PRESENT STATUS OF FISH FARMERS AND AQUACULTURE PRACTICES IN RANGPUR DISTRICT

A THESIS

BY

MD. SHAHIDUL IASLAM
Examination Roll No. 1605548
Session: 2016-2017
Semester: July- December 2017

MASTER OF SCIENCE (MS)

IN

AQUACULTURE

DEPARTMENT OF AQUACULTURE

HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY UNIVERSITY, DINAJPUR

DECEMBER 2017

PRESENT STATUS OF AQUACULTURE PRACTICES IN RANGPUR DISTRICT

A THESIS

BY

MD. SHAHIDUL IASLAM
Examination Roll No. 1605548
Session: 2016-2017
Semester: July- December 2017

Submitted to the Department of Aquaculture
Hajee Mohammad Danesh Science and Technology
University, Dinajpur
In partial Fulfillment of the Requirements
For the degree of

MASTER OF SCIENCE (MS)

IN

AQUACULTURE

DEPARTMENT OF AQUACULTURE

HAJEE MOHAMMAD DANESH SCIENCE AND
TECHNOLOGY UNIVERSITY, DINAJPUR

DECEMBER 2017

PRESENT STATUS OF AQUACULTURE
PRACTICES IN RANGPUR DISTRICT

A THESIS

BY

MD. SHAHIDUL IASLAM
Examination Roll No. 1605548
Session: 2016-2017
Semester: July- December 2017

Approved as to style and content by

....
Dr. A.S.M. Kibria   Dr. Imran Parvez
Supervisor   Co-Supervisor

....

Dr. A.S.M. Kibria

Chairman

Examination Committee

and

Chairman, Department of Aquaculture

Hajee Mohammad Danesh Science and Technology University

Dinajpur

December 2017

DEDICATED
TO
MY BELOVED PARENTS

DECLARATION

I declare that this MS thesis entitled Present status of aquaculture practices in Rangpur district, which I submit to Department of Aquaculture, was carried out by me for the degree of Masters in Aquaculture under the guidance and supervision of (Dr. A.S.M. Kibria), (associate Professor) Department of Aquaculture, Hajee Mohammad Danesh Science and Technology University, Dinajpur.

Furthermore, I took reasonable care to ensure that the work is original, and has not been taken from other sources except where such work has been cited and acknowledged within the text.

The Author

ACKNOWLEDGEMENTS

All praises are due to "Almighty Allah" the supreme authority of this universe, which enabled me to complete the research work as well as to prepare this dissertation for the degree of Master of Science (MS) in Aquaculture.

I feel proud to express heartfelt, deepest sense of gratitude and honor to research supervisor Dr. A.S.M. Kibria, Associate Professor, Department of Aquaculture, Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur, for his careful guidance, calm endurance, constant encouragement, unique supervision, scholarly advice, constructive criticism and sustained support during the course of this investigation despite his heavy schedule of work.

I find it great pleasure in expressing appreciation, deep, gratitude and immense indebtedness to his respectable research co-supervisor and Associate Professor Dr. Imran Parvez, Department of Fisheries Biology & Genetics, Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur, for his illuminated suggestions, co-operation, guidance, direction, affectionate feelings in planning, conducting and completing the study.

I like to express my greatest pleasure, sincere appreciation to Professor Dr. Nahid Akter, Chairman, of the Examination Committee and Head, Department of Aquaculture, Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur, for her

CONTENTS

CONTENTS (Contd.)

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF ABBREVIATIONS AND ACRONYMS

BBS : Bangladesh Bureau of Statistics

Dec : Decimal

DoF : Department of Fisheries

FAO : Food and Agricultural Organization

GDP : Gross Domestic Product

ha : Hector

HSC : Higher Secondary Certificate

IMCs : Indian Major carps

Kg : kilogram

NGO : Non-Government Organization

SPSS : Statistical Package for Social Sciences

SSC : Secondary School Certificate

UFO : Upazila Fisheries Officer

ABSTRACT

The current study was conducted for a period of 12 months commencing from February, 2017 to January, 2018 in Rangpur district to assess the present status of aquaculture practices. Present status of farmers were assessed in terms of age, sex, marital status, household size, education, sources of information, experiences, training, availability of water, species preferences, feeding frequencies, annual incomes etc. The farmers' age group of 36 to 40 years was the highest (27.5%) and 20 to 25 years was lowest (3.75%). About 91.25% of respondents were male where 8.75% were female in sex. Maximum (88.75%) farmers were married. Most of the farmers (61.25%) had 2 to 4 family members while very few farmers (10%) had 8 to 10 family members. Regarding the educational level 46.25% of farmers hold primary level of education, 11.25% were illiterate and only 6.26 % completed graduation. Majority (57.50 %) of respondents got fish culture information from friends and fellow farmers. Few farmers (2.5%) got their information from internet. Only 5% of farmers had no experience on fish farming. On the other hand 38.75% farmers had 6 to 10 years farming experiences. In the present study 83.75% ponds were of personal ownership and 16.25% ponds under lease. About 79% of the ponds contained water throughout the year and only 21% pond possess water for a period of 6 to 8 month of the year. In the survey it was found that 11.25% of fish farmers practice integrates aquaculture and 73.75 % of the farmers practiceed polyculture. Generally in the homestead aquaculture Indian Major Carps (IMCs) dominated. In the study areas 17.5% farmers collected fingerlings from government hatchery while 82.5 % of farmers collected from private hatchery and nursery. Study showed that 77.5% farmer used commercial feed and remaining 22.5% farmers used homemade feed. The feeding frequencies were 26.25, 65 and 8.75%, one, two and three times respectively in a day. It was observed that 40% of the farmers hadannual income level Tk.50000 or below. Income level of 26.25% farmers was between Tk. 50001 and

100000. About 23.75% of farmers had income from Tk. 100001 to 200000 and only 10% farmers had income above Tk. 200000. The main problems identified were irregular electricity supply 88.70%, high cost of fish feeds 88.50%, high price of input 78.60% and disease 77.80%.

Key Words: Survey, Fish farmer, Aquaculture, Rangpur district.

CHAPTER I

INTRODUCTION

1.1 General Information

Bangladesh, with its rich inland waters and river assemblies has significant capture fishery and aquaculture potential. The favorable geographic position of Bangladesh comes with a great number of aquatic species and provides plenty of resources to provision fisheries potential. Fish is a popular complement to rice in the national diet, giving rise to the adage *Maache-Bhate Bangali* (a Bengali is made of fish and rice) (Ghose, 2014). Fisheries and aquaculture in Bangladesh play a major role in alleviating protein deficiency and malnutrition, enhancing employment and foreign exchanges. Aquaculture practice has become a noteworthy and gainful methodology to attain self-sufficiency in food sector and also to lessen poverty in developing country like Bangladesh (Ahmed, 2008).

Fish play an important role in Bangladeshi diet, providing more than 60% protein of animal sources. Aquaculture production accounted for over half of the country's total fish production (55.15%) (DoF, 2016). Bangladesh ranked 4th position in the world for inland capture fisheries production in 2014-2015 and 5th position for culture fisheries production. Southern region of Bangladesh is much oriented and sophisticated for capture and culture fishery (Ahmed *et al.*,

2008). But northern part, Rangpur is comparatively backward to fish culture in term of commercial practice (DoF, 2016). The survey was ran to collect data for focusing on the present status of fish culture as well as gather problems associated with fish culture in Rangpur district.

1.2 Role of Fisheries Sector in Bangladesh

Fisheries sector contributes to national GDP by 3.69% and contribution to agricultural GDP is 22.60% (DoF, 2016). To increase the total fish production in Bangladesh a speedy emphasis on northern part has a great significance. The water resources basically inland water bodies declining day by day due to increasing population size (Azim *et al.,* 2002). Therefore, to make protein available to the people, it is essential to increase the fish production in Bangladesh by developing aquaculture technologies in Rangpur.

1.3 Present Aquaculture Status of the Country

About 11 million people are directly or indirectly make their livelihood out of activity associated with fisheries and 1.92% of annual export earning comes from the fisheries sector. It ranks 3rd among the export oriented industries Bangladesh has gigantic inland close water (794,361 ha) which is contributing 55% of total fish capture. There were 32,005 tones fish produced from 16,905 hectors of ponds, beels, haors and floodplains (DoF, 2016). During the last 5 years fish production increased by 14,320 tones. Rangpur is one of

the most important districts for short cycle aquaculture practice in the Bangladesh. Over the last 10 years (2004-2005 to 2013-2014 FY), the fish production growth was fairly steady and at an average of 5.38% per year (FRSS, 2015). The total land area of Rangpur district is 515.63 sq. km and riverine area 25.66 sq. km. About 25,810 ponds were present in the district (BBS 2011).

Bangladesh is a transitional zone of flora and fauna. It is quite natural that the water resources of the existing extent and magnitude should harbor and support populations of a large variety of vertebrate and invertebrate aquatic living organisms. Rangpur district is located in Bangladesh 25^0 34′ N $89^0$15′E. Rangpur district, including its upozilas namely Sadar, Badarganj, Gongachara, Taragonj, Pirgacha, Pirgonj, Mitapuku, and Kaunia. Among these Mithapukur upozila can be considered as one of the epitomes pond fish production areas in the district. The ponds are suitable for aquaculture practices (BBS, 2002). Considering the above fact, the present study was carried out to assess the status of pond fish farming in Rangpur district of Bangladesh.

Freshwater fish farming plays an important role in the livelihoods of rural people in our country. Halim (2006) observed aquaculture production, mainly pond aquaculture were liable source of attaining increased fish production so as to provide food security. Apart from direct self-employment opportunities from fish farming practices, pond fish farming offers diverse livelihood opportunities. Pond fish

farming has been proved to be a profitable business. So many fish farmers took farming activities as their secondary occupation and most of the people involved in fish farming improved their socio-economic condition through pond fish farming activities where Rangpur district is retrograde. In general fish culture in Rangpur is characterized by the use of semi- intensive systems. Khan (2012) observed the pond areas remain under water almost throughout the year. Generally, households use pond water for various domestic and sometimes agriculture purposes. Ponds are also generally used for fish culture. In view of the above consideration; the present investigation was carried out to evaluate the status of the current fish farming in Rangpur district and to find out the constraints connected to fish farming. Only 7.71% ponds all over the country are used for commercial scheme and the rest are used for non-commercial practices.

The production rate from this sector can be raised manifolds through suitable pond management techniques using the existing carrying capacity of different types of ponds in relation to species carried and selection of species (Hossain and Das, 2013). The present research was carried out to assess aquaculture and livelihood status of fish farmers in Rangpur district, Bangladesh. Livelihood comprises the abilities, the assets (natural, physical, human, financial and social capital), the activities and the accesses to these that together determine the living gained by the individual household. A livelihood

is a sustainable when it can cope with and recover from stresses and shocks and maintain or improve its capabilities and assets both now and in future, while not decline the natural resource base. Fish and fishery resources play a vital role in improving the socio-economic condition, combating malnutrition, getting foreign currency and creating employment openings in Bangladesh.

Inland fisheries production has improved over the years, but the productivity per hectare water area is not yet attained at its optimum. In recent years, the bulk of the production has been obtained from freshwater fishery (83.22%) (DoF, 2016). There have been few reviews of the development and potential of fisheries and aquaculture in many parts of Bangladesh published and very few studies have been published on the present status of aquaculture practices in Rangpur. BBS (2004) reported that there were 5,277,572 hectare water bodies of which 915,506 hectare ponds are suitable for fish culture, but most of them remain unaccustomed in Bangladesh. If the existing ponds are carried under fish culture through proper planning, suitable management and re-excavation of the water bodies, the present fish production level can easily be improved two to three times of the existing level. Therefore, if farmers adopt improved fish culture technology then fish production will bigger in this region.

In Bangladesh, the major constraints to increase fish production through aquaculture are lack of technical knowledge non-availability

of credit and multi-ownership of pond (Hussain, 2007). Information on socio-economic outline of the fish farmers forms a good base for planning and development of the economically backward sector. Lack of adequate and authentic information on socio-economic condition of the target population is one of the serious impediments in the successful implementation of developmental programme. The social content is especially important particularly access arrangement and assessments of profits to livelihood (Azucena *et al.,* 2001).

The study conducted the relative economic performance (land holding, labor, family member, education utilization, gender etc.), evaluation the social changes (nutrition, housing, mobility, group involvement etc.) and also to identify the constraints associated with fish culture and livelihood as well as present status of the farmers. Most of the farmers are marginal and they usually face a lot of problems like diseases hence cause economical losses. Disease is one of the main constrains to aquaculture and may eventually become a limiting factor to the economic success of the fish farmers. Some diseases have caused severe damage, not only the livelihood of fish farmers, but also to the future expansion of the industry (FAO, 2010). Rural farmers are mostly resource poor with little or no knowledge of health management and have inadequate opportunities to improve management skills. Their ability to respond effectively to fish disease problem is also very limited. Normally they use lime as a common treatment. Fisheries resources in Bangladesh are diversified, having

more than 260 freshwater fish species, 24 freshwater prawns, 475 marine fish species, 36 marine or brackish water shrimps and 20 exotic species (DoF, 2015).

Farmer of Rangpur district mainly practice carp polyculture in their pond. In some areas, farmers stock predatory species like Chitol, Boal, Aire, Shol, etc. for their high value and demand in the markets. But these predators are unsafe to other carps and Small Indigenous Species (SIS). The farmers of the Rangpur district are facing problems of scarcity of water throughout the year except the monsoon season. The ponds are seasonal and backyard pond rather than commercial pond of other districts such as Mymensingh. A survey by Biswas *et al.* (2000) in northwest Bangladesh reports that more than half the small ponds positioned close to homestead areas and beside farmers' fields had either been dug or renovated in recent times for the purpose of fish culture. Freshwater aquaculture is under practice in the northern region of Bangladesh. A few fish ponds are partially cultured after cropping but it has become one of the important sources of livelihood for the people of that area. For the improvement of cultural system and future planning, the information regarding present aquaculture practices at the grass root level is absolutely needed. This research work is commenced on present status of aquaculture practices in Rangpur find out the problems and constrains of farmer. This study also seeks to understand how fish farming lead to advance the status and practices of fish farming.

1.4 Fish Culture in Rangpur:

Fish farming practice has changed the economical condition of many farmers in Rangpur district in recent years. A good number of farmers are engaged in cultivating rui, katla, mrigal, monosex tilapia, pangas, koi etc. Majority practice pond culture, some practice cage culture, Low production cost and easy farming method also encouraged fish farming. In Rangpur approximately 29,713 metric tons of fish was produced in 2016 (DoF, 2017).

1.5 Fisheries and Aquaculture:

Fisheries is the science that deals all the aspects about harvesting or raising of fish. This is the branch that deals the aspects like type of fish, purpose of cultivation and harvesting that particular type of fish, way of fishing and type of boats used for that purpose. On the other hand, aquaculture simply means fish farming and in broader sense, it is farming of aquatic organism like fish and plants for breeding and rearing. Aquaculture is done on commercial basis both for cultivation of fresh and salty water organisms. It is done in controlled condition to make the environment ideal for survival and growth of aquatic animals.

1.6 Justification of the Study

In current years fish culture is becoming a tremendously business that increasing rapidly in Bangladesh. The amplification of aquaculture practice is increasing day by day. In aquaculture fish feed plays an important role because it directly control the quality of fish and it is becoming critical for the food safety as well as efficient

20

high quality feeds that ensures optimal growth for different fish species farmed under a variety of different conditions.

For the proper development of the farmers in the study area, it is essential to understand the baseline information to initiate proper development steps and improve the demographic condition of the farmers. Many studies have been done in other areas of Bangladesh such as Trishal (Sheheli *et al.* 2013) and Tarakanda (Ali *et al.* 2010) upazilas of Mymensingh district. However, research was not conducted on the present status of fish farmers in Rangpur district. The study was aimed to reveal the demographic conditions of the farmers and aquaculture practices in the study areas. So the study will carry a great consequence for future.

1.7 Objectives of the Study:

Under the consideration of the above facts, the following objectives were taken for the study:

  To assess the fish farmers status in Rangpur district;

  To observe the current aquaculture practices;

  and

  To assess the current aquaculture problems in the study area.

CHAPTER II

REVIEW OF LITERATURE

Before conducting any experiment, it is very essential to review the prior research work which is associated with it. The review paper is based on the targeted objective.

Fish culture is widely practiced in different area of Bangladesh. Studies on production technologies and present status of aquaculture studies have been conducted in different regions of the country but still there are very few studies on Rangpur region. Inadequate numbers of studies have been conducted in Bangladesh at the village levels. Only few revisions concerning the socio-demographic, aquaculture status were accompanied by different organization. In this chapter an attempt has been taken to review some of these related studies and the literatures that were taken under study provide the demographical information, educational level, system of aquaculture practices and so on.

Halim *et al. (2017)* conducted a research to identify the status of farmers. Average pond size was 0.12 ha where polyculture of Indian major carps and exotic carp were cultured by most of the farmers (97%). In the study areas, 67% of the ponds were seasonal and 33% were perennial. Annual income was Tk.117,750 /ha/yr.

Ahmed *et al*. (2017) conducted a study to know the status of pond fish farming in Saidpur upazila under Nilphamari district of Bangladesh.

Average size of ponds were 8-30 decimals and containing 3-6 month water holding capability with 65% seasonal ponds. Most of the farmer applied locally produced feed. About 30 % people did not found fish diseases, 55 % people mentioned that diseases occurred occasionally and 15% found outbreaks of diseases in every year. Main problem is water shortage and inadequate technical information therefore more extension and inquiry are needed to increasing production.

Rahman *et al.* (2017) assessed the present status of aquaculture and showed that the mean stocking weight of fish was 0.25, 0.20 and 0.24kg in three different ponds. Findings showed that all the locations that mean aquaculture areas showed the aquaculture suitability and it has a great potential for further aquaculture raise and this greatest water resource will be a lucrative source to aquaculture commercial for the adjacent people as well as the people of the country.

Shamsuzzaman *et al.* (2017) performed a research on present status and future direction of aquaculture and describe that the growth in the aquaculture production has been made possible with the implementation of scientific and technological modernization. From 2000 to 2016, aquaculture production increased from 712,640 to 2,060,408 MT. Aquaculture productions is well below production targets despite the huge gains seen in the aquaculture sector.

Moslem and Harun (2017) showed that the average pond size was 0.27 ha and depth 2.8 meter with 8% seasonal and 92% perennial ponds while 95% ponds were single and 5% multiple ownership.

Maximum of the farmers 97% carried out polyculture, 2% monoculture system and 1% integrated culture practice with average stocking density of 12,350 fry/ha, 93% applied supplementary feed and 7% depend on natural feed only and yield 4,246 kg/ha/year.

Hasanuzzaman (2016) observed that, the average pond size was 0.27 ha with 8% seasonal and 92% perennial ponds while 95% ponds were single and 5% multiple proprietorship.

Utmost of the farmers 97% carried out polyculture, 2% monoculture system and 1% integrated culture system; 93% applied supplementary feed and 7% depend on normal feed and yield 4,246 kg/ha/year and 92% of fish farmers had improved their socio-economic situation through fish farming and 8% farmers have not yet upgraded their status.

Sarwer *et al.* (2016) showed that the pond dimension of the area was 0.24 ha where 64% of the farms operators having pond of single ownership, 32% having ponds of multi-ownership and 4% having of tenancy ponds. Percentages of small, medium, large and very large ponds were 26, 38, 28 and 8 respectively, whereas 48% of the ponds were seasonal and 52% are perennial. Annual income of fish farmers was BDT 75,000 to 100,000. Among the fish agrarians 15% was illiterate whereas 19, 31, 14, 12 and 9 percent were educated up to primary, secondary, higher secondary and graduate level.

Islam *et al.* (2016) observed that the farmers had started to shift their crop land to aquaculture as they considered it more profitable compared to rice production. Aquaculture sector in the 21st century is facing the challenges of food safety for the increasing population, habitat degradation, urbanization, and industrial development. Since fishery is a productive development sector in Bangladesh, it has high potential to donate in the socio-economic development of the country.

Ali *et al.* (2016) carried out an experiment observed the average pond size was 0.17 ha with seasonal (33.34%) and perennial ponds (66.66%), while 70% ponds were single and 30% multiple ownership.

Most of the fish farmers were belonged to the age category of 31 to 40 years and 45% household had family members 4 to 5.

Abbas (2015) found that 63% of the fish farmers were still within the economically dynamic age bracket of 20 to 49; 80% of the respondents had tertiary education while 70% had an average of 4 years of farming experience. Earthen pond was used by about 78% of the respondents to culture fish; 88% of the farmers proficient monoculture while 12% practiced polyculture. Annual income of fish farmers was Tk.90,000 to 130,000. The net income analysis exposed that fish farming was profitable in the study area.

Sanusi *et al.* (2014) revealed a high literacy level (95.4%) which was sufficiently enough to provision information on technology used. Results further revealed that the major restrictions encountered by the farmers were lack of quality brooding stocks (26%); paucity of capital (19%) and high costs of feeds (17%). Minor perceived problems were high labor costs; poor storage facilities and mortality rate due to diseases.

Moni *et al.* (2014) suggested government and non-government organizations ensuring efficient expanding training program and confirming supply of quality fish fry and fingerlings.

Khatun *et al.* (2013) reported to evaluate of socioeconomic status of fish farmers. Greatest of the farmers (46%) were belonged to the age groups from 36 to 50 years. About 18% had no education while 16,

42, 14 and 10% had primary, secondary, higher secondary and graduation level of education respectively. Annual income farmers (34%) were Tk.75,000 to 1 00,000. Poor knowledge on fish farming, high price of fish feed, poor marketing facilities and absence of money for fish farming were identified as the major constraints.

Mondal *et al*. (2013) revealed that how fish farmers can accomplish positive sustainable livelihood through access to a wide range of livelihood assets. Higher economic return (Tk.119,360/ha/year) and social assistances were found to be gained by the fish farming community through human capital development. Lack of operating capital, vulnerability and deficient institutional support were identified as major constraints to long term sustainability.

Paul *et al* (2013) observed that most of the farmers (30%). were fitting to the age groups from 35 to 40 years old.

Pravakar *et al.* (2013) found that Indian major carps and exotic carps were mainly cultured, 10% of ponds remained seasonal and 90% were perennial. About 20% of fish farmers were involved in fish farming as their main occupation while 45, 25 and 10%were involved in business, agriculture and service respectively. About 94% of the fish farmers reported their socio-economic situations were improved through fish farming.

Sheheli *et al.* (2013) showed most of the farmers (89%) made income from fish production. Farmers had improved their socio-economic

conditions through fish production which plays an important role in increasing income, food production and work opportunities. The impact study of fish farming on livelihood of fish farmers shows that overall 64% fish farmers have increased overall livelihood from fish farming during the last four years (2010- 2013).

Kabir *et al.* (2012) exposed that the average pond size was 0.83 ha with a range from 2.5 ha to 15 ha and 80% of the fish farmers practiced polyculture while only 20% farmers practiced monoculture.

Kundu (2012) found that 40% of the farmers belonged to 41-50 years age group, followed by 29% in 31-40 years. About 10% of the farmers were illiterate, 53% and 25% had primary and secondary level of education, while 2% of them were bachelor degree holders. The average family size of the respondents was 5.95.

Shirajee *et al.* (2010) an average annual rate of nearly 20%. Around 400,000 ha of freshwater ponds and ditches are used for aquaculture and more than 900,000 households are involved in aquaculture activities. Conditions are highly favorable for the rapid expansion of aquaculture. This is mainly due to the recent rapid advances in seed and feed production.

Islam (2010) collected data from 100 fish farmers in Maulvibazar District. The average pond size was 0.11 ha. Various farms used fertilizers, feeds, nutrients, chemicals, and antibiotics. The

constraints for sustainable pond fish farming in the areas were lack of technical knowledge.

Ali (2009) surveyed that, the average pond size was 0.17 ha with seasonal (33.34%) and perennial ponds (66.66%), while 70% ponds were single and 30% multiple ownership. Most of the fish farmers were belonged to the age category from 31 to 40 years and household had family members from 4 to 5.

Masum (2009) collected data from 50 farmers from eight unions in Pabna Sadar upazila, Pabna. Most of the fish farmers belonged to moderately low knowledge category. But age, religious affiliation, major profession and family size of the respondents had no relation with aquaculture knowledge.

Kabir (2009) found that average farm size was 0.525 ha in the surveyed areas. About 80% of the farmers were illiterate. They also used both surface and underground water in their farm. Almost all the farmers (90%) have improved their socio-economic conditions through fish farming.

Hossain *et al*. (2009) conducted an experiment and found that the average annual household income of the farmers ranges from Tk.77,396 -96,888.

Kausar (2009) found that, the problems associated with fish farming, as well as offer a model, based on the literature, and interviews with

fish farmers, to make small-scale fish farming both more environmentally, and more economically, sustainable.

Rahman (2008) studied the socio-economic status of farmers of Jamuna river. It was found that age group of 30-40 years was the highest (67.5%) and age group less than 30 years was the lowest (17.5%). The average family size was 5.68 persons. Among the fishermen,52.5% illiterate, 22.5% semiliterate (capable of writing their name), 15% educated up to primary level, 7.5% educated up to secondary level and 2.5% educated up to S.S.C. level were recorded.

Shohel (2007) studied that the most important social problem was theft of fish from pond (53%) followed by multiple ownership (23%) and interference by influential persons (17%) respectively.

The fish farmers faced the problems of scientific knowledge and technology, non availability of fish seed, insufficient contact of concerned agencies to a greater extent 37%, 33% and 30%, respectively.

Hossain (2007) observed that the largest family size (7.26) was found farmers. Regarding the educational level, 66.67% of the farmers were illiterate, 30% of them had primary and 3.33% of them had secondary level of education.

Tanjeena *et al.* (2007) performed a study to determine the pond fishery resources and the livelihood status of fish farmers. Pond sizes of the area varied from 15 to above 180 decimal of which maximum

ponds (57.8%) were operated by single owner. Field observation revealed that 65.5% ponds were used for fish culture, whereas 28.5% and 6% ponds were culturable and derelict, respectively. Among them 23.3% was illiterate whereas 14.4, 8.9 and 6.7% were educated up to primary, secondary and higher secondary or above level, respectively.

Alam (2006) perceived that the major source of water was well hand pump. Farmers' annual returns averaged Tk.137,500 which was below the annual least income of an average. Poverty index was 0.867, resulting to a poverty gap index of 0.629, implying high scarcity incidence. Respondents' mean age was 42 years; with average household size of 5 people; 83% were literate; with 17 years of fishing experience.

Zaman *et al.* (2006) conducted a study to determine the pond fishery resources and the livelihood status of fish farmers. Pond sizes were varied from 15 to above 180 decimals of which maximum ponds (57.8%) were operated by single owner. The highest percentage (33%) fish farmers earned Tk. 25,000-50,000 per year, 32% earned Tk. 50,000-100,000 and the rest 25% earned above Tk. 125,000 annually.

Hossain (2006) performed a study and stated that the average production rate was 14,943 kg/ ha/ year. From the survey, it was found that all ponds were under polyculture system and farmers stocked mainly pang as along with indian major carps and exotic carps.

Pandey and Dewan (2006) argued that, in spite of the growing popularity of aquaculture in the state, fish farmers have been experiencing financial, social and technical constraints in fish farming practices. These constraints are adversely affecting farmers in obtaining expected fish yields and income. In this study, the most common problem areas were identified, analyzed and ranked on the basis of farmers' perception.

Talukdar and Sonataki (2005) conducted an experiment and revealed that majority (63 %) of farmers belonged to medium category of adoption. The acceptance behavior of culture practices was influenced by the factors like extension, economic motivation and knowledge of farmers. In view of the above findings, the study recommends that efforts should be made by extension agencies through their various programmes to highlight the economic benefits of fish farming.

Islam (2005) observed in the study 60% of ponds were seasonal and 64% were perennial; 76% of farmers had single ownership.

Ahmed (2003) conducted a study mainly to assess the different culture practices and to determine the relative profitability of pond fish production. The average fish production cost were estimated at Tk. 23,210 to Tk. 24,790 ha/yr. annual income found Tk. 59,119 to 56,484 ha/yr. He stated the carp polyculture is a profitable business and 71% farmers have improved their socio-economic condition through the income of fish farming. Lack of money, lack of technical

knowledge, non-availability of quality seed and poor institutional support were the major problems of sustainable development of carp polyculture.

Robbani (2002) conducted an experiment and found production was from 1 to 2 tons per acre per year. Majority of farm owners showed their preference for culturing major carps.

Inbreeding problems, lack of technical knowledge on scientific fish culture, incidence of fish disease, credit facilities, security, marketing, multiple-ownership and lack of quality feed were identified as the constraints of fish culture.

Chowdhury and Maharjan (2001) argued that the problems faced by the fishermen were multiple ownership of pond, multiple use of pond water, lack of technical knowledge, non-availability of quality fish seed, lack of pesticide, lack of experience, fish disease etc.

Sultana (2001) observed that the farmers made profits from both polyculture and carp nursery technologies. The study however, revealed that the carp nursery was more profitable (Tk. 10,444 ha^{-1}) than the production of polyculture (Tk. 50, 0 21 ha^{-1}). The study has also identified some major problems associated with economic, technical and social aspects that have currently been facing by the producers in adopting polyculture and carp nursery technologies.

Quddus and Rahman (2000) found that the education levels below SSC, below Bachelor and above were 43, 38 and 19 respectively and

single owners belonged to 54% of the ponds. Farmers' annual income was 92 thousand taka. Considering the problems of fish culture, multiple-ownership was found to be the most important one.

Lewis (1997) surveyed that annual fish production which were mostly in perennial (72%) water body, is about 546 kg/ha. This potential can be easily realized if stronger extension support is given to farmers owning and operating the existing small water bodies.

Rana (1996) conducted an experiment covering 60 ponds and found that pond size and stocking of fingerlings had a negative effect and pond ownership, feed, and fertilizer has positive effect on pond fish culture. Major problem associated with fish production were non-availability of feed, lack of equipment and scientific knowledge, flood, multiple ownership, high price of inputs and theft of fish.

Shohag (1996) determined that the ownership pattern of fish ponds, production practices, costs and return of pond fish culture and different factors affecting the yield. It was observed that low production price, lack of water during dry months and lack desired fingerling in proper time were identified as the most crucial problems in pond fish production.

Saha *et al.* (1995) found that increasing inputs such as fish seed, organic matter, fertilizer, labor and pond size resulted more production. At the same time he found that fish farmers did not apply any feed of animal origin.

All the above sources of literature helped to complete the research work. The literature also cleared the field of composition study and assistant assist to analysis of result. Finally literatures helped to writing the thesis paper carried with great significance.

CHAPTER III

MATERIALS AND METHODS

Proper methodology is essential that enables the researchers to collect effective and dependable information and to analyze the information properly in order to accomplish a decent conclusion. The present study was undertaken and finished according to the subsequent order of method. The data collection approach and analysis is described below.

Flow chart of methodology
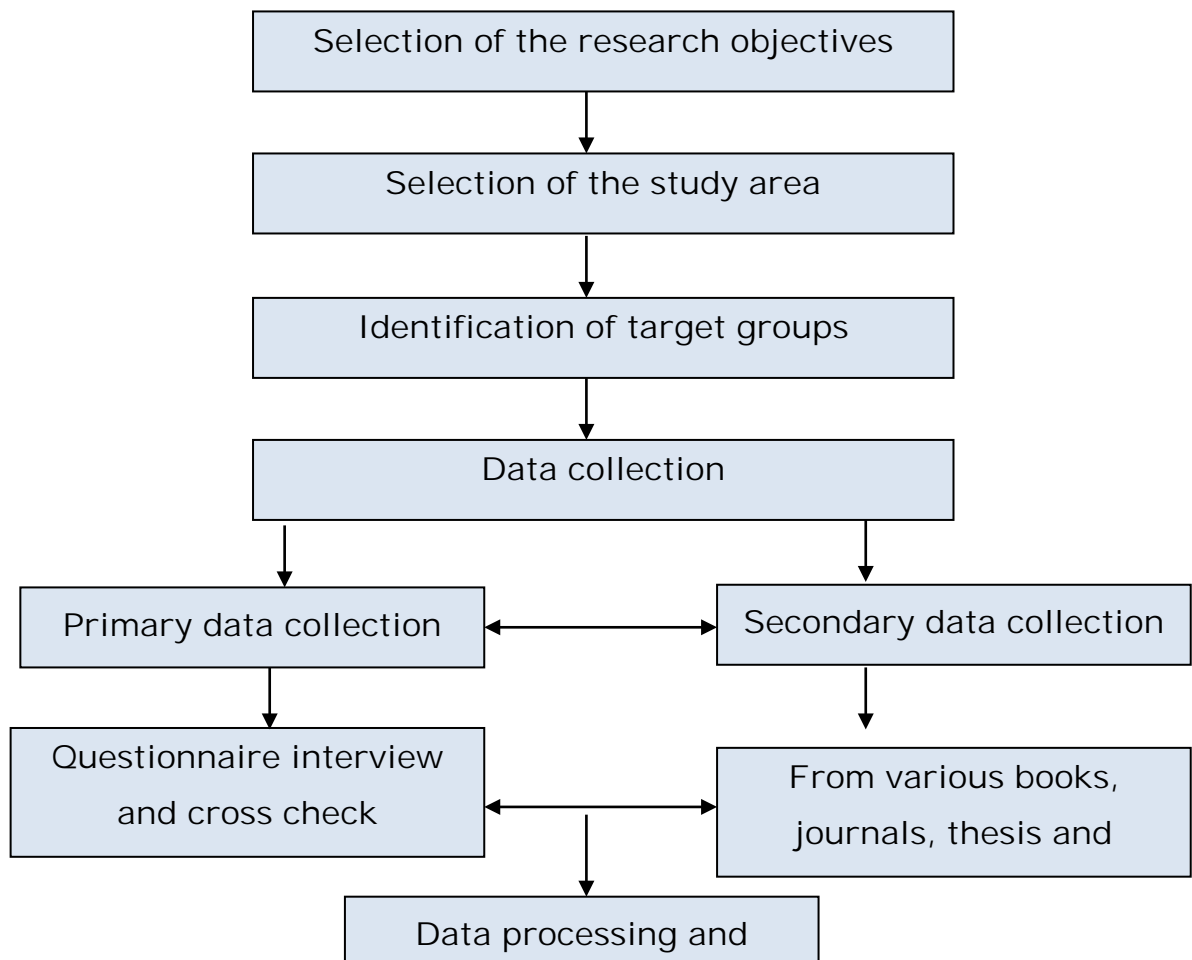
Figure 3.1 Design of the research methodology.

3.1 Study Period

The study was conducted for a period of 12 months commencing from February, 2017 to January, 2018. The survey was conducted with fish farmers of the selected upazilas of Rangpur district.

3.2 Selection of Sites and Fish Farmers

Total population in Rangpur district were 3,211,000 and the area 2368 square km (BSS, 2011). A total of 80 fish farmers were randomly selected from the eight upazilas of Rangpur district. Five villages were selected from each upozila in order to collect data. The upozilas were Sadar, Badarganj, Gongachara, Taragonj, Pirgacha, Pirgonj, Mitapuku, and Kaunia. In the research work, four villages of each upozila were randomly selected as the representative part of that upazila. Rangpur is surrounded by Lalmonirhat, Gaibandha, Nilphamari and Dinjpur district. Most of the people in the selected areas were fish farmers; few were service holder and businessmen.
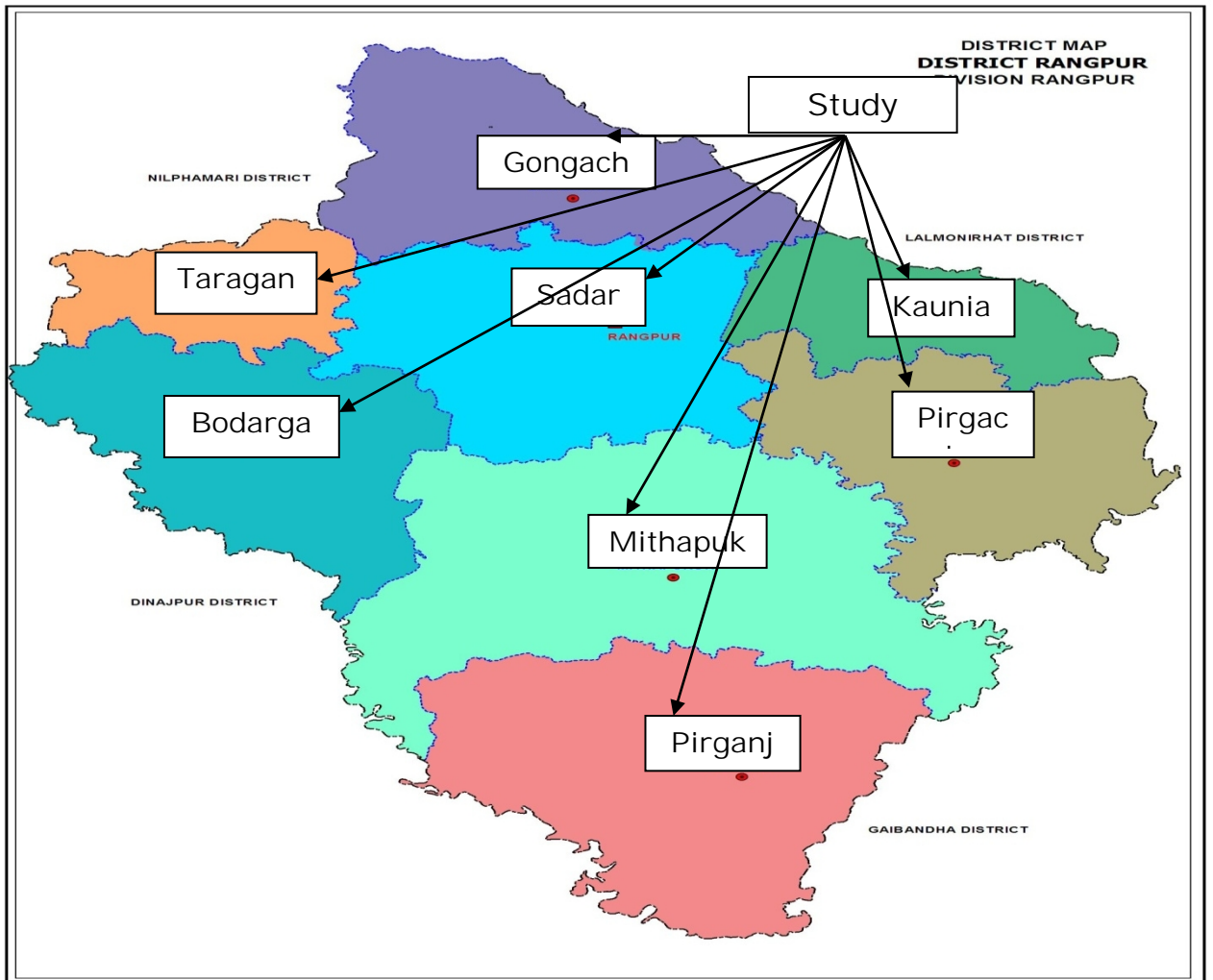
Plate 1 Map of Rangpur district indicating the study areas.

3.3 Questionnaire Preparation

The questionnaire was prepared on the base of the objectives mentioned. Before completion of the questionnaire, it was pre-tested through a field study. The questionnaire was completed and prepared for survey in Rangpur district. The questionnaire designed to information on gender, education, training exposure, age, pond area, water depth, and species cultured, management strategies etc. The questions were specific and were free from any kind of impact.

3.4 Data collection

For data collection, a reasonable size of sample was considered. Firstly, a survey schedule was prepared. The farmers were interviewed at their pond sites and each interview required about 30 minutes .To find out information about the situation, investment, return and prior to involvement in fish cultivation as well as to identify problems.

3.4.1 Primary Data Collection

For the confirmation of the secondary data, primary data was used. The study area visited officially to check on standards in term of fish culture. By using questionnaire interviews and direct observations, primary data were gathered for this survey.

3.4.2 Secondary Data Collection

Secondary data were collected from appropriate government, Department of Fisheries (DoF), District Fisheries Office, Upazila Fisheries Officer (UFO) and respective organs fisheries sector in concerned region.

3.5 Questionnaire Interviews

Eighty fish farmer was carefully chosen as the most suitable in the study area through careful inspection for the questionnaire interviews. The questionnaire was changed, modified and rearranged according to the experiences gathered in the trial. The farmers who commercially cultured fish were mainly measured for collection of personal information and fish farming information. For collecting data simple random sampling method was followed in 80 fish farmers in the selected areas with questionnaire interviews. Information about fish culture, constraints and socio-economic status of farmer were the collected through of the interview.

Plate 2 Questionnaire interview during data collection in Rangpur

3.6 Data Analysis

Data analysis is a procedure of studying, cleansing, transforming, and modeling with the goal of determining useful information, suggesting assumptions, and supportive decision-making. The key purpose of data analysis is to show what the data is trying to express.

The collected data were double-checked for consistency and accuracy. The collected data were rewritten, coded and entered into

Microsoft Excel spread sheet. The collected data were cautiously summarized and scrutinized and finally analyzed the brief data in tabular form. The qualitative data was converted into quantitative numbers whenever required after processing, scaling and indexing of the essential and relevant variables to complete subsequent statistical analysis for drawing inferences. The outcomes presented in percentile, pie chart & bar graph were analyzed and drawn by using MS Excel 2007 and SPSS (Ver. 22). The data was necessary as inputs to the analysis are definite based upon the desires of those directing the analysis.

CHAPTER IV
RESULTS

4.1 Demographic Information

The demographic features included age, sex, and marital status, and family size, educational level of farmer, farming experience, pond ownership and annual income of the fish farmers.

4.1.1 Age

Fish farmers' ages varied from 20 to 60 years. The fish farmers were classified into eight categories on the basis of their age: age between 20 and 25 years coded as 1; 26 -30 years coded as 2; 31-35 coded as 3; 36-40 years coded as 4; 41-45 years coded as 5; 46-50 years coded as 6; 51-55 years coded as 7 and age between 56 and 60 years coded as 8. The analysis of field survey has been showed that 3.75 % of the respondents belonged to the age group of 20-25, which occupies the lowest portion, 27.5% respondents belonged to the age group of 36-40 which occupies the highest portion. Age distribution of fish farmers are shown in the flowing graph. The Figure 4.1 showed the highest number of farmers' was between 36 and 40 years and the lowest number were between 20 and 25 years.
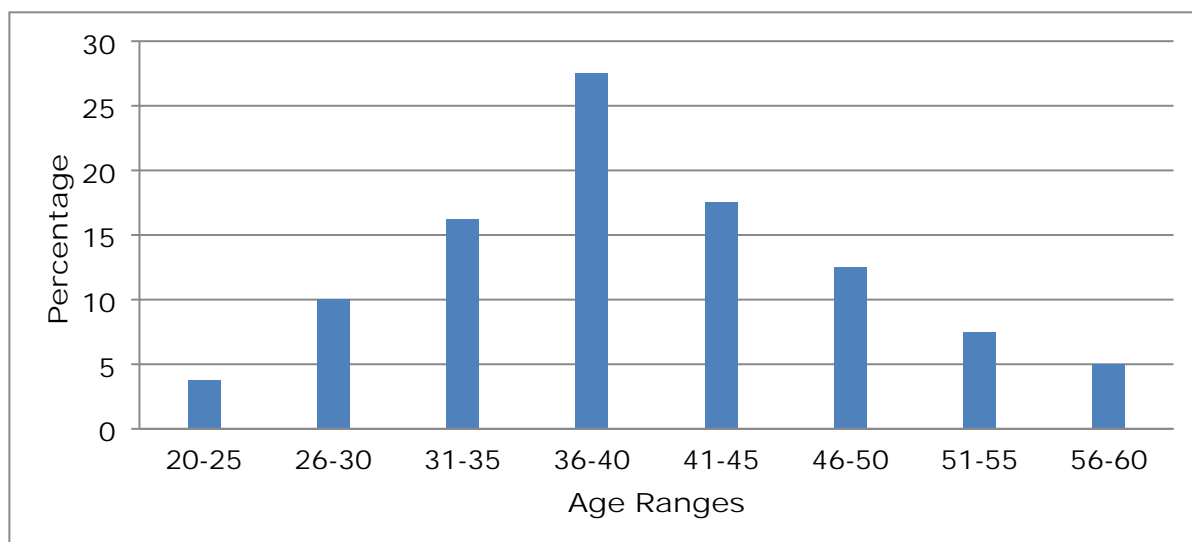
Figure 4.1 Age distribution of fish farmers in Rangpur.

4.1.2 Sex

The majority of the farmers were male. There were 91.25% of respondents were male where 8.75% were female. Sex category is showed in Table 4.1.

Table 4.1: Sex frequency and percentages of the fish farmers in Rangpur

Sex of farmers	Frequency (n=80)	Percentage
Male	73	91.25
Female	7	8.75
Total	80	100.00

Source: Field survey (2017)

4.1.3 Marital Status

The fish farmers were classified into two categories on the basis of marital status. Maximum of the farmers were married (88.75%). The survey presented that there was 11.25% single fish farmers while

farmers was married. Marital status of the selected fish farmers are showed in Table 4.2

Table 4.2: Marital status of the selected fish farmers

Marital status	Number of farmers n=80	Percentage (%)
Single	9	11.25
Married	71	88.75
Total	80	100.00

Source: Field survey (2017)

4.1.4 Household Size (persons)

The survey showed that family size of farmers had 2 to 4 family members which belonged to 61.25%. There were 5 to 7 family members 28.75% and 8 to 10 family members 10%. The average family members were 5 in number.
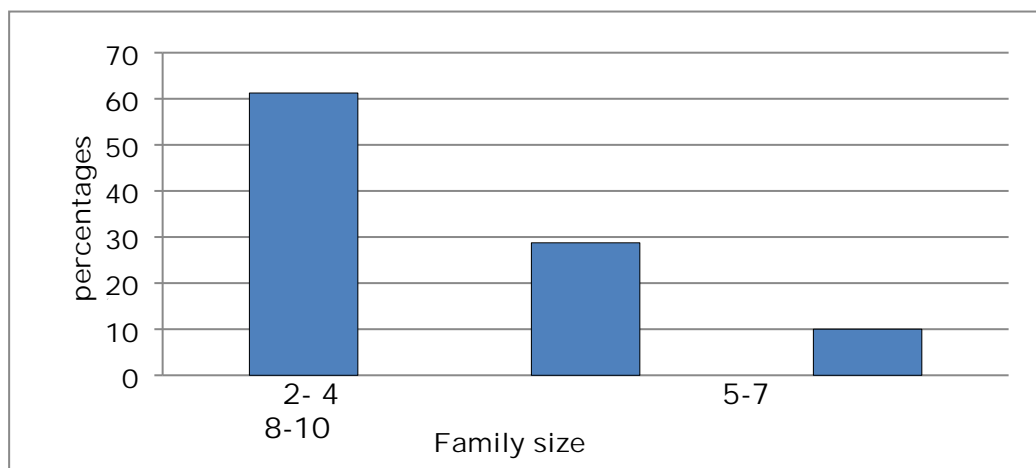
Figure 4.2 Family size and percentage of the farmers

4.1.5 Educational Level

The distribution of the farmers on the basis of their educational levels is opened in Figure 4.3. Based on the educational criterion the fish farmers were classified as 'illiterate, primary, SSC, HSC and graduate. There was 11.25% illiterate fish farmers in the selected area. About 46.25% of respondents achieved primary education, which is the highest percent of educational level, 21.25%, achieved SSC level. About 15% of respondents completed HSC level and 6.25% completed graduate. The graph shows that most the farmers (46.25%) were primary passed.
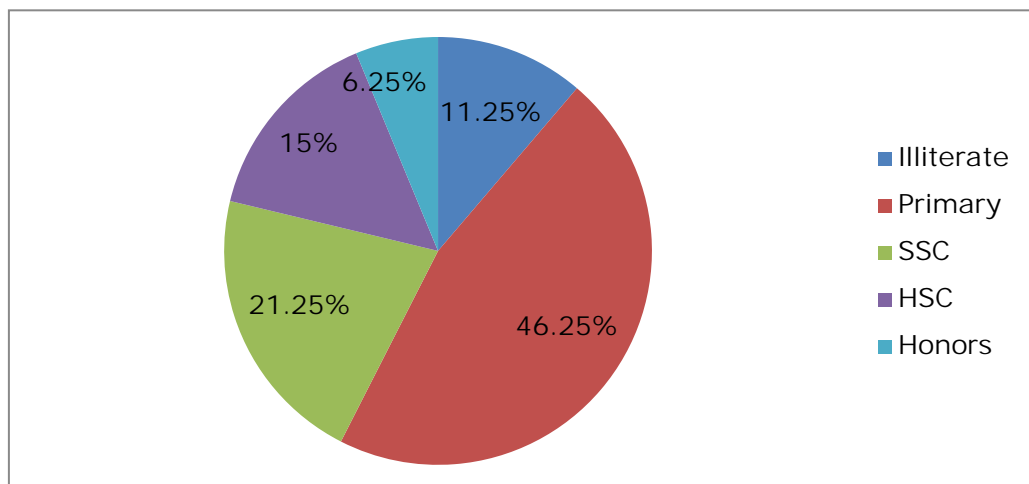
Figure 4.3 Educational levels of fish farmers in the study areas

4.2 Fish Culture Information

4.2.1 Sources of Information

The aquaculture information for culture practice, 23.75% of respondents got their information from extension agent. Majority (57.50 %) of respondents got their information from friends and fellow farmers and 11.25 % of respondents got their information from mass media. From internet 2.5% farmers got their information.
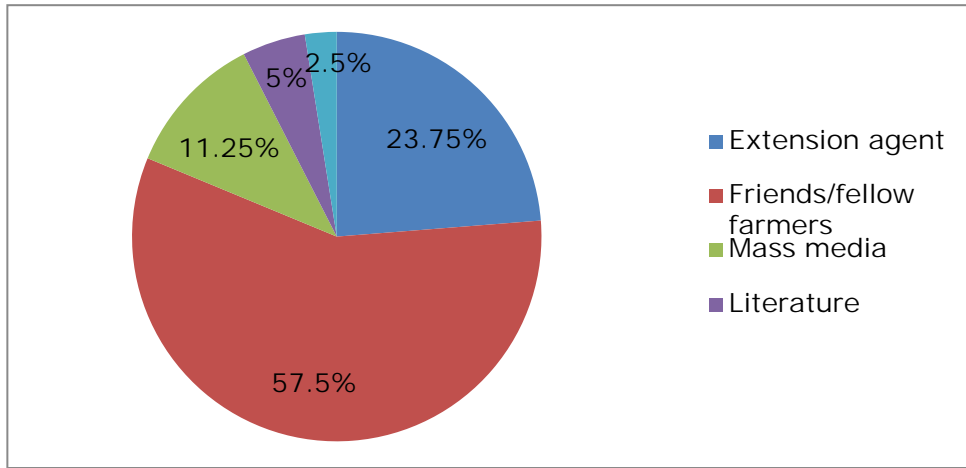
Figure 4.4 Sources of information for fish farmers

4.2.2 Farming Experiences

The selected fish farmer's experiences were 5% no experience in fish culture; 33.75% farmers had 1-5 year farming experience and 38.75% farmers had 6-10 years farming experience which is the highest percentage. Then 16.25 percent fish farmers have 11-15 years experience and 6.25% fish farmers over 15 years farming experience. In the survey areas most of the fish farmers were experienced.
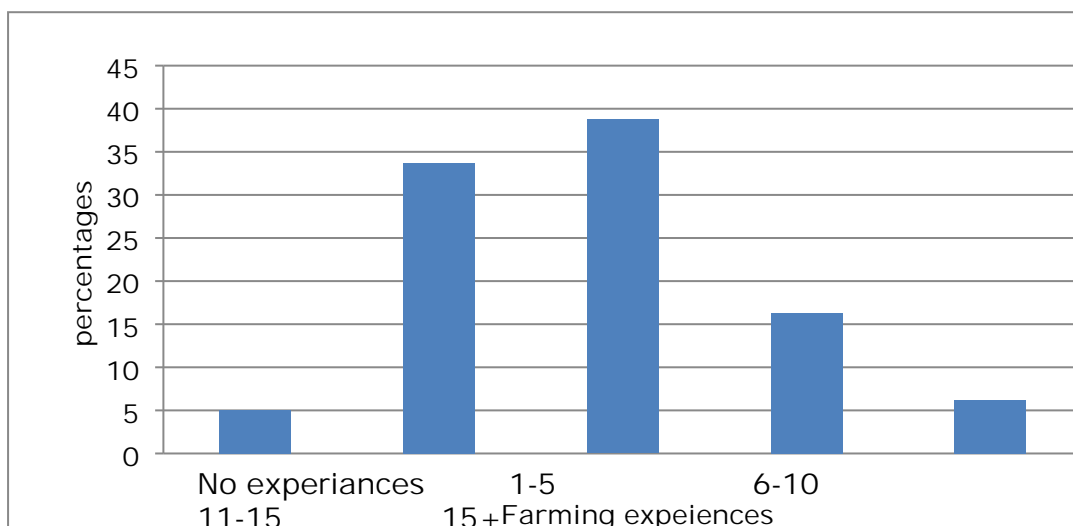
Figure 4.5 Farming experiences (years) of farmers

4.2.3 Training Status

Training is one of the necessary tools to improve fish culture. The survey showed that 35 percent of farmers were trained while 65 percent were not trained. The trained farmers got training from various GO and NGOs program

Table 4.3: Training status of fish farmers in fish culture

Training status	Frequency	Percentage
Trained	28	35.00
Non-trained	52	65.00
Total	80	100.00

Source: Field survey (2017)

4.2.4 Pond Ownership

In the present study 83.75% ponds were personal ownership and 16.25% ponds were under lease. Socio-economic appearances of the fish pond owners usually influence the extent of utilization of their ponds and the availability of the pond owners.

Table 4.4: Pond ownership of fish farmer

Pond owner status	Frequency	Percentage
Personal ownership	67	83.75
Leased	13	16.25
Total	80	100.00

Source: Field survey (2017)

4.2.5 Availability of Water

Based on the availability of the water, the ponds were grouped into two categories; a) perennial and b) seasonal pond. The study revealed that 79% of the ponds contained water throughout the year and only 21% pond possess water for a period of 6 to 8 month of the year. In the dry season farmer uses ground water for run to the course of fish culture of water is very important for fish culture activities
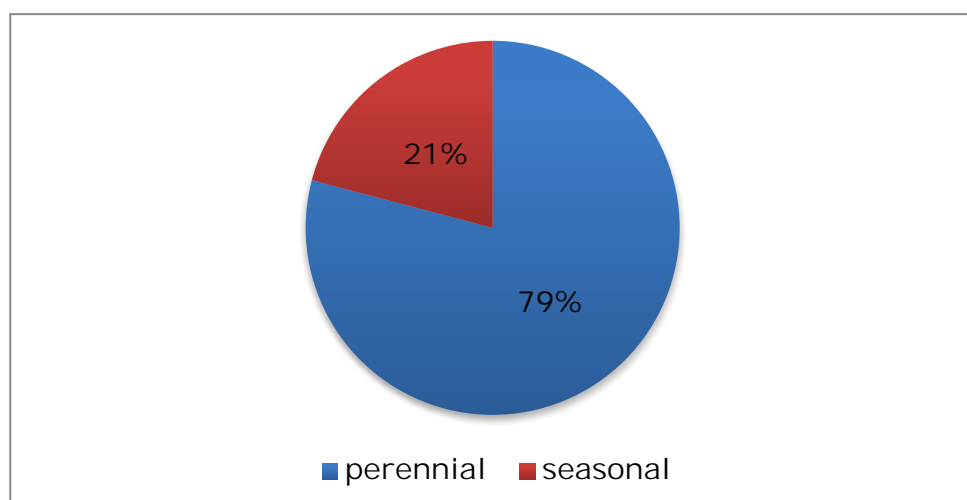
Figure 4.6 Availability of water in the selected ponds.

4.2.6 Fish Farming Practices

In the survey it was found that 11.25% of fish farmers practiced integrated fish farming that is combination of fish production with crops like as rice-fish culture. About 15% of the fish farmers practices

47

monoculture while 73.75 % of the farmers practice polyculture. Polyculture in ponds is the leading production system for most part of the country.
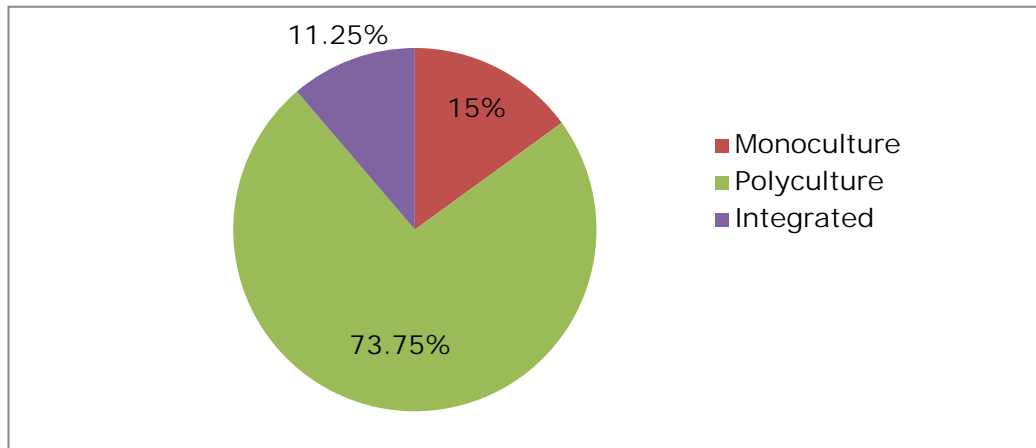
Figure 4.7 Fish farming practices followed by farmers.

4.2.7 Species Preferences

There was a great diversity in preference of the species under culture in the selected areas. Generally in the homestead aquaculture Indian Major Carps (IMCs) was dominated, but in this study it was found about 9 species were most common. The species included Indian Major Carps where 71 out of 80 farmers stocked Rui in their ponds followed by catla 62, common carp 57, tilapia 63, sarpunti 42, bighead carp 23, grass carp 24, bata 19 and silver carp 47. Species preferences farmers in is shown in Figure 4.8.
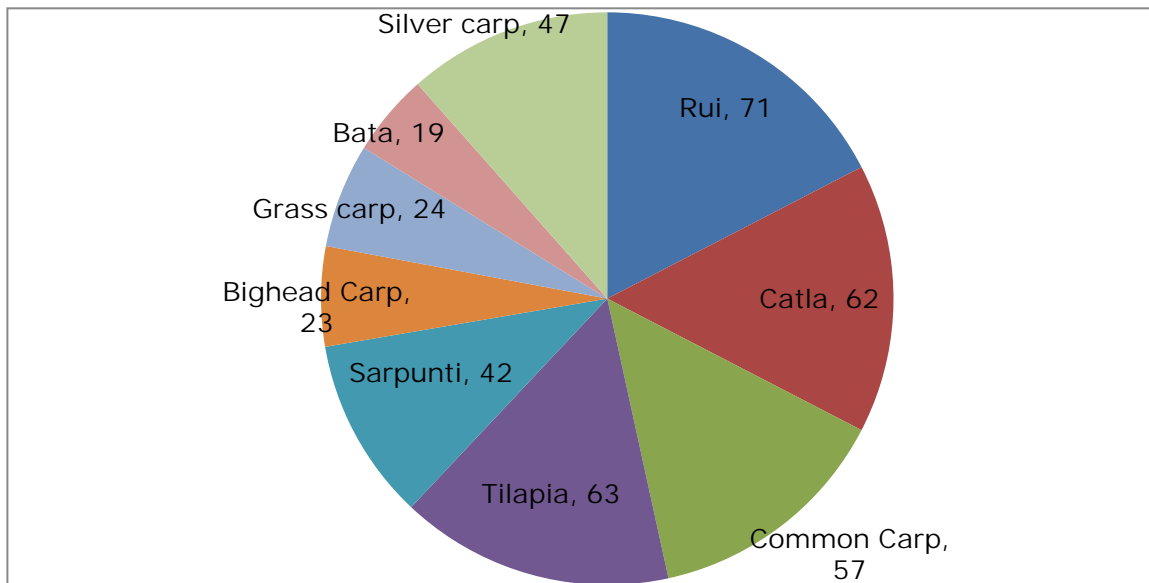
Figure 4.8 Species preferences frequency of farmers

4.2.8 Sources of Fish Seed

There are several sources of fish fingerlings from where a farmer usually collects fingerlings. In the surveyed areas no farmers had personal fish hatchery and they didn't depend on wild sources. No farmers got fingerlings from wild sources. The surveyed areas about 17.5% of fish farmer collected fingerlings from government hatchery while 82.5 % of farmer collected from private hatchery and nursery.
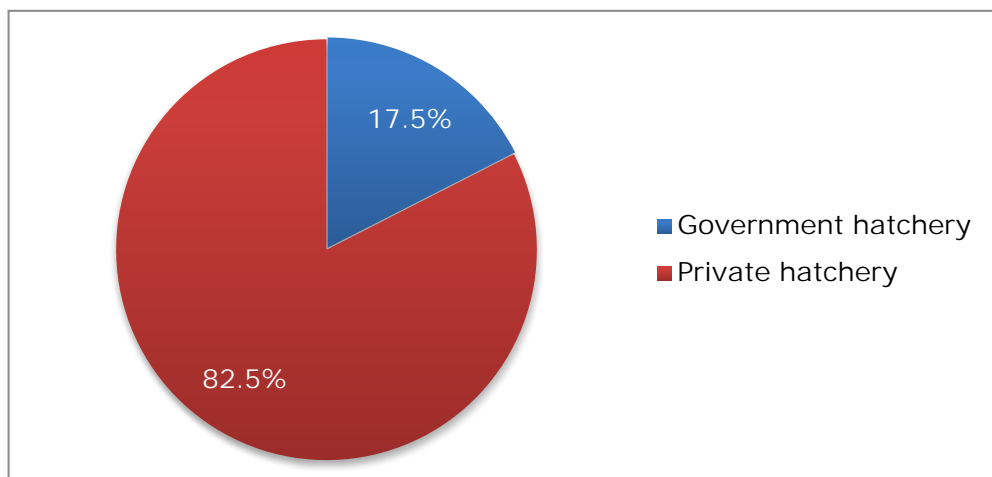
Figure 4.9 Sources of fish seeds in the study areas

4.2.9 Feeds Used for Cultured Species

In the study areas there were two type feeds used by farmers: commercial and homemade feed. It was perceived that the pond fish farmers used wheat bran, rice bran, and mustard oilcake in their fish ponds. Commercial feed which available in the local market. All the farmers used different type of feed. Study showed that 77.5% farmer used commercial feed and remaining 22.5% farmers used homemade feed in their culture pond.

Table 4.5: Use of Feed by the selected fish farmers

Type of Feed	Frequency (n=80)	percentage
Commercial feed	62	77.5
Homemade feed	18	22.5
Total	80	100.00

Source: Field survey (2017)

4.2.10 Feeding Frequencies

The current study showed that feeding frequencies were 26.25, 65 and 8.75 % one, two and three times respectively in a day. Figure 4.10 shows the feeding frequencies in study areas.
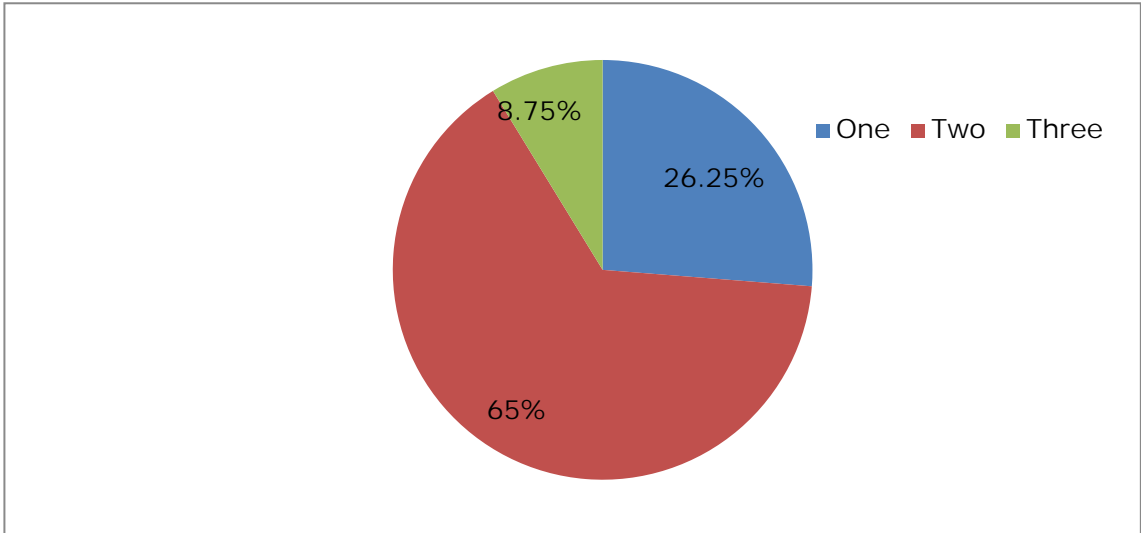
Figure 4.10 Feeding frequencies applied to the study areas.

4. 2.11 Annual Incomes

In the study, it was found that 40% of the farmers were included in annual income level Tk.50000 or below. There were 26.25% farmers had income level from tk.50001 to 100000. About 23.75% farmers had income level from Tk.100001 to 200000 and only 10% farmers had income above Tk. 200000.
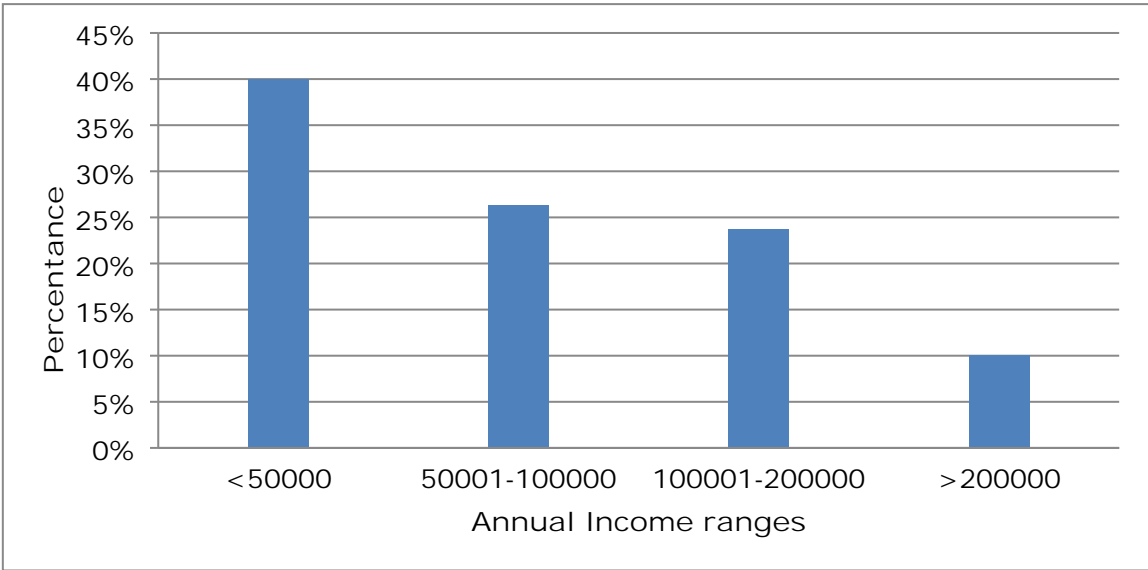
Figure 4.11 Annual incomes (Tk.) of farmer in the study areas

51

4.2.12 Constraints to Fish Farming

In the study area there were several constraints to smooth aquaculture operation that fish farmers faced. The following (Table 4.6) showed that irregular electricity supply and high cost of fish feeds were consecutively high level of 88.70 and 88.50 %. Besides, inadequate supply fish feeds were 49.50%, inadequate infrastructure 77.50% and poor hatchery facilities 64.30%. In the study areas suitable land acquisition and cannibalism was consecutively low level of 23.70 and 6 %.

Table 4.6: Constraints to fish farming in the study area (n=80)

Constraints	Percentages
Irregular electricity supply	88.70
High cost of fish feeds	88.50
Irregular water supply	87.00
High price of input	78.60
High cost of management	78.00
Disease and poaching	77.80
Inadequate infrastructure	77.50
Poor hatchery facilities	64.30
Inadequate skills workers	59.80
Inadequate supply fish feeds	49.50
Poor marketing	46.60
Poor extension services	46.00
Poor finance	32.00

Poor water quality	45.60
Suitable land acquisition	23.70
Cannibalism	6.00

Source: Field survey (2017)

CHAPTER V

DISCUSSION

Considering the objectives, eight upazilas of Rangpur district was purposively selected for the study. From the study area 80 fish farmers were randomly sampled. Using pre-tested questionnaire data were collected through face to face interview. The purpose of this chapter is to argue the findings and evaluation to other results with nearby findings. The results obtained from the study are discussed as follows:

5.1 Demographic Information

The survey showed that 27.5% of the respondents belonged to the age group from 36 to 40. It was observed 80% of the respondent's age in the study area was above 25 years. Rana (1996) found that 70% farmers were 18 to 45 age group. Olaoye *et al.* (2013) reported that 37.8 percent of the respondents belonged to the age group of 31-40 years, which was less than to the present study, because most of the fish farmer in the study area was young. Paul *et al.* (2013) revealed that most of the farmers (30%) were belonged to the age groups of 35-40 years which also less than to the present study. Now the young are showing interest in fish culture and getting engaged themselves in this field.

It was observed that 91.25% fish farmers were male. Islam *et al.* (2016) found that 90% of farmers were male and 10% were female. Ahmed (2003) observed about 96% farmers were male and 4% were female that is alike to the existing study. Women are involving themselves in fish culture day by day.

In the present study, it was originated that 88.75% fish farmers were married. Ahmed *et al.* (2004), Rahman *et al.* (2015) and Saha (2003) obtained married farmers at 94, 92 and 68% respectively.

In the present study area, the usual family size was 5 family members. The total number of family members ranged from 2 to maximum 10. The highest 61.25% farmer has family size from 2 to 4 members. Olaoye *et al.* (2013) reported that 68.5% population had household size between 3 and 5 members, which was more or less same to the present study.

From the present study it was found that majority (46.25%) of the fish farmers completed primary education; 21.25% of the fish farmers completed secondary (SSC) education; 15% done HSC and very lowest 6.25% completed graduation while about 11.25% of the farmers were illiterate. Gupta (2010) observed that most of the fish farmers (64%) were illiterate; 15.3% had primary level, 19.3% had secondary level and only 1.3% completed graduation. Olaoye *et al.* (2013) studied that 3.2% were illiterate, 19.8% had primary level, 27.8% had secondary level and only 39.6% had tertiary level of education. (BBS, 2002) the reported literacy rate was found higher than the national adult literacy level of 65%. Educational talent of farmers can co-operate a significant role for the winning pond management strategies. It was observed that literate farmers could farm management easily.

5.2 Fish Culture Information

The sources of information were 23.75% from extension agents, 57.50% from friends/fellow farmers, 11.25% from mass media, 5% from literature and 2.5% internet. Ibemer and Ezeano (2014) surveyed in river state and found 17.8% of farmers got information from extension agents, 58.9% from friends/fellow farmers, 14.4%,from mass media, 5.6% from literature and 8.8% from internet which more or less same to the present study.

According to the survey 38.75 % farmers had highest fish farming experience belonged to 6-10 years. The lowest 5 percent farmers had no farming experience in the present study. Pandey (2013) showed that 69.16% farmers had highest fish farming experience between 4 and 10 years. The lowest (12%) percent fish farmers had no farming experience. Olaoye *et al.* (2013) observed that 40.5% farmers had highest farming experience belonged 11 to 15 years. On the other hand 8.1 percent farmers had no farming experience, which was more or less similar to the present study. Nwosu and Onyeneke (2013) revealed that 18% of the farmers had 8 to 14 years of experience in fish farming, while only 12% of the fish farmers had no fish farming experience. Fish farming practice plays an important role for advanced level of fish production. If the farmers desire to get higher fish production, fish farming practice is essential

From the present study, it was found that only 35% received formal training in different time and 65% were non-trained. Training is an effective tool to transmit of new technology to root levels. Rahman (2007) stated that most of fish farmers were not well trained. It was an additional obstruction to get the highest fish production. In the current years, training had been provided by DoF, NGOs and other institutes to the fish farmers. The farmers had some access training and technical assistance on formulation and application of feed, nutrition and maintaining nutritive quality of fish feed. Munilkumar *et al.* (2007) noted that a trained farmer can easily face to the normal problems that occur in his pond.

Among the studied area 83.75 % farmers had owned pond and 16.25% farmers had leased pond. Majority of farmers had owned pond. Socio-economic appearances of the fish pond owners usually influence the extent of utilization of their ponds and the availability of the pond owners. Ahmed (2002) found 82% of fishers had their owned pond which was more or less similar to the present study.

In the surveyed areas most of the farmers had perennial ponds (79%) and rest of (21%) seasonal ponds. Olaoye *et al.* (2013) showed that 82.75% of farmers had perennial pond. The availability of water in the recent study was more or less similar to the present study. Sarker (2004) noted that water is an essential input in fish rearing. In the studied areas the most source of pond water was rain water. During dry season some supplied ground water when it was needed.

In the recent study there was 11.25% of farmers practiced integrates fish farming that was combination of fish production with crops like as rice-fish culture and 73.75 % farmers practiced polyculture. Only 15% of the fish farmers practiced monoculture in case of monosex tilapia in the study areas. Rahman (2003) found that 68.25% fish farmers practiced polyculture which was more or less similar to the present study. Polyculture in ponds is the leading production system for most part of the country.

In this study, it was found that about 9 fish species were most preferable to the farmers and common, where 71 out of 80 farmers stocked Rui in their ponds. A great variety of the species under culture was chosen by farmers. Generally in the homestead aquaculture Indian Major Carps (IMCs) was dominated. Khan (2012).Generally farmers prefer carps due to easy culture, less risk, high production performance, great market demand etc.

Among the sources of fish fingerlings personal hatchery, government hatchery, private hatchery, and wild sources can be noted. In the surveyed no farmers had personal fish hatchery and they didn't depend on wild sources. In the surveyed areas about 17.5 % of farmers collected fingerlings from government hatchery while 82.5 % of farmers collected fingerlings from private hatchery and nursery. Ibemer and Ezeano (2014) found that 38.9% collected fingerlings from government hatchery.

Study showed that 77.5% farmers used commercial feed in their culture pond and remaining 22.5% farmers used homemade feed in their culture ponds. Rahman (2008) found that 79.50% farmers used commercial feed in their ponds which was more or less similar to the present study. It was perceived that the farmers used wheat bran, rice bran, and mustard oilcake in their fish ponds. Commercial feed was available in the local market. All of farmers used different type of feed. Good quality feed is the pre-condition of higher fish growth.

The current study showed that there was 65% farmers supplied feed in pond 2 times; on the other hand 26.25% supplied feed one time in one day and only 8.75% supplied 3 times. Kundu (2012) showed that 29% of frames supplied two times feed to fish in one day which was similar to the present study. The growth performance subjected to different feeding frequencies. Ajani *et al.* (2011) showed the feeding frequency had a significant effect (p<0.05) on growth of *tilapia* and a positive relation between growth and increasing feeding frequency of this species.

In the recent study, it was found that 40% of the farmers' annual income was below Tk. 50000 which was the highest frequency and only 10% farmers had annual income more than Tk.200000 taka. Halim *et al.* (2017) observed that average annual income of the respondents Tk. 1.77 lac. Khatun *et al.* (2013) showed that the majority (45%) of respondents had very low annual income which was below Tk. 50000 which was similar to the recent study.

In the study area there were several constraints. Most of the farmers (88.70%) faced irregular electricity supply. The survey showed that irregular electricity supply and high cost of fish feeds were consecutively high level of 88.70 and 88.50 %. Besides, inadequate supply fish feeds were 49.50%, inadequate infrastructure 77.50% and poor hatchery facilities 64.30%. In the study areas suitable land acquisition and cannibalism were consecutively low level of 23.70 and 6 percent. All the constraints consecutively reducing with advancement and development of aquaculture extension.

CHAPTER VI

SUMMERY AND CONCLUSION

The survey was carried out to discover the present status of aquaculture practices in Rangpur district. Pond fish farming has been proved to be a lucrative dealing in this area. For the upgrading of fish culture method and future planning the information concerning present aquaculture practices is necessary. The study also seeks to understand how fish farming guide to improve the status and practices of fish farming. The survey and study were driven a period of one year between February 2017 and January 2018. A total of 80 farmers were randomly selected from eight upazilas of Rangpur district. The questionnaire was prepared emphasizing the objectives of the study.

The questionnaire accommodated many different questions to find out information on age, sex, marital status, household size, education, farming experiences, training status, pond ownership, farming practices, seed sources, species preferences, feeds, income and constraints to aquaculture in the study areas.

First of all, a survey schedule was prepared for data collection and the farmers were interviewed at their pond sites. Each interview required about half an hour. The collected data were cheeked, edited, coded, and entered into Microsoft Excel spreadsheet. The qualitative data was converted into quantitative numbers whenever required after processing, scaling and indexing of the necessary and relevant

variables to perform subsequent statistical analysis for drawing inferences by using MS Excel 2007 and SPSS (Ver. 22).

The study exposed that the age of the respondents varied from 20 to 60 years. There were 91.25% of respondents male and 8.75% were female in sex. The survey presented that there were 11.25% single fish farmers and 88.75% married. The highest family size (61.25%) consisted between 2 to 4 persons. The highest number of farmers (46.25%) had primary level of education and the lowest number (6.25%) of farmers had honors level of education. On the other hand 11.25% farmers were illiterate. The majority (57.50 %) of respondents got their information from friends and or fellow farmers. Only 2.5% of respondents got their information from internet. In terms of experience of fish farming, 5.25% fish farmers had no fish farming experience. There were 33.75% fish farmers had from 1 to 5 years and 38.75% farmers had from 6 to 10 years experience. Only 6.25% farmers had more than 15 years of fish farming experience. The survey showed that 35% farmers were trained form various GO and NGOs in different time while 65% farmers were not trained. In the present study 83.75% farmers had personal ponds and 16.25% farmers ran culture practice on leased ponds. It was found that 79% ponds contained water throughout the year round and 21% pond holed water for a period of 6 to 8 months. There was 15% of the fish farmer practice monoculture while 73.75 % of the farmers practiced polyculture. It was found that only 11.25% farmers practiced integrates fish farming with rice.

Species preferences were very common in the study areas. Mostly in the homestead aquaculture Indian Major Carps (IMCs) is dominated. But in this study it was found about 9 species were common stock. The species included Indian Major Carps where 71 out of 80 farmers stocked Rui in their ponds and followed by catla 62, common carp 57, tilapia 63, sarpunti 42, bighead carp 23, grass Carp 24, bata 19 and silver carp 47.

In the surveyed areas about 17.5 % of fish farmers collect fish seed from government hatchery while 82.5 % of farmers collect seed from private hatchery. Study showed that 77.5% farmers used commercial feed in their ponds and remaining 22.5% farmers used homemade feed. The current study showed that 65% farmers supplied feed in pond 2 times. On the other hand 26.25% supplied feed one time and 8.75% supplied 3 times in a day. In the study, it was found that 40% of the farmers were included in annual profits level below Tk. 50000 which was the highest frequency and only 10% farmers had income above Tk. 200000. In the areas several constraints were found to smooth aquaculture operation that farmers faced. The study showed that irregular electricity supply and high cost of fish feeds were consecutively high level of 88.70 and 88.50 %. Besides, inadequate supply fish feeds were 49.50%, inadequate infrastructure 77.50% and poor hatchery facilities 64.30%. In the study areas suitable land acquisition and cannibalism were consecutively low level of 23.70 and 6 %.

Recommendation

Based on the major conclusion of this study, the subsequent suggestions are made to progress the fish production:

a) There is required for training to increase farmer's skill about fish culture tricks.

b) Government and non-government organizations should provide training facilities to farmers.

c) A numbers of hatcheries should be established for sufficient supply of fish seed.

d) Ensure food security, income and poverty alleviation programmers in the study areas.

e) Ensure to supply of high quality fish feeds.

f) Ensure water quality management in the selected areas.

g) Fisheries extension service should be strengthened to guess the potential growers, flow booklets and pamphlets about update technologies of fish farming.

h) Make easy of information exchanges among fish farmers.

i) More researches should be run to increase more fish production.

REFERENCES

Abbas AM. 2015. Economic Analysis of Fish Farming and Its Contribution to Household Poverty Alleviation in Akure South and Owo Local Government Areas of Ondo State, Nigeria (Doctoral dissertation).

Ahamed S, Hasan KR, Mahmud Y and Rahman MK. 2017. Present Status of Pond Fish Farming: Evaluation From Small Scale Fish Farmer under Saidpur Upazila, Nilphamari, Bangladesh. Journal of Experimental Agriculture International. 17(5): 1-7.

Ahmed KKU, Hasan KR, Ahamed SU, Ahmed T and Mustafa G. 2004. Ecology of Shakla *Beel* (Bramhmanbaria), Bangladesh. Bangladesh Fisheries Research Institute, Riverine Station, Chandpur 3602, Bangladesh, 'World Fish Center-Bangladesh. Bangladesh Journal of Fisheries. 9: 101-110.

Ahmed F. 2003. Comparative Study on Carp Polyculture of Three Different NGOs in Mymensingh District. MS Thesis, Department of   Aquaculture,   Bangladesh   Agricultural   University, Mymensingh. pp. 65-70.

Ahmed N, Demaine H and Muir JF. 2008. Freshwater Prawn Farming in Bangladesh: History, Present Status and Future Prospects. Aquaculture Research. 39: 806-819.

Ahmed N. 2002. Socio-Economic Aspects of Freshwater Prawn Culture Development in Mymensingh, Bangladesh. A report prepared for ICLARM, Dhaka. p.25

Ajani F, Dawodu MO and Bello-Olusoji OA. 2011. Effects of Feed Forms and Feeding Frequency on Growth Performance and

Nutrient Utilization of *Clarias gariepinus* Fingerlings. African Journal of Agricultural Research. 6 (2): 318-322.

Alam G. 2006. Status of Fish Farming and Livelihoods of Fish Farmers in Some Selected Areas of Mithapuqur Upazila in Rangpur District. MS Thesis, Department of Fisheries Management, Bangladesh Agriculture University, Mymensingh, p. 59.

Ali H, Azad MAK, Anisuzzaman M, Chowdhury MMR, Hoque M and Sharful MI. 2010. Livelihood Status of the Fish Farmers in Some Selected Areas of Tarakanda Upazila of Mymensingh District. Journal of Agroforestry and Environment Science. 3(2): 85-89.

Ali MA. 2016. An Investment on Some Socioeconomic and Technical Problems in Pond Fish Culture in Two Districts of Bangladesh. Bangladesh Journal of Aquaculture. 8(1):47-51.

Azim ME, Wahab MA, and Verdegem MCJ. 2002. Status of Aquaculture and Fisheries in Bangladesh. World Aquaculture. 6 (7): 37-40.

Azucena CWW, Oliver MSS, Jonen BP, Viray MH and O'Malley S. 2001.Utilizing Different Aquatic Resources for Livelihoods in Asia. A Resource Book, Printed in Philippines. p. 361.

BBS. 2004. Bangladesh Bureau of Statistics. Statistics Division. Ministry of planning, Government of the People's Republic of Bangladesh, Dhaka. p. 673.

BBS. 2002. Statistical Yearbook of Bangladesh Bureau of Statistics, Statistical Division, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka. p. 660.

BBS. 2011. Fisheries Statistical Year Book of Bangladesh. Fisheries Resources Survey System, Department of Fisheries, Bangladesh, Dhaka. p. 41.

BBS.2011. Bangladesh Bureau of Statistics, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka. p.312.

Biswas SS, Hossain MI, Mazumder MS and Akteruzzaman M. 2000. An Economic Analysis of Pond Fish Culture of BRAC in Some Selected Areas of Mymensingh District. Progress in Agricultural Science. 11(2):243-249.

Chowdhury MH and Maharjan KL. 2001. Pond Fish Production through People's Participation in Rural Bangladesh, Journal of International Development and Cooperation. 7(2): 11–28.

DoF 2016. National Fish Week 2016. Compendium (In Bengali). Department of Fisheries, Ministry of Fisheries and Livestock, Bangladesh. p.148.

DoF. 2015. National Fish Week Compendium (in Bangla). Department of Fisheries, Ministry of Fisheries and Livestock, Bangladesh. p. 148.

FAO. 2010. State of World Aquaculture. Fisheries Department. FAO Fisheries Technical Paper. pp. 21-26

FRSS. 2015. Fisheries resources survey system (FRSS), fisheries statistical report of Bangladesh Department of Fisheries. p. 57

Ghose B. 2014. Fisheries and Aquaculture in Bangladesh: Challenges and Opportunities. Annals of Aquaculture and Research. 1 (1):1-5

Gupta N. 2010. Development of Freshwater Fish Farming and Poverty Alleviation. Department of Aquaculture, Bangladesh Agricultural University Mymensingh.

Hossain MI and Das NG. 2013. Status and prospects of aquaculture practices in Baruraupazila, Comilla, Bangladesh. Journal of the Asiatic Society of Bangladesh, Science. 39(1): 69-76.

Halim MA, Rayhan A, Sharmin S and Mondal KD.2017. Status of Pond Fish Farmers in Some Selected Areas of Mithapukur Upazila under Rangpur District, Bangladesh .SSRG International Journal of Agriculture & Environmental Science (SSRG-IJAES). 4 (3):13-17.

Halim S. and Ahmed MK 2006. Women in fisheries in Bangladesh: Level of involvement and scope for enhancement. World Fish Center. pp: 159-168.

Hasanuzzaman M, Rahman MA and Salam MA. 2016. Identification and Quantification of Pesticide Residues in Water Samples of Dhamrai Upazila, Bangladesh. Applied Water Science. pp. 1-8.

Hassanuzzaman AKM. 1997. Comparative Study on Pond Fish Production under Different Management System in Some Selected Areas in Rajshahi District. MS Thesis, Department of Agricultural Production Economics, Bangladesh Agricultural University, Mymensingh. p. 76.

Hossain MA, Khan MAR, Mannan MA. 2002. Present Status of Pond Fishery in Dhamaihat upazila, Naogoan. University Journal of Zoology Rajshahi University. pp.79-80.

Hossain T. 2007. Study on Biodiversity of 'Fish Fauna, Socioeconomic Condition of The Fishermen in the Kolimar Haor, Itna, Kishorgonj. MS Thesis, Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh. p. 38.

Hussain MS. 1999. Status of Backyard Pond Utilization in Some Selected Areas of Bangladesh. Bangladesh Journal of Fisheries. 22(1): 113-118.

Ibemer IF and Ezeano CI. 2014. Status of Fish Farming in River State, Nigeria. Journal of Fisheries and Aquatic Science. 9 (5):321-329.

Islam MS. 2005. Socio-Economic Status of Fish Farming In Some Selected Areas of Dinajpur District. MS Thesis, Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh. pp. 37-38.

Islam MS, Jahan H and Al-Amin AKMA. 2016. Fisheries and Aquaculture Sectors in Bangladesh: An Overview of the Present Status, Challenges and Future Potential. Journal of Fisheries and Aquaculture Research. 1(1): 2-9.

Islam, S. 2010. Studies on Pond Fish Farming and Livelihoods of Rural Farmers in Some Selected Areas of Moulavibazar District. MS Thesis, Department of Aquaculture, Bangladesh Agricultural University. Mymensingh. p. 36.

Kabir KMR, Adhikary RK, Hossain MB and Minar MH. 2012. Livelihood Status of Fishermen of the Old Brahmaputra River, Bangladesh. World Applied Science Journal. 16(6): 869-873.

Kabir MS. 2009. Assessment of the Livelihood Status of the Fish Farmers in Some Selected Areas of Trishal upazilla under Mymensingh District. MS Thesis, Department of Aquaculture, Bangladesh Agricultural University, Mymensingh. p. 39.

Kanak MK. 1997. Performance of Exotic Fishes in Polyculture with Indian Major Carps under Three Different Species Combination. MS Thesis, Department of Aquaculture, Bangladesh Agricultural University, Mymensingh. p. 76.

Kausar RM 2009. Fisheries Knowledge of Pond Owners in Two Villages of Mymensingh District. MS Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh. p. 46.

Khan MS. 2012. Socio-economic Aspects of Fish Farmers in Some Selected Areas of Sreemongal Upazila under Moulvibazar District. MS Thesis, Department of Aquaculture, Bangladesh Agricultural University, Mymensingh. p. 57.

Khatun S, Adhikary RK, Rahman M, Sikder MNA and Hossain MB. 2013. Socio-economic Status of Pond Fish Farmers of Charbata, Noakhali, Bangladesh. International Journal of Life Science and Pharm Research. 2(1): 356-365.

Kundu M. 2012. Study on the Socio-economic Aspects and Livelihood of Fishermen in Gopalpur Upazila under Tangail District. MS Thesis, Department of Aquaculture, Bangladesh Agricultural University, Mymensingh. p. 48.

Lazu MAA. 2011. Quality Assessment of Farm Made Fish Feed in Different Thai Pangus (Pangasiushypophthalmus) Farms of

Muktagacha Upazila in Mymensingh District. MS Thesis, Department of Aquaculture, Bangladesh Agricultural University. Mymensingh. p. 63.

Lewis D. 1997. Rethinking Aquaculture for Resource-Poor Farmers: Perspectives from Bangladesh. Food Policy.22(6): 533-546.

Masum SM. 2009. Assessment of the Aquaculture Knowledge of the Fish Farmers of sadarupazila under Pabna District. MS Thesis, Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh. p. 61.

Mondal MAH, Ali MM, Sarma PK and Alam MK. 2013. Assessment of Aquaculture as a Means of Sustainable Livelihood Development in Fulpur upazila under Mymensingh District. Journal of Bangladesh Agricultural University.10(2): 391-402.

Moni NN & Khan NN. (2014). Fish Cultivation as A Livelihood Option for Small Scale Farmers-Study in Southwestern Region of Bangladesh. IOSR Journal of Humanities and Social Science, 19(7), 42-50

Moslem IUM and Harun RM. 2017. Assessment of Aquaculture and Livelihood Status of Fish Farmers in Dhamrai Upazila of Dhaka District, Bangladesh. . Annals of Veterinary and Animal Science. 4(1):31-43.

Munilkumar S and Nandeesha MC.2007. Aquaculture Practices in Northeast India: Current Status and Future Directions. Fish Physiology and Biochemistry. 3(3):399–412.

Nwosu CS and Onyeneke RU. 2013. Effect of Productive Inputs on Pond Fish Production on Fish Output in Owerri, Imo State, Nigeria. Global Advanced Research Journal of Agricultural Science. 2(1): 23-28.

Olaoye OJ, Ashley-Dejo SS, Fakoya EO, Ikeweinwe NB, Alegbeleye WO, Ashaolu FO and Adelaja OA. 2013. Assessment of Socio-Economic Analysis of Fish Farming in Oyo State, Nigeria. Global Journal of Science Frontier Research Agriculture and Veterinary.13(9): 45-55.

Pandey D, and Hijam B. 2013. Fish Farmers' Perceived Constraints in Transfer of Aquaculture Technology in Bishnupur District of Manipur, India. 9: 7-50.

Pandey SK and Dewan R. 2006. Constraints in Fish Farming Practices in Uttar Pradesh, India: An Analysis. Journal of the Indian Fisheries Association.33: 183-189.

Paul B, Faruque H and Ahsan DA. 2013. Livelihood Status of the Fishermen of the Turag River, Bangladesh. Middle-East Journal of Scientific Research.18(5): 578-583.

Pravakar P, Sarker Supratim B, Rahman M and Hossain BM. 2013. Present Status of Fish Farming and Livelihood of Fish Farmers in Shahrasti Upazila of Chandpur District, Bangladesh. American-Eurasian Journal Agricultural & Environmental Science. 13 (3): 391-397.

Quddus MA. and Rahman MS. 2000. Socio-Economic Conditions of Pond Owners of Demara, Dhaka. Bangladesh Journal of Fisheries Research. 4 (2): 203-207.

Rahman MA. 2007. An Economic Study of Pond Fish Culture in Some Selected Areas of Mymensingh district. MS Thesis, Department of Agricultural Economics, Department of Agricultural Production Economics, Bangladesh Agricultural University, Mymensingh. p. 94.

Rahman MH. and Miah TH. 2001. Economics of Pond Fish Culture in Some Selected Areas of Bangladesh. Bangladesh Journal of Fisheries Research, 5(1): 95-100.

Rahman MM, Hoque MM, Karim R and Sarker MM. 2017 . Present Status and Scope of Fisheries Culture at Chalanbeel in Bangladesh. International Journal of Advanced Research in Biological Sciences. 4(6):34-40.

Rahman MM, Mondal MN, Shahin J, Fatema J, and Fatema MK. 2015. Potentialities of Pond Fish Farming in Kaliakair Upazila under

Gazipur District, Bangladesh. Research in Agriculture Livestock and Fisheries. 2 (3): 517-528.

Rahman MM. 2003. Socio-Economic Aspects of Carp Culture Development in Gazipur, Bangladesh. MS Thesis, Department of Agricultural Economics, Bangladesh Agricultural University, Mymensingh. p. 83.

Rahman MM. 2008. Status of Fish Marketing in Gazipur, Bangladesh. MS Thesis, Department of Fisheries Management, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh. p. 51.

Rana MS. 1996. An Economic Analysis of Pond Fish Culture in Some Selected Areas of Sirajgonj District. MS Thesis, Department of Agricultural Economics, Bangladesh Agricultural University, Mymensingh. p. 52.

Robbani MG. 2002. Survey Of Certain Parameters Of Fish Farming In Three Selected Areas Of Bangladesh. MS Thesis, Department of Aquaculture, Bangladesh Agricultural University, Mymensingh. pp. 67.

Saha MK. 2003. A Study on Fish Production Technology in North-west Bangladesh. MS Thesis, Department of Aquaculture, Bangladesh Agricultural University, Mymensingh. p. 54.

Saha NC, Islam MS, Saha JK and Mondal PC. 1995. Economics of pond fish production in some selected areas of Bangladesh. Bangladesh Journal of Aquaculture. 17: pp. 13-18.

Sanusi SM. 2014. Profitability of Small Scale Fish Farming in Minna Agricultural Zone of Niger state in Nigeria. Indian Journal of Economics and Development, *10*(4), 382-386.

Sarker C. 2004. Socio-Economic Aspects of Pond Fish Cultured Women in Some Selected Areas of Habigonj District. MS Thesis, Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh. p. 34.

Sarwer MG, Ali MY, Bhowmik S, Asadujjaman M and Sharmin MS. 2016. Pond Farming and Livelihood Status of Fish Farmers in Subarnachar, Noakhali, Bangladesh. Agriculture and Biology Journal of North America.7 (3):134.139.

Shamsuzzaman MM ,Tania NJ, Mamun AB, Barman PP and Xu X. 2017. Fisheries Resources of Bangladesh: Present Status and Future Direction. Aquaculture and Fisheries. 2(4): 145-156.

Sheheli S, Fatema K, Haque SM. 2013. Exiting Status and Practices Of Fish Farming in Trishal Upazila of Mymensingh District. Progressive Agriculture. 24(2): 191-201.

Shirajee SS, Salehin MM and Ahmed N. 2010. The Changing Face of Women for Small-Scale Aquaculture Development in Rural Bangladesh. Aquaculture Asia Magazine, 15(2): 9-16.

Shohag MSH. 1996. A socio-economic study on the supervised credit pond fish culture in Nandailthana of Mymensingh district. MS Thesis. Department of Agricultural Economics, Bangladesh Agricultural University, Mymensingh. pp. 107.

Shohel MA. 2007. Aquacultural Activities and Livelihoods of the Farmers in some Selected Areas of Kahalooupazila, Bogra. MS Thesis, Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh. p.18.

Sultana S. 2001. Socioeconomic impact of the adoption of BFRI evolved polyculture and carp nursery technologies in some selected areas of Trisal Upazila in Mymensingh district. M.S. Thesis, Department of Agricultural Economics, Bangladesh Agricultural University, Mymensingh. p. 101.

Talukdar PK and Sonataki BB. 2005. Correlates of adoption of composite fish culture practices by fish farmers of Assam, India. Journal of Agricultural Sciences.1 (1): 12-18.

Tanjeena Z, MAS Jewell and AS Bhuiyan. 2006. Preesent Status of Pond Fishery Resources and Livelihood of The Fish Farmers of Mohanpur upazila in Rajshahi District. University Journal of Zoology. Rajshahi University. 25: 31-35.

APPENDIX

Department of Aquaculture

Hajee Mohammad Danesh Science and Technology University, Dinajpur

Questionnaire

Research Title: Present Status of Fish Farmers and Aquaculture Practices in Rangpur District.

Respondent No.:   Date:

(Please answer the following questions)

A. Personal Information:

Name of the farmer: ....

Address: Village............................
Upazila...........................

    Contact No. :

1. Age: ....Years

    2. Sex :   ☐ Male   ☐ Female
    3. Marital status: :   ☐ Single   ☐ Married

4. House size (members): ....
5. Educational level:

    ☐ Illiterate   ☐ Primary   ☐ SSC   ☐ HSC   ☐
    Graduation

B. Basic fish culture Information:

1. Sources of information:

☐ Extension agent ☐ Friends/fellow farmers ☐ Mass media Literature

☐ Internet

2. Farming experiences: ....years.

3. Training status ☐ Trained Non-trained

4. Pond ownership: ☐ Personal Leased

5. Availability of water: ☐ Perennial Seasonal

6. Fish farming practices: ☐ Monoculture ☐ Polyculture Integrated aquaculture

7. Species preferences: ....

8. Sources of fingerlings: ☐ Wild ☐ Government Private hatchery

9. Feeds Used for Cultured Species: ☐ Commercial feed Homemade feed

10. Feeding Frequencies: ☐ One time ☐ Two times Three times

11. Annual Incomes: BDT ....

12 Constraints to Fish Farming:

Constraints	Yes	No
Inadequate infrastructure		
Inadequate supply fish feeds		
Irregular electricity supply		
Poor finance		
Poor hatchery facilities		
High cost of fish feeds		
Suitable land acquisition		
High price of input		
Disease and poaching		
Irregular water supply		
Poor water quality		
High cost of management		
Poor extension services		

Poor marketing		
Inadequate skills workers		
Cannibalism		

Thank you for your kind information and cooperation.

………………………………
(Signature of the interviewer)
the farmer)

…………………………
(Signature of