



E-ISSN: 2347-5129
P-ISSN: 2394-0506
(ICV-Poland) Impact Value: 5.62
(GIF) Impact Factor: 0.549
IJFAS 2017; 5(2): 38-41
© 2017 IJFAS
www.fisheriesjournal.com
Received: 09-01-2017
Accepted: 10-02-2017

Md. Abdul Halim
Scientific Officer, Bangladesh
Fisheries Research Institute,
Freshwater Sub-station, Jessore-
7402, Bangladesh

Debashis Kumar Mondal
Senior Scientific Officer,
Bangladesh Fisheries Research
Institute, Brackish water station,
Paikgacha, Khulna, Bangladesh

M. A. Salam
Professor, Department of
Aquaculture, Faculty of
Fisheries, Bangladesh
Agricultural University,
Mymensingh-2202, Bangladesh

Md. Shahdat Hossain
Scientific Officer, National
Institute of Biotechnology,
Ganakbari, Ashulia, Savar,
Dhaka, Bangladesh

Correspondence
Md. Abdul Halim
Scientific Officer, Bangladesh
Fisheries Research Institute,
Freshwater Sub-station, Jessore-
7402, Bangladesh

International Journal of Fisheries and Aquatic Studies

Impacts of climate change on pond fish farming in Amtoli, Borguna, Bangladesh

**Md. Abdul Halim, Debashis Kumar Mondal, M. A. Salam and Md.
Shahdat Hossain**

Abstract

The present study was carried out to understand the impacts of climate changes on pond fish farming in Gulishakhali Union, Amtoli, Borguna from January to June, 2012. The main components of climate change that would impact the ponds fish farming includes high temperature, less rainfall, salinity intrusion, seasonal fluctuation and prolonged drought. Most of the fish ponds (47%) were moderate size and majority of pond fish farmers (35%) had 6 to 10 years' experience. For high temperature the main problems faced by pond fish farmers were disease out-break (33%) and insufficient water in the ponds (29%). The key problem caused by less rainfall was lower growth of fishes (54%). Most of the farmers (39%) changed their profession due to salinity intrusion. For seasonal fluctuation, major problem faced by fish farmers were lower fish production (45%). The main problem due to prolong drought was reduced egg production (43%).

Keywords: Climate change, impact, climatic factors, pond fish farming and professional change

1. Introduction

Climate change has a great impact on fisheries, pond fish culture and agricultural crops production. The climate has very complex relationships with the seasonality including variations of temperature, rainfall and day length [8]. At present, concentration of CO₂ in the atmosphere is 350 ppm that will increase to 500-700 ppm in 2050 [14]. The ultimate result is global warming. The Intergovernmental Panel on Climate Change projected that the atmospheric temperature will rise by 4-8°C globally by 2100 [16]. The variation in the global climate or in regional condition climate over time, such as sunlight intensity, droughts, greenhouse gas emission, temperature rise, unexpected rainfall, floods and cyclones, arsenic contamination, losses of ecosystem which caused by processes of internal and external forces. A rise in sea level of 0.5 to 1.5 m would result in an increase in the severity of flooding, damage to coastal structures, destruction of wetlands and saltwater intrusion into drinking water supply. During last century, sea level raised by 10cm, if the rate is continued, the North-eastern China would turn into desert and, Bangladesh, India, Malaysia and Indonesia will get more wet [5, 21].

Climate change is already modifying the distribution of both marine and freshwater species. Warm-water species are being pushed towards the poles and experiencing changes in habitat size and productivity [22]. In addition, climate change is affecting the seasonality of biological processes, altering marine and freshwater food webs, with unpredictable consequences of fish production [6]. Climate change has both direct and indirect impacts on fish stocks that are exploited commercially. It has direct effects on physiology and behavior which hamper growth, reproduction capacity, mortality and distribution [1]. Climate change has indirect effect on the productivity, structure, and composition of the ecosystems on which fish depend for their food and shelter [2]. Climate change stresses will aggravate existing pressure on fisheries and aquaculture and threaten their capacity to provide food and livelihoods. Worldwide, fish products provide 15% or more protein consumed by nearly 3 billion people and support livelihoods of 520 million people, many of them are women [5].

The capture fisheries worldwide have declined sharply in recent decades or collapsed due to over fishing [20] and the major fishing grounds are concentrated in the zones which are threatened by pollution, the mismanagement of freshwater, habitat and coastal zone

modification. On the other hand, Bangladesh Fisheries Development Corporation (BFDC) mentioned that fisheries resources in the Exclusive Economic zone (EEZ) of the Bay of Bengal would have been declined by 25 to 30% over the last decades [7]. In addition, Food and Agricultural Organization revealed that around 100 important fish species have disappeared from the fresh water as well as from the Bay of Bengal over the last couple of decades [4]. Due to climate change, Bangladesh faces various types of problem such as drying up water bodies, egg not fertilized, lower hatching rate, late fry availability, shrinking breeding cycle and overheat hamper breeding [17]. The fish farmers are rendering unemployed as fish production and fish diversity is reducing gradually due to climate change. Therefore, the present work was planned to see the impact of climate change on pond fish farmers in south region of Bangladesh, particularly Amtoli Upazila of Borguna district.

2. Materials and methods

The present study was conducted in Gulshakhali union from January to June, 2012 under Amtoli upazila of Borguna district with an area of 720.76 sq km adjacent to the river Burishwari and Andharmanic. Twenty five pond fish farmers from Gulshakhali union were interviewed using a well define and pre-tested questionnaire. Focus group discussion (FGD) was conducted with the pond fish farmers to acquire some information which were lack in the questionnaire interview. Secondary data was collected through consulting literature and publications available in the Upazila Fisheries Office, Bangladesh Bureau of Statistics and from Government and nongovernment organizations involved in fisheries activities. Data were collected in local units which were converted into standard units to minimize error. After collection, data were sorted and analyzed using Microsoft Excel-2007 and SPSS-20 to present in graphical forms.

3. Results and Discussion

3.1 Farmers perception about climate change

In the study area, it was found that people have been known about changing scenario of climate events like high temperature, less rainfall, salinity intrusion, seasonal fluctuation and prolonged drought etc. In the study area reviewed through secondary data and research reports, people’s perception is also important considering their behavior and responsive actions [9].

3.2 Pond size

In the study area three types of pond were observed. There were 35% farmers who had smaller ponds (5-15 decimals), 47% had moderate size ponds (15-25 decimals) and 18% had larger size ponds (25-50 decimals) (Fig:- 1). The average pond size used for pangas farming was found to be 3.12 acre [19].

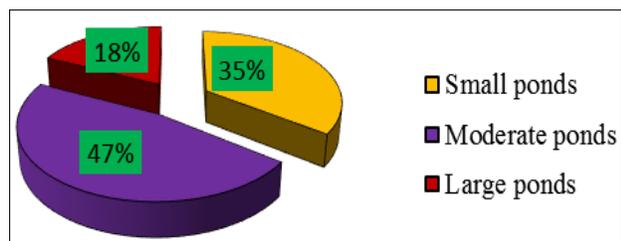


Fig 1: Percentage of fish ponds size owned by the farmers from Gulshakhali union.

3.3 Experience of pond fish farmers

About 35% farmers had 6-10 years of experience, while 31% had 1-5 years, 24% had 11-20 years and 10% had 21-30 years of experience in pond fish farming (Fig:- 2). The people about 80-90% are involved with shrimp farming with 10-15 years’ experience in the south-west coastal region of Bangladesh [18].

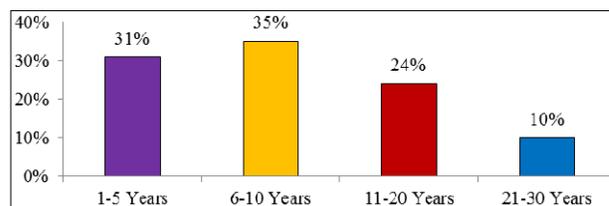


Fig 2: Experience of pond fish farmers.

3.4 Impacts of climate change on pond fish farming

Climate change is a growing concern throughout the globe. It has a great impact on pond fish farming. About 62% pond fish farmers had mentioned that high temperature was the main climatic factor which hampered production of fish farming, 18% mentioned less rainfall, 12% mentioned salinity problem, 5% mentioned seasonal fluctuation and 3% mentioned prolonged drought which have been influenced the pond fish culture (Fig:- 3).

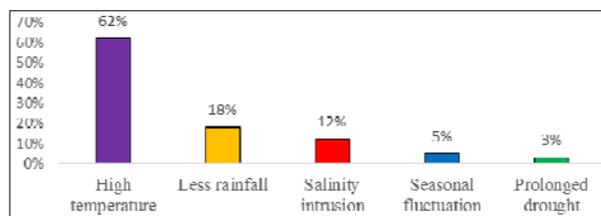


Fig 3: Impacts of climate change on pond fish farming.

3.4.1 Temperature

In the study area, 62% pond fish farmers had mentioned that due to high temperature, the water level has decreased. For this reason, the acid-sulfate soil has been increased in ponds water. About 95% of the pond fish farmers had reported that various problems have been faced due to high temperature such as disease out-break (33%), over heat of pond water (13%), bad water quality (8%), insufficient water in the ponds (29%), reduce feeding activity (7%) and lower growth rate (10%) (Fig: 4).The present research findings were more or less similar [12, 18]. According to estimates from the United Nations [23] a mean temperature increase of 2 °C could cause GDP to decline by 4-5%.

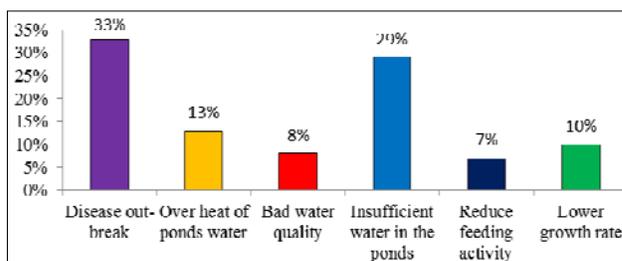


Fig 4: Percentage of problems faced by farmers due to high temperature.

3.4.2 Less rainfall

About 18% farmers had reported; less rainfall was the cause of less water availability which in turn hampered the fish production by reducing feeding activity, disease prevalence, mass mortality of fishes. It was reported that less rainfall caused lower growth of fishes (54%), low production (18%), loss of crops (10%), less water availability (8%), mass mortality of fishes (6%) and diseases (4%) (Fig:- 5). The present findings are more or less similar to the finding [11] which reported the body deformation, spots or lesions on skins.

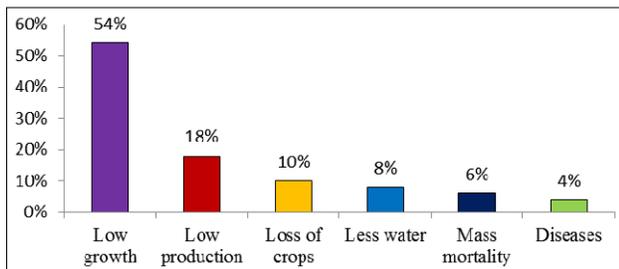


Fig 5: Percentage of problems faced by farmers due to less rain fall.

3.4.3 Salinity intrusion

Salinity intrusion had a tremendous negative impact on fishery in the study area. Natural disaster like cyclone *Sidr* partly damaged the soil, lands were found to be only used for saline tolerant pond fish culture because of extreme salinity. Before *Aila* and *Sidr*, it was found that 73% of the farmers occupation were pond fish culture, 17% had agriculture 3% had small business and 7% were day laborers (Fig:- 6).

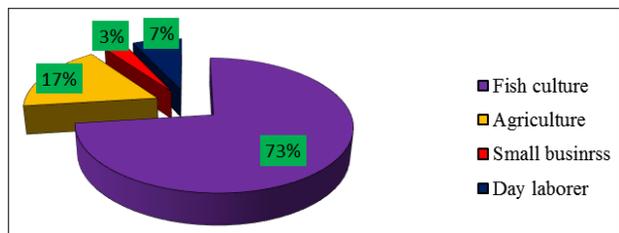


Fig 6: Percentage of occupations before *Aila* and *Sidr*.

Most of the pond fish farmers had changed their profession such as 39% day laborers, 12% fry collectors, sewing and shopkeepers 20%, floating vegetables culture 14% and net making and mending 15% were also taking place as the adaptation measures by the people after *Aila* and *Sidr* (Fig:- 7). High salinity intrusion has disturbed the ecological function of these organisms in their ecosystems. Due to increased salinity, the fish species in Paikgacha and Rampal have been reduced from 29 to 12 and 24 to 19 species respectively during the period 1975-2005 [10].

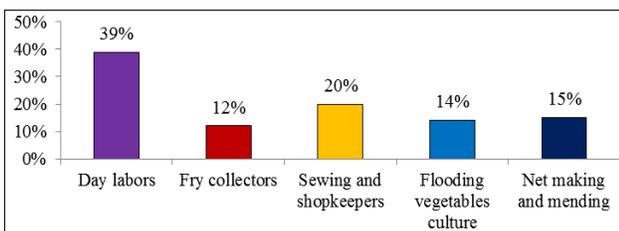


Fig 7: Percentage of farmers change their professions after *Aila* and *Sidr* during the study period.

3.4.4 Seasonal fluctuation

Seasonal fluctuation (5%) likely to be the most influential climatic parameter. It has great impact in fisheries sector. It was found that seasonal fluctuation; reduce fish production (45%), reduce farmer safety (16%), damage their home (23%), destroy their crops (11%) and destroy ecosystems of fishes (5%) (Fig:- 8). Seasonal fluctuation caused higher number of species and individuals caught during dry months of the study period [13].

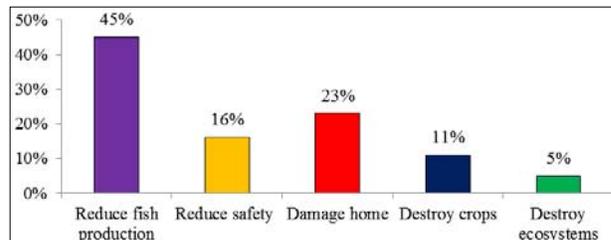


Fig 8: Percentage of problems faced by fish farmers due to seasonal fluctuation.

Increased frequency of extreme weather events will affect the safety of fishers, damage homes, services and infrastructure, particularly in coastal areas [15] and will also damage many coastal ecosystems.

3.4.5 Prolonged drought

About 3% pond fish farmers had reported that fish production was reduced due to prolonged drought. Majority 97% of the respondents had mentioned that due to prolonged drought reduce egg production (43%), reduce breeding performance (17%), reduce egg hatching (32%), and larval dispersion (8%) of ponds fishes in study area (Fig:- 9). Reduced dry season flow rates in South Asian rivers and most African river basins are expected to result in reduced fish yields due to impacts on spawning and larval dispersion [3].

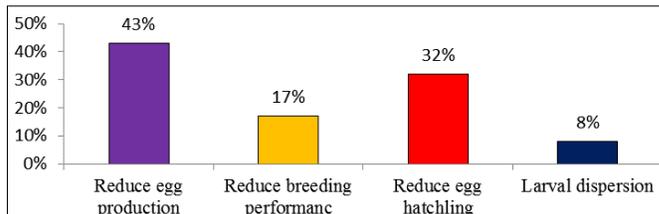


Fig 9: Percentage of problems faced by fish farmers due to prolonged drought.

4. Conclusion

Bangladesh is widely recognized to be one of the most climate vulnerable countries in the world. It experiences frequent natural disasters, which causes loss of life, damage to infrastructure and economic assets, and adversely affects the pond fish farming. The present research was undertaken to assess the impacts of climate change on pond fish farming in southern region of Bangladesh. Most of the pond fish farmers reported that high temperature, less rainfall, salinity intrusion, seasonal fluctuation, prolonged drought affected the fish production. Due to climate change fish are susceptible to disease and could not recover from disease. Most of the pond fish farmers had changed their occupation that made their socio-economic condition vulnerable. The changing environment put the pond fish farmers in a great challenge as they have to shift their forefather occupation to alternative employment opportunities on which they are not adopted.

5. References

- Abbink W, Garcia AB, Roques JAC, Partridge GJ, Kloet K, Schneider O. The effect of temperature and pH on the growth and physiological response of juvenile yellowtail kingfish *Seriola lalandi* in recirculating aquaculture systems. *Aquaculture*. 2012; 330-333:130-135.
- Brander KM. Global fish production and climate change. The national academy of sciences of the USA. 2007; 104(50):19709-19714.
- FAO. Building adaptive capacity to climate change: Policies to sustain livelihoods and fisheries. New directions in fisheries – A series of policy briefs on development, Rome, Italy. 2007; 8:16.
- FAO. Fisheries report. FAO expert workshop on Climate change implications for fisheries and aquaculture. Rome, Italy. 2008, 7-9.
- FAO. Fishstat plus. Universal software for fishery statistical time series. 2009. Available at www.fao.org/Statistics/Software/Fishstat/En.
- FAO. World fisheries must prepare for climate change, State of world fisheries and aquaculture. Rome, Italy. 2009, 2.
- FAO. Shelton C. Climate Change Adaptation in Fisheries and Aquaculture. Fisheries and Aquaculture Circular No. 1088. Italy, Rome. 2014, 34.
- Gill GJ. Seasonality and agriculture in the developing world: A problem of the poor and powerless. Cambridge university press, Cambridge. 1991.
- Grothmann T, Patt A. Adaptive capacity and human cognition: The process of individual adaptation to climate change. *Global Environmental Change*. 2005; 15(3):199-213.
- Gain AK, Uddin MN, Sana PS. Impact of river salinity on fish diversity in the south-west coastal region of Bangladesh. *International Journal of Ecology and Environmental Sciences*. 2008; 34(1):49-54.
- Habib MAZ. Aeromonad infection in the fishes of small scale farmer's ponds and its control. MS Thesis. Department of aquaculture, BAU, Mymensingh. 2001, 71.
- Handisyde NT, Ross LG, Badjeck MC, Allison EH. The effects of climate change on world aquaculture: A global perspective. 2006. www.aquaculture.stir.ac.uk/GISAP/gis-group/climate.php.
- Imevbore AMA. The chemistry of Lake Kainji waters. Edited by Imevbore AMA, Adegoke SO; ecology of lake kainji, transition from river to lake. University of IFE press. 1975; 19(2):123-131.
- IPCC. An assessment of the intergovernmental panel on climate change. Cambridge University Press, New York. 1996.
- IPCC. Climate Change. Impacts, adaptation, and vulnerability contribution of working group II to the third assessment report of the intergovernmental panel on climate change. Cambridge, UK. 2007a.
- IPCC. Climate Change. Synthesis report. Contribution of working groups I, II and III to the fourth assessment report of the intergovernmental panel on climate change [Core Writing Team, Pachauri, RK and Reisinger A (eds.)]. IPCC, Geneva, Switzerland. 2007b, 104.
- Islam MA, Wahab MA, Alam ABMS. Effect of temperature on the monosex tilapia (*Oreochromis niloticus*) egg production in a private hatchery and nursery system. Aqua-internship program Asia link project, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh. 2010.
- Islam MA, Islam MS, Wahab MA. Impacts of climate change on shrimp farming in the south-west coastal region of Bangladesh. *Research in Agriculture, Livestock and Fisheries*. 2016; 3(1):227-239.
- Monir MS, Haque MR, Rahman S. Study on technical aspects of Pangas (*Pangasianodon hypophthalmus*) farming in Mymensingh region. *International Journal of Sustainable Crop Production*. 2011; 6(1):36-42.
- Pauly D, Christensen V, Dalsgaard J, Froese R, Torres JF. Fishing down marine food webs. *Science*. 1998; 279(5352):860-863.
- UNEP. Meeting on common/compatible systems of access to data. United Nations System-Wide Earth-Watch, DPCSD/UNEP, Final Report, New York. 1996.
- UN. United Nation report warns fishing industry on climate change. *Climate and energy*. 2009.
- UNFCCC. Findings and strategy for addressing climate change in Greece. 2015.