GALDA – FINFISH POLYCULTURE: A PREVAILING POND CULTURE SYSTEM IN THE SOUTHWEST OF BANGLADESH

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ABSTRACT

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A field survey was conducted on 50 Galda-finfish polyculture farms in 5 villages of Dumuria Upazilla in Khulna District to assess present culture practices adopted by the farmers. The questionnaire used in the survey included questions on the physical conditions of the ghers, pre-stocking and post-stocking management measures of the ghers, harvesting, production and information on cost and benefit of the operation. In case of pond management, tilling, liming, fertilization and feeding were common practices. Most of the farmers use nothing for predator control. Fertilizers including TSP and Urea were commonly used. Stocking rate of prawn fry was highly variable, so also the rate of stocking of the fin fishes. The fin fish species were rohu *Labeo rohita*, catla *catla catla*, silver carp *Hypophthalmicthys molitrix*, grass carp *Ctenopharyngodon idella* and khorsula *Mugil corsula*. Cost benefit analysis of the culture practice showed the operation to be quite profitable.

Keywords: Prawn, Polyculture, Fin-fish, Gher

INTRODUCTION

Bangladesh is a riverine country. It has vast and varied type of waters such as ponds, tanks, canals, flood plains, lakes, lagoons, beels, haors, baors and a long coastline displaying high diversify in their biotic and abiotic characteristics. Blessed with a conducive climate, the country offers immense scope and potential for a considerable increase in fish production. Fisheries contributes 63 % of the national animal protein intake, about 5.24 % of the total GDP and more than 4.76 % of the total foreign exchange earnings (Anonymous 2003).

The freshwater prawn known as galda (*Macrobrachium rosenbergii)* has emerged in the last few years as one of the most important aquatic resource. These species has a number of advantages if compared with other crustaceans. It adapts with a wide range of temperature (15^0C to 35^0sC) (Humayun *et al*., 1988). Fast growing individuals of the species reach the marketable size in about 6 to 7 months (Paul, S.K, 1994). Its high nutritional value and omnivorous feeding habit has made this species an excellent candidate species for polyculture with the Indian major carps. Polyculture is a culture technique in which more than one species are cultured in a specific pond for a given period of time. It is more preferable because of the feeding levels, operational procedure and finally more production rate than that of monoculture. Published reports on the polyculture of galda with Indian major carps in Bangladesh are not very common. Ahmed *et al.,* (1996) carried out a polyculture trial galda with catla, rohu, mrigal and silver carp and obtained a production of 2980 kg/ha where galda production was 600 kg/ha.

Galda has very high demand in domestic and international markets. The import data from the developing countries show that shrimp import expanded in five years since 1997 from 4 to 7 billion US $ and in the next five years it will be 10 billion US $ (Islam *et al.*, 2002). In Bangladesh, prawn farming mainly takes place in the districts of Khulna, Satkhira, Bagerhat, Patuakhali, Bhola, Noakhali, Pirojpur and Narail. Khulna and Bagerhat districts are the most productive zones for prawn culture. In this region, the culture ponds are constructed mainly in the low lying areas. The dykes of the ponds are made on the surface of the ground with soil taken from a canal dug in the periphery of the ponds. The ponds are locally known as 'gher'. Most of the ghers are run on traditional basis. The prawn seed are naturally available in the coastal rivers and are collected by a huge group of people in the area; also there are some instances of stocking of the ghers by hatchery produced prawn seed.

Most of the fish farmers are poor and they are interested to produce maximum output from minimum input. The culture techniques adopted by the farmers was found to be traditional with variability in the use of inputs and methods of management measures applied. The farmers are mostly marginal and have the inherent inability to afford high input culture systems. The consequence is this that this highly productive resource is not being harnessed with the application of modern technologies. There is an ample scope for developing this practice geared with modern means thereby increasing the production significantly. This, in turn, is likely to contribute to the socio-economic development of the large group of farmers engaged in the culture system in the country.

MATERIALS & METHODS

The study was performed in five villages under Dumuria Upazilla, Khulna District. The ghers were selected randomly. The information was collected from the gher owners through structured questionnaire. In case of the ghers with multiple ownerships, data were collected from the owners, who were considered more

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knowledgeable about prawn culture. The collected data were then verified by interviewing the other owners who were available during the time of data collection.

Data related to dyke condition, water depth during both dry season and rainy season, types of bottom soil were collected through direct observation. Other information like pond area, ownership, financial support, feeding, fertilization, liming activities, stocking density, species composition, production cost, total income and net profit were collected through interview. The data were analyzed with simple statistical tests like central tendencies and dispersion.

RESULTS AND DISCUSSION

Physical conditions of the ghers

Observations were made on the physical conditions of the ghers. The parameters were type of soil upon which the ghers were constructed, conditions of the dykes, area of the ghers and depth of the water maintained both during winter and rainy season. These parameters were deemed important with regard to the maintenance done on the farms by the farmers and also for assessing the productive conditions of the ghers. Table 1 shows the size range of the ghers.

Table 1. Size of the ponds (decimal) in the surveyed area

Size of the pond (decimal)	***No. of the gher***
≤ 100	18
> 100 – 200	8
> 200 – 300	6
> 300 – 400	7
> 400 – 500	6
> 500	5
Total	50

It can be seen that, the size range varies between 100 – 500 decimal; majority being of the size range of ≤ 100 decimal. Observation on the bottom soil type of the farms revealed that majority of the farms (60%) had loamy soil content and that was known to be highly productive type. Twenty percent of the ghers had sandy loam, 10% with clay, 4% with clay loam and 6% with peat soil type; ghers with peat soil types was found to be highly unproductive. Galda culture ghers should be made on soil type that holds water very good and silt or clay or mixture of these two with a small portion of sand is considered to be ideal soil type for galda gher construction. Signolka and New (1985) suggested that clay content of galda farm should not exceed 60%. Figure 1 shows the percentage composition of the soil type in the gher surveyed.

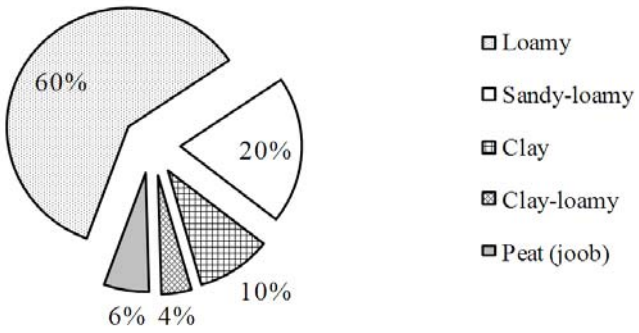

Figure 1. Percentage distribution of the ghers on the basis of soil type

The parameter on the depth of water in the ghers maintained both during winter season and rainy season, again, was an important one. There is the practice of overwintering of the crop in the ghers. And in that case, water depth remaining in the ghers during the dry winter months can come out as a determining factor for successful carrying away the crop in the following warmer growth period during summer months.

Table 2. The depth range of the ghers maintained dry and rainy season

Season	***Depth of water (feet)***	***Number of gher***
Dry season	2.5-4	32
	>4-6	15
	>6	3
Rainy season	3-5	16
	>5-7	12
	>7-9	10
	>9	12

Because all the ghers surveyed were rain-fed, the water depth situation maintained during dry season is of most considerable. It can be seen from the Table 2, the depth ranges in the ghers during dry season were from 2.5 to > 6 feet which can be quite satisfactory for over-wintering the crop.

Pre-stocking management

The pre-stocking management, as the farmers practice, includes removal of bottom mud, dyke repairmen and control of weeds. At this stage, liming is a common practice, though it is extremely complex. Lime directly regulates the pH of water and soil. Lime also acts on transparency and hardness of water. The pH of bottom soil ranged between 7–8 and thus requirement of lime is not felt that much in the area of the study. As a result of that in the survey it was difficult to bring out any specific norm in the application of lime in the ghers. The rates of application, as being practiced by the farmers appeared to be highly variable. The figure 2 shows the range of lime application in kilogram per 50 decimal gher. It can be seen that > 8 – 10 kg/50 decimal dose was the prevalent in the study area.

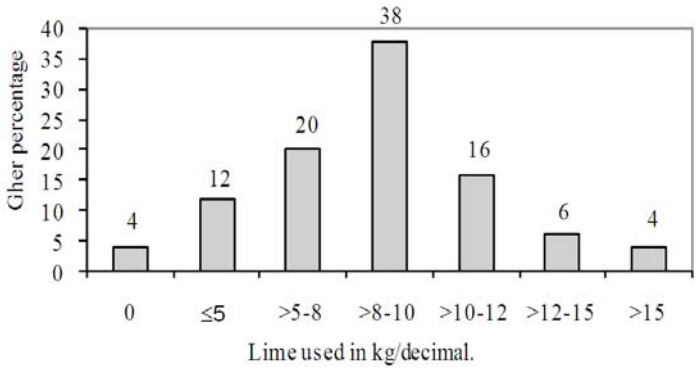

Figure 2. Percentage of application of lime in the surveyed ghers

For production of natural feed in the gher, fertilization both by organic and inorganic fertilizers is essential. Fertilization of the gher during preparation is also done, though a variability was noticed both in the form of doses and types of fertilizer.

Table 3. Fertilizer used in the ghers

Fertilizer	***Number of ghers***
Cowdung, urea and TSP	12
Urea and TSP	24
Cowdung and TSP	10
TSP	4

It appeared that majority of the farmers used fertilizer (43 of the 50) either organic or inorganic, however, the dose of application could not definitely be known. The observation revealed that the organic manure-cowdung and inorganic fertilizer-Urea and TSP were used either in combination or separately by the farmers, but the rate and proportion could not be definitely reckoned.

Stocking

Stocking management with regard to stocking materials, their size, ratio, species composition and density are all very crucial and do have relation with the water quality and productivity of the gher.

Observations made on the stocking scenarios of the ghers, revealed a total of five different fin fish species to go with galda. The stocking density, species ratio and size of the fry of both galda and the fin fish species were found to be variable in the different ghers. The average stocking rate of prawn and finfish/decimal of the village Mesagona, Ukhra, Kipna, Shingra, Angardoha are 80.35 and 7.73, 58.25 and 8.02, 51.9 and 10.15, 59.6 and 6.05, 40.5 and 4.34 respectively. Figure 3 shows stocking density of galda and the fin fish species in the ghers surveyed in the five villages of the study area.

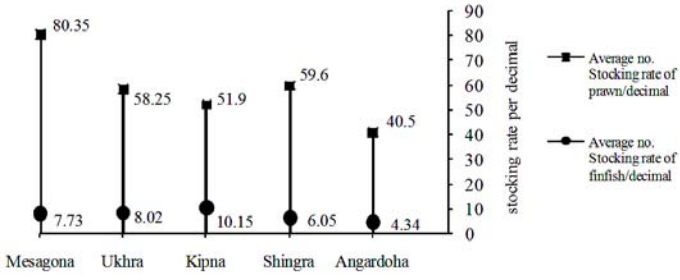

Figure 3. Average stocking rate of prawn and finfish/decimal in five villages

It was further revealed that the stocking of the fin fish species does not happen with any predetermined species type and their ratio or density to be stocked with. But it was observed that every farmer stocked rohu and silver carp commonly in his ponds. The size of the fin-fish fry appeared to be highly variable; the range was found to be 2-5 inches in case of all the species. The five different fin-fish species that were cultured with galda had many different combinations and the number of ghers having different species combination is shown in Table 4.

Table 4. Type of fin fish species with galda stocked in the ghers.

Species combination category	Name of species	Number of gher
Single species with galda	--	--
Two species with galda	Galda, rohu, silver carp	3
Three species with galda	Galda, rohu, silver carp, catla	2
	Galda, rohu, silver carp, grass carp	5
	Galda, rohu, silver carp, khorsula	4
Four species with galda	Galda, rohu, silver carp, catla, khorsula	7
	Galda, rohu, silver carp, catla, grass carp	10
	Galda, rohu, silver carp, grass carp, khorsula	5
Five species with galda	Galda, rohu, silver carp, catla, grass carp, khorsula	14

Post stocking management

Feeding

Observation on the feeding practice of the farmers revealed that, feeding was regularly done on 38 ghers. Eight ghers were found on irregular feeding and 4 were on without feeding. The feed used appeared to have different combinations of seven main different components. These are fish meal, snail meat, rice bran, wheat bran, mustard oil cake, wheat flour and sometimes biscuits crumbs.

The study revealed that the daily feeding was done in 38 ghers (76%) out of 50 ghers. The remaining of 8 ghers (16%) and 4 ghers (8%) were found to have irregular feeding and no feeding respectively. Different types of feed used by farmers are given in the Table 5.

Table 5. Feed types used in the shrimp ghers

Type of feed	***Number of gher***
Fish meal, snail meat, rice bran, wheat bran, mustard oil cake, wheat flour and biscuits crumbs	8
Fish meal, snail meat, rice bran, wheat bran, mustard oil cake	12
Fish meal, snail meat, rice bran	15
Fish meal, snail meat	11
Total	***46***

The feed ingredients are soaked in water and made dough before application in the ghers. The proportion of the ingredients could not be definitely known, however, rice bran is the principal item of the feed. Fish meal, snail meats are seen to be generally used in the feed. The rate of feeding, similarly, does not have a strictest basis, being based on empirical knowledge and experience. They apply at the rate of 100-200 gm/decimal pond size at the initial stage of stocking, being increased to 500-1000 gm when the prawn gets larger size.

Water quality and general management

The ghers studied were all rainfed. There were no provisions of filling the ghers with underground water. Thus the water quality in the ghers especially during the winter dry months becomes a crucially important consideration. However, the farmers from their experience try to keep the water quality optimum for the production of the prawn. They routinely check if there is disease with the prawn. If any disease is noticed, they harvest those and sell those in the market. The ghers are always secured by one guard during the daytime and another during night time. In the ghers, one or two labors are engaged in various services like pond preparing, liming, feeding, fish transporting and selling, harvesting and so on.

Harvesting

The farmers harvest the crop one or twice in the culture season. The entire crop is periodically sampled for the presence of the bigger prawn. They call these “piece fishes”, which they start selling from August to September. Once after those piece fishes are exhausted, the smaller ones are kept in the gher until December to January when they again check the crop. If yet bigger sized prawn are available then those are harvested and sold. The last remaining crop which is composed of mainly smaller prawns, are kept for over-wintering, for them to get bigger in the next growing season in summer.

The fin fish species that are there in the ghers, are mainly used for home consumption by the farmers. So they pay little attention as to the revenue that comes from the sale of those fishes. The main concern of the farmers are the prawn and the paddy that they grow in the middle portion of the gher, the over-wintered crop remains in the peripheral canal and the paddy is grown in the middle cultivated portion of the gher.

Cost benefit analysis

Cost benefit analysis is the analysis of total cost for the production and the profit from the production. The production cost included purchasing of PL of prawn and fry of fin fishes. It also included purchasing of lime and feed etc. Production cost is also based on labor management, house repairing, harvesting gears, basket, night

guard and transport. The total production cost of a 100 decimal gher was found as BDT[1] 19,680. The total prawn, finfish and paddy production were 120, 210 and 1200 kg obtained from the gher that costs BDT 60,600 in total. Thus net profit was BDT 40,920. It should be emphasized that cost and benefit analysis would provide the information necessary to determine the relative profitability of various production techniques, comparing the utility of major inputs, such as land, labor and capital, with that of alternative production activities through improving the efficiency of the farm operation. Production cost of a 100 decimal gher is given below:

Table 6. Production cost of a 100 decimal gher

Serial Number	Items		Amount / number	Rate in BDT	Total cost
1	Prawn fry		6000	1.5	9,000
2	Catla		200	2	400
3	Rui		300	2	600
4	Silver carp		100	1.5	150
5	Grass carp		100	1	100
6	Khosula		300	2	600
7	Lime		20 kg	8	160
8	Fertilizer		40 kg	20	800
9	**Feed**	Snail	300 kg	4	1,200
		Fish meal	50 kg	20	1,000
		Others	60 kg	10	600
10	Labor		20	50	1,000
11	House repairing		200		
12	Harvesting		---	---	---
13	Basket		15	10	150
14	Spade		2	110	220
15	Night guard		2,500		
16	Transport		500		
17	Dike repairing		---	---	---
18	Others				500
Total					**19,680**

The cost benefit analysis of a 100 decimal gher is given below:

Total area = 100 decimal
Total input = BDT 19,680
Total prawn production = 120 kg
Total finfish production = 210 kg
Total paddy production = 1,200 kg
Total value of prawn = BDT 42,000
Total value of other fishes = BDT 9,000
Total value of paddy = BDT 9,600
Net profit = (60,600 – 19,680)
= BDT 40,920

CONCLUSION

The study was done on the physical condition, existing practice and problems of the ghers. The farming system adopted by the farmers is not anyway modern or based on scientific method. Most of the farmers were not aware of the necessity of gher preparation aiming at increasing productivity and appropriate ratio of stocking and feeding. To properly manage the gher, continuous monitoring and supervision are necessary. For these reasons necessary information with regard to modern technology has to be transferred to the farmers. Prawn yield in the ghers can be increased by applying modern farming techniques such as intensification of culture operation through regularization of gher size, increasing stocking density, employment of aeration system and appropriate application of fertilizer and feed.

REFERENCES

Ahmed M. S., S. Ali, M. S. Shah and G. A. Latifa, 1996. *Polyculture of giant freshwater prawn, Macrobrachium rosenbergii with some carps*. Bangladesh Journal of Zoology, 24 (2), pp 103-108.

[1] BDT (Bangladeshi currency called taka) 1 = USD 0.63 APPROX (as on the study year 2005).

Anonymous, 2003. *Matshya Pakkha Saranika, Matshya Adhidaptar*. Ministry of Fisheries and Livestock: pp. 30, 110-111.

Islam, M. A., Hossain, M. A., Haque, A. and Rahman, M.S., 2002. *Raising of Freshwater Giant Shrimp (Macrobrachium rosenbergii) in a Semi-controlled Pond Under Various Dietary Conditions of the Stocking Pond.* Bangladesh Journal of Fisheries: pp.35.

Humayun, N.M., Alam, A.N., 1988. *Observation of the Pond Growth rate of Macrobrachium rosenbergii at different stocking density*. Bangladesh J. Zool*:* pp. 48.

Paul, A.K., 1994. *Bangladesher Raptanijoggo Matshya Sampad (Exportable Fisheries in Bangladesh)*. Tuli-Mili Prokashoni, Khulna*:* pp. 41.

Singolka, S., New, M.B., 1985. *Fresh Water Prawn Farming. A Manual for the Culture of Macrobrachium rosenbergii*, *FAO Fish Technology Paper*. pp. 36.