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PRESENT STATUS OF FISH DISEASES AND ECONOMIC LOSSES DUE TO INCIDENCE OF DISEASE IN RURAL FRESHWATER AQUACULTURE OF BANGLADESH

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ABSTRACT

Bagum N, Monir MS, Khan MH (2013) Present status of fish diseases and economic losses due to incidence of disease in rural freshwater aquaculture of Bangladesh. *J. Innov. Dev. Strategy*. 7(3), 48-53.

The study was carried out to know the present status of fish diseases and economic losses due to incidence of disease in three districts of Bangladesh namely Mymensingh, Sylhet and Rajshahi during the period from March 2010 to June 2013 using questionnaire interview and focus group discussion (FGD). A total of 300 fish farmers were interviewed and twenty FGD sessions were conducted. The most prevalent symptoms of diseases as reported by the farmers were Epizootic Ulcerative Syndrome (EUS) (31.33%), red spot (21.33%), fin/gill rot (16.7%), grayish white spot (6%), parasites (external) (5%), gulping for air (4%) and dropsy (4%). The average prevalence of fish diseases was highest (27.0%) in Rajshahi followed by Mymensingh (24.6%) and Sylhet (18.3%) districts. The overall average prevalence of fish diseases was found 22%. About 76.70% diseases were reported mainly in winter season and highest number of farmers (27.33%) used lime and salt to treat fishes. The average disease control cost as high as BDT 3,688 ha^{-1} yr^{-1} was in Mymensingh district followed by Rajshahi BDT 3,449 ha^{-1} yr^{-1} and Sylhet BDT 3,243 ha^{-1} yr^{-1}. The overall average disease control cost was BDT 3,460 ha^{-1} yr^{-1}. It was found that the highest average economic loss was BDT 30,023 ha^{-1} yr^{-1} (14.4%) in Rajshahi and the lowest BDT 20,390 ha^{-1} yr^{-1} (10.8%) in Mymensingh district. The present study indicated that the overall average economic loss due to fish diseases was BDT 24,870 ha^{-1} yr^{-1} (12.9%). Hence, management of such fish disease should be given top priority to save the freshwater aquaculture industry from huge economic loss.

Key words: *fish disease, economic losses, freshwater aquaculture*

INTRODUCTION

Bangladesh is one of the 15 leading aquaculture producing countries in the world achieving a rank of 6th position (FAO 2011). Aquaculture contributed about 52.92% of total fish production of the country during 2011-12 (DoF 2013). The major portion of aquaculture production of Bangladesh comes from rural freshwater aquaculture. Rural aquaculture is the extensive or improve extensive system, low-cost farming of aquatic organisms by farming households or communities, using technology appropriate to their resources base (Edward and Demaine, 1997). In spite of tremendous potential production, rural freshwater aquaculture of Bangladesh has been suffering from out break of diseases. The common fish diseases in Bangladesh are ulcer type disease including Epizootic Ulcerative Syndrome (EUS), tail and fin rot, bacterial gill rot, dropsy, fungal diseases and parasitic diseases (Chowdhury 1993). Infectious diseases caused by bacterial and fungal pathogens have been recognized as a serious threat to aquaculture in Bangladesh (Zahura *et al.* 2004).

Disease is one of the major constrains to aquaculture and may eventually become a limiting factor to the economic success of the fish farmers. Some diseases have caused serious damage, not only the livelihood of fish farmers, but also to the future development of the industry. The intensification and expansion of fish culture is facing a severe threat from pathogens as they are the prime cause for mass mortalities and poor growth thus, affecting the yield and marketability of fishes. Rural farmers are mostly resource poor with little or no knowledge of health management and have inadequate opportunities to improve management skills. Their ability to respond effectively to fish disease problem is also very limited. As a result, they suffer from financial losses due to fish disease. So, prevalence of fish diseases has negative impacts on fish production. Disease cause deterioration in the food value of fish and may even result in their mortality. The occurrence of parasitic diseases in the form of epidemic is a great threat to the major protein supply in Bangladesh. It is not only disturbing the supply of protein but also brings about a pessimistic impact on country's economy. Hossain *et al.* (2011) estimated the losses due to mortality and retardation/cessation of growth of fish in ponds in West Bengal as a result of epidemic infections. In China, it was estimated that around 10% culture area is suffering from disease, with annual losses of fish production is around 15% (Wei 2002). In Bangladesh only a few studies have been carried out on the economic impact of fish diseases. The most severe economic impact of fish diseases in Bangladesh was due to the occurrence of EUS in 1988 and the loss was estimated at about US$ 3.38 million in 1988 (Barua 1994). Assessing the economic impact of disease in rural aquaculture is vital in order to develop farmers-oriented primary fish health management. The study may help rural fish farmers, researchers and aquatic animal health specialists to know the present status of fish health and approximate economic losses due to disease out-break in fish farms.

MATERIAL AND METHODS

Selection of study area

The study was conducted in three selected districts of Bangladesh *viz.*, Mymensingh, Rajshahi and Sylhet due to abundance of fish resources.

Data collection and sampling

A combination of participatory, qualitative and quantitative methods was used for data collection. Data were collected from March 2010 to December 2013. A traditional survey method of direct interview from the selected fish farmers was followed, using pre-tested questionnaire. After collecting primary data, focus group discussion with farmers and cross-check interviews with key informants were carried out to justify the previously collected data. A total of 300 farmers having different farm size were interviewed. Category of fish farmers on the basis of farm size such as, small (<0.3 ha), medium (0.3-0.5 ha) and large (>0.5 ha) in the study area.

Data analysis

The data from the questionnaire were grouped and categorized according to the different fish farmers. The whole data were processed by the MS Excel program and in the tabular from in the computer. Mainly the tabular and graphical methods were used for analyzing the data.

RESULTS

Diseases causing fish death

When fish farm owners were asked about kind of diseases in their ponds, a range of diseases was reported by them according to their occurrence. The most commonly reported diseases were EUS (31.33%), red spot (21.33%), fin/gill rot (16.7%), grayish white spot (6%), parasites (external) (5%), gulping for air (4%) and dropsy (4%) (Table 1). EUS was the most common disease that had a significant negative impact on carps fish (*Catla catla*, *Labeo rohita* and *Cirhinus cirhosus*) especially in Sylhet (32%) and Rajshahi (35%) districts. It was found that grayish white spot disease (18%) was especially found in cultured *Heteropneustes fossilis* in Mymensingh. However, EUS, red spot, fin or gill rot were sever in all the three districts of Bangladesh.

Table 1. Diseases causing fish death reported in farmer's pond

Abnormality/Disease	Mymensingh (% of farmers)	Sylhet (% of farmers)	Rajshahi (% of farmers)	Overall (% of farmers)
Red spot	16	23	25	21.33
Grayish white spot	18	0	0	6.0
Rot (fin/gill rot)	11	21	18	16.70
EUS	27	32	35	31.33
Cotton fungus	7	4	1	4.0
Dropsy	4	5	7	4.0
Parasites (external)	7	3	5	5.0
Big head	3	6	4	4.33
Whirling	4	2	2	2.70
Gulping air	3	4	3	3.33

Prevalence of fish disease

The average prevalence of diseases in fishes was about 11.2-30.4% which varied according to farm size. Average prevalence of disease in small farmer's ponds was the highest (30.4%) followed by medium (24.1%) and large farmer's ponds (11.2%). It was also found that average prevalence of fish diseases in farmer's ponds was highest (27.0%) in Rajshahi district followed by Mymensingh (24.6%) and Sylhet (18.3%). However, the overall average prevalence of fish diseases was found as 22% (Table 2).

Table 2. Prevalence of fish diseases in different districts and farms categories

Farm category (ha)	Mymensingh	Sylhet	Rajshahi	Average (%)
<0.3	32.6	24.3	34.4	30.4
0.3-0.5	25.8	17.5	29.2	24.1
>0.5	15.4	13.0	17.4	11.2
Average	24.6	18.3	27.0	22.0

Disease occurring season

It was found that 76.70% disease were reported in winter season, 7.70% in summer season, 7.33% in both the seasons, 6.70% in rainy season and 1.70% in any season in ponds (Table 3).

Table 3. Disease occurring season in farmer's pond

Season	Mymensingh (% of farmers)	Sylhet (% of farmers)	Rajshahi (% of farmers)	Overall (% of farmers)
Winter	63	85	82	76.70
Summer	16	5	2	7.70
Winter and Summer	3	8	11	7.33
Rainy season	13	2	5	6.70
Any season	5	0	0	1.70

Table 4. Chemotherapeutics used for fish disease control

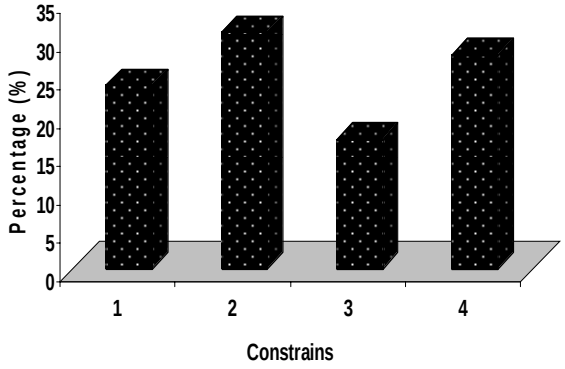
Therapeutics used	Mymensingh (% of farmers)	Sylhet (% of farmers)	Rajshahi (% of farmers)	Overall (% of farmers)
Lime only	5	24	28	19.0
Salt only	6	13	15	11.33
Potash only	12	16	14	14.0
Lime, salt together	34	23	25	27.33
Lime, salt and potash together	13	6	5	8.0
Antibiotics and vitamin together	27	9	7	14.33
Pesticides	3	9	6	6.0

Chemotherapeutics for fish disease control

A number of chemotherapeutics were reported for controlling fish disease in framer's pond (Table 4). Application of liming was the most common practice followed by salt, potassium permanganate ($KMnO_4$), antibiotics and various types of pesticides. It was found that highest number of farmers (27.33%) used lime + salt together followed by lime only (19.0%), potash only (14.0%), and lime + salt + potash together (8.0%). About (27%) of framer's in Mymensingh were treated fish by using antibiotics + vitamins. About 6.0% farmer's used various types of pesticides for the control of parasitic disease (Table 4).

Constraints in fish health management

The fish farmer's faced different constraints when fish disease outbreaks in their farms. It was found that lack of knowledge on fish disease (24%), lack of knowledge on treatment (31%), lack of advisory services from government and non-government organization (17%) and lack of training facility about fish disease treatment (28%) (Fig. 1).



Legends:

1. Lack of knowledge on fish disease
2. Lack of knowledge on treatment
3. Lack of advisory services from GO/NGO organization
4. Lack of training facility about fish disease treatment

Fig. 1. Constraints faced by fish farmer's in fish health management

Disease control cost

A number of chemotherapeutics and measures were reported for controlling fish disease in framer's pond(Table 4). The average cost of fish disease control (including prevention and treatment) in large farmer's pond was highest (BDT 3,795 ha^{-1} yr^{-1}) followed by medium (BDT 3,507 ha^{-1} yr^{-1}) and small farmer's ponds (BDT 3,079 ha^{-1} yr^{-1}) (Table 5). The highest disease control cost BDT 3,688 ha^{-1} yr^{-1} was found in Mymensigh district and lowest BDT 3,243 ha^{-1} yr^{-1} was in Sylhet district. However, the overall average disease control cost was BDT 3,460 ha^{-1} yr^{-1}(Table 5).

Table 5. Cost of fish disease control (BDT ha^{-1} yr^{-1})

Farm category (ha)	Mymensingh	Sylhet	Rajshahi	Average
<0.3	3,211	2,964	3,062	3,079
0.3-0.5	3,803	3,260	3,458	3,507
>0.5	4,050	3,507	3,828	3,795
Average	3,688	3,243	3,449	3,460

Fish production value

Expected and actual fish production values were varied according to the size of farms, cultured fish species, type of culture systems and district. The highest average expected fish production value BDT 238,107 ha^{-1} yr^{-1} was found in Rajshahi and lowest BDT 201,500 ha^{-1} yr^{-1} was in Sylhet district. After selling fish at the end of the years, it was found that Rajshahi district also had the highest average actual production value BDT 208,083 ha^{-1} yr^{-1}, while Sylhet district had the lowest BDT 177,303 ha^{-1} yr^{-1} (Table 6).

Economic losses due to fish disease incidence

The economic loss due to fish disease incidence was estimated by differences between the expected production value and the actual production value. The average economic losses due to fish diseases was highest BDT 28,126 ha^{-1} yr^{-1} in small sized farms than in medium BDT 24,257 ha^{-1} yr^{-1} and large sized farms BDT 22,227 ha^{-1} yr^{-1}, respectively (Table 6). It was found that the highest average economic loss was BDT 30,023 ha^{-1} yr^{-1} (14.4%) in Rajshahi and the lowest BDT 20,390 ha^{-1} yr^{-1} (10.8%) in Mymensigh district. However, the overall average economic loss due to fish diseases was BDT 24,870 ha^{-1} yr^{-1} (12.9%) (Table 6 and 7).

Table 6. Average expected and actual fish production value and economic losses (BDT ha^{-1} yr^{-1}) due to incidence of fish disease

Farm category (ha)	Mymensingh			Sylhet			Rajshahi		
	Expected value	Actual value	Loss value	Expected value	Actual value	Loss value	Expected value	Actual value	Loss value
<0.3	185,400	162,560	22,840	178,500	151,080	27,420	215,200	181,080	34,120
0.3-0.5	198,500	178,980	19,520	190,400	166,860	23,540	238,420	208710	29,710
>0.5	241,300	222,490	18,810	235,600	213,970	21,630	260,700	234,460	26,240
Average	208,400	1,88010	20,390	201,500	177,303	24,197	238,107	208,083	30,023

Table 7. Economic losses (BDT ha^{-1} yr^{-1}) of the farmer's due to fish disease

Farm category (ha)	Mymensingh	Sylhet	Rajshahi	Overall average
<0.3	22,840 (14.0%)	27,420 (18.1%)	34,120 (18.8%)	28,126 (16.9%)
0.3-0.5	19,520 (10.9%)	23,540 (14.1%)	29,710 (14.2%)	24,257 (13.0%)
>0.5	18,810 (8.4%)	21,630 (10.1%)	26,240 (11.2%)	22,227 (9.9%)
Average	20,390 (10.8%)	24,197 (13.6%)	30,023 (14.4%)	24,870 (12.9%)

DISCUSSION

Fish diseases are one of the major constraints resulting from intensification of aquaculture and may eventually become a limiting factor to the economics of a successful and sustainable aquaculture industry. The study identified different types of diseases in freshwater aquaculture farming in Bangladesh. The most commonly reported diseases was EUS (33.33%), followed by red spot (21.33), tail and fin rot (16.70), grayish white spot in *H. fossilis* (6.0) and dropsy (4.0). Similar conditions were also reported by some other authors (Faruk *et al*. 2012; DoF 2002; Mazid 2001).

The present study showed that EUS was the most common disease that had a significant impact on major carps fish (*C. catla*, *L. rohita* and *C. cirhosus*) especially in Sylhet (32%) and Rajshahi (35%) districts of Bangladesh. EUS was first reported in Bangladesh in 1988 and pathogenic fungus, *Aphanomyces invadans* was identified as the causative agent of the disease (Khan and Lilley, 2002). In Sylhet and Rajshahi districts of Bangaldesh, maximum farmer's ponds do not have permanent source of water and such ponds depend for water on rainfall, rice field, and near river/ditch. Dahail *et al.* (2008) indicated that ponds receiving water from rice field and river/ditch had showed high relative risk of EUS.

In the study area, about 21.33% farms were infected with red spot disease and the clinical signs of the disease were red spot or haemorrhages on skin and at the base of fins, sometimes ulcers in the skin, finally lost scales and died. Red spot disease is caused by a group of motile aeromonas septicaemia including *Aeromonas hydrophila, A. sobria,* and *A. caviae*. This disease often occurs during the change from the dry to rainy season and during the flood season (Khoi *et al*. 2008). Conditions that favor red spot disease are also high stocking densities, environmental pollutants and a large amount of organic mud in the pond (Roberts 1997).

Fish farmers in the study area reported that gill or fin rot is found frequently in major carps. This disease is characterized by the white margins on the fins and putrefaction of the gill or fins. It is caused by the bacteria called *Myxobacter* and *Flavobacterium* (Turnbull 1997). This disease occurs mostly among the young ones during summer months. Besides the high temperature, high organic material settled at the bottom of the pond is also a predisposing condition for the outbreak of this disease.

It was reported that maximum parasitic disease problem found in Mymensingh and minimum in Sylhet district. It was also observed that the *Argulus* causing a major threat to the fish farmers in the study area as it induces mortality, growth and economic losses to the carp farms. Hossain *et al*. (1994) reported that highest mortality of carp fingerlings were reported from nurseries infected with protozoan and monogenean parasites.

In the study area, about 76.70% disease was found mainly in winter season. It agrees with the works of Faruk *et al.* (2004) who reported that about 79% disease was found in winter season. Hossain and Paul (1993) reported

that the immune system of fish suppressed this time due to low temperature and fish become more susceptible to fish disease.

A number of chemotherapeutics were reported for controlling fish disease. Liming and salting together was the most common practice followed by application of lime only, salt only, potassium permanganate, antibiotics, pesticides and insecticides. Faruk *et al.* (2012) reported that mostly lime was applied in treating brood and health management. Lime is very effective in maintaining pH, water color, turbidity, increase the rate of decomposition and to treat disease fishes. Sultana (2004) also observed that lime is very effective and widely used common chemical in Bangladesh.

Economic losses from diseases are likely to increase as aquaculture expands and intensifies. The estimated economic loss due to fish disease varied from farm to farm based on the intensity of infection and the management practices adopted by farmers. Mohan (1999) reported that ectoparasites, protozoan, monogenetic trematodes and fish lice are some of the very important pathogens that have significant impact on the yield in carp hatcheries and seed production centers in India. In the present estimate, the average overall economic loss and control cost due to disease was found BDT 24,870 ha^{-1} yr^{-1} and BDT 3,460 ha^{-1} yr^{-1}, respectively. However, about 12.9% of the production value was lost due to fish disease. Faruk *et al*. (2004) reported that average loss due to fish disease was BDT 20,615 ha^{-1} yr^{-1}. Ahmed (2004) reported that the freshwater louse, *Argulus* caused mortality, growth and economic losses to the carp farms and hatcheries. They also reported 7.6% loss of net profit in carp hatcheries and nurseries was occurred due to diseases.

The economic loss due to disease could be attributed to reduced growth rate, which was possibly due to poor food conversion ratio (FCR) in infected fish. It was also observed that farmers spent extra feed to regain better FCR and ultimately better growth. Similarly, Sinnott (1998) reported that sea lice infested fishes were 5-15% lesser in weight due to reduced fish growth and suggested that 5% more feed was required to compensate the reduced FCR.

The economic loss due to incidence of fish disease in Rajshahi district was the highest. This might be for higher stocking density, poor water quality, poor knowledge about fish disease control and inexperience for better fish health management techniques. On the hand, Mymensingh district had the lowest loss due to incidence of fish disease. This might be due to stocking of healthy and disease free fingerlings with proper stocking density, optimum feeding rate and following better fish health management systems.

CONCLUSION

Assessing the impacts of disease in aquaculture system is not easy, as only acute losses are recognized and quantified. Chronic mortalities and poor growth caused by disease are generally not recognized. In order to quantify disease losses, farmers should be able to identify disease as the reason for crop loss, slow growth or poor harvest. Rural farmers are mostly resource poor with little or no knowledge of health management and have inadequate opportunities to improve management skills. Therefore, it is important to train farmers to carry out field-level diagnosis and assess the likely impacts of diseases.

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