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Article

Shrimp disease investigation and culture strategies in Bagerhat district, Bangladesh

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Abstract: The present study was conducted in three upazilla (Bagerhatsadar, Fakirhat and Rampaul) to investigate the shrimp diseases and culture strategies of Bagerhat district in 2012. Post larvae (PL-13/21) from hatchery and natural were used to stock in the study area. The highest mean stocking density was recorded in the ghers of Rampaul (16796±7729.69 PL/ha), where the maximum survival rate was also found (63.00±11.52 %). The highest dose of lime was recorded as 302.58±50.92 kg/ha at Bagerhat sadar; cowdung was recorded as 605.16±118.46 kg/ha at Fakirhat upazilla and urea was recorded as 29.02±5.84 kg/ha (Bagerhat sadar) respectively. The maximum doses of MP and TSP were recorded as 34.58±4.51 kg/ha at Bagerhat sadar and Fakirhat and 27.79±3.71 kg/ha at Bagerhat sadar respectively. No supplementary feed were fed to shrimp, in where culture dependent on natural foods. The highest shrimp production was found in Fakirhat upazila (667±307.05 kg/ha) and the lowest production was in Rampaul upazilla (497±268.97 kg/ha). Sudden change of p^H , low dissolved o_2 levels, salinity variations, nutritional deficiency and other environmental changes causes yellow head viral disease (YHD), white spot syndrome viral (WSSV), vibriosis, fusarium and protozoan were recorded during the experimental period.

Keywords: shrimp; disease investigation; culture strategies

1. Introduction

Bangladesh is enriched with a vast aquatic resource in the forms of both freshwater and brackish water. Brackish water bodies are suitable for shellfish production. The subtropical country, Bangladesh has a favorable condition for shrimp culture. Different water bodies are very productive in this country. This country blessed 60 shrimp species. Bangladesh entered the global export market for shrimp in the early 1970s. It is the second largest foreign income earner. Rapid expansion of shrimp culture was started in BD from the 1980. The contribution of coastal aquaculture, Particularly black tiger shrimp (*Penaeusmonodon*) culture to both rural and national economics have become a major source of export earnings and employment in the coastal areas of Bangladesh. Bangladesh has a huge area of coastal tidal land (Territorial water 2640 sqmiles) continental shelf 41040sqmiles. Exclusive Economic zone 24,800 sq miles and an extended coast line of about 710 km of which only 0.143 million hectares of land has been brought under brackish water shrimp aquaculture. In 2011-12 the country produced 239460 metric tons of shrimp and prawn of all kinds (Jatio Motshow Sopthah, 2012). Shrimp culture is widely practiced in Khulna, Satkhira, Bagerhat, Cox's bazar due to entrance of tidal water throughout

the year in this regions. Among the fisheries sectors about 77% foreign exchange comes by shrimp exporting. Though rapid expansion of shrimp culture was started in BD from the 1980s but the production of shrimp 250 kg/hactre/year that is negligible comparing to the other countries. There are several diseases out break during culture period causes drastic loss of the farmers. According to most of scientist, prevention is badly requirement to reduce the disease risk of shrimp than take measures for medication after outbreaks. So diseases prevention and management now considered as the prime issue in production and expansion of this shrimp sector. Scientist propose that better pond management and management during culture period can play salient role in the prevention of most disease which usually attack shrimp culture period. As most of our farmer either not well educated or illiterate, they are not conscious about pond management and culture management as well. Beside feasible culture management system is yet to develop which can easily be adopted by the farmers regarding the existing culture environment. It is hope that information that is collected through this study will very much relevant to identify the diseases occurrence and management guideline considering different factors related to gher and culture management for shrimp. The main objective of this study was the prevalence of shrimp diseases and relationships with season, the diseases producing factors and the culture strategies in the selected area.

2. Materials and Methods

2.1. Study area

The study area was conducted on sadar upazilla of Bagerhat, Fokirhat and Rampaul in Bagerhat district. Bgerhat region is the most pioneer and popular for shrimp production. The study area located at the coastal region of Bangladesh (Figure 1). Ghers or farms were randomly selected for data collection and project research. The figures show the study region.

2.2. Data collection

Data was collected by direct interviewing of the farmers. Prior to collect data a structured questionnaire was prepared. The questionnaire was prepared adhering to the objectives of the study. FGD (Focus Group Discussion), PRA (Participatory Rural Appraisal), RRA (Rapid Rural Appraisal), telephone interview, collection of secondary data were used to collect data.

2.2.1. Collection of secondary data

Secondary data were collected from Fisheries and Marine Resource Technology, Khulna University and DoF, Bagerhat district, Shrimp Research Institute and also collected from internet browsing.

2.3. Data analysis

The data from questionnaire sheet and secondary sources were grouped, categorized and interpreted in tabular form by using the computer software, MS word, MS Excel and analyzed according to objectives of the study. Some data had numeric and some contained narrative facts. Most attention has been given in this phase because any wrong observation might cause wrong result. Processed data have been analyzed in the possible simple format. The analysis is statistical and calculative as far as possible for the purpose of the study.

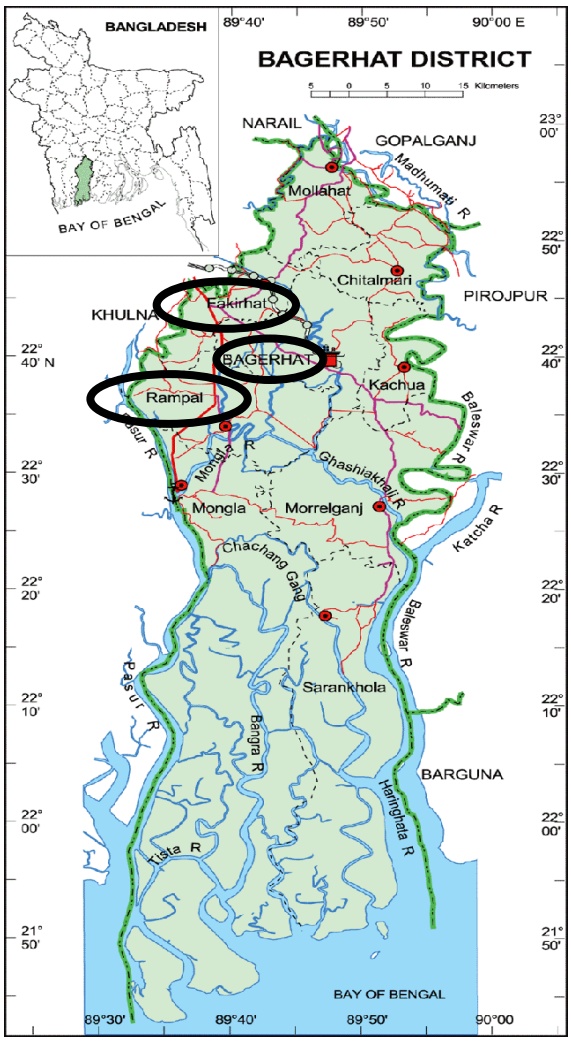

Figure 1. Map showing the study area.

3. Results and Discussion

3.1. Present status of shrimp culture

3.1.1. Fry source and stocking

Fry are collected from hatchery and natural source (wild collection). Many hatcheries have been established in the study area for supplying of post larvae (PL) to the farmers. The highest mean stocking density was recorded in the ghers of Rampaul (16796±7729.69 PL/ha) (Table 1).The maximum survival rate was found in the ghers of Rampaul (63.00±11.52 %) followed by Fakirhat and Bagerhat (Table 1).

Table 1. Stocking density and survival rate of the shrimp PL in ghers.

Area	Stocking density (PL/ha)			Survival rate (%)		
	Min	Max	Mean±SD	Min	Max	Mean±SD
Bagerhat	11362	22230	16178±4534	45	50	54.25±10.90
Rampaul	9633	26182	16796±7729.69	55	80	63.00±11.52
Fakirhat	7410	22230	12535±6662	50	75	59.25±11.35

The stocking densities recorded in the present study was much lower than the findings of Kalam *et al.* (2010b) who recorded stocking density of 25140 PL/ha in their study area of Monirampur upazila of Jessore district.

3.1.2. Feed and feeding

Generally no artificial feed was supplied in the ghers of the study areas. Studied ghers were completely dependent on natural foods. Farmer used fertilizers to enhance the growth of natural foods. The present findings differ from the result described by Kamal *et al.* (2010a) who mentioned that various supplement feeds were supplied to the ghers for enhancing the growth within sort period of time.

3.1.3. Use of lime and fertilizers

Most of the farmer did not use inorganic fertilizer during pond preparation. Farmer use inorganic fertilizer mainly for growing plankton in the gher during post stocking management. In the study area, 32% farmers used inorganic fertilizer during culture period. However 80% farmers were also found who used organic fertilizers during culture period. As inorganic fertilizer TSP is mostly used. Some farmers also applied phosphate fertilizer in their ghers. Mean application rates of lime and various fertilizers are shown in Table 2. The highest application rate of lime was found 302.58±50.92 kg/ha in the ghers of Bagerhat (Table 2). Both organic and inorganic fertilizers were used in the ghers to enhance the natural food production. Only one organic fertilizer, cow dung was applied with the highest rate of 605.16±118.46 kg/ha in ghers of Fakirhat upazila (Table 2).In case of urea application, the highest mean application rate was found 29.02±5.84 in the ghers of Bagerhat (Table 2). Whereas, the maximum doses of MP and TSP were recorded as 34.58±4.51 kg/ha (Bagerhat and Fakirhat) and 27.79±3.71 kg/ha (Bagerhat) (Table 2).

Table 2. Application of lime and fertilizers in ghers.

Area	Mean application rate (kg/ha)				
	Lime	Urea	MP	TSP	Cow dung
Bagerhat	302.58±50.92	29.02±5.84	34.58±4.51	27.79±3.71	592.8±112.28
Rampaul	259.35±76.80	23.47±3.19	31.49±4.22	19.76±13.42	605.15±107.66
Fakirhat	247±87.91	22.85±5.48	34.58±4.51	18.28±10.85	605.16±118.46

3.1.4. Gher type

In the study area, gher size varied greatly. In the study area, the maximum gher size was 40.08 ha and the minimum size of gear was 0.40 ha. Most shrimp farmer had their own gher; however 38.68% farmer had both own and leased gher. The average lease value (tk/acre) in the study area was found to be varied around tk.1000. Due to expansion of shrimp culture, lease value increased over the year. High lease value was found in Fakirhat at tk. 15000 per acre in some area.

3.1.5. Shrimp production in gher

Shrimp production status in the ghers of the study locations are shown in table 3. The highest shrimp production was found in Fakirhat upazila (667±307.05 kg/ha) followed by Bagerhat and the lowest production was in Rampaul upazila (497±268.97 kg/ha) (Table 3).

Table 3. Shrimp production status in the ghers of the study area.

Location of ghers	Production (kg/ha)		
	Min	Max	Mean±SD
Bagerhat	445	890	645±185.09
Rampaul	297	890	497±268.97
Fakirhat	386	1037	667±307.05

The maximum production of shrimp recorded in this study was found higher than that of Kamal *et al*. (2010a) who reported 595 kg/ha yield in their study area.

3.2. Disease occurring season by changing water quality parameter

Shrimp diseases occurred almost all the year around, virus disease can be occurred any time in the gher but mainly dependent on the change of water quality parameters, in monsoon period heavy rainfall is occur in our country, in addition of huge waters makes the gher water diluted, and due to changes of water quality diseases developed rapidly. The excess water flows from one gher to another, via canal resulting in rapid spread out of diseases. Water quality variations in the studied ghers are presented in Figure 2.

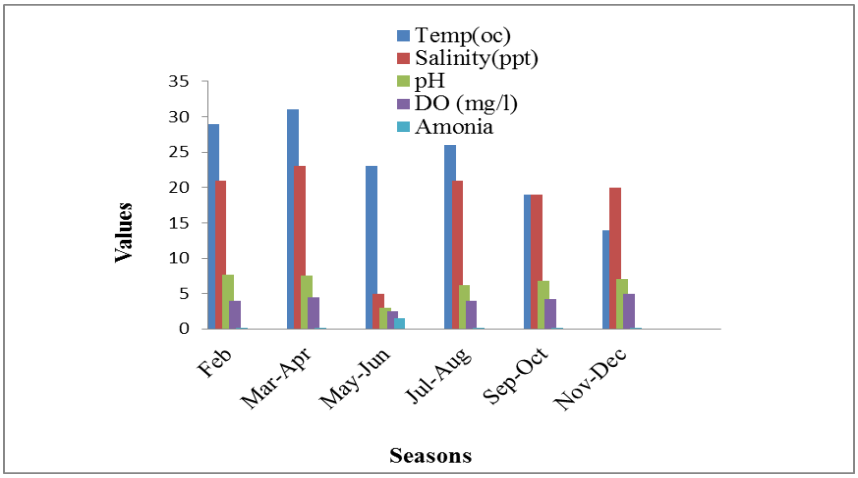

Figure 2.Variation of water quality in different season.

The present findings differs from the result mentioned by Kamal *et al.* (2000b) who reported that the highest value (31.90 ^{0}C) was in August and the lowest temperature (30.27 ^{0}C) was recorded in September in post larvae (PL) rearing ponds. Others parameters like DO was found lower than that of the findings of Kamal *et al.* (2010b). However, pH level found in this study was similar to the findings of Kamal *et al.* (2010b).
The pH was also similar to the findings of Boyd and Zimmermann (2000), who reported that the ideal environment for nursing of prawn post-larvae should have pH values of 7.0 to 8.5.

3.3. Diseases of shrimp

In the study area viral, bacterial, fungal, protozoan disease are occurred and diseases occur for deficiency of nutrition and environmental change. Occurrence of disease in the study area is shown in the Figure 3 and Table 4.
Brook *et al.* (1997) reported that viral diseases are the most devastating because they are difficult to detect and impossible to treat in ponds. So, several ghers in the study areas were at grave peril as these ghers have already been affected by the viral diseases.
Kamal *et al.* (2010a) stated the ignorance of farmers about disease of prawn or shrimp. They recorded some disease in their study area but the reasons were unknown to the gher operator.

Table 4. Investigation of shrimp disease in different area.

Name of disease	Agent	Type	Syndrome	Measure	Area		
					Rampaul (%)	Fakirhat (%)	Bagerhat (%)
Yellow head	Yellow head virus	Virus	White, brown gills, yellowing the cephalothorax	Improved husbandry	12	10	13
Vibriosis	Vibrio spp.	Bacterial	Black spot on carapace	Maintaining water quality	07	06	09
WSSV	White spot syndrome virus	Virus	Loose shell, darkened body surface, appendages	Improved husbandry	20	23	19
Fusariosis	Fusariumsolani	Fungas	Secondary infection affects adults	Improved husbandry	05	03	07
Protozoan infestation	Vorticella, Opercularia.Vaginicola, Aagineta	Protozoan	External parasites that inhibit swimming, feeding, moulting	Improved husbandry, formalin, merthiolate, copper based algicids	02	2.8	3

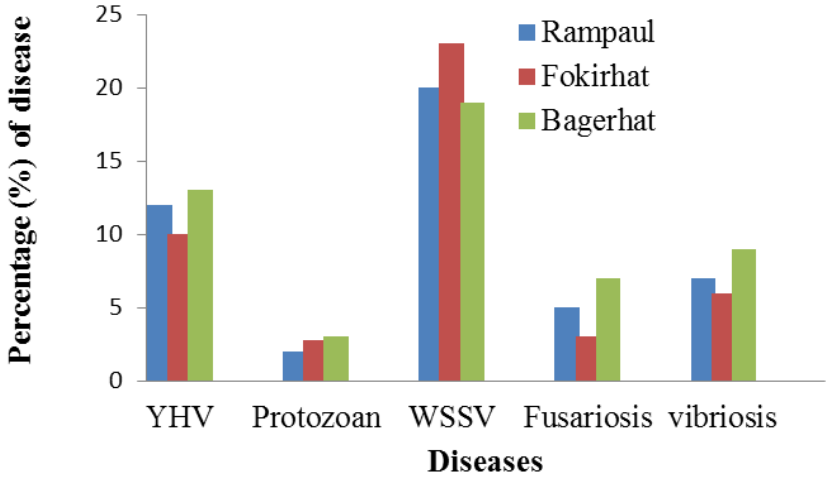

Figure 3. Occurrence of diseases in the study area.

3.4. Causes of shrimp diseases

During the period of study, several causes are responsible for shrimp diseases were recorded. These causes are diseases infected fry are stocked in the gher, PCR tested fry are not stocked in the gher, water flow from one disease infected gher to another gher by canal, changes of water quality parameter in the gher, nutritional deficiency and changes of environmental condition. But a sudden change in pH or low dissolved oxygen levels can precipitate an outbreak of Yellow Head Virus disease, and pollution from outside, such as insecticide residues, that have a very high direct toxicity on shrimp may be important at sub lethal levels as predisposing factors for disease (Flegel 1996) and fluctuations of normal environmental conditions e.g. oxygen, temperature, salinity have a significant effect on the virulence of *Vibrio harvey*i, with salinity being more lethal to shrimp than temperature (Shivappa 1997).

3.5. Shrimp health management

The careful planning and avoidance of diseases are crucial factors for successful shrimp culture. A large number of diseases caused by virus, bacteria, fungi, protozoa, nutritional deficiency and abrupt changes in environmental parameter. Shrimp health management is focused on disease prevention through proper nutrition, maintenance and stress reduction. Minimizing water quality fluctuation, maintaining stable micro algal culture etc. Post larval health should be evaluated on a daily basis. A random sample of 50-100 PL should be checked. The investigation should include on PL deformities, abnormal swimming activity, hepatopancreas's color and volume, gut content, fouling level, amount of fecal strands, moulting rate, animal stress signs and other unusual behavior, details of sampling should always be recorded. To overcoming the pathogenic problem, application of disinfectants and antibiotics is a common practice in shrimp culture (Karuna Sagar *et al.*, 1996). Chowdhury*et al.*, (2015) stated the drug and chemicals used for good aquaculture practice.

3.5.1. Daily observations

Plankton bloom, colour of water, behavior of shrimp. Shrimp with empty guts, excess feed on trays. Shrimp with soft shell or heads, fouling on shell. Shrimp with deformities, discolouration of shrimp appendages, dense white muscles in shrimp. Shrimp with bent or cramped tails. Pond bottom condition. Stressors like unionized ammonia and nitrate in the presence of high pH, insufficient oxygen and carbon dioxide levels, extreme changes in salinity, temperature, pH, alkalinity, molting, excess handling, presence of heavy metal and parasitism.

3.5.2. Pathogen detection

For shrimp farmers, the most important aspect of disease diagnosis is the ability to detect the pathogen and minimize the losses. The diagnostic process involves detecting the agent responsible for the disease and its contribution to the disease. Rapid diagnostic tools like staining, haemolymph smears, squashes, bacterial cultures and gill and hepatopancreas exams can be used to monitor health and for diagnosis. Farms should use

outside laboratories for analyzing molecular assays like dot blots, in situ hybridization and polymerase chain reaction (PCR) to confirm diseases.

4. Conclusions

From the study, it was evident that brackish water shrimp *(Penaeusmonodon*) culture has experienced a rapid increase in recent times in greater Bagerhat region. Farmers get a very low production from the still existed traditional culture system. Besides, an outbreak of disease during culture period sometimes causes drastic loss and in the recent year's disease attack is the common problem and obviously alarming in shrimp farming. It is very true that scientists are yet to invent the proper medicine or antibiotics for medication or to reduce the shrimp diseases. Most of the scientists suggest proper management of the shrimp farm to keep the disease risk at the bottom. Therefore intensive study on different management system basis on lot of variables is prime necessity to find out the optimum scale of culture and pond management system for the sake of the improvement of this sector. Farmers should be given proper training so that they easily accept and adopt the improved technology of culture and management system. Most of our farmers are poor, therefore they should be provided with easy credit facilities to bear the excess cost if necessary to adopt the new and fruitful technologies of culture management. It is the high time for government and non-government organizations to come up with concerted efforts for improvement and sustainability of the sector.

Conflict of interest

None to declare.

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