SHRIMP CULTURE PRACTICES AT FARMERS' LEVEL IN BAGERHAT DISTRICT

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ABSTRACT

A study was conducted on culture practices of shrimp at farmers' level in Bagerhat District. Investigation was based on a sample of 123 shrimp farmers from the seven Thanas (Fakirhat, Mollahat, Sadar, Rampal, Mongla, Chitalmari and Kachua) of the District, 73.17% farmers produced shrimp with white fishes. Farmers (54.47%) started to culture during 2000-2004 in this area. The culture period was typically four months for bagda and six to seven months for golda. Hatchery PL are stocked mainly in May to June for prawn and from late March for bagda. The average stocking density of shrimp PL golda and bagda was 24.16 and 12.16 thousand/ha in the farms. Varieties of feeds such as cooked rice, fishmeal, oilcake and snail muscle were used for shrimp culture. Mainly virus disease was responsible for the great loss of shrimp in this area. About 46.34% of the surveyed farms faced a huge damage due to WSBV. The average bagda and golda production was 350.37 kg and 428.08 kg/ha/year. Long term sustainability of shrimp farming facing problems due to lack of money, poor supply of good quality PL, lack of technical knowledge, hi*gher* production costs and poor institutional support. It might be however, necessary to establish shrimp hatcheries and provide training facilities, extension service, institutional and policy support to the farmers with the help of DoF and NGOs.

Key Words: Shrimp culture, *Gher*, Virus diseases, Production

INTRODUCTION

Prawn and tiger shrimp are generally called shrimp in the southern part of Bangladesh. In this region, freshwater aquaculture is virtually limited for the farming of *Macrobrachium rosenbergii* (prawn) and brackish water aquaculture of *Penaeus monodon* (tiger shrimp) together with carps or integrated culture with paddy. *Macrobrachium rosenbergii* is one of the most commercially valued species for aquaculture (Mitra *et al.*, 2005). It is widely distributed in freshwater as well as in brackish water, mainly in ponds, rivers, canals and estuaries (Ahmed, 1957). There are about 81 species of shrimps including *M. rosenbergii, P. monodon, P. merguiensis* and *P. durarum* are available in south-east Asian countries. However, *P. monodon* and *M. rosenbergii* have got great aquaculture potential and commercially cultured in Bangladesh (Akand and Hasan,1992). Presently

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prawn is commercially cultured in the costal districts and these areas have become the centers for prawn farming in Bangladesh. Moreover, there is 710 km long coast line along the south-eastern part of our country. In this vast area of brackish water body, tiger shrimp culture has been expanded. Bagerhat district is one of this area where tiger shrimp farming has been cultured extensively in Rampal, Mongla and a portion of Fakirhat Thana (Khanom, 1999). According to Islam (1999), the culture area of prawn is estimated as 6,000 hectares of which 3,261 hectares are located in Bagerhat district, whereas 1,429 hectares in Fakirhat Thana. Earlier most of the farmers used to cultivate their farms by traditional method. But now a days most of the farmers' culture shrimps in their farms by traditional, improved traditional or semi-intensive methods. Although there is a bright prospect of tiger shrimp culture in our country, planned action program has not yet been taken. For tiger shrimp culture most of the farmers act as small land holder. If they are provided with technical assistance production of shrimp can be increased manifolds. Commercial prawn farming has recently taken place in Bagerhat area in *ghers*.

The *gher* is an enclosure made for shrimp cultivation by modifying rice-fields through building hi*gher* dikes around the fields and excavating a canal several feet deep inside the periphery of the dikes to enter water during the dry season (Kendrick, 1994). According to DFID (1997), *gher* farming can be considered as a method of combining aquaculture and agriculture on one plot. During the rainy season the whole water body is used for cultivation of shrimp and fish. However, during dry seasons the trenches are used for shrimp and fish culture and rice is planted in the central plot. Shrimp especially prawn can be cultured with carps in low lying paddy fields, shallow ponds, shallow portion of baor, canal beside road and rail line and irrigated canals of fresh water bodies (Khanom, 1999). Shrimp yield in *ghers* can be increased by applying modern technology such as intensification of culture operation through regularization of *gher* size, stocking density, adding aeration system, application of fertilization and feeds. Considering the back drop of the state of affairs of shrimp farming, in general the present study was undertaken to investigate the present status of shrimp culture and also to understand the different characteristics of shrimp culture practices in Bagerhat district.

MATERIALS AND METHODS

The study was carried out in seven Thanas namely, Fakirhat, Mollahat, Chitalmari, Sadar, Kachua, Rampal and Mongla in Bagerhat district. The *ghers* (farms) were selected randomly from each Thana. The survey was conducted over three months (January to March 2007) in the study areas where the study was mainly concentrated on the category of shrimp farming, types, culture techniques and physical condition of the farms such as dike condition and ownership patterns, depth of water and problems during culture time. Data related to pre-stocking management including presence or absence of drying, liming and fertilization were collected. Information on stocking including place PL collection, stocking density of PL, feeding, liming, manuring, water quality and presence or absence of aquatic weeds during culture period were collected. A questionnaire was

prepared for collection of relevant information in accordance with the objectives. Both open and closed form of questions was used to collect information. Simple and direct questions were included in the questionnaire to ascertain the opinion of the shrimp farmers. Data were collected by questionnaire interviewing of 123 shrimp farmers in the seven selected Thanas. Farmers were selected for questionnaire interview through random sampling and Participatory Rural Appraisal (PRA) tools like Large Group Discussion (LGD), Focus Group Discussion (FGD) and Cross-Check interviews with Key Information (KI). Besides primary information study, secondary data were collected from different sources, such as books and journals, Export promotion Bureau (EPB), Department of Fisheries (DoF), Statistical year book of Bangladesh (2001), relevant thesis, reports, official records, newspapers and library etc. Collected information obtained from the survey was accumulated, grouped and interpreted according to the objectives as well as parameters. Some data have contained numeric and narrative facts. The collected data were then edited, summarized and tabulated and analyzed by Microsoft Excel and Statistical Package for Social Science (SPSS).

RESULTS AND DISCUSSION

Fish farmers of Bagerhat district used both natural and hatchery post larvae (PL) in their farms. Only 20% farmers of Fakirhat Thana released naturally collected PL and farmers of other Thana did not stock any PL of natural resource. Farmers of Mongla and Kachua Thana (60% of each) used hatchery produced PL whereas 80% farmers in Rampal and 75% farmers in Mollahat Thana released both natural and hatchery PL. Post larvae were collected either from arat (Business establishment with storage facilities for selling and purchasing) of PL mockams (Business centre, place where located a number of arats). There were five PL mockams (Faila, Rampal, Digraj, Chila and Faltita bazar mockam) in the study areas. It has been found that 52.85% of farmers collected PL from arats, 47.15% collected through forias (Man, who purchases from producers and sells to buyers) and other collected directly from hatchery. It was also observed that natural PL were collected mainly from Chila and Digraj bazar mokam and hatchery PL from Faila, Rampal, Digraj, Chila and Faltita bazar mockam through forias. Buyers of far away carried shrimp PL with cock-sheet containers, while local buyers (forias) carried PL in aluminium pots to the local areas or to long distances as per contract. It was found that PL were transported with both cock-sheet box and aluminium pot used by 53.66% farmers (buyers) (Table 1).

Shrimp farming was not a very old practice in Bagerhat district. Among the interviewed farmers only 8.95% started shrimp farming before 1995. About 30.80%, 54.47% and 6.50% farmers started shrimp farming in the year ranging 1995-99, 2000-04 and after 2004 respectively. The highest number of farms (80%) was established in the year between of 2000 to 2004 in Sadar Thana. No farms were established in Mollahat, Chitalmari, Sadar, Kachua before 1995 and Sadar, Chitalmari after 2004. Interviewed farmers stated that they started shrimp cultivation to earn more money as shrimp farming was profitable than agriculture.

Table 1. Information on shrimp PL collection, its origin and stocking by the farmers of Bagerhat district

Characteristics	Category	Percentages of farmers in seven selected thanas in Bagerhat district (N = 123)							Percentages among the total farmers
		Fakirhat (n = 20)	Mollahat (n = 20)	Sadar (n = 20)	Rampal (n = 20)	Mongla (n = 20)	Chitalmari (n = 13)	Kachua (n = 10)	
Origin of PL collection	Natural	20	0	0	0	0	0	0	3.25
	Hatchery	10	25	55	20	60	30.77	60	35.77
	Both	70	75	45	80	40	69.23	40	60.98
Places of PL collection	Hatchery	0	10	0	0	0	0	0	1.63
	Arat	100	40	60	65	40	7.69	30	52.85
	Foria	0	50	40	35	60	92.31	70	47.15
Transporting system of PL to the farmers	Aluminium pot	10	0	0	5	0	0	0	2.44
	Cocksheet box	20	20	45	50	85	30.77	60	43.90
	Both	70	80	55	45	15	63.23	40	53.66

* n = Sample size, * N = Total sample size

Size of maximum (67.48%) shrimp farms was between 1 to 5 acres. It was observed that very small numbers (18.70%) of farms were below 1 acre and above 5 acres were 13.82%. The highest number of larger farms i.e. more than 5 acres was found in Mongla and less than 1 acre in Sadar Thana. Farms were operated by both single and multiple owners, 54.47% farms had single owner and the rest 45.53% farms had multiple owner. Single ownership was hi*gher* (85%) in Fakirhat Thana and lower (25%) in Rampal Thana.

Some farmers were found to culture shrimp PL in their own land and some used leased pond. A few farmers used both own and leased land for PL culture. It was found that 39.84% farmers used own land for PL culture while 53.64% and 6.50% farmers used leased and both own and leased land respectively. In Fakirhat 65% and in Mongla 70% farmers cultured shrimp in their own and leased land. Leasing cost in general was estimated at Tk. 4,000-14,000 per acre per year in the study area.

In the study area 36.59% farmers cultured tiger shrimp (bagda) and freshwater prawn (golda) PL. However, among the surveyed farms 33.33% farmers cultured bagda and 30.08% cultured golda PL. It was also observed that almost 100% farmers cultured bagda PL in Mongla Thana but bagda PL was cultured in Fakirhat, Mollahat and Chitalmari Thana. Most of the farmers 85% cultured golda in Mollahat Thana.

It was found that 73.17% farmers cultured shrimp with white fishes whereas only 26.83% surveyed farmers cultured only shrimp (bagda and golda) i.e. monoculture system. The maximum monoculture system was found in Mongla Thana (85%). Whereas in Chitalmari almost 100% farms were under polyculture system.

About 9.76% farms had good dikes whereas 45.53% and 44.72% farms had moderate and damaged dikes respectively. It was also found that no good dikes were observed in Sadar, Mongla and Kachua Thana. About 80% farms in Mongla and Kachua Thana were found damaged dikes (Table 2).

Pre and post stocking management of the shrimp farm

In the study area, it was found that as pre-stocking management 54.47% farms were dried. Maximum 75% farms were dried in Fakirhat whereas 65% farmers in Sadar Thana did not dry their farms. In pre-stocking management 18.70% and 21.14% farmers applied only organic manure and inorganic fertilizer respectively. In Fakirhat Thana, 80% farmers used fertilizers after stocking but in Mongla Thana about 85% farmers did not use any fertilizers. Farmers, 69.92% used lime at different doses. Lime was used by 80% farmers in Mollahat and Rampal whereas 60% farmers of Kachua Thana did not use lime. About 85% farmers in Rampal used pesticides in shrimp farms. Shrimp farmers (68.29%) used underground water from nearby canals and underground water to farms if necessary. The shrimp farms (47.97%) had water depth in a range of > 3 ft whereas 12.20% and 39.84% had the water depth in the range of < 2 ft and 2-3 ft respectively (Table 2).

Table 2 (Continued)

Characteristics	Category	No. of farmers in seven selected thanas in Bagerhat district							Total (N = 123)	Percentages (%) the total
		Fakirhat (n = 20)	Mollahat (n = 20)	Sadar (n = 20)	Rampal (n = 20)	Mongla (n = 20)	Chitalmari (n = 13)	Kachua (n = 10)		
Drying	Yes	15	8	7	11	12	8	6	67	54.47
	No	5	12	13	9	8	5	4	56	45.53
Application of fertilizer	Organic	4	4	5	4	0	4	2	23	18.7
	Inorganic	4	8	10	2	0	2	0	26	21.14
	Both	0	8	0	2	0	2	0	12	9.76
	No fertilizer	12	0	5	12	20	5	8	62	50.41
Application of lime	Yes	15	16	14	16	13	8	4	86	69.92
	No	5	4	6	4	7	5	6	37	30.08
Application of Pesticides	Yes	12	12	11	17	6	2	5	65	52.58
	No	8	8	9	3	14	11	5	58	47.15
Source of water	Canals	9	6	14	20	20	6	9	84	68.29
	Borring	11	14	6	0	0	7	1	39	31.71
Water depth (in ft.)	< 2	0	3	2	3	2	3	2	15	12.2
	2-3	13	13	9	5	4	1	3	49	39.84
	> 3	7	4	9	12	14	8	5	59	47.97
PL releasing technique	Direct	4	0	9	12	17	3	7	52	42.28
	After acclimatization	16	20	11	8	3	10	3	71	57.72
Feed used	Ready made	3	6	13	4	3	8	7	44	35.77
	Formulated	2	0	0	5	0	0	0	7	5.69
	Both	15	14	5	7	0	5	0	46	37.4
	No feed	0	0	2	4	17	0	3	26	21.14

Pre-stocking management

Table 2 (Continued)

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Characteristics	Category	No. of farmers in seven selected thanas in Bagerhat district							Total (N = 123)	Percentages (%) the total
		Fakirhat (n = 20)	Mollahat (n = 20)	Sadar (n = 20)	Rampal (n = 20)	Mongla (n = 20)	Chitalmari (n = 13)	Kachua (n = 10)		
Fertilization in feed	Yes	3	4	1	2	2	4	2	18	14.63
	No	17	16	19	18	18	9	8	105	85.37
Post stocking	Yes	16	11	8	9	3	3	6	56	45.53
	No	4	9	12	11	17	10	4	67	54.47
Water color	Clear	0	7	0	0	0	0	0	7	5.69
	Light green	16	12	1	3	4	0	1	43	34.96
	Grayish	2	1	7	5	8	6	6	36	29.27
	Blackish	2	0	12	12	8	7	3	37	30.08
Presence of aquatic weeds	Yes	6	4	17	16	12	3	6	64	52.03
	No	14	16	3	4	8	10	4	59	47.97
Shrimp health monitoring	Yes	20	14	7	13	4	12	7	77	62.60
	No	0	6	13	7	16	1	3	46	37.4
Use of chemicals for moulting	Yes	7	11	3	5	2	4	3	35	28.46
	No	13	9	17	15	18	9	7	88	71.54
Disease problems	Yes	9	2	11	11	13	4	7	57	46.34
	No	11	18	9	9	7	9	3	66	53.66
Training about shrimp farming	Yes	14	14	7	3	2	7	2	49	39.84
	No	6	6	13	17	18	6	8	74	60.16
NGOs contribution to the farm	Yes	2	3	3	0	0	3	2	13	10.57
	No	18	17	17	20	20	10	8	110	89.43

* n = Sample size, * N = Total sample size

The average stocking density of bagda and golda PL and white fishes were found 24.16, 12.16, 0.45 thousand/ha respectively in the study areas. The highest stocking density of bagda PL was found in Mongla (40.95 thousand/ha) whereas lowest in Mollahat (8.08 thousand/ha) Thana. It was also obsereved that, average 0.45 thousand/ha white fish (fingerlings of Rohu, catla, mrigal, silver carp, grass carp, sarpunti etc.) fries were stocked in the shrimp farms of Bagerhat districts (Table 3).

Water color of (34.96%) shrimp ponds were light green whereas 5.69%, 29.27% and 30.08% farms had clear, grayish and blackish color water respectively. In Sadar Thana 85% farms had aquatic weeds but no aquatic weeds were available in maximum (80%) farms in Mollahat. Water quality was monitored by all farmers. Whereas health monitoring were followed by 62.60% farmers. Most of them used sampling technique for this issue. Among farmers 71.54% did not use chemicals for moulting of shrimp whereas 53.66% faced disease problems where maximum infection was noted (70%) in Kachua (Table 2).

Harvesting was done using cast nets in small-scale farms where in large-scale farms (>5 acres) used ber jal, cast net and sludge gates. During farming financial problems, land, theft, availability of quality PL and muscle power were common problems (Table 4). It was found that 60.16% farmers had no training before starting of farming but got later from various sources (39.84%). Most of the farmers 89.43% were not interested to take loan from NGOs for their high interest and complexity. In Chitalmari Thana only 23.08% farmers were involved in taking loan.

In the study area the average annual yields of bagda; golda and white fishes were 350.37, 428.08 and 172.52 kg/ha. The highest bagda production was found in Mongla (673.34 kg) whereas lowest in Chitalmari Thana (105.04 kg), similarly the highest production of golda were found in Mollahat Thana (879.91 kg) lowest (143.35 kg) in Rampal. White fish gained the highest production at Fakirhat 203.60 kg/ha (Table 5).

About 47.97% shrimp farms had an average depth of water was > 3 ft and other farms had a range of 2-3 ft. So, there was less chances to increase water temperature of shrimp farms and to create stress for prawns. New (2002) suggested that at 0.3 m water depth of prawn culture system with 34^oC temperature in sunny noon can cause stress to prawn. However, Mongla and Rampal are situated at the adjacent to the Bay of Bengal and the Sunderbans, naturally water temperature was hi*gher* than the other five Thanas of the study area.

The average stocking density of the study was found 36.33 thousand/ha which was almost similar to Thangadurai (1991), who reported the density 30.01 thousand/ha. McGinty and Alston (1993) recommended 25 thousand/ha stocking density for shrimp farming. Whereas Tidwell *et al*. (1992) indicated a good production with the stocking density of 19.66 thousand/ha. However, white fishes were stocked at 0.44 thousand/ha in shrimp farms in Bagerhat district. Though polyculture was adopted by the maximum farmers in their shrimp culture practices. No additional feeds were supplied to shrimp farms for this white fish. Stocking densities of shrimp PL were hi*gher* in all farms as they believed that hi*gher* stocking of PL can yield hi*gher* production.

Table 3. Average stocking density of shrimp PL and white fishes (thousand/ha) in the shrimp farmers of Bagerhat district

Types of PL/Fry	Study area							Total	
	Average stocking density (thousand/ha)							Mean	SD
	Fakirhat (n = 20)	Mollahat (n = 20)	Sadar (n = 20)	Rampal (n = 20)	Mongla (n = 20)	Chitalmari (n = 13)	Kachua (n = 10)		
Bagda	27.09	8.08	16.27	33.29	40.95	20.15	23.29	24.16	10.89
Golda	11.93	24.03	13.51	3.13	0	16.74	15.75	12.16	8.22
White fish	0.27	0.51	0.83	0.37	0.34	0.34	0.37	0.45	0.19

n = Sample size, SD = Standard Deviation

Table 4. Problems faced by the farmers during shrimp farming in the study area of Bagerhat district

Problems	Study area							Total (N=123)	Percentages (%) of the total
	Fakirhat (n = 20)	Mollahat (n = 20)	Sadar (n = 20)	Rampal (n = 20)	Mongla (n = 20)	Chitalmari (n = 13)	Kachua (n = 10)		
Financial	4	16	15	1	6	8	3	53	43.09
Land	4	7	6	13	5	6	5	46	37.40
Theft	2	2	1	1	14	6	1	27	21.95
Good quality PL	4	0	0	0	8	0	2	14	11.38
Muscle power	0	0	0	0	3	0	0	3	2.44
No problem	11	1	3	7	2	2	4	30	24.39

* n = Sample size, * N = Total sample size

Table 5. Production of shrimp and white fishes (Kg/ha) in the study areas of Bagerhat
district

Types	Study area							Total	
	Average production (Kg/ha)								
	Fakirhat (AP$_1$)	Mollahat (AP$_2$)	Sadar (AP$_3$)	Rampal (AP$_4$)	Mongla (AP$_5$)	Chitalmari (AP$_6$)	Kachua (AP$_7$)	Mean of average production (MAP)	SD
Bagda	468.08	111.39	325.27	575.18	673.34	105.04	194.31	350.37	227.65
Golda	545.22	879.91	494.66	143.35	0	613.15	320.21	428.08	297.90
White fish	203.60	198.39	196.63	119.10	115.64	202.29	172.06	172.52	39.14

* AP = Average production, * S = No. of study areas (S=7), * MAP = Mean of average production, * MAP = (AP$_1$+ AP$_2$+ AP$_3$+ AP$_4$+ AP$_5$+ AP$_6$+ AP$_7$)/S, * SD = Standard Deviation

Different artificial feeds have been used in shrimp farms which were cooked rice, fishmeal, oil cake, kura, chira, snail muscle etc. Boonyaratpalm and New (1993) obtained better production when used soybean meal, cornmeal, broken rice and rice bran in shrimp farming. William *et al*. (1995) reported a production of 1,024 - 1,662 kg/ha of prawn fed with formulated diet. Tidwell *et al*. (1993) got suitable production using fishmeal, oilcake and rice bran.

About 53.66% shrimp farms were attacked by several diseases - *P. monodon* baculovirus (MBV), White Spot Syndrome Virus (WSSV), soft shell, tail rot disease etc. Nash *et al*. (1988) reported MBV in *P. monodon* in brackish water pond and mortalities occurred (90%) within 2 weeks after infection. Domestic animals, birds, frogs, snakes, crafts and gears used in farms might be the reasons for disease out break from farm to farm. Farmers (60.16%) had no training on shrimp farming as Rudramoorthy (1964) observed that the training process brought out a continuous improvement of farm management by the staff. In the study area only 13.82% farmers could write their names, they were aware about the benefit of training.

Farmers in the study area got 428.08Kg/ha shrimp production per year, where tiger shrimp production was 350.37 Kg/ha/year. Similar production rate were also reported by Jose *et al*. (1992) and Ali *et al*. (2000). However, Roy *et al*. (1999) obtained 231 kg/ha/crop *P. monodon* for a culture period of 149 days. Few differences in production were created due to differences of farm sizes, stocking densities, feed and management skills etc. In some cases the production was hi*gher* due to continuous stocking of shrimp PL.

From the investigation, it was identified that lack of money was a single most important problem for shrimp farming. The other problems associated with land, theft, quality of PL and muscle power. Das (1993) and Mahamud (1998) however, mentioned about the problems of shrimp farms which were the non scientific culture methods, lack of credit and quality PL.

CONCLUSION

Farmers should have knowledge on different aspects of shrimp culture practices such as, *gher* preparation, PL collection and stocking, water quality monitoring, fertilization, feed, disease and its control measures, harvesting, marketing etc. for hi*gher* production. In general, the production rate of shrimp is very low compared to other countries. However, production can be raised up to 2 to 3 folds by improving culture systems and management practices. Authorities should concern about import of virus infected stocks, disease monitoring, taxation etc. which are important for successful improvement of the traditional *gher* farming system to achieve sustainable development of the rural shrimp farmers.

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