ADVERSE EFFECT OF FLOOD ON FISH PRODUCTION AS PERCEIVED BY THE FARMERS OF GANGACHARA UPAZILA UNDER RANGPUR DISTRICT

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CERTIFICATE

This is to certify that the thesis entitled "ADVERSE EFFECT OF FLOOD ON FISH PRODUCTION AS PERCEIVED BY THE FARMERS OF GANGACHARA UPAZILA UNDER RANGPUR DISTRICT" submitted to the **Department of Agricultural Extension and Information System,** Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfilment of the requirements for the degree of **MASTERS OF SCIENCE (M.S.) in AGRICULTURAL EXTENSION AND INFORMATION SYSTEM,** embodies the result of a piece of bonafide research work carried out by **AL NAHIAN, Registration No. 19-10375** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that any help or source of information, received during the course of this investigation has been duly acknowledged.

Dated:
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Dedicated
to
My Beloved Parents

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The Author

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ABSTRACT

Bangladesh is frequently cited as one of the most vulnerable countries to climate change specially to flood. Every year flood affects the farmers of Bangladesh in agriculture and fisheries sectors and causes a huge economic loss. The purpose of the study was to ascertain the adverse effect of flood on fish production as perceived by the farmers and to explore the relationship between the selected characteristics of the fish farmers and their perceived adverse effect on fish production. The study was conducted at three (3) selected unions (Gajghanta, Morneya and Barabil) of Gangachara Upazilla which known as severe flood prone areas under Rangpur District. The data were collected from 103 flood affected fish farmers who were proportionately and randomly selected as the sample from the three (3) selected unions. The researcher himself collected data by personal contact with the flood affected fish farmers through a well structured interview schedule during the period from 16 july to 07 August, 2022. The study explored that majority (59.2%) proportion of the fish farmers perceived medium adverse effect of flood, while 40.8% perceived high adverse effect of flood on fish production. On the basis of Standardized Adverse Effectiveness Index (SAEI), it was observed that 'outbreak of fish diseases due to flood' ranked 1st followed by 'destruction of pond/hatchery dike', 'unavailability of fair price', 'unavailability of transportation facilities', 'pollution of pond/hatchery water', 'unavailability of Labour', 'invasion and Penetration of undesirable species due to flood', 'unavailability of storage facilities', 'unavailability of inputs', 'unavailability of eggs, larva, fry, fingerling etc.', 'unavailability of marketing facilities', 'unavailability of necessary chemicals' and 'unavailability of weather information'. Pearson's Product Moment Correlation co-efficient (r) was computed to determine the relationships between the selected characteristics of the fish farmers and their perceived adverse effect on fish production. The result showed that age, education, fish farming experience, training received in fish farming, fish farm size, and extension media contact of the farmers had negative significant relationships with their perceived adverse effect of flood on fish production. On the basis of the findings it may be concluded that reducing adverse effect of flood is very essential to regularize fish production during flooding time. Emphasis should be given to reduce higher order of adverse effects of flood on fish production.

Keyword: Flood, Adverse effect, Fish farmers, Fish production

CHAPTER I
INTRODUCTION

1.1 Background of the study

Bangladesh is at the forefront of climate change impacts. Over the last decade, it has seen some of the strongest storms on record, massive flooding, and exponential property losses (Khatun & Saadat, 2021). The country is one of the most vulnerable to climate change due to two main reasons, other than greenhouse gas emissions and high population density. The first is geographical factors, like its regional position, landscape and the location of its population centres. This alone means that over 50% of the country's population lives in high climate exposure areas deemed highly vulnerable to climate impacts. The second is economics (Khatun & Saadat, 2021). While the country has the eighth largest population, it is ranked 137th in terms of GDP per capita, globally. The economic impacts of climate change in Bangladesh will be severe, but the people living in Bangladesh are not ready to deal with them (Khatun & Saadat, 2021).

In developing countries like ours (Africa and Asia) produce about 11 million tonnes of inland fish annually, 90% of the global total (Welcomme et al., 2016). Bangladesh is one of the most compatible territory for fish production in the world and also the largest flooded wetland and the 3rd largest biodiversity in South-east Asia (Hossain, 2014). As the people on the planet increasing tremendously the only source of increasing fish production to meet the requirement of the people is aquaculture, particularly inland culture (FAO, 2010).

Bangladesh, with its rich inland waters and river systems, has significant capture fishery and aquaculture potential. The favourable geographic position of Bangladesh comes with a large number of aquatic species and provides plenty of resources to support fisheries potential. The fisheries can broadly be classified into three categories: inland capture fisheries, inland aquaculture and marine fisheries, of which the inland aquaculture sector is contributing more than 55% of the total production (Shamsuzzaman et al., 2016). The inland fishery is further divided into two sub-sectors: the inland capture fishery and inland culture fishery. In Bangladesh the inland capture fishery has five types of habitat containing approximately 853,863 ha of river and estuary, 1,77,700 ha of Sundarbans, 114,161 ha of beel, 68,800 ha of Kaptai lake, and 2,651,567 ha floodplain (FRSS, 2019). On the other hand inland culture fishery, which has six types of habitat containing an area of 4,04,497 ha of pond, seasonal 1,51,942 ha of cultured water body, 5,671 ha of baor, 2,57,888 ha of shrimp/prawn farm, pen culture 7,263 ha, and 17.9 ha of cage culture (FRSS, 2019). An analysis of time series data for 2003-2014 reveals the declining trend of capture fishery habitat area while an increasing trend of culture fishery habitat area (Shamsuzzaman et al., 2017).

Among various segments of the fisheries sub-sector, the inland aquaculture has generally experienced the fastest growth, with the establishment of new methods, species, and intensification and improvement of farming, particularly in pond aquaculture, entirely over the country (Planning Commission, 2016). In Bangladesh, aquaculture production systems are mainly extensive and improved extensive, with some semi-intensive, and intensive systems, in very few cases (Hossain, 2014). Inland pond culture represents the mainstay of aquaculture in Bangladesh is presently dominated by carps. This sector contributed 55.93% of the total fish production in 2014-2015. Pond aquaculture is mostly practised closed water inland fisheries in Bangladesh and contributed 43.79% (1,613,240 MT) to the total fish production in 2014-15 (Shamsuzzaman et al., 2017).

This sector experienced more or less consistent growth rate, ranging from 7.32% growth in 2009-2010 to 4.04% growth in 2013-2014 (Bangladesh Economic Review, 2014). As indicated in the inland open water fisheries are still a major source of the total fish production, but share has been declined, from 38.68% in 2000-2001 to only 27.79% in 2014-2015. Conversely, inland closed water fisheries contributions have been increasing, from 40.01% in 2000-2001 to 55.93% in 2014-2015.

Table 1.1 : Fish exports and imports scenarios of Bangladesh (2010-2016)

Years	Imports		Exports	
	Quantity (t)	Million US $	Quantity (t)	Million US $
2010-11	28,981.19	13.1846	96,469.23	443.1063
2011-12	37,180.12	18.72	92,479.18	598.4771
2012-13	63,062.81	28.08	84,904.50	611.5135
2013-14	69,778.11	39.4914	77,328.86	560.6393
2014-15	97,383.67	39.5161	83,524.37	636.7686
2015-16	88,593.50	43.2276	75,337.93	605.878

Source: Shamsuzzaman et al., 2020

The fisheries sector plays a very important role in the national economy, contributing 3.69% to the Gross Domestic Product (GDP) of the country and 22.60% to the agricultural GDP (FRSS, 2016). On recent study it is said that 2% of export earnings on the total earnings come from this sector (FRSS, 2019). In Bangladesh everyday 80% of animal protein and 7% of total protein that people consume is come from the fish meat (Ghose, 2014). More than 17 million people including about 1.4

million women depend on fisheries sector for their livelihoods through fishing, farming, fish handling, and processing (BFTI, 2016).

Table 1.2 Fish production scenarios of Bangladesh (2014-2021)

Year	Sources-wise production (MT)			Total
	Inland open water	Inland closed water	Marine	
2014-2015	1023991	2060408	599846	3684245
2015-2016	1048242	2203554	626528	3878324
2016-2017	1163606	2333352	637476	4134434
2017-2018	1216539	2405415	654687	4276614
2018-2019	1235709	2488601	659911	4384221
2019-2020	1248401	2583866	671104	4503371
2020-2021	1301244	2638745	681239	4621228

Source : Yearbook of Fisheries Statistics of Bangladesh 2014-21

According to FAO report on The State of World Fisheries and Aquaculture 2018, Bangladesh ranked 3rd in inland open water capture production and 5th in world aquaculture production (Shamsuzzaman et al., 2020). Currently Bangladesh ranks 4th in tilapia production in the world and 3rd in Asia (Shamsuzzaman et al., 2020). The national fish hilsa as a single species has been making the highest contribution of 12.15% to the country's total fish production. Geographical Indication Registration Certificate has also been achieved for our national fish hilsa named as 'Padma ilish'. Bangladesh is one of the world's leading fish producing countries with a total production of 43.84 lakh mt in 2018-19, where aquaculture accounts for 56.76% of the total fish production. (FRSS, 2018). It had been expected that the country will continue to achieve the projected production target of 45.52 lakh mt of fish by 2022 in conformity with the targets of vision-21 of the present Government.

Bangladeshi has one of the biggest and most active deltas. The Padma, the Meghna and the Jamuna contribute to a high potential for fresh and brackish water capture and culture fisheries, in addition to the vast marine resources. Despite Bangladesh's long coastline and large freshwater and marine water bodies, fisheries are underdeveloped compared to other industry sectors. But this sector is one of the leading sector in many country like China, Russia, Norway, United States, etc. and these countries earn a huge foreign currency by exporting fish and fish related products.

It has comprehensive and highly diversify fisheries resources. But 70% of the delta is <1 m above sea level and regularly flooded and 10% flooded when water retreats into numerous water-bodies like river, lakes, canals (Cooke et al., 2016). In recent flooding in Sylhet has caused losses of more than Tk 140 crore for the local aquaculture industry, with farmers in Sunamganj district being the worst affected, according to a preliminary estimate by the Department of Fisheries "This is a preliminary estimate, the actual losses of farmers would be higher as almost all farms in Sunamganj have been inundated," said Md Motaleb Hossain, deputy director of the DoF in Sylhet (The Daily Star, 2022). Some 32,802 farmers, who were raising fish such as carps on 5,258 hectares of land in the division, saw their hopes for profit dashed by torrential rainfall in the country's north-east and flash floods upstream in India's Meghalaya and Assam (The Daily Star, 2022). In 2019 in the Jamalpur district of Bangladesh, the flood inundated 9,032 ponds and 2,984.32 tons of fish escaped from the pond into flood water which total price was 48 crore Tk (The Daily Star, 2019). The 2004 (July - August) flooding incident was quoted as the "worst flood in 6 years." Aside from the heavy monsoons that the country experiences, this flood was said to have also been caused by melting snow in the Himalayan Mountains, which caused a sudden rise in river discharge. Additionally, the country's excessive urbanization has also led to rapid deforestation, which is quoted to have caused soil erosion which reduces the ability of the land to absorb water. Being an LEDC (less economically developed country), many people were impoverished and were unable to develop better infrastructures and technology to protect the country from flooding, following the 1998 incident. As a result, many civilians suffered from the natural disaster.

1.2 Statement of the Problem

Bangladesh had observed so many setbacks that resulted from environmental disaster, in these some being natural and others man-made. Natural disaster that often occur in Bangladesh are storm, erosion, drought, diseases and flooding. Flooding is a natural disaster that frequently impact negatively on the inhabitants of the whole region of Bangladesh. Rapid changes in temperature, precipitation, droughts, floods and erosion have created significant production losses for aquatic farmers in Cambodia, Laos, Myanmar, Thailand, Vietnam and Ghana (IPCC, 2022). Climatic change impacts are believed to increase frequency of occurrence of floods (Ayo-Lawal, 2007; & Osman-Elasha, et al. 2007). Observed impacts on inland aquaculture systems have generally been site and region specific (IPCC, 2022). In view of above discussion, the researcher was interested to undertake a research study entitled ‘Effect of flood on fish production as perceived by the farmers of Gangachara Upazila under Rangpur District’ to find out the answer of the following research questions:

- What were the adverse effects of flood on fish production?
- What were the features of the selected characteristics of the fish farmers?
- Is there any relationship existed between the selected characteristics of the farmers with their perceived adverse effect of flood on fish production?

1.3 Specific Objectives

The following specific objectives were formed to give proper direction to the study:

1. To ascertain the adverse effect of flood on fish production as perceived by the fish farmers
2. To assess and describe some selective socio-economic characteristics of fish farmers
3. To explore the relationship between each of the selected characteristics of the fish farmers and their perceived effect on fish production

1.4 Justification of the study

It is stated that fish production is very important factor for Bangladesh economy. In the world, Bangladesh is the third largest country in fisheries sector. Bangladesh has huge potential in this sector to export and can earn a lot of foreign currency which will help our reserve. Climate models developed by the IPCC indicate that Bangladesh may experience 10% to 15% more rainfall by 2030. The major focus of the study is to assess the effect of flood in fish production. Every year flood damages crops, livestocks, fisheries, housing and human being. As a flood is a common phenomenon in our country, it is necessary to increase flood coping mechanism of the farmer to reduce the loss due to flood. Findings of the study, will be helpful to planners and extension workers in planning and execution of programs for disseminating the knowledge about flood to the fish farmers.

1.5 Scope of the study

The findings of the study must be particularly applicable to the study area. However, the findings may also have generally implications for other areas of Bangladesh, where socio-economic, physical, cultural and geographical conditions are mostly similar to the study area. The findings are not the solution of flood occurring but this study can help the fish farmer to reduce the losses of their fish production. Thus, the findings are expected to be useful to students, researchers, extension workers and particularly for planners in formulating future plans related to nation building activities.

1.6 Assumption of the study

- The respondents included in the sample for this study were competent enough to furnish proper responses to the queries included in the interview schedule.
- The researcher who acted as interviewer was adjusted to social and environmental conditions of the study area. Hence, the data collected by him from the respondents were free from bias.
- The responses furnished by the respondents were valid and reliable.
- Views and opinions furnished by the respondents included in the sample were the representative views and opinions of the whole population of the study area.

1.7 Limitation of the study

- The study was conducted on only 03 selected unions under Gangachara Upazila at Rangpur district.
- The researcher had to depend on the data furnished by the selected fish farmers during the interview.
- There were many characteristics of the farmers but only eight characteristics were selected by the researcher to justify the study.
- There might many effects of flood on fish production but researcher only cited 13 major effects faced by the farmers during flooding time.
- Reluctance of fish farmers to provide information.

1.8 Definitions of Related Terms

The terms that have been commonly used in thesis paper are defined and expound with specific meaning are given below:

Fish: Fish are cold blooded aquatic animals typically with backbone, internal gill, and fins depend primarily on water body as a medium in which to live.

Fish farmers: The farmers whose livelihoods partially or completely depend on fisheries or fish related activities are called fish farmers.

Fish production: Fish production involves with culturing fish commercially in ponds or reservoirs.

Age: Age of a fish farmer referred to the period of time (years) spent by him starting from birth to the time of interview.

Education: The knowledge or skill obtained or developed by a learning process. It desirable change in knowledge, skill, attitude and ability in an individual through reading, writing, working, observing and other related activities.

Family size: The total number of member in a family with counting the farmer also.

Benefit-Cost ratio (BCR): The benefit-cost ratio indicates the relationship between the cost and benefit of investment for analysis in a certain period of time. It is calculated by (benefit/cost)*100.

Fish farming experience: It is defined as how many years a farmer practically involved with fish farming activities.

Training received in fish farming: Training is defined as teaching, or developing in oneself or others, any skills and knowledge or fitness that relate to specific useful competencies. It was used offered by the GOs or NGOs to improve knowledge & skills of farmers for better performance in fish culture activities.

Fish farm size: The term fish farm size referred the total area where the fish farmers carried out his fish farming activities that has been owned him or obtained from leasing system.

Extension media contact: It refers to the receiving of information or advice from various sources such as mass media, group activities, extension personnel etc.

Flood: A flood is an overflow of water that submerges land that is usually dry. Floods are an area of study in the discipline of hydrology. It is the most common and widespread natural severe weather event over the world.

Adverse effect: A hazard is a process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation. The outcomes from the hazard are called adverse effect.

CHAPTER II
REVIEW OF LITERATURE

Review of literature gives direction to the researcher to carry out the research programme. The present study is concerned with the effect of flood on fish farmers and its relationship with their selected characteristics. An effort was made to know the findings of the past past researches. This chapter deals with the reviews of past works that relate to the investigation directly or indirectly. No research has been conducted on the effect of flood to the fish farmer and the researcher found only a few studies which are indirectly related to the present study. The researcher intensively searched internet, websites, available books, journals and printed materials from different sources. This chapter consists of three sections. The first section deals with the general findings of flood effect to the farmers; second section is dedicated to an observation on the findings related to the relationship between the selected characteristics of the farmers and the effect of flood and the last section deals with the conceptual framework of the study.

2.1 Review of literature on general context on effect of flood

Islam (2015) in his study observed that temperature and rainfall were increasing day by day as well as flood frequency. These frequent floods cause damage of lives and properties in Tangail District. From the analytical result of the study, believed that due to climate change temperature and rainfall are changing, frequency of flood is increasing. It is also said in this study that, climate change becomes the most vulnerable issue to the environmental specialist, geographers, politicians, policy makers, and the other stakeholders. Climate change has a great impact on Bangladesh especially in Tangail District because it is situated in the influence zone of the Brahmaputra-Jamuna river system, which is one of the largest river systems in the world.

Muhammad (2010) focus to determine the problems faced by the farmers in T-aman cultivation due to flood and to explore the relationships between the problems faced by the farmers and their selected characteristics. The study revealed that highest proportion (63.2 percent) of the respondents had medium problem in T-aman cultivation due to flood, while 20.8 percent and 16 percent of the respondents had low and high problems respectively. The Problem Faced Index indicated that the farmers faced highest problem in "fully damaged field requires re transplantation". This was followed by "poor yield in the flood affected fields" and "high price of seeds and seedlings after flood". However, the less serious problems were identified as "high price of labour, fertilizers and pesticides after the affect of flood". "unavailability of labour after flood" and "shortage of fertilizers and pesticides in after flood condition".

Younus and Harvey (2013) revealed the Intergovernmental Panel on Climate Change (IPCC) (2007, 2012:11) warned that the mega deltas in South Asia (e.g. the Ganges Brahmaputra Meghna River Basin) will be at great risk due to increased flooding, and the region's poverty would reduce the capacity of the inhabitants to adapt to change. This paper provides a "bottom up" impact approach which focuses on a methodological contribution for assessment of vulnerability and adaptation (V & A) in a riverine flood-prone area, "Islampur" in Bangladesh, where various impact assessment guidelines have been taken into consideration.

Paul Shitangsu (2013) explored people's perception about flood disaster management and mitigation measures undertaken by the Government and non-government organisations in the Chalan Beel area of Bangladesh on the basis of questionnaire survey over 181 households considering the pre, during and post flood activities. The present study finds that, the Government has given more attention on structural flood management measures in the study area, whereas non-structural and long-term sustainable flood management strategies have received a little attention. Most of the respondents found the warning system not effective (30.2%), while 43% thought it as rarely effective a system with high dissatisfaction (32.6%) and dissatisfaction (40.9%). The Government's relief, rescue and rehabilitation operations are insufficient considering people's needs. Most of the respondents (63.5%) mentioned that they had not received search and rescue operation in their locality, about one-fourth of respondents (23.2%) are highly dissatisfied, 40.3% are dissatisfied, and 24.9% are moderately satisfied on relief assistances. A large portion of the respondents (76.8%) mentioned that they did not receive any help or financial assistance to rebuild their livelihood. More than half of the respondents (50.3%) are dissatisfied, one quarter of the respondents are highly dissatisfied, only 10.5% are satisfied with the livelihood rehabilitation undertaken by Government and NGOs. About 62.4% of respondents find that the flood management activities undertaken by Government are not effective because of improper implementation, corruption and inefficiency. On the other hand, about two-third of the respondents (67.4%) are dissatisfied, 22.1% are highly dissatisfied on the role of Government organisations in flood disaster management activities.Therefore, the present study suggests that it is important to develop people's awareness and suitable coping strategies which may be employed to enhance long-term resiliency of people of the flood prone areas of Bangladesh.

Paul and Routray (2011) explored indigenous coping strategies and identify underlying demographic, socio-economic and other relevant variables that influence the adoption of coping strategies in three distinct cyclone-prone coastal villages of Bangladesh. The study finds that cyclones and induced surges are a recurrent phenomenon in coastal Bangladesh; hence people are used to adjusting their

lifestyle and adopting their own coping strategies intelligently. Adoption of a particular set of coping strategies depends not only on the magnitude, intensity and potential impacts of the cyclone and induced surge, but also age, gender, social class, dissemination of early warning information, locational exposure, external assistance, social protection and informal risk sharing mechanisms within the community. Indigenous cyclone disaster prevention and mitigation strategies significantly minimize the vulnerability of the people. Under extreme situations, when such disasters surpass the shock-bearing capacity of the victims, informal risk sharing mechanisms through social bonding and social safety-nets become vital for short-term survival and long-term livelihood security. Therefore, proper monitoring and understanding of local indigenous coping strategies are essential in order to target the most vulnerable groups exposed to disasters. Additionally, proper dissemination of early warning and government and non-government partnerships for relief and rehabilitation activities should be prioritized to ensure pro-poor disaster management activities. The study also recommends effective monitoring of the impact of aid to ensure corrective measures to avoid the development of relief dependency by disaster victims.

Rayhan (2010) examined the poverty, risk and vulnerability for flood hazards in the year 2005. Cross sectional household survey was carried out after two weeks of the flood in four districts and 600 rural households were interviewed through three stages stratified random sampling. A utilitarian approach is used to assess flood vulnerability and its components: poverty, idiosyncratic and aggregate risks to capture the effect of flood on household's welfare. To estimate the correlates of flood vulnerability, a set of fixed households' characteristics are used as explanatory variables. The results depict that elimination of poverty would increase household welfare and thus lessen vulnerability mostly amongst its components. Poverty and idiosyncratic flood risk are positively correlated and highly significant. Households with higher educated members, male headed and owner of the dwelling place are less vulnerable to idiosyncratic flood risk. Possession of arable land and small family size can reduce the poverty and aggregate flood risk.

Tingsanchali and Karim (2005) studied on Flood hazard and risk assessment was conducted to identify the priority areas in the south west region of Bangladesh for flood mitigation. Simulation of flood flow through the Gorai and Arial Khan river system and its floodplains was done by using a hydrodynamic model. After model calibration and verification, the model was used to simulate the flood flow of 100-year return period for a duration of four months. The maximum flooding depths at different locations in the rivers and floodplains were determined. The process in determining long flooding durations at every grid point in the hydrodynamic model is laborious and time-consuming.

Therefore the flood durations were determined by using satellite images of the observed flood in 1988, which has a return period close to 100 years. Flood hazard assessment was done considering flooding depth and duration. By dividing the study area into smaller land units for hazard assessment, the hazard index and the hazard factor for each land unit for depth and duration of flooding were determined. From the hazard factors of the land units, a flood hazard map, which indicates the locations of different categories of hazard zones, was developed. It was found that 54% of the study area was in the medium hazard zone, 26% in the higher hazard zone and 20% in the lower hazard zone. Due to lack of sufficient flood damage data, flood damage vulnerability is simply considered proportional to population density. The flood risk factor of each land unit was determined as the product of the flood hazard factor and the vulnerability factor. Knowing the flood risk factors for the land units, a flood risk map was developed based on the risk factors. These maps are very useful for the inhabitants and floodplain management authorities to minimize flood damage and loss of human lives.

Paul (1997) presented main findings of flood research conducted so far in Bangladesh. The paper emphasizes unconventional findings and points out how some of these findings differ from the popular perceptions regarding some important aspects of flooding. The available studies clearly suggests that research into the impact of flooding on human settlement and other relevant aspects is much less developed in Bangladesh than the body of literature focusing on human adjustment to flood hazard. The paper identifies flood research gaps in the context of Bangladesh and suggests a new arena for future research. Each flood has a devastating effect on the live, livelihood and properties of the country. However, both the governmental and non-governmental have taken a number of initiatives to tackle the adverse impacts of flooding in Bangladesh. This study suggests that execution of a comprehensive flood management plan and a coordinated approach among the different flood management actors will foster the flood risk reduction in Bangladesh.

Rob (1990) classified floods into five types: general or monsoonal; flash floods; high intensity rainfall floods; cyclonic surges; accidents. Seven flood vulnerable areas are identified, mostly confined to hydrologically distinct basins and plains. The following causes of floods are examined: excessive local rainfall; cross boundary run-off; low elevation and flatness; decaying channels and situation; rise of sea level; tectonic situation; human interference (embankments, canals, deforestation). Various curative or preventive measures are proposed: stream bank protection; embankments; excavations; flood shelters; town and village protection works. It is concluded that floods have become a recurring hazard for the country; there is a gradual deterioration.

Paul (1984) studied post-flood agricultural adjustments. The study concluded that floods are not necessarily harmful. Normal floods are rather beneficial to agriculture. Abnormal floods, however, cause adjustment problems to farmers. Montgomery (1985) studied crop losses caused by floods, through analyzing deviations from trend. The study concluded that weather-related factors are still dominant in Bangladesh agriculture.

NASA Image (2007) revealed that large portion of Bangladesh was awash with floods when the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Aqua satellite captured the top image on August 3, 2007. In July 2007, heavy monsoon rains filled the Brahmaputra, Padma, and Meghna Rivers, leading to the floods. Then wetlands that surround these rivers are full of water, and the rivers themselves are swollen and flooded. By 3 August, the main highway connecting Dhaka to the rest of the country was impassable, many districts were flood-affected and 500,000 people had been marooned. By 7 August an estimated 7.5 million people had fled their homes. By 8 August more than 50,000 people had diarrhoea or other water-borne diseases and more than 400,000 people were in temporary shelters. By 11 August, flood deaths were still occurring in Bangladesh, the number of people with flood-related diseases was increasing and about 100,000 people had caught dysentery or diarrhoea. By 15 August, five million people were still displaced, the estimated death toll was nearly 500, and all six of Bangladesh's divisions were affected.

Brammer (2010) revealed that the strategic and options for flood control in Bangladesh have debated for many years which showed on Bangladesh Flood Action Plan (FAP). The main objectives of the Bangladesh Flood Action Plan (FAP), to protect the country from river floods, were not achieved, for several political, economic and institutional reasons. Demographic and economic changes in the following 20 years have increased Bangladesh's exposure to damaging floods. The country's newly elected government is committed to providing flood protection and surface-water irrigation as a means to achieve national food grain self-sufficiency. Therefore, the feasibility and affordability of comprehensive flood and water management systems need to be re-examined. The technical assessment must take into account the finding that severe floods in Bangladesh are caused mainly by heavy rainfall within Bangladesh as well as the increased flood and cyclone risks associated with global warming. An institutional assessment should examine practical means to overcome governance constraints and to increase local responsibility for managing flood protection and irrigation projects.

GOB-Republic of France (1989) suggested that flood damages be collected from various 'reports' 'prepared' by various institutions and agencies, who generally maintain the damage records in physical, but not monetary terms (e.g. number of people affected, houses damaged),. As the records are largely prepared based on visual assessment of affected properties, it is suggested to 'review' and analyze such cautiously' before using this. It is recommended to use 'best possible guesses; from damage records of past floods, in appraising flood protection projects.

2.2 Past Research Findings Relating to the Relationships of Flood disaster Effect to Farmers

This section deals with a review of previous studies relating the association of the selected characteristics of the farmers and the effect of flood to their fish production. Eight (8) characteristics of the fish farmers were selected in this study.

2.2.1 Age and adverse effect of flood

Rana (2020) observed in his study that age has positive and significant relationship with disaster management ability.

Khatun (2009) observed in his study that age has negative and non-significant relation with flood coping ability.

Munna (2009) found in his study that age has negative and highly significant relation with flood coping ability.

Islam (2005) obeserved in his study that age has negative and non-significant relation with flood coping ability.

Karmakar (2004) found significant and positive relationship between age of the farmers with their in adopting aquaculture activities.

Karim (1996) observed in his study that age has positive and non-significant relation with perception on flood coping mechanisms.

Mansur (1989), Akanda (1994) and Hasan (1995) also found no relationship between age and problem faced in their respective studies.

2.2.2 Education and adverse effect of flood

Islam (2005) and Khatun (2009) found in his study that education has positive and highly significant relation with flood coping ability.

Rana (2020) obeserved in his study that education has negative and non-significant relation with disaster management ability.

Alam (2009) and observed in his study that education has negative and highly significant relation with faced constrains on flood.

Karim (1996) observed that education has positive and non-significant relation with on flood coping machanisms.

Munna (2009) Observed in his study that education has positive and non-significant relation with flood coping ability.

Hasan (1995) in his study found that there was no relationship between education of the farmers and flood effect in crop production activities.

Hoque (2001) found a significant negative relationship between education and flood effect of the FFS farmers in practising IPM.

Similar findings were obtained by Mansur (1989). Rahman (1995). Rahman (1996). Faroque (1997). Pramanik (2001).

2.2.3 Family size and adverse effect of flood

Rana (2020) observed that family size has positive and highly significant relationship with disaster management ability.

Khatun (2009) in his study found hat family size has positive and significant relation with flood coping ability.

Alam (2009) and Islam (2005) in their study found that the relationship between family size and the effect of flood was positive and non-significant .

Karim (1996) observed in his study that family size has negative and non-significant relation with perception on flood coping mechanisms.

2.2.4 Benefit-cost Ratio and adverse effect of flood

Rana (2020) observed that annual family income and cost has positive and highly significant relationship with disaster management ability.

Khatun (2009) observed in his study that annual family income has positive and highly significant relation with flood coping ability.

Alam (2009) observed in his study that annual family income and cost has negative and non-significant relation with faced constraints on flood.

Karim (1996) found in his study that annual family income has positive and significant relation with perception on flood coping mechanisms.

Munna (2009) and Islam (2005) found in their separate study that annual family income cost ratio has positive and highly significant relation with flood coping ability.

Islam (2009) observed in his study that annual family income has positive and highly significant relationship between farmer with flood coping ability.

2.2.5. Experience and adverse effect of flood

The researcher could not find any literature involving relationship between farming experience and problem confrontation of the farmers. But a study conducted by Akanda (1994) found out the relationship between farming experience of the farmers in cultivation help to minimize the effect of flood confrontation. The findings indicated that there was significant relationship between farming experience and the problem faced by the farmers.

2.2.6. Traning and adverse effect of flood

Karim (1996) observed in his study that training exposure has positive and highly significant with their perception on flood coping mechanisms.

Khatun (2009)observed in his study that training exposure has positive but non-significant relation with flood coping ability.

2.2.7. Farm size and adverse effect of flood

Rana (2020) observed that farm size has positive and highly significant relationship with disaster management ability.

Khatun (2009) observed in his study that farm size has positive and highly significant relation with flood coping ability.

Munna (2009) and Islam (2005) found in their separate study that farm size has positive and highly significant relation with flood coping ability.

Alam (2009) and Karim (1996) observed in their study that farm size has positive but non-significant relation with faced constrains on flood.

2.2.8 Extension media contact and adverse effect of flood

Rana (2020) observed that extension media contact has positive and highly significant relationship with disaster management ability.

Khatun (2009)observed in his study that extension media contact has positive but non-significant relation with flood coping ability.

Alam (2009) observed in his study that extension media contact has negative and highly significant relation with faced constraints on flood.

Munna (2009) and Islam (2005) found in their separate study that extension media contact has positive and highly significant relation with flood coping ability.

Karim (1996) observed in his study that extension media contact has positive and highly significant with their perception on flood coping mechanisms.

Hasan (1995) in his study found that there was no relationship between Extension contact of the farmers and their problem confrontation in crop production activities.

Rahman (1995) in his study conducted that extension contact of the farrmer had significant negative relationship with their problem confrontation in cotton cultivation. Similar findings were obtained by

Rahman (1996). Faroque (1997). Pramanik (2001), Hossain (2002), Bhuiyan (2002), Ahmed (2002). Salam (2003) and Halim (2003) their respective studies.

The study of Ismail (2001) revealed that there was no significant relationship between farm youths' extension contact and their agricultural problem confrontation. Similar findings were obtained by Raha (1989) and Hoquc (2001) in their respective studies.

2.3 Research Gap

From reviewing of the past literatures, it was found that some research works tried to find out the effects of flood on crop production. No work was found particularly to determine the adverse effect of flood on fish production. On this consideration the present research work was tried to find out the adverse effects of flood on fish production.

2.4 Conceptual framework of the study

This study is concerned with the adverse effect of flood on fish farmers. Thus, exploration the adverse effect of flood on fish farming perceived by the farmers was the main focus variable and 8 selected characteristics of the farmers were considered as the experimented variables of the study. These were- a) age, b) education, c) family size, d) benefit-cost ratio, e) farming experience, f) training received in fish farming, g) farm size and h) extension contact. Again, in order to have a clear understanding of the nature of adverse flood effect, the focus or predicted variable was considered from the view of several numbers of effects as shown below:

- Outbreak of fish diseases due to flood
- Pollution of pond/hatchery water
- Destruction of pond/hatchery dike

- Invasion of undesirable species due to flood
- Unavailability of eggs, larva, fry, fingerling's
- Unavailability of fair price
- Unavailability of transportation facilities
- Unavailability of storage facilities
- Shortage of necessary chemicals
- Unavailability of weather information
- Unavailability of marketing facilities
- Shortage of inputs
- Shortage of Labour

Considering the above mentioned discussion, a conceptual framework has been developed for this study, which is diagrammatically presented in Figure 2.1.

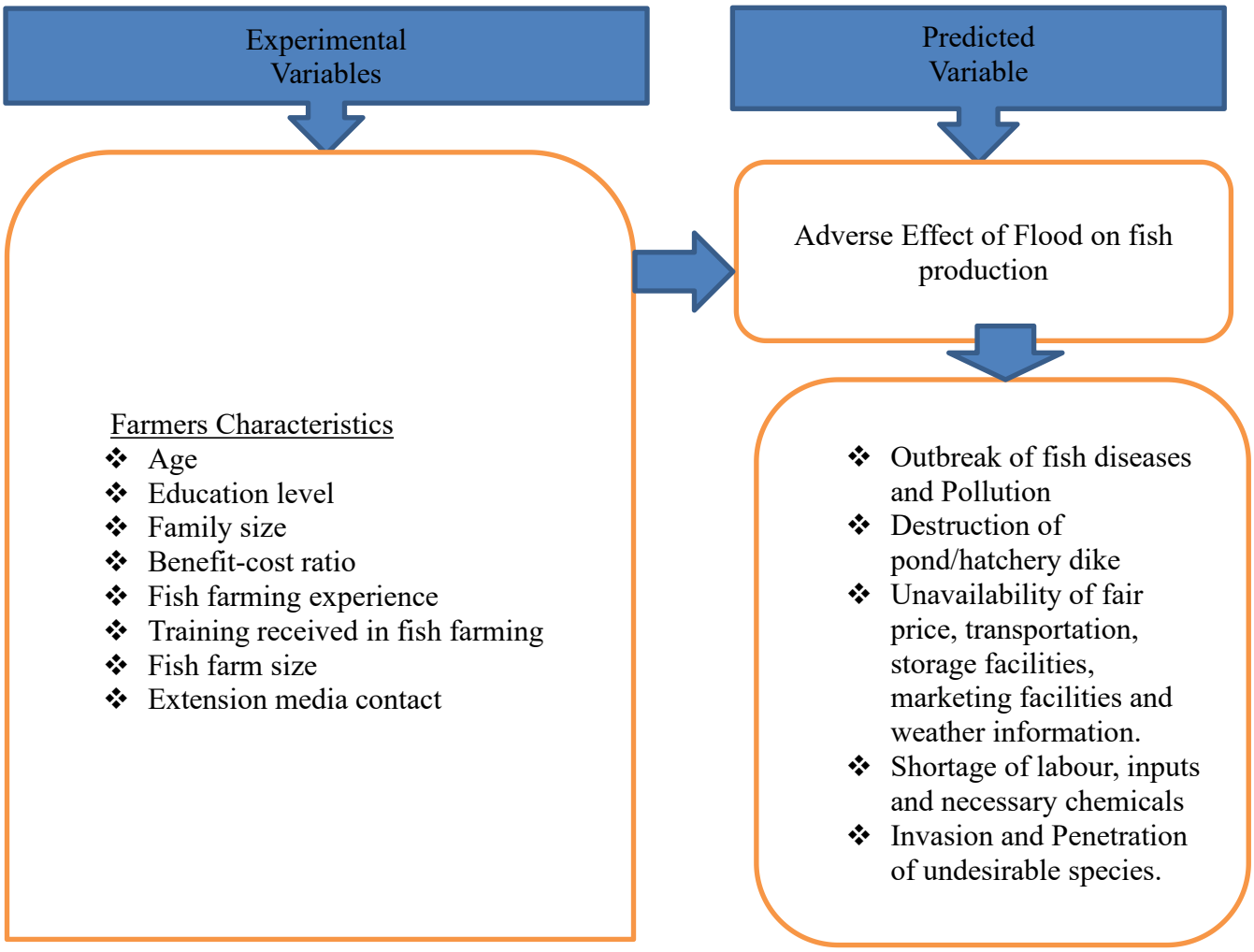

Figure 2.1 Conceptual framework of the study

CHAPTER III
METHODOLOGY

Methodology refers to the methods and procedures in the research work. A sequential description of the methodologies followed in conducting this research work has been presented in this chapter.

3.1 Locale of the Study

The study was conducted Gangachara upazila in Rangpur district which is known as flood prone area of the country (Islam, 2017). Data on effect of flood to the fish farmers were collected where the target farmers were available in 9 unions. Out of 9 unions of Gangachara upazilla, 3 unions namely Gajghanta, Morneya and Barabil were selected purposively. The main reasons for selecting this study area were:

- Gangachara upazila was primarily selected as a suitable area for the study because this upazila is situated near the bank of Tista river which comes under regular flood and farmer are highly vulnerable to flood damage.
- The land of this upazila generally low comparative the other upazila in rangpur district.
- Almost every year flood occurs in these villages and causes human sufferings and damage fish production.

A map of Rangpur district with showing Gangachara upazila and a map of Gangachara upazilla showing study area have been shown in figure 3.1 and 3.2 respectively.

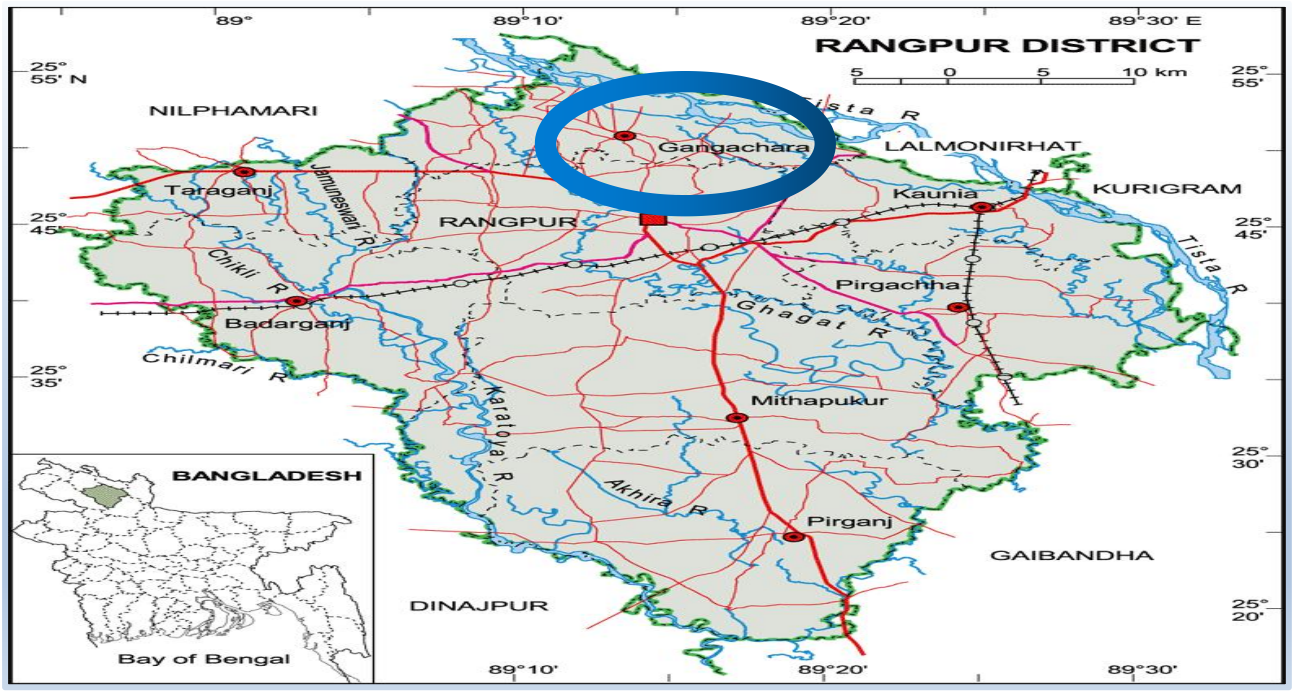

Figure 3.1 Map of Rangpur district showing Gangachara upazila

3.2 Population of the study

The researcher himself with the cooperation of Upazilla Fisheries Officer (UFO), collected three (3) updated lists of all the fish farmers of the selected three (3) unions. The total numbers of fish farmers in these three (3) unions were 1026 which constituted the population of the study.

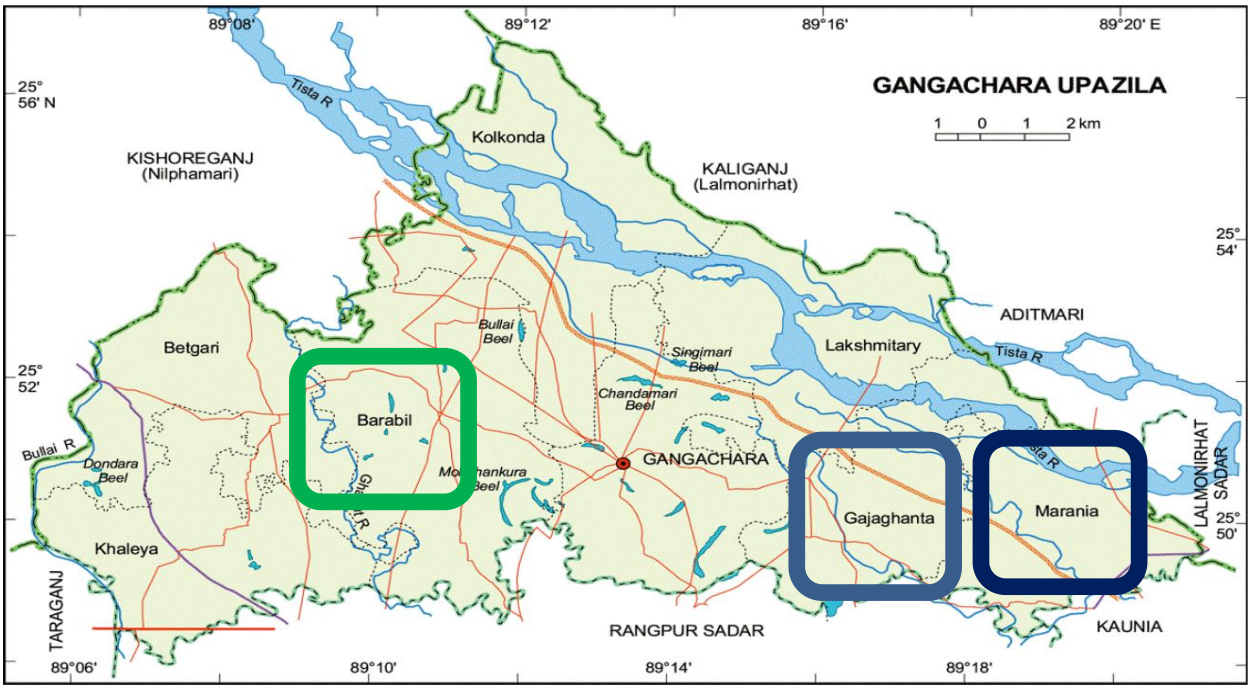

Figure 3.2: Map of Gangachara upazila in Rangpur district

3.3 Sample of the study

By taking 10% of the population 103 fish farmers were selected as the sample of the study by using proportionate (union wise) and random sampling method. Simultaneously a reserved list of 21 farmers was made in order to use in case of non-availability of sampled farmers. The detailed distribution of population and sample are showed in Table 3.1.

Table 3.1 Union-wise distribution of the population and sample and reserve list

Name of unions	Population	Sample	Reserved list
Gajghanta	448	45	9
Morneya	279	28	6
Barabil	299	30	6
Total	1026	103	21

3.4 Research instruments

In a social research field interview schedule is a popular instrument for data collection. A draft interview schedule was prepared after through consultation with farmers and supervisions of the researcher which were pre-tested by 20 respondents of the study area excluded from sample. Necessary correlation modification and adjustment were done based on the pre-tested data. Then final interview schedule was prepared and multiplied for final data collection.

3.5 Variables and their measurement

A variable is any measurable characteristic which can assume varying or different values in successive individual cases (Ezekiel and Fox, 1959). In any scientific research, the selection and measurement of variables is most important factor. The researcher reviewed the literatures to widen his understanding about the nature and scope of the variables relevant to this research. The selected individual characteristics of the fish farmers were the experimental variables (namely, age, education, family size, benefit-cost ratio, fish farming experience, organizational participation/ b training exposure, fish farm size, and extension contact). Effect of flood on fish production was the main focus of the study which was considered as the predicted variable.

3.6 Measurement of adverse flood effect as perceived by the fish farmers on fish production

Adverse effects as perceived by the fish farmers in fish production due to flood was the main focus of the study. It was measured on the basis of the adverse effects faced by the fish farmers on fish production. A scale was used for measuring flood effects as perceived by the farmers on fish production. The scale contained 13 probable effects, which the farmers might face in respect of fish production due to flood. Each respondent was asked to indicate the extent of effects as perceived by him / her against each effect item by checking any one of the four alternative responses as ‘high effect’, ‘moderate effect’, ‘low effect’ and ‘no effect’. Weights were assigned to these responses as 3, 2, 1 and 0 respectively. Weights for responses against all the 13 effect-items of a respondent were added together to obtain his/her perceived effect score. Therefore, the effect score of the farmers could range from 0 to 39, where 0 indicated no effect and 39 indicated very high effect of flood on fish production.

To compare the severity among the effect, Adverse Effectiveness Index (AEI) was computed for each effect-item with help of the following formula:

$AEI = E_h \times 3 + E_m \times 2 + E_l \times 1 + E_n \times 0$

Where,

AEI= Adverse Effectiveness Index (AEI)

E_h= Number of farmers perceived high effect

E_m= Number of farmers perceived moderate effect

E_l = Number of farmers perceived low effect

E_n= Number of farmers perceived no effect

Thus, the AEI of the farmers could range from 0-309, where 0 indicated no effect and 309 indicated highest effect. Standardized Adverse Effectiveness Index (SAEI) was then computed for each item with the following formula:

$$SAEI = \frac{\text{AEI of the item}}{\text{Highest possible AEI}} \times 100$$

Where, SAEI= Standardized Adverse Effectiveness Index

AEI= Adverse Effectiveness Index

Highest possible AEI was 309

Thus, SAEI could range from 0-100, where '0' indicated no adverse effect and '100' indicated highest adverse effect. Rank order made with the descending order of the SAEI of the effect-items.

3.7 Measurement of the selected characteristics of the fish farmers

The socio-economic characteristics of the fish farmers like age, education, family size, benefit-cost ratio, fish farming experience, training received in fish farming, fish farm size, and extension contact were selected as the experimental variables of the study. Measurement of all these characteristics are discussed in the following sub-sections.

3.7.1 Age

The age of a fish farmers was measured in terms of actual years from his/her birth to the time of interview on the basis of the fish farmer's statement. Age define the significance of biological maturity of an individual. Age is used in social research to understand the demographic character of a population. A score of 1 (one) was assigned for each year of age. Question of this characteristic appears in item no. 1 in the interview schedule. (Appendix-A)

3.7.2 Education

Education was measured as the fish farmer's ability to read and write or the level of formal education received from educational institution. This characteristics was measured by assigning one (1) score for 1 year successful schooling. If a fish farmer did not know how to read and write his educational score was zero (0). A respondent got actual score of 5 for successfully passed primary level, 8 score for J.S.C, 10 score for S.S.C, 12 score for higher secondary and 16 score for tertiary education respectively. This variable appears in item no. 2 in the interview schedule. (Appendix-A)

3.7.3 Family size

Family size of a fish farmer was measured by counting total number of persons in his/her family including himself and other person living and being dependent fully or partially on his/her income. The total number of persons was considered as his/her family size score .This variable appears in item no. 3 in the interview schedule. (Appendix-A)

3.7.4 Benefit-Cost Ratio (BCR)

BCR of a farmer was counted by the ratio of gross annual income and cost of fish production. It was measured on the basis ratio of his family's yearly earning from fisheries production and the total cost for fish culture by using the following formula:

$$\text{BCR}=\frac{\text{Total earning from fish production}}{\text{Total expenditure for fish farming.}}\times 100$$

It was expressed in percentage (%).

3.7.5 Fish farming experience

Farming experience was determined by total number of years since a farmer engaged in fish culture. The actual experience given by the respondents was measured by assigning a score of one (1) for each year from starting the fish culture. This characteristic appears in item no. 5 in the interview schedule. (Appendix-A)

3.7.6 Training received in fish farming

Training received of a fish farmers was measured by total number of days attended in different fish culture related training programs in his/her life from different organizations. A score of 1 was assigned for per day receiving training of a farmer. This variable appears in item no. 6 in the interview schedule. (Appendix-A)

3.7.7 Fish farm size

The fish farm size of a farmer referred to the total area of pond either owned by a farmer or obtained from others on lease during the study period, on which he carried out fish farming operations. The total farm size in decimal was considered as fish farm size score of the farmers. Here a score of 1 (one) was assigned for 1 decimal of the farm size. This characteristic included in item no. 7 in the interview schedule. (Appendix-A)

3.7.8 Extension media contact

This variable was measured by computing an extension contact score on the basis of a fish farmer's extent of contact with seven selected media with five alternative response as regularly, often, occasionally, rarely, and not at all by assigning weights as 4, 3, 2, 1 and 0 respectively. Logical frequencies were assigned for each alternative response for each of the 7 selected items. The extension contact score of a respondent was computed by summing up his/her scores against all the seven items, which could vary from zero 0 to 28, where '0' indicated no extension contact and '28' indicated the highest level of extension contact. This characteristic appears in item no. 8 in the interview schedule. (Appendix-A)

3.8 Collection of data

Data were collected personally by the researcher himself through face to face interview from the selected fish farmers keeping in mind the objectives of the study. Necessary co-operation was achieved from the Upazilla Fisheries Officer (UFO) and staff of Gangachara fisheries office. Interviews were usually conducted with the respondent in their homes. At the time of interview the researcher took all possible care to establish rapport with fish farmers so that their co-operation and response to the questions and statements in the schedule was excellent. The entire process of collecting data was completed in July and August, 2022.

3.9 Statement of Hypothesis

A hypothesis is a conjectural statement of the relation between two or more variables which can be put to a test to determine its validity. Hypothesis are always in declarative sentence form and they are related, either generally or specifically from variables to variables (Kerlinger, 1973). In broad sense hypotheses are divided into two categories: (a) Research hypothesis and (b) Null hypothesis.

3.9.1 Research hypothesis

Research hypothesis states a possible relationship between the variables being studied or a difference between experimental treatments that the researcher expects to evaluate. The research hypothesis was formulated: 'there was significant relationships between each of the selected characteristics of the fish farmers and their perceived effect of flood on fish production'.

3.9.2 Null hypothesis

A null hypothesis states that there is no relationship between the concerned variables. The null hypothesis was formulated: 'there was no significant relationships between each of the selected characteristics of the fish farmers and their perceived effect of flood on fish production'.

3.10 Categorization of data

For describing different characteristics, the farmers were classified into several categories. These categories were developed by considering the nature of distribution of data, general understanding prevailing in the social system and possible scores system. The procedure for categorization of data in respect of different variables is elaborately discussed while describing those variables in Chapter 4.

3.11 Data Processing

After completing the field survey, all data were coded, compiled & tabulated following the objectives of the study. All local units were converted into standard units. In case of qualitative data, proper scoring technique was followed to convert the data into quantitative form. The individual responses to all questions of the interview schedule were transferred into a excel sheet to simplify tabulation, categorization and organization.

3.12 Statistical Procedures

The collected data were analysed according to the objectives of the study. The analysis was performed using SPSS (Statistical Package for Social Sciences) computer package and the statistical measures such as range, means, standard deviation, number and percentage distribution were used to describe the variables. Rank order was made to compare the items of effectiveness of flood on fisheries production. Pearson's Product Moment coefficient of correlation (r) was used to describe the relationships between the concerned variables. Five percent (0.05) level of probability was used for the rejecting of any null hypothesis.

Chapter IV

Result and discussion

In this Chapter, the findings of the study and interpretation of the results have been presented according to the objectives of the study. This Chapter has been divided into three sections. The first section deals with the adverse effect of flood on fish production with Item-wise Effectiveness of Flood Effect as perceived by the farmers on fish production. The second section deals with the selected characteristics of the fish farmers. Finally, the third section deals with the relationships between the fish farmers selected characteristics and their perceived flood effect on fish production.

4.1 Adverse effect of flood on fish production

The observed score of flood effect on fish production as perceived by the farmers ranged from 15 to 36 against the possible range of 0 to 39 with an average of 24.50 and standard deviation of 5.631. Based on the possible range, the fish farmers were classified into two categories namely medium effect (14-26) and high effect (above 26). The distribution of the fish farmers according the effect is given in Table 4.1.

Table 4.1 Distribution of adverse flood effect on fisheries production

Categories	Farmers' (n=103)		Mean	SD
	Number	Percentage		
Medium (14-26)	61	59.2	24.50	5.631
High (above 26)	42	40.8		
Total	103	100		

Data revealed that majority (59.2%) portion of the fish farmers perceived medium adverse effect of flood, while 40.8% perceived high adverse effect of flood on fish production. It means that all the farmers perceived medium to high adverse effect of flood on fish production.

4.1.1 Item-wise Effectiveness of Flood perceived by the farmers on fish production

The observed Standardized Adverse Effectiveness Index (SAEI) of the effect items ranged from 38.188 to 88.997 against the possible range of 0-100. Based on descending order of SEI, rank order was made as shown in Table 4.2. On the basis of descending order of SAEI, it was observed that 'outbreak of fish diseases due to flood' ranked 1st followed by 'destruction of pond/hatchery dike' and 'unavailability of fair price'. Fourth to thirteen ranked items were 'unavailability of transportation facilities', 'pollution of pond/hatchery water', 'shortage of Labour', 'invasion and

penetration of undesirable species due to flood', 'unavailability of storage facilities', 'shortage of inputs', 'unavailability of eggs, larva, fry, fingerling etc.', 'unavailability of marketing facilities', 'shortage of necessary chemicals' and 'unavailability of weather information'.

4.2 Standardized Adverse Effectiveness Index (SAEI) with Rank Order

Sl no	Items	Number of farmers' perceived					AEI	SAEI	Rank order
		High Effect	Medium Effect	Low Effect	No Effect	Total			
1.	Outbreak of fish diseases due to flood	71	30	2	0	103	275	88.997	1st
2.	Destruction of pond/hatchery dike	67	28	7	1	103	264	85.437	2nd
3.	Unavailability of fair price	64	32	7	0	103	263	85.113	3rd
4.	Unavailability of transportation facilities	57	29	15	2	103	244	78.964	4th
5.	Pollution of pond/hatchery water	52	28	20	3	103	232	75.081	5th
6.	Shortage of Labour	38	31	34	0	103	210	67.961	6th
7.	Invasion and Penetration of undesirable species due to flood	26	33	44	0	103	188	60.841	7th
8.	Unavailability of storage facilities	19	30	48	6	103	165	53.398	8th
9.	Shortage of inputs	19	30	48	6	103	165	53.398	9th
10.	Unavailability of Eggs, larva, fry, fingerling etc	13	29	55	6	103	152	49.191	10th
11.	Unavailability of marketing facilities	10	22	54	17	103	128	41.424	11th
12.	Shortage of necessary chemicals	5	18	68	12	103	119	38.511	12th
13.	Unavailability of weather information	5	25	53	20	103	118	38.188	13th

Data contained in Table 4.2 indicate that "outbreak of fish diseases due to flood" ranked first as it was the most severe problem faced by the fish farmers during flood. In this study area most pond fish

farmers do not have a good understanding of health and disease issues in their system. In aquaculture system flood effect is very prone to disease outbreak. According to fish farmers perception, most of the diseases mainly occurred during the flood season.

Destruction of pond/hatchery dike ranked 2nd position in the rank order. It was occurred due to high flow of water. During the flood the high wave of water breakdown the dike and due to damages of the dike the fish escape from the fish farm. The cost of the farmers for repairing the dike enhanced their production cost which affect on the total production system.

Farmers are often deprived of fair price for their produce in normal time. Table 4.2 revealed that unavailability of fair price was the 3rd severe effect. Due to flood the farmers were unable to sell their harvested fish in fair price. This also related with transports facilities. Unavailability of transportation facilities was the 4th effect perceived by the farmer during flood. In this study area most of the fish farmers were unable to transport their production to the market as most of the roads are submerged under water during the flood.

Pollution of pond/hatchery water was the 5th major effect of flood faced by the farmers. Nitrogen and phosphorus typically enter streams and reservoirs from fertilizers, dog waste, and other sources. Over time, these nutrients build up in the water and promote algae and water plant growth, and as they decay, they lower oxygen levels in the water. Synthetic pesticides used for weed and bug control are toxic in even small amounts. In the study area this happen during the flood and pollute the water-body which leads to hampered overall fish production.

It was observed that Shortage of labour obtained 6th position in rank order. During flood it was very difficult to find out the labour if it was possible, the cost of the labour was very high. Invasion and Penetration of undesirable species due to flood was the 7th major effect of flood as perceived by the farmers. It leads to decrease the fish production and the cost of the fish production increase with increasing the level of undesirable species.

Unavailability of storage facilities was the 8th effect of flood faced by the farmers. Shortage of inputs was the 9th effect of flood faced by the farmers. Unavailability of Eggs, larva, fry, fingerling etc was the 10th effect of flood as perceived by the farmers. This effect was also related with transport facilities. Unavailability of marketing facilities, Unavailability of weather information and Shortage of necessary chemicals were the 11th, 12th and 13th respectively faced effect of flood as perceived by the farmers.

4.2 Selected characteristics of the farmers

Actually, there are numerous interrelated and constituent attributes that are characterized on individual and form an integral part of farmers' livelihood. However. the eight (8) selected characteristics of the fish farmers such as age, education, family size, benefit-cost ratio, fish farming experience, training received in fish farming, fish farm size and extension media contact might greatly influenced the effect of flood on fish production as perceived by the fish farmers. Salient features of these characteristics are presented in table 4.3.

Table 4.3 Salient features of the selected characteristics of fish farmers' (n=103)

Sl no.	Characteristics of the fish farmers'	Range		Mean	Standard Deviation
		Possible	Observed		
1	Age (Year)	Unknown	25-67	42.73	10.978
2	Education (Schooling year)	Unknown	0-16	8.534	5.1598
3	Family size (Number)	Unknown	2-13	6.17	2.250
4	Benefit-cost ratio (%)	Unknown	184.62-636.36	362.4788	97.24630
5	Fish farming experience (Year)	Unknown	0-25	8.31	6.047
6	Training received in fish farming (No. of days)	Unknown	0-12	3.43	3.098
7	Fish farm Size (Decimal)	Unknown	15-120	43.0874	26.2977
8	Extension media contact (Score)	0-28	5-25	13.49	5.008

4.2.1 Age :

The observed age of the farmers ranged from 25 to 65 years with a mean of 42.73 years and standard deviation of 10.978. The respondents were classified into three age categories namely, young (upto 35 years), middle aged (36-50 years) and old (above 50 years) as shown in Table 4.4.

Table 4.4 Distribution of the farmers according to their age

Categories	Farmers'		Total respondents (n)
	Number	Percentage	
Young aged(0-35)	**35**	**34**	**103**
Middle aged(36-50)	**44**	**42.7**	
Old aged(51-67)	**24**	**23.3**	
Total	**103**	**100**	

The largest (42.73%) proportion of the farmers was middle aged, while 34 percent of them were young aged and 23.3 percent were old aged. Thus, about three fourth 76.7 percent of the farmers belonged in young to middle aged categories. In above discussion it is revealed that 25 to 50 aged farmers were involved in fish production than old aged farmers. But the researcher also found that the old aged farmers were highly experienced and more training received than young to middle aged farmers. The old aged farmers were also had large farm than young aged farmers. Khatun (2009) also found the same findings in her research.

4.2.2 Education:

Education of the farmers ranged from 0 to 16 years of schooling having an average of 8.534 years with a standard deviation of 5.1598. On the basis of their education, the respondents were classified into five categories as shown in Table 4.5.

Table 4.5 Distribution of the farmers according to their education

Categories	Farmers'		Total respondents (n)
	Number	Percentage	
Illiterate (don't read and write)	**17**	**16.5**	**103**
Primary education (1-5 class)	**16**	**15.5**	
Secondary education (6-10 class)	**27**	**26.3**	
Higher secondary (11-12)	**28**	**27.1**	
Above higher secondary	**15**	**14.6**	
Total	**103**	**100**	

Data contained in Table 4.5 indicates the only 16.5 percent of the farmers could not sign their name that's means they are illiterate (don't read and write). It was found that 15.5 percent had primary level of education, 26.3 percent had secondary level of education, and 27.1 percent had higher

secondary level of education. Only 14.6 percent were crossed their higher secondary level and they were highly educated. Education is the process of self-development of a person's mind and helps a person to be intelligent, practical, pragmatic and aware and to get useful information to solve their daily work problems. Educated farmers can get useful information by reading leaflets, booklets, books, newspapers and other printed materials (Islam 2004). Education expands understanding and develops the ability to analyse information and situations to make rational decisions. Most of the farmers in this study were not highly educated and this may be the reason why the farmers highly affected.

4.2.3 Family Size:

Family size scores of the farmers ranged from 2 to 13 with an average of 6.17 and standard deviation of 2.250. According to family size, the respondents were classified into three categories as shown in Table 4.6.

Table 4.6 Distribution of the farmers according to their family members

Categories	Farmers'		Total respondents (n)
	Number	Percentage	
Small family (up to 4)	**28**	**27.2**	**103**
Medium family (5 - 8)	**59**	**57.3**	
Large family (above 8)	**16**	**15.5**	
Total	**103**	**100**	

Data contained in Table 4.6 indicates that about half (57.3%) of the farmers had medium family while 15.5 percent of them had large family and only 27.2 percent of them had small family. Thus, about three fourth (72.8%) of the farmers had medium to large family.

4.2.4 Benefit-Cost Ratio

The observed score of benefit-cost ratio (BCR) in fish farming of the farmers ranged from 184.62 to 636.36 with the average of 362.4788 and standard deviation of 97.24630. Based on the BCR score, the fish farmers were classified into three categories such as low (upto 250), medium income (251-500) and high income (above 500) as shown in Table 4.7.

Table 4.7 Distribution of the farmers according to their benefit-cost-ratio

Categories	Farmers'		Total respondents (n)
	Number	Percentage	
Low BCR (0-250)	**12**	**11.7**	**103**
Medium BCR (251-500)	**80**	**77.6**	
High BCR (above 500)	**11**	**10.7**	
Total	**103**	**100**	

Data indicated that highest (77.6%) proportion of the farmers achieved medium BCR while 11.7 percent farmers achieved low BCR and only 10.7 percent farmers achieved high BCR from fish farming. Thus, overwhelming majority 88.3 percent of the fish farmers achieved medium to high BCR from fish farming.

4.2.5 Fish farming Experience

The observed score of fish farming experience of the farmers ranged from 0 to 25 with average of 8.31 and the standard deviation of 6.047. Based on farming experience score, the farmers were classified into three categories considering mean and standard deviation such as low, medium and high experience as shown in Table 4.8.

Table 4.8 Distribution of the farmers according to their fish farming experience

Categories	Farmers'		Total respondents (n)
	Number	Percentage	
Low (up to 5)	**43**	**41.7**	**103**
Medium (6 - 10)	**33**	**32.1**	
High (above 10)	**27**	**26.2**	
Total	**103**	**100**	

Data revealed that majority (41.7%) of the farmers had low farming experience, while 32.1 percent and 26.2 percent had medium and high farming experience respectively. Muhammud (2010) found that farmers who have been in the fish farming profession for a long time gain a lot of experience. Experience guides farmers on how to deal with and mitigate problems from various angles. Low and medium experienced farmers generally tend to make risk-based decisions. Nowadays farmers take up

alternative occupations thereby losing their professional knowledge and experience. Thus, extension agencies should provide rehabilitation by providing them with practical training. In this study overwhelming majority (73.8%) of the farmers had low to medium type of experience in fish farming.

4.2.6 Training received

Training received scores of the farmers ranged from 0 to 12 with the mean and standard deviation of 3.43 and 3.098 respectively. Based on their training exposure scores, the respondents were grouped into three categories as 'no training received' (0), 'low training received' (1 to 3days) and 'medium training received' (4 to 12 days). The distribution of the farmers according to their training received is shown in Table 4.9.

Table 4.9 Distribution of the farmers according to their received training

Categories	Farmers'		Total respondents (n)
	Number	Percentage	
No training (0)	**23**	**22.3**	**103**
Low training (1-3)	**39**	**37.9**	
Medium (4-12)	**41**	**39.8**	
Total	**103**	**100**	

Data in Table 4.9 revealed that majority (39.8%) of the farmers received medium training compare to 37.9 percent received low training and 22.3 percent of the respondents were found under no training received category. Rana (2020) found that training generally increases the capacity and awareness of individuals, which they can apply to their farm work. Training exposure is an important factor, which helps farmers to gain in-depth knowledge and improve their farming and enhance their skills. Trained farmers can easily cope with and manage unfavourable conditions in fish farming. Most (77.7%) of the farmers in this study had low to medium training exposure which should be increased for developing farmers' knowledge and skills to handle complex situations like flood.

4.2.7 Fish farm size

The fish farm size of the respondents varied from 15 to 120 decimal and the average being 43.0874 and standard deviation of 26.29773. The respondents were classified into three categories on the basis of their fish farm size. The categories were low farm size, medium farm size and high farm size. The categories and distribution of farmers are shown in Table 4.10.

Table 4.10 Distribution of the farmers according to their farm size

Categories	Farmers'		Total respondents (n)
	Number	Percentage	
Small farm size (0-25)	39	37.9	103
Medium farm size (26-70)	45	47.5	
Large farm size(above 75)	19	14.6	
Total	103	100	

Data presented in the Table 4.10 showed that majority (47.5%) of the farmers had medium fish farm compared to 14.6 percent had large farm size and 37.9 percent had small farm size. Thus, overwhelming majority (85.4%) of the respondents had small to medium fish farm size.

4.2.8 Extension Media Contact

The observed extension media contact scores of the farmers ranged from 5-25 against the possible range of 0 to 28 with the mean of 13.49 and standard deviation of 5.008. According to their extension media contact scores, the farmers were classified into three categories such as Low (up to 9),medium (10 - 18) and high (above 18) as shown in Table 4.11.

Table 4.11 Distribution of the farmers according to their extension contact

Categories	Farmers'		Total respondents (n)
	Number	Percentage	
Low (up to 9)	28	27.2	103
Medium (10 - 18)	52	50.5	
High (above 18)	23	22.3	
Total	103	100	

Data presented in the Table 4.11 indicated that about half (50.5%) of the farmers had medium extension media contact compared to 27.2 percent low and 22.3 percent high extension media contact. Findings again revealed that most (77.7%) of the farmers had low to medium extension contact. This must be due to low rate of literacy level, backward infrastructural communication facilities and low level socio-economic status of majority of the respondents. Roknuzzaman (2004) also found similar results in his study. Therefore, concerned extension agencies (both GOs and NGOs) should pay more attention to appropriate media sources. Media communication of fish farmers might reduce various problems in the study area.

4.3 Relationships between the selected characteristics of the fish farmers and adverse effect of flood on fish production

The purpose of this section is to deal with the association of each of the selected characteristics of the fish farmers with their perceived effect of flood. The characteristics included age, education, family size, benefit-cost ratio, fish farming experience, training received in fish farming, fish farm size and extension media contact.

Pearson's Product Moment Correlation Co-efficient (r) was computed in order to find out the extent of relationship between each of the selected characteristics of the fish farmers with their perceived adverse effect of flood in fish farmers. To reject or accept any null hypotheses at 0.05 level of probability was used. Results of correlation have been shown in Table 4.12. Correlation co-efficient among all the variables may be seen in correlation matrix (Appendix B).

Table 4.12 Relationships between the selected characteristics of the farmers' and their perceived adverse effect of flood on fish production

Focus Issue	Selected Characteristics	Correlation coefficient (r)	Tabulated 'r' value with 101 df	
			At 0.05 level	At 0.01 level
Adverse effect of flood on fish production as perceived by the fish farmers	Age	-0.284**	0.195	0.254
	Education	-0.204*		
	Family size	-0.072		
	Benefit-cost ratio	0.186		
	Fish farming experience	-0.371**		
	Training received in fish farming	-0.439**		
	Fish farm size	-0.433**		
	Extension media contact	-0.510**		

NSnon-significant

**significant at 0.01 level (2-tailed) and

**significant at 0.05 level (2-tailed).

4.3.1 Age and adverse flood effect on fish production

The calculated value of 'r' (-0.284) was higher than the tabulated value of 'r' (0.254) with 101 degree of freedom at 0.01 level of probability as shown in Table 4.12. It lead to the following

observations:

- Age of fish farmers had significant but negative relationship with their perceived adverse effect of flood on fish production.
- The concerned null hypothesis was rejected.

The above findings revealed that adversed flood effect on fish production of small aged fish farmers is higher than the older aged fish farmers. It might be due to that aged farmers can cope with the adversed effect of flood in fish production as they might have higher experience and higher training.

4.3.2 Education and adverse flood effect on fish production

The coefficient of correlation between education of the farmers and their adverse effect of flood on fish production is presented in Table 4.12. The coefficient of correlation between the concerned variables was found as -0.204. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables of the study under consideration.

- The relationship showed a negative trend between the concerned variables.
- The observed value of "r" (-0.204) between the concerned variables was found to be greater than the tabulated value of "r" (0.195) with 101 degrees of freedom at 0.05 level of probability.
- The null hypothesis was rejected.
- The relationship between the concerned variables was statistically significant at 0.05 level of probability.

Based on the above findings it was concluded that educational level of the farmers had significant negative relationships with their perceived adverse effect of flood on fish production. This represents that educational level of the respondent farmers was an important factor in facing adverse effect of flood on fish production due to flood. And with the increase in educational level of the respondents, adverse effect faced by the farmers due to flood on fish production was decreased.

4.3.3 Family size and adverse flood effect on fish production

The calculated "r" (-0.072) value was smaller than that of the tabulated value "r" (0.195) with 101 degree of freedom at 0.05 level of probability as shown in Table 4.12 and observations were:

- The relationship showed a negative trend between the concerned variables.
- The null hypothesis could not be rejected.
- Relationship between the variables was statistically non significant at 0.05 level of probability.

It could be said that flood effect is not significantly related with family size.

4.3.4 Benefit-cost ratio (BCR) and adverse flood effect on fish production

The coefficient of correlation between the benefit-cost ratio of fish production of the farmers and their perceived adverse effect on fish production due to flood is presented in Table 4.12. The coefficient of correlation between the concerned variables was found as 0.186. The following observations were made on the basis of the value of correlation coefficient.

- The relationship express a negative trend between the concerned variables.
- The observed value of "r" (0.186) between the concerned variables was found to be smaller than the tabulated value "r" (0.195) with 101 degrees of freedom at 0.05 level of probability.
- The null hypothesis could not be rejected.
- The relationship between the concerned variables was statistically non significant at 0.05 level of probability.

Based on the above findings it was concluded that BCR of fish production of the farmers had non-significant and negative relationships with their perceived effect of flood on fish production.

4.3.5 Fish Farming experience and adverse flood effect on fish production

The computed "r" (-0.371) value was greater than the tabulated value of "r" (0.254) with 101 degree of freedom at 0.01 level of probability as shown in Table 4.12, where observations were:

- The relationship showed a negative trend between the concerned variables.
- Hence, the concerned null hypothesis could be rejected.
- The relationship between the concerned variables was statistically highly significant at 0.01 level of probability.

Here, fish farming experience had statistically significant relationship with adverse flood effect on fish production. It was important that high experienced fish farmers perceived less adverse effect due to flood but the small experienced fish farmers was highly affected due to flood as because highly experience farmers might have more training and extension contact. Training and extension contact make them able to cope with the adverse effect of flood on fish production.

4.3.6 Training received in fish farming and adverse flood effect on farmers on fish production

The computed "r" (-0.439) value was larger than the tabulated value of "r" (0.254) with 101 degree of freedom at 0.01 level of probability as shown in Table 4.12 and the observation were:

- The relationship showed a negative trend between the concerned variables.
- The concerned null hypothesis could be rejected.
- The relationship between the concerned variables was statistically significant at 0.01 level of probability.

Based on the above findings it was concluded that training received of the fish farmers had significant negative relationships with their adverse effect on fish production due to flood. This represents that training was an important factor in facing adverse effect by the farmers due to flood and with the increasing rate of training received percentage of the fish farmers, perceived adverse effect on fish production due to flood was decreased.

4.3.7 Farm size and adverse flood effect on fish production

The computed "r" (-0.433) value was higher than that of the tabulated value of "r" (0.254) with 101 degree of freedom at 0.01 level of probability as shown in Table 4.12. The findings showed that:

- The relationship express a negative trend between the concerned variables.
- Hence, the concerned null hypothesis could be rejected.
- The relationship between the concerned variables was statistically significant at 0.01 level of probability.

Based on the above findings it was concluded that fish farm size of the fish farmers had significant negative relationships with their perceived adverse effect on fish production due to flood. This represents that farm size was a most important factor in facing adverse effect by the farmers due to flood and with the increasing size of the farm of the fish farmers, facing adverse effect on fish production due to flood was decreased.

4.3.8 Extension media contact and adverse flood effect on fish production

The computed "r" (-0.510) value was larger than the tabulated value "r" (0.254) with 101 degree of freedom at 0.01 level of probability as shown in Table 4.12. And the observations were:

- The relationship express a negative trend between the concerned variables.
- Hence, the concerned null hypothesis could be rejected.
- The relationship between the concerned variables was statistically significant at 0.01 level of probability.

Based on the above findings, it was said that extension media contact of the fish farmers had significant negative relationships with their perceived adverse flood effect on fish production. This represents that extension media contact was very important factor in facing adverse effect by the farmers due to flood and with the increasing of extension media contact by fish farmers decreasing their facing adverse effect on fish production.

CHAPTER V

SUMMARY OF FINDINDS, CONCLUSIONS AND RECOMMENDATIONS

The study was conducted at Gangachara upazila in Rangpur district which is known as flood prone area of the country. Data on effect of flood to the farmers were collected where the target farmers were available in 9 unions. Out of 9 unions of Gangachara upazilla, 3 unions namely Gajghanta, Morneya and Barabil were selected purposively. The researcher himself collected data through personal contact with the farmers. This chapter deals with the summary of findings, conclusions and recommendations of this study.

5.1 Findings

5.1.1 Adverse effect of flood on fish production

Majority (59.2%) proportion of the fish farmers perceived medium adverse effect of flood, while rest 40.8% perceived high adverse effect of flood on fish production.

Item-wise adverse Effectiveness due to flood

On the basis of descending order of Standardized Adverse Effectiveness Index (SAEI), it was observed that 'outbreak of fish diseases due to flood' ranked 1st followed by 'destruction of pond/hatchery dike', 'unavailability of fair price', 'unavailability of transportation facilities', 'pollution of pond/hatchery water', 'shortage Labour', 'invasion and Penetration of undesirable species due to flood', 'unavailability of storage facilities', 'shortage of inputs', 'unavailability of eggs, larva, fry, fingerling etc.', 'unavailability of marketing facilities', 'shortage of necessary chemicals' and 'unavailability of weather information'.

5.1.2 Selected characteristics of the fish farmers

Age: The largest (42.73%) proportion of the farmers was middle aged, while 34 percent of them were young aged and 23.3 percent were old aged.

Education: The highest (27.1%) proportion of the farmers had higher secondary education, 26.3 percent had secondary education, 16.5 percent were illiterate, 15.5 percent had primary level education and only 14.6 percent had above higher level education.

Family size: Above half (57.3%) of the farmers had medium family while 15.5 percent of them had large family and only 27.2 percent of them had small family.

Benefit-cost ratio: Highest (77.6%) proportion of the fish farmer had medium Benefit-Cost Ratio

(BCR) while 11.7 percent and 10.7 percent had low and high benefit-cost ratio respectively from fisheries production.

Experience in fish production: Majority (41.7%) proportion of the farmers had low fish farming experience compared to 32.1 percent had medium and 26.2 percent had high fish farming experience.

Training received on fish production: About 39.8 percent of the farmers received medium training while, 22.3 percent fish farmer didn't receive any training and 37.9 percent of the farmer received low training.

Fish farm size: Majority (47.5%) of the farmers had medium fish farm compared to 14.6 percent had large farm size and 37.9 percent had small farm size.

Extension media contact: About half (50.5%) of the farmers had medium extension media contact compared to 27.2 percent low and 22.3 percent high extension media contact.

5.1.3 Relationship between the selected characteristics of the farmers and their perceived adverse effect of flood on fisheries production

Age, education, fish farming experience, training received, farm size and extension media contact of the farmers had significant negative relationships with their perceived adverse effect of flood on fish production. Family size had non-significant negative relationships and Benefit-Cost Ratio (BCR) had positive but non significant relationship with their perceived adverse flood effect on fish production.

5.2 Conclusions

According to the findings of this study and logical interpretation in the light of relevant facts the researcher has drawn the following conclusions:

- Majority (59.2%) proportion of the fish farmers perceived medium adverse effect of flood and rest 40.8 percent perceived high adverse effect of flood on fish production. It may therefore concluded that reducing adverse effect of flood is very essential to regularize fish production during flooding time. Emphasis should be given to reduce higher order of adverse effects of flood on fish production.

- Age of the farmers had negative significant relationship with their perceived adverse effect of flood on fish production. It may therefore, concluded that older farmers were able to cope with

adverse severe effect of flood on fish production due to their higher experience, training and extension contact.

- Education of the farmers had a negative significant relationship with their perceived adverse effect of flood on fish production. It may therefore, concluded that highly educated farmers were able to cope with adverse effect of flood on fish production due to their higher level of knowledge, training and extension contact.

- Fish farming experience of the farmers had statistically negative significant relationship with their perceived adverse flood effect on fish production. It may therefore, concluded that highly experienced farmers were able to cope with adverse effect of flood on fish production due to their management skills, observation and extension contact.

- Extension media contact of the fish farmers had negative significant relationships with their perceived adverse flood effect on fish production. It may therefore, concluded that farmers with high extension media contact were able to cope with adverse effect of flood on fisheries production due to their dealing capacity, management skills and training.

5.3 Recommendation

5.3.1 Recommendation for policy implication

Based on the conclusions of the study following recommendations were made for policy implication:

- Majority portion (59.2%) of the fish farmers perceived medium adverse effect and rest 40.8% perceived high adverse effect of flood on fish production. Therefore it may be recommended that the following issues should be address to reduce flood to regularize fish production:
    - The depth of rivers and canals should be increased by digging to control water level.
    - Drainage system should be improve to control water flow.
    - Roads and dams should be build properly and strongly to protect fish farm.
    - Sluice gates and culverts should be built at proper site and ensured it's activeness.
    - Important adverse effects should be addressed on priority basis.

- Age of the farmers had negative significant relationship with their perceived adverse effect of flood on fish production. Therefore, it may be recommended that emphasis should be given to address the adverse effect of the flood on younger farmers to regularize their fish production.

- Education of the farmers had a negative significant relationship with their perceived adverse effect of flood on fish production. Therefore, it may be recommended that emphasis should be given to address the adverse effect of the flood of lower educated farmers to regularize their fish production.

- Fish farming experience of the farmers had statistically negative significant relationship with their perceived adverse flood effect on fish production. Therefore, it may be recommended that emphasis should be given to address the adverse effect of flood of less experienced farmers to regularize their fish production.

- Extension media contact of the fish farmers had negative significant relationships with their perceived adverse flood effect on fish production. Therefore, it may be recommended that emphasis should be given to increase the level of extension media contact of the farmers to regularize their fish production.

5.3.2 Recommendations for further study

This study explored the adverse effect of the flood on fish production. As a limited and tiny research has been conducted in this study which cannot give much information. Further research should be undertaken to extend over more information and following suggestions were made for next study:

- The present study was carried out at three unions of Gangachara upazila under Rangpur district. It is suggested that similar study should be carried out in different flood prone areas of Bangladesh.
- This study was conducted with eight (8) selected characteristics of fish farmers. It is highly recommended that the next study should be consider with other variables.
- In this study family size and BCR has no significant relationship with the flood effect on fish farmer in fish production of the selected area. In this context more attention should be needed to follow up correction in further study.
- In this study, only the flood effect was considered to evaluate the situation of the farmers in their fish production. But on the further study not only flood effect, the other major natural disaster like river-errosion, drought etc. should be considered to established a strong policy recommendation.

CHAPTER VI
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APPENDIX - A

THE INTERVIEW SCHEDULE

Department of Agricultural Extension and Information System

Sher-e-Bangla Agricultural University Dhaka-1207

An Interview Schedule for the Study Entitled

ADVERSE EFFECT OF FLOOD ON FISH PRODUCTION AS PERCEIVED BY THE FARMERS OF GANGACHARA UPAZILA UNDER RANGPUR DISTRICT

Serial No:……

Name of the respondent:……

Village:…….. Union: .....

Upazila:…….. District:……..

Mobile No:……..

(Please answer the following questions put tick wherever necessary)

1. **Age:** How old are you?..... years

2. **Education:** Please mention your educational status.
   - Can't read or write----
   - Can sign only----------
   - Read up to class ----------
   - Others (specify).....…

3. **Family size**: Please mention the members of your family members (includingyourself)
   1 Male.....numbers
   2 Female..... numbers
   C. Total A+B=.....…….

4. **Benefit-cost ratio:** Please mention cost and income in fish production last year.

Expenditure	**Cost (Tk)**	**Source of income**	**Income (Tk)**	**BCR**
Preparatory expenses		Fish culture		
Input (fingerling, feed, medicine and others) costs		Hatchery		
Harvest and transportation cost		Nursery		
Total Cost (Tk)		**Total Income (TK)**		

5. **Experience in fish culture:** How many years have you been involved in fish culture? year(s).

6. **Professional Training Experience:** Have you received any training related to fishculture?

Yes / No

If yes, please mention the name the following ones:

SL. No.	Name of the training course	Name of the organization	Days
01			
02			
03			

7. **Land area in fish production: ..**…….

8. **Extension media contact:** Please indicate the nature of your contact with the following information media

Sl no.	Media of Sources	Nature of visit				
		Regularly (4)	Often (3)	Occasionally (2)	Rarely (1)	Not at All (0)
1.	Progressive farmers/ Neighbors	More than 8 times/ month	5-6 times / month	3-4 times / month	1-2 times / month	
2.	Input dealers	More than 4 times/ month	3 times / month	2 times / month	1 time /month	
3.	Sub-Assistant Agriculture Extension Officer	More than 5 times /month	4-5 times /month	2-3 times/ month	1 time /month	
4.	Upazila fisheries officer	More than 6 times/year	5-6times/ year	3-4 times/ year	1-2 time/ year	
5.	NGO workers	More than 5 times /month	4-5 times/ year	2-3 times/ year	1 time/ year	
6.	Listening fish production programmed in Radio	More than 5 times /month	4-5 times/ month	2-3 times/ month	1 time/ month	
7.	Watching fish production programmed in TV	More than 5 times / month	4-5 times/ month	2-3 times/ month	1 time/ month	

9. **Adverse effect of flood:** Please mention the adverse effects of flood on fisheries production as perceived by you.

Sl. No.	**Items**	**Extent of effect**			
		High effect (3)	Moderate effect (2)	Low effect (1)	No effect (0)
1.	Outbreak of fish diseases due to flood				
2.	Pollution of pond/hatchery water				
3.	Destruction of pond/hatchery dike				
4.	Invasion and Penetration of undesirable species due to flood				
5.	Unavailability of Eggs, larva, fry, fingerling etc.				
6.	Unavailability of fair price				
7.	Unavailability of transportation facilities				
8.	Unavailability of storage facilities				
9.	Shortage of necessary chemicals				
10.	Unavailability of weather information				
11.	Unavailability of marketing facilities				
12.	Shortage of inputs				
13.	Shortage Labour				

Thanks for your kind

Co-operation.

Date:

(Signature of the interviewer)

Appendix-B.
Correlation Matrix

Characters	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	Y
X_1	-								
X_2	.067	-							
X_3	.256**	-.204*	-						
X_4	-.198*	-.079	-.068	-					
X_5	.742**	.011	.191	-.397**	-				
X_6	.368**	.145	.067	-.107	.361**	-			
X_7	.559**	-.004	.162	-.433**	.770**	.402**	-		
X_8	.289**	.083	.226*	-.203*	.359**	.406**	.441**	-	
Y	-.284**	-.204*	-.072	.186	-.371**	-.439**	-.433**	-.510**	-

^{NS}non-significant

**significant at 0.01 level (2-tailed) and

**significant at 0.05 level (2-tailed).

X_1= Age
X_2= Education
X_3= Family size
X_4= BCR
X_5= Experience
X_6= Training
X_7= Farmsize
X_8= Extension media contact
Y= Adverse effect of flood