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ENVIRONMENTAL IMPACT ASSESSMENT OF FISH DISEASES ON FISH PRODUCTION

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ABSTRACT

The present research work was conducted from July 2008 to June 2009 to investigate intensity of infestation of parasites in freshwater fishes and the impact of fish diseases on fish production in northern region of Bangladesh. Possibility of out break of diseases due to deterioration of environmental factors of water bodies was included in this study. The diseases identified were ulcer diseases, EUS (Epizootic Ulcerative Syndrome), Ichthyophthiriasis, Trichodiniasis, Chilodoneliasis, Myxoboliasis, Dactylogyrosis, Gyrodactylosis, Argulosis, Pernicious anaemia, Red spot disease, Red Pest of freshwater eel, Mouth fungus, Branchiomysis, Abdominal dropsy and whirling disease. The infestation more occurred in young fishes than in adult fishes. The overall water qualities of water bodies fluctuated from July 2008 to June 2009. Physicochemical parameters have more or less significant combined effect on the deterioration of water quality as well as fish diseases. Gills were the most affected sites and parasites damaged gill filaments by rupturing blood capillaries, causing necrosis, coagulation and hemorrhage. The present study revealed the prevalence of different organisms in fishes, which are potential pathogen for them. Fishes were infested by parasites and other pathogens. From overall study it was observed that the parasites, bacteria and fungus were most important pathogen for outbreak of diseases. It was also observed that there was a direct relation between disease outbreak among fishes and environmental factors. Low alkalinity reduces the buffer capacity of water and badly affects the pond ecosystem, which in turn cause stress to the fish and become more susceptible to diseases. In case of low aquatic environmental temperature fish reduces metabolic activities, which in turn makes the fish more susceptible during the winter period towards parasitic infection.

Keywords: Environment, Impact, Fish, Disease, Production

INTRODUCTION

In spite of tremendous potential production, fishery industry has been suffering from out break of diseases. The normal growth of fishes is interrupted or inhibited if they are heavily infected with ecto-parasites or endo-parasites, and these parasites, like those of other vertebrates feed either on the digested content of the host's intestine or the host's own tissue (Markov, 1946). Tripathi *el al* (1978) estimated the losses due to mortality and retardation / cessation of growth of fish in ponds in west Bengal as a result of epidemic infections. Disease is considered to be one of the important factors to decrease the fish production both in farming system and in wild condition. The death of fish caused by disease is of highest significance in fish culture; hence to achieve healthy fish stock we have to keep

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maintenance of health relationship between fish and their environment. Heavy parasitic infection to carp fry increase mortality reduces growth and survival of fry and fingerlings (Shariff and Vijiarungam, 1986). The physiological and biological features of the host affect the composition of parasite (Dogiel, 1961). Diseases at times assume the magnitude of epidemics. Fish pathogens cause significance loss to wild and cultured freshwater fishes. Large-scale mortality of fish often occurs in ponds and tanks due to environmental stress followed by parasitic afflictions and bacterial, viral, fungal, protozoan and monogenean infections. When ecto-parasites or endo-parasites heavily infect the fishes, the normal growth of them is interrupted or inhibited, and these parasites, like those of other vertebrates feed either on the digested content of the host's intestine or the host's own tissue (Markov, 1946). Trpathi *et al* (1978) estimated the losses due to mortality and retardation / cessation of growth of fish in ponds in west Bengal as a result of epidemic infections. Parasites cause deterioration in the food value of fish and may even result in their mortality. The occurrence of parasites of fresh water fishes 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 bad impact on our country's economy. In Bangladesh the common fish diseases are ulcer type disease including epizootic ulcerative syndrome, tail and fin rot, bacterial gill rot, dropsy, fungal diseases and parasitic diseases (Chowdhury, 1993). Under these circumstances, we have to take several steps towards finding effective solutions to prevent spread of aquatic animal disease. Measure of disease prevention and health management in fish culture has to be taken. Since the disease has tremendous impact on fish production, consumption, and trade and aquaculture practice in the country, it is necessary to investigate the true causal pathogen and pathogenecity etc. of the disease.

MATERIALS AND METHODS

During the survey on fish production statistics 20 nursery operators, 40 fish farmers and 40 fishermen from each of the study areas were interviewed for production statistics. All total 80 nursery operators, 160 fish farmers and 160 fishermen, in total 400 persons were interviewed during the period of investigation. The survey was done through questionnaire and participatory rural appraisal methods in four districts in northern region namely Rajshahi, Naogaon, Natore and Bogra districts. The research work was conducted during July 2008 to June 2009. The water quality was measured with the filed Hach Kit. Disease was observed with naked eyes first, then by magnifying glass and by the movement and behavior. After having removed the fish from the water, the colour of the body was noted. The skin was always examined with a magnifying glass. It was determined whether there were deformities of the vertebral column and of the mandibles, or perforation and /or shortening of the opercula. Finally the anus was examined for any swelling, and the texture of the muscle was determined to see whether any ulcer or inflammation were present. The diseases were identified according to the methods of Amlacher(1961).

RESULTS AND DISCUSSION

Fish disease has got inverse impacts on fisheries resources. Economic losses due to fish diseases were investigated. At present fish parasites and other pathogen are causing heavy economic loss due to mortality and morbidity of carp brood stock. Infected market size fish may become unsuitable for human consumptions due to heavy infestation causing serious economic loss to the poor farmers. The impacts of diseases on fisheries resources are presented in Tables from 1 to 5. During the period of

July 2008 to June 2009 the average optimum fish production in pond is recorded 3705 Kg/ha and that of in beel and river is 380Kg/ha in Rajshahi area. Average fish production loss due to different type of diseases like bacterial, fungal, protozoan, monogenean, crustacean, Malnutrition, O_2 deficiency and water pollution is 58.10%, 32.60%, 46.0%, 44.0%, 37.70%, 15.30%, 19.40% and 24.90% respectively and over all loss 34.25% (Table 1). In Naogaon area the average optimum fish production in pond is recorded 3952 Kg/ha and that of in beel and in river is 402Kg/ha during the period of July 2008 to June 2009. Average fish production loss due to diseases of bacteria, fungus, protozoa, monogenea, Crustacea, Malnutrition, O_2 deficiency and water pollution is 51.37%, 30.06%, 36.40%, 32.84%, 31.16%, 12.86%, 15.94% and 22.38% respectively and over all loss 29.12% (Table 2). During the period of July 2008 to June 2009 the average optimum fish production in pond is recorded 3750 Kg/ha and that of in beel and river is 370Kg/ha in Natore area. Average fish production loss due to different type of diseases like bacterial, fungal, protozoan, monogenean, crustacean, Malnutrition, 62 deficiency and water pollution is 56.84%, 31.92%, 42.69%, 40.92%, 33.18%, 15.17%, 19.25% and 24.34% respectively and over all loss 33.04% (Table 3). In Bogra district the average optimum fish production in pond is recorded 3815 Kg/ha and that of in beel and in river is 390Kg/ha during the period of July 2008 to June 2009. Average fish production loss due to diseases of bacteria, fungus, protozoa, monogenea, Crustacea, Malnutrition, O_2 deficiency and water pollution is 64.01%, 38.69%, 47.27%, 51.45%, 38.24%, 17.44%, 21.77% and 25.18% respectively and over all loss 38.0% (Table 4). Average mortality of fingerlings was 36.5% and adult fish was 40.75%. Average fingerlings and adult was 38.62% (Table 5)

Table 1: Depletion of Fish production due to fish disease and water pollution in Rajshahi

Type of Disease /other factor	Optimum production of fish (Kg/h)		Production loss (due to disease) (Kg/h)		Average loss (%)
	Pond	Beel & River	Pond	Beel & River	
Bacterial disease	3705	380	2223	150	58.10
Fungal disease	3705	380	1235	96	32.60
Protozoan disease	3705	380	1741	140	46.0
Monogenean	3705	380	1667	130	44.0
Crustacean	3705	380	1296	80	33.70
Malnutrition	3705	380	555	70	15.30
O_2 deficiency	3705	380	741	50	19.40
Water pollution	3705	380	926	90	24.90
Mean	3705	380	1298	100.75	34.25

Table 2: Depletion of Fish production due to fish disease and water pollution in Naogaon

Type of Disease /other factor	Optimum production of fish (Kg/h)		Production loss (due to disease) (Kg/h)		Average loss (%)
	Pond	Beel & River	Pond	Beel & River	
Bacterial disease	3952	402	2115	122	51.37
Fungal disease	3952	402	1224	85	30.06
Protozoan disease	3952	402	1470	115	36.40
Monogenean	3952	402	1310	120	32.84
Crustacean	3952	402	1285	72	31.16
Malnutrition	3952	402	495	65	12.86
O_2 deficiency	3952	402	630	64	15.94
Water pollution	3952	402	890	85	22.38
Mean	3952	402	1177	91	29.12

Table 3: Depletion of Fish production due to fish disease and water pollution in Natore

Type of Disease /other factor	Optimum production of fish (Kg/h)		Production loss (due to disease) (Kg/h)		Average loss (%)
	Pond	Beel & River	Pond	Beel & River	
Bacterial disease	3750	370	2212	130	56.84
Fungal disease	3750	370	1220	95	31.92
Protozoan disease	3750	370	1635	124	42.69
Monogenean	3750	370	1558	128	40.92
Crustacean	3750	370	1285	82	33.18
Malnutrition	3750	370	552	73	15.17
O_2 deficiency	3750	370	741	52	19.25

Water pollution	3750	370	915	88	24.34
Mean	3750	370	1264.75	96.5	33.04

Table 4: Depletion of Fish production due to fish disease and water pollution in Bogra

Type of Disease /other factor	Optimum production of fish (Kg/h)		Production loss (due to disease) (Kg/h)		Average loss (%)
	Pond	Beel & River	Pond	Beel & River	
Bacterial disease	3815	390	2520	170	64.01
Fungal disease	3815	390	1510	116	38.69
Protozoan disease	3815	390	1825	162	47.27
Monogenean	3815	390	2010	152	51.45
Crustacean	3815	390	1505	102	38.24
Malnutrition	3815	390	653	80	17.44
O_2 deficiency	3815	390	850	65	21.77
Water pollution	3815	390	960	98	25.18
Mean	3815	390	1479	118	38.0

Table 5: Fish mortality due to disease in four districts during July2008 to June 2009

Type of Disease /other factor	Mortality of fingerlings (%)	Mortality of adult fish (%)	Average Mortality of fish (%)	More affected fish
Bacterial disease	30	68	49	Adult fish
Fungal disease	20	40	30	Adult fish
Protozoan disease	60	50	55	Fingerlings
Monogenean	64	52	58	Fingerlings

Type of Disease /other factor	Mortality of fingerlings (%)	Mortality of adult fish (%)	Average Mortality of fish (%)	More affected fish
Crustacean	35	45	40	Adult fish
Malnutrition	10	16	13	Adult fish
O_2 deficiency	40	30	35	Fingerlings
Water pollution	33	25	29	Adult fish
Mean	36.5	40.75	38.62	

The losses occurring due to diseases in aquaculture systems sometimes can be very frustrating especially to the rural poor and small scale fish farmers. Economic losses due to fish diseases could be as high as Tk. 26,817/ha/year and average disease control cost was Tk. 2,905 /ha/year (Faruk *et al*, 2004). Mohan (1999) reported those ectoparasites, protozoan, monogenetic trematodes, fish lice, endoparasitic protozoans are some of the very important pathogens that have had significant impact on the yield in carp hatcheries and seed production centers in India. Perhaps parasite acts either as a pathogen or vector for diseases (Roberts *et al*., 1986). Hossain *et al*. (1994a) reported that highest mortality of carp fingerlings were reported from nurseries infected with protozoan and monogenean parasites. Fish fry at the young stage become more susceptible to pathogen because of their immature immune system (Anderson, 1974), which support the present findings. Assistance of farmers from Government and non-government sectors on fish health management are very rare. There is a risk to livelihoods of fish farmers and fishermen from fish disease and fish health problems. Rural farmers were mostly resource poor with little or no knowledge of health management and had inadequate opportunities to improve management skills. Their ability to respond effectively to fish disease problem was also very limited. As a result, they suffered from financial losses due to fish disease. So prevalence offish diseases had negative impacts in fish production. About 14% of the actual production could be loss due to fish disease (Faruk *et al.* 2004). Fish farmers have been utilizing pesticides to control *Argulus* infestations. Due to indiscriminate use of pesticides, the pond environment has been deteriorating affecting the productivity of pond adversely (Ahmed 2004). It was observed that the Bangladeshi farmers are using pesticides excessively as a quick treatment for the *Argulus* sp., which is posing a major threat for sustainable carp culture development in the country. The pesticide is not only killing the *Argulus* but also affecting the abundance of crustacean planktons and many other non-target species (Ahmed 2004). Prolong use of pesticides in the ponds may create environmental hazards which may lead to threat to the consumers. Disease reduces growth and survivability of fish, which reduces reproduction of fish and hence lowers the fish population. Ultimately this leads to loss of fish production.

When much mortality of fish occurs due to the presence of epizootic, every attempt must be made to collect and destroy the dead fish. When the wastewaters pollute the watercourse, the physic-chemical parameters deteriorate and fish diseases occur. A sample of the water should be taken and analyzed

chemically when fish die without showing any definite macro- or microscopical symptoms of disease. For a concrete diagnosis fixed material and cultures should be forwarded to the nearest Fish Pathology Laboratory. The address of the appropriate Fish Disease Laboratory may usually be obtained from the Department of Fisheries. The competent authorities of the nearest Fish Pathology Laboratory should be consulted for a definite ruling on the question, in case of any doubt as to what decision should be taken with regard to fish disease. Have to control water level fluctuation, aquatic vegetation, organic debris and water pollution. Water quality check, prevention of algal bloom and control of O_2 depletion should be maintained. Different size and age groups of fish stocking should be avoided. Fish health management should focus on the development of strategies for farm-oriented primary health management packages including mobile diagnostic centers. The farmers and the extension agents should be trained up on simple diagnostic procedure and effective therapy and awareness creation among the farmers. There should be legislation on the safe use of the chemotherapeutic agents in fish disease prevention and control. With proper health management practices, the country can be saved from the economic losses caused by health problems in fisheries resources. Enough facilities regarding fish disease research should be provided to the educational institutions. Stocking of healthy and disease free fingerlings should be maintained properly. Proper stocking density of healthy fish, their right feed in optimum doses and right feeding time should be maintained.

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