at the rate of 100 kg/ha. Inorganic fertilizers like triple super phosphate and urea (ratio 3:1) at the rate of 30 kg/ha were applied. Initially tidal water was allowed to enter up to a depth of about 40-60 cm and awaited for natural feed development then level was finally increased up to 90cm (Ali *et al.* 1999). As per necessity, portion of water (approximately 20%) was exchanged from ponds during the new and full moon.

Stocking

Hatchery produced post larvae (PLs) of shrimp *P. monodon* were stocked (during mid May) at the rate of 15000 PLs ha^{-1} along with fingerlings of *Liza parsia*, *Mugil cephalus* and *Rhinomugil corsula* of collected from local rivers were stocked 8,000; 1,000 and 2,000 fry/ha, respectively in treatments T_1, T_2, T_3 and T_4, (Table 1).

Feeding

Commercial nursery shrimp feed (Saudi-Bangla) Starter-1 was fed the shrimp twice a day at dawn and dusk at the rate of 100% of stocking bio-mass during first week and then the rate were gradually reduced to 60, 40 and 20% in the subsequent 2^{nd}, 3^{rd} and 4^{th} week respectively.

After 30 days, shrimp and fin-fishes were fed with supplement feed made from locally available ingredients. Four diets were formulated using rice bran (RB), fishmeal (FM), mustard oil cake (MOC), wheat flour (WF), oyster shell powder (OS) and animal grade vitamin premixes (Table 2). Feeds were fed twice a day (at dawn and dusk) at the rate of 3-5% of estimated crop. The ingredients RB, FM, WF, OS and vitamin, were proportionally weighted and mix together except MOC. The mixture were added with soaked MOC and was made into dough balls (Wood *et al.* 1991). These balls were supplied in some particular places in ponds as the animals could easily get their feed. Feed supplying often stopped for day or per serve whenever the weather became cloudy or after heavy rainfall.

Sampling and data collection

Water quality parameters i.e., air and water temperature, pH, salinity, transparency were monitored once in a week. After 87th day of culture, harvest was done for *P. monodon* by selective cast netting. Remaining finfish species i.e., *L. parsia*, *M. cephalus* and *R. corsula* those were reared in the same ponds for stipulated 195 days of culture. The final harvest of finfish and rest of shrimp was done by completely drain out the ponds.

Table 1. Stocking density, stocking time, initial and final weight of shrimp *P. monodon* and brackishwater finfish species *L. parsia, M. cephalus* and *R. corsula* used in the study

Species	Stocking rates individual/ ha	Stocking period (months)	Initial length (cm)	Initial wt. (g)	Culture period (days)	Final weight (g)			
						T_1	T_2	T_3	T_4
P. monodon	15,000	Last of May	1.10	0.005	87-195	37.49 (±2.97)	31.19 (±3.15)	38.18 (±2.22)	35.62 (±2.19)
L. parsia	8,000	Mid of May	4.62	1.41	195	19.93 (±8.13)	22.37 (±5.18)	16.02 (±7.45)	16.13 (±6.16)
M. cephalus	1,000	Aug.-early Sep.	4.22	1.22	85	8.37 (±1.60)	7.90 (±0.67)	5.13 (±1.24)	7.32 (±1.16)
R. corsula	2,000	Sep.–mid Oct.	3.94	0.63	45	3.20 (±0.53)	3.28 (±0.64)	4.46 (±1.59)	3.57 (±0.86)

Figures in the parentheses indicated ± standard deviation.

Table 2. Formulation of experimental diets (%)

Ingredients	Diets (%)			
	T_1	T_2	T_3	T_4
Fish meal	48.07	38.45	28.84	19.22
Mustard oil cake	14.42	24.04	33.65	43.27
Rice bran	28.85	28.85	28.85	28.85
Wheat flour	3.85	3.85	3.85	3.85
Oyster shell powder	4.33	4.33	4.33	4.33
Vitamin premixes	0.48	0.48	0.48	0.48
Total	100.00	100.00	100.00	100.00
Calculated protein (%)*	32.90	30.94	29.03	27.03

*Protein level: fishmeal A grade (50.81%), mustard oil cake (30.33%), rice bran (11.88%) and wheat flour (17.78%) (Bhuiyan *et al.* 1989).

Results and discussion

Treatments wise physico-chemical properties of ponds during the experimental period are shown in Table 3. The mean physico-chemical properties of water in the treatment ponds during the experimental period were found suitable except salinity. Water temperature ranged between 27.98 and 28.01±SD °C, pH between 8.29 and 8.46±SD and transparency was between 20.33 and 25.48±SD cm in all treatments however, salinity, which was ranged between 5.97 and 6.09±SD ppt. However, the parameter wise range was found within the limit for shrimp and brackishwater fin-fish culture (Ali *et al.* 1999, Roy *et al.* 1999). The variation was observed for water transparency ranged between 20.33 and 25.48±SD cm was also favorable for shrimp culture (Grey 1990). The transparency/visibility often higher might be due to growth of aquatic weeds and low for turbidity due to suspended particles after heavy rainfall, erosion of dyke due to strong wind action or silt carried by tidal water. However, Hossain (1987) attributed the variation to the differential formation of plankton and qualitative incursion of silt laden in water during tidal exchange.

Table 3. Mean physico-chemical properties of water during the experimental period

Treatments	Water temp. (°C)	Salinity (ppt)	pH	Transparency (cm)
T_1	27.98 (±5.08)	5.97 (±2.99)	8.29 (±0.49)	24.28 (±9.04)
T_2	27.85 (±4.79)	5.91 (±3.22)	8.34 (±0.52)	25.48 (±9.10)
T_3	28.01 (±4.95)	5.91 (±3.26)	8.46 (±0.59)	20.33 (±7.65)
T_4	27.39 (±6.12)	6.09 (±2.88)	8.29 (±0.49)	24.47 (±12.22)

Figures in the parentheses indicated ± standard deviation.

The treatment wise mean production in shrimp fin-fish polyculture was shown in Table 4. Data revealed that, the total production range between 90.5 and 183 kg/ha/195 days in all treatments might be considered as low. Shofiquzzoha *et al.* (2001) obtained 242.68 kg/ha in similar species combination and stocking density while, the animal fed with commercial shrimp feed (30% protein level) for 195 days. Ali *et al.* (2000) formulating feed with fish meal, rice bran, mustard oil cake, wheat bran and vitamin premix (30-32% protein level) and fed at the rate 3% of estimated crop while stocked 40,000 PLs and 10,000 fry/ha for a culture period of 225 days and produced *P. monodon* and *L. parsia* of 449.37 and 171.05 kg/ha, respectively. Roy *et al.* (1999) obtained 231 kg/ha/crop of *P. monodon* for a culture period 149days in monoculture system. The low production obtained in the present study might be due to inaccurate proportions or low efficacy of the food ingredients used in the rations. Lovell (1989) mentioned about dietary protein level of penaeid shrimp ranged 28 to 60% and for *P. monodon* the range were 42 to 46% how eve, values differ on animals size, level of dietary energy, feeding rate and availability of natural food organism. Wood *et al.* (1991) mentioned that, feeds to be water stale for minimum of two hours, raw materials must also be selected in terms of their functional properties or ability to induced water stability, nutritive and as well as an attractants. Hossain *et al.* (2000) emphasized on digestible crude protein, organic matter or lipid and energy content in feed and ingredients.

The treatment wise production of shrimp-fish were calculated (Table 4). Study revealed that, among treatments, growth/production of shrimp *P. monodon* and finfish species *L. parsia* were significant ((P<0.05). However, species *M. cephalus* and *R. corsula* production as well as total production found insignificant.

Among the four treatments, *P. monodon* showed comparative better performance in treatments T_3 and T_4 (Table 4) where the two of five feed ingredients *viz.,* fishmeal and mustard oil cake were used at 28.84 and 33.65% respectively, in treatment T_3; however, in treatment T_4, it was 19.22 and 43.27% respectively. Finfish *L. parsia* showed its better performance in treatment T_2 (fishmeal 38.45% and mustard oil cake 24.04% were used).

Table 4. Production (kg/ha) of shrimp and finfish in polyculture system

Commodity produced	T_1	T_2	T_3	T_4
Shrimp *Penaeus monodon*	39.51^{c}	54.08^{c}	108.25^{a}	105.00^{ab}
Finfish *Liza parsia*	37.12^{c}	117.75^{a}	48.87^{c}	66.83^{b}
Finfish *Mugil cephalus*	9.00	7.92	5.59	5.66
Finfish *Rhinomugil corsula*	4.88	3.88	5.47	6.23
(Total finfish)	(51.00)	(129.55)	(59.93)	(78.72)
Total production	90.51	183.63	168.18	183.72

In this study, *P. monodon* showed better growth when fed diet of fish meal and mustard oil cake 28.84 and 33.65% respectively in T_3, and was 19.22 and 43.27% in

treatment T_4 respectively. The results indicated that, it needed to be more decisive of selecting feed ingredients (*e.g.* protein, lipid etc) and/or ratios to producing sustainable production of these species in polyculture system.

References

Ali, M.S., A.FM. Shofiquzzoha and S.U. Ahmed, 1999. Effect of submerged aquatic vegetation on growth and survival of *Penaeus monodon* (Feb.). *Bangladesh J. Fish. Res.,* 3: 145-149.

Ali, M.S., A.FM. Shofiquzzoha and S.U. Ahmed, 2000. Observation on the production performances of *Penaeus monodon* with *Liza parsia* under different cropping systm. *Bangladesh J. Fish. Res.,* 4(2): 141-145.

Grey, C.W., 1990. A guide to shrimp and prawn culture in Bangladesh. BAFRU/ODA, Institute of Aquaculture, University of Stirling, Stirling KFK9 4LA, Scotland. U.K., 49 pp.

Hossain, S.M.Z., 1987. Studies on some physico-chemical parameters of tide fed shrimp ponds. *Bangladesh J. Fish.,* 10: 47-56.

Hossain, M.A., P. Jahan and K. Kikuchi, 2000, Nutrient digestibility coefficients of diets with varying energy to protein ration for Japanese flounder, *Paralichthys olivaceus. Bangladesh J. Fish. Res.* 4(2): 105-112.

Bhuiyan, A.K.M.A, N.N. Begum, M. Begum and M.E. Hoq, 1989. Survey of potential fish feed ingredients of Bangladesh on the basis of their availability and biochemical composition, Final report. Fisheries Research Institute, Mymensingh, Bangladesh. 70pp.

Hoq, M.E., G.C. Halder and M. Begum, 1994. Experimental pond culture of tiger shrimp, *Penaeus monodon* Feb. with various stocking rates and supplemental feeding. *Progress. Agric.,* 5: 55-61.

Lovell, R.T., 1989. Diet and fish husbandary. *In:* Fish Nutrition, Second edition (J.E. Halver, ed.). Academic press, Inc. pp. 519-604.

Roy, P.K., S.U. Ahmed and A.F.M. Shofiquzzoha, 1999. Optimization of stocking density for environmental friendly improved extensive shrimp farming system in south-west part of Bangladesh. *Bangladesh J. Fish. Res.* 3: 137-143.

Shofiquzzoha, A.F.M., M.L. Islam and S.U. Ahmed, 2001. Optimization of stocking rates of shrimp (*P. monodon*) with brackishwater finfish in a polyculture system. *Online J. Biol. Sc.* 1(8): 694-697.

Wood, J., J. Coulter and I. Rajendran, 1991. India's expanding prawn culture industry- where will the raw materials come from? *In*: Proceeding of the symposium on aquaculture production (V.R.P. Sinha and H.C. Srivastava eds.), held in December 1988, under aegis of Hindustan Lever Research Foundation. pp. 257-268.

(Manuscript received 19 March 2002)