PRESENT STATUS OF SMALL SCALE FISH FARMERS IN SELECTED AREAS OF DINAJPUR DISTRICT

A THESIS

BY

MD. FARUK MIA
Examination Roll No. 1605207
Session: 2016-2017
Semester: January- June 2017

MASTER OF SCIENCE (MS)

IN

AQUACULTURE

DEPARTMENT OF AQUACULTURE

HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY UNIVERSITY, DINAJPUR

JUNE 2017

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Submitted to the Department of Aquaculture
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Approved as to style and content by

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Dinajpur

June 2017

DEDICATED
TO MY
BELOVED PARENTS

DECLARATION

I declare that this MS thesis entitled Present Status of Small Scale Fish Farmers in Selected Areas of Dinajpur 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 Md. Abu Zafar, Assistant 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

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*"**Commit to the lord whatever you do, and your plan will succeed**" I start with the name of almighty, who is most beneficent and merciful. I am greatly thankful to God for giving me blessing and always illuminating me with the light of success. The dissertation is prepared in accordance with the requirement of the Department of Aquaculture for Master of Science (MS) degree in Aquaculture.*

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The Author

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LIST OF ABBREVIATIONS

DoF = Department of Fisheries

FAO = Food and Agricultural Organization

NGO = Non-Government Organization

UFO = Upazila Fisheries Officer

GDP= Gross Domestic Product

BC= Before Christ

ADB= Asian Development Bank

IMCs= Indian Major carps

SSC = Secondary School Certificate

HSC = Higher Secondary Certificate

SPSS = Statistical Package for Social Sciences

BBS = Bangladesh Bureau of Statistics

ABSTRACT

For the improvement of aquaculture production, the demographic, pond condition and current aquaculture practices of selected fish farmers in Birganj upazila, Dinajpur district were studied for a period of six months effected from October 2016- March 2017. Randomly selected 67 small scale fish farmers of three villages of Moricha Union Parishad of Birganj upazila were interviewed to know the age, education, training exposure, pond area, water depth, and availability of water, species cultured, management strategies and production status by using the semi-structured questionnaire. The collected data were cheeked, edited, coded, and perform subsequent statistical analysis by using MS Excel (2007) and SPSS (Ver. 22). The study showed the age of the farmers ranged from 22 to 68 with 37% primary education and 15% illiterate. Thirty six percent fish farmers had no experience on fish farming; 24% had 1-5years; 19% had 6-10 years; 16% had 11-15 years and 5% had more than 15 years of fish farming experience. Most of the farmers (52.24%) had pond having the size range from 5 to 10 decimal with the mean depth 4.44 ft. It was found that 79% of ponds contained water throughout the year and 21% pond had water for a period of 6 to 8 months. Diversified species was found to culture in the ponds, about 13 species were found that Indian Major Carps and Small Indigenous Species of Fish, where 63 out of 67 farmers stocked Tilapia in their ponds and followed by Rohu (44), Silver Carp (43), Common carp (41), Mola (38), Thai sarpunti and Magur (35), Shing (34), Koi (33), Bighead carp (13), Catla (12), Bata (9) and Grass Carp (6). The polyculture system consisted of 3 to 10 species. About 76% farmer used feed in culture pond and none of the farmers were found to take any measures for maintaining proper water quality. Fish farmers partially harvested their produced fish from their pond by using cast net, borsi, jhaki jal etc. The fish production in the selected area where Tilapia ranked highest with 22% produced fish and followed

by Silver carp (18%), Rohu (13%), Common carp and Thai sarpunti (11%), Koi (6%), Shing (4%), Bighead carp, Magur and Mola (3%), and the least was Catla, Bata, and Grass carp (2%). About 92.5 % farmers use fish only for consumption purposes, the remaining farmers (7.5%) used for both consumption and sales. The main problems identified are lack of capital, poor technical knowledge, lack of social awareness, poaching and flooding.

CHAPTER I

INTRODUCTION

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INTRODUCTION

The area of the country is 147,570 square kilometres (km2), 7% of which is permanently under water (BBS 2007a, CIA 2008). The population is 160 million (CIA 2016), a quarter of which is urban. From the early days of its civilization, Bangladesh has been largely agrarian, and it remains so, though economic growth has been achieved in the past 3 decades through fast-growing non-farm sectors. It is mostly a flat delta with fertile alluvial soils, a favourable tropical climate, and readily accessible surface and ground water. Diverse ecologies support the year-round farming of multiple rice crops, over 100 other crops (including various types of other cereals, oilseeds, pulses, spices, fruits, vegetables, roots and tubers), livestock, poultry and fish (BBS 2004a and 2007a, Bose 2001). Because of the ubiquitous presence of water bodies large and small, most inhabitants of the vast floodplains were, from time immemorial, never far from where fish was naturally available. Fish remains the preferred and most important protein source for Bangladeshis. Fish is the second most important agricultural crop in Bangladesh and its production contributes to the livelihoods and employment of millions of people (Ghose, 2014). There are thousands of ponds, tanks, beels, haors, baors, canals and rivers all over the country. Fish culture in such closed water bodies as ponds and lakes was recorded to have started in 350 BC on the Indian subcontinent (Banglapedia 2008a). This sector contributes 3.65% to the national GDP and almost one-fourth (23.81%) to the agricultural GDP (DOF, 2016). In recent years, this sector performs the highest GDP growth rate in comparison to other agricultural sectors (crop, livestock and forestry). The growth rate of this sector over the last 10 years is almost steady and encouraging, with an average of 5.22 percent. It has registered a yearly rate of increase at

5.35% during last several years, the production was 36.84 million MT in 2014-15 (DoF, 2016). It is expected that total fish production in 2020-21 will be 45.52 million MT (DoF, 2016). Bangladesh is ranked 5th as aquaculture producing country in the world (FAO, 2015). Last 10 years average growth rate of fisheries is 5.4%, where the activities of aquaculture shows the growth performance of 8.2%. Bangladesh is a land of rivers. It is full of marine and freshwater resources. Total number fishermen of Bangladesh are 13.16 million including 8 million people who are inland fishermen and 5.16 million people who are marine fishermen. It is important to note that fisheries sector plays a vital role in the national economy of Bangladesh (Moni& Khan 2014). According to available statistics, it is found that the total fish production of the country shows a consistently increasing trend during the last 30 years. Annual fish production of Bangladesh from various sectors includes, inland open water fisheries accounts for 10,23,991 MT (27.79%), Inland closed water accounts for 30,85,048 MT (83.72%) and Marine fisheries accounts for 5, 99, 846 MT (16.28%) (Fisheries Statistical Report of Bangladesh, 2014-2015). Within the overall agro-based economy of the country, fish production is crucial for livelihoods, income, animal protein, employment opportunities, nutritional security and food supply (Sheheli, 2013). About 10% of the population directly and indirectly depends on fisheries for their livelihood (DoF, 2011).

Aquaculture in Bangladesh is a very significant and growing industry. With careful management it has the potential to be an important tool in addressing issues such as malnutrition and poverty. Certain species of fish have very high levels of important micronutrients such as vitamin A and aquaculture has been shown to be a considerably more profitable activity than other forms of agriculture such as rice production. Many households in Bangladesh have a small pond located next to their dwelling area that is used to produce fish for home consumption as well as to be sold in markets. (Bloomer

2012). Aquaculture practice has become a promising and gainful methodology to attain self-sufficiency in food sector and also to alleviate poverty in developing country like Bangladesh (Ahmed, 2003). The social content is especially important particularly access arrangement and assessments of benefits to livelihood (Azucena *et al*., 2001). The benefit received by households from these ponds is highly variable and is strongly dependent on the management practices employed. Such management practices include: species produced in the ponds, seasonality of production, culture practice and management practice (Bloomer, 2012). Only 7.71% ponds all over the country are used for commercial venture and the rest are used for non-commercial practices. Whereas, the production rate from this sector can be raised many folds through proper pond management techniques using the existing carrying capacity of different types of ponds in relation to species stocked and selection of species (Hossain and Das, 2013).

In Bangladesh, around 46% of children between the ages 6 to 7 years are stunted and 70% are wasted due to malnutrition (Ahmed *et al.*, 2007). The greater emphasis should be given to meet the animal protein deficiency among the people as well as to boost up fish production in this country through proper management of open water fishery and aquaculture. But fish production from open water bodies is decreasing day by day. Once upon a time, these unique ecosystems supported huge and diverse biodiversity. At present, most of the water bodies are contaminated by agricultural, industrial and municipal waste as a pollutant and those are accumulated by runoff into these resources. Fish production is also decreasing due to natural causes like flood, drought, etc. But it is important that closed water or pond aquaculture production is increasing day by day due to necessitate and demand of the people (Ahmed, 2003). In addition, more return also come from the fish production (DoF, 2011).

A total of 260 species have been noted in freshwater; about 200 species are truly freshwater, while the remaining 60 are examples of estuarine and marine species. To date 12 exotic species have been introduced. The livelihoods of more than 1.65 million people (over 11% of the total population) directly depend on fish; of these, 10% are women who are directly involved in the fisheries sector. To fulfill the need of time, dependency on culture fisheries and pond aquaculture is increasing to a great extent, of which pond aquaculture is of greatest importance. With the increasing demand for fish and the decline in capture fish production, small indigenous species (SIS) farming in Bangladesh is becoming more intensive (Ahmed *et al*., 2007). Around 400,000 ha of fish ponds/ditches and more than 900,000 households are involved in aquaculture (ADB, 2010). Freshwater aquaculture is contained mainly of pond aquaculture, particularly the polyculture of a variety of species, including native (shing, magur, koi, mola) and exotic major carps (silver carp, bighead carp, grass carp, common carp), and non-native tilapia (Ghose, 2014).

The northern district-the greater Dinajpur is situated at higher level from the Bay of Bengal and also the dry part of Bangladesh. Most of the ponds are leaky, hence the water retention capacity of the pond of this regions are very less. The farmers of the greater Dinajpur district are facing problems of scarcity of water throughout the year except the monsoon season. That's why the ponds are seasonal and backyard pond rather than commercial pond of other districts such as Mymensingh, Comilla and Jessore. For instance, a survey by Barman (2001) in northwest Bangladesh reports that more than half the small ponds located close to homestead areas and beside farmers' fields had either been dug or renovated in recent times for the purpose of fish culture. Pond fish farming has been proved to be a profitable business than rice cultivation; so many farmers in rural areas are converting their rice field into aquaculture pond. Many pond fish farmers in

rural areas have taken fish farming activities as their secondary occupation. But, they are not be able to culture fish to their ponds for the entire duration, for this they need to culture fish only for 3-4 month of a year. If the water retention capacity of the ponds of this area could possible to enhance, the farmers would be able to practice fish culture throughout the year. They might be interested to culture fish in semi-intensive or intensive technique. Freshwater fish cultivation is normally practiced in the northern region of Bangladesh. In Birganj Upazila, fish are partially culture after cropping but it has become one of the important sources of livelihood for the people of that area. In addition, it has created livelihood movement followed by socio-economic vulnerability of the poor. For the improvement of cultural system and future planning, the information regarding present aquaculture practices at the grass root level is absolutely necessary. Based on the above context, this research work is commenced on problem and constrains of small scale fish farming and its impact on the fish cultivators' families in three villages of Birgang Upazila. This study also seeks to understand how fish farming lead to improve the status and practices of fish farming as well as improve their livelihood. The study was based on the following objectives:

- To know the demographic condition of fish farmers.
- To know the characteristics of the pond in the study area.
- To know the fish production status.

CHAPTER II

REVIEW OF LITERATURE

CHAPTER II

REVIEW OF LITERATURE

Pond fish culture is widely practiced in different South-Asian countries including Bangladesh. Studies on production technologies and farmers socio-economic studies have been conducted in different regions of these counties, but still there are very few studies in the northwest part of the countries. Limited numbers of studies have been conducted in Bangladesh at the village level. Only few studies concerning the socio-demographic, aquaculture status were conducted by different organization. Hence, in this chapter an attempt has been taken to review some of these related studies.

Munish (2017) study that, presently studies were designed to look into various problems/constraints which are hampering the growth of fish farming in the study area. It was observed in the study area that lack of awareness regarding fisheries schemes, non-availability of quality seed & feed, lack of water, misuse of subsidy, lack of proper exposure visits & institution credit, non-availability of insurance cover besides compartmental approach and discrimination in allocation of ponds were the main constraints faced by fish farmers.

Hasanuzzaman *et al*. (2016) conducted 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. Most of the farmers 97% carried out polyculture, 2% monoculture system and 1% integrated culture system with average stocking density was found 12,350 fry/ha, 93% applied supplementary feed and 7% depend on natural feed and yield 4,246 kg/ha/year and 92% of fish farmers have improved their socioeconomic condition through fish farming and 8% farmers have not yet improved their status.

Ali *et al*. (2016) survey 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, represented 57.5% nuclear and 42.5% joint family, average education level of 8.2 years schooling.

Sarkar *et al*. (2016) revealed that 40% of the ponds were seasonal and 60% perennial, of which 85% with single ownership and 15% accompanied by multiple ownership. The average pond size was 0.13 ha and depth 2.6 m. To sustain natural food production, farmers generally used cow dung, urea and TSP at the rate of 2,600, 300 and 150 kg/ha/yr, respectively. The fish were fed by supplementary feed (45% farm) e.g., rice bran and mustard oil-cake with an average quantity of 2,200 and 550 kg/ha/yr, respectively and artificial pellet feed (55% farm).

Sanusi *et al*. (2015) revealed a high literacy level (95.4%) which is adequately enough to support information on technology use. Results further revealed that the major constraints encountered by the farmers are scarcity of quality brooding stocks (26%); paucity of capital (19%) and high costs of feeds (17%). Lesser perceived problems are high labour costs; poor storage facilities and mortality rate due to diseases.

Abbas (2015) showed that 63% of the fish farmers were still within the economically active age bracket of 20-49; 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 practiced monoculture while 12% practiced polyculture. Significant determinants of intensity of fish farming were pond size (0.0004), number of ponds (0.1051), feed (0.6411), start-up capital (-0.6771), labour (-0.0003), years of experience (0.0105) and level of education (0.0169). An average

quantity of 3,097.00 kilogram of table size fish was harvested from an average pond size of 353.00m2 at the end of the production cycle. The net farm income analysis showed that fish farming was profitable in the study area with a profit of N2, 432.37/m2 being realized by a farmer at the end of the production cycle.

Nandi *et al*. (2014) observed that 42% of the farmers lived in rented apartments while 26% occupied their own apartments of single rooms (73%), with iron sheet roof (62%), floored with cement concrete (81%). The major source of water was borehole hand pump; with farmers using unauthorized refuse heaps and covered pit latrines. Farmers' annual income averaged N137,500 (881.41 USD) which is below the annual minimum income of an average Nigerian. Poverty index was 0.867, resulting to a poverty gap index of 0.629, implying high poverty incidence. Respondents' mean age was 42 years; with average household size of 5 people; 83% were literate; with 17 years of fishing experience. This indicates that fish farmers in the area were young, literate and experienced.

Moni *et al*. (2014) show that Recognizing the importance of small scale fish farming in the region, present study suggest government and non-government organizations ensuring efficient marketing, expanding training program and ensuring supply of quality fish fry and fingerlings.

Mondal *et al*. (2013) revealed that how fish farmers can achieve positive sustainable livelihood through access to a wide range of livelihood assets. Higher economic return (BDT 1,19,360/ha/year) and social benefits were found to be gained by the fish farming community through human capital development. Lack of operating capital, vulnerability and insufficient institutional support were identified as major constraints to long term sustainability.

Paul *et al*. (2013) revealed that most of the fishermen were belonging to the age groups of 35-40 years old (30%) in Birulia and 40-45 years old (56%) in Boroibar.

Pravakar *et al.* (2013) investigated, the status of fish farming and livelihood of fish farmers in the Shahrasti Upazila, Bangladesh from February to September, 2010. Indian major carps and exotic carps were mainly cultured where 10% ponds were seasonal and 90% perennial. About 20% of fish farmers were involved in fish farming as their primary occupation while 45%, 25% and 10%were involved in business, agriculture and service respectively. About 94% of the fish farmers reported their socioeconomic conditions were improved through fish farming.

Sheheli *et al.* (2013) investigate the existing status and practices of fish farming. Most of the farmers (89%) made profit from fish production. Farmers have improved their socio-economic conditions through fish production which plays an important role in increasing income, food production and employment opportunities. The impact analysis 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).

Joadder *et al.*, (2013) demonstrated that, most of the farming (46%) were established within last ten years. Fifteen different fish species were cultured. Three types of farm were observed, such as own (48%), leased (38%) and both (14%). Fish farming (58%) was the major income source for farm owners. Most of the (72%) farms depend on underground water. Total fish productions have gradually been increased in all the farms. The benefits of fish farm owners were increased in income (92% farm owners), social status (74% farm owners), employment opportunity (58% farm owners), ingestion of fish (42% farm owners) and poverty alleviation (70% farm owners).

Olaoye *et al*. (2013) revealed that the mean age, household size and fish farming experience were 46 years, 6 persons per household and 9.3 years respectively.

Pandey *et al*. (2013) revealed that the majority of fish farmers belonged to middle age groups with medium level of education, family size, land holding, experience in fish farming and income. The study identifies the lack of visits; lack of farmer friendly literature; lack of training and capacity building; inadequate financial support; poor implementation of schemes; high wages and labour cost as some of the constraints.

Baruwa *et al*. (2012) obtained revealed that, both aquaculture and artisanal fisheries were profitable in the study area as depicted by gross margin and benefit-cost ratio of (N104, 392.07; 1.34) and (N 271, 175; 1.36) (N, Nigerian Currency, N157 = 1$US) respectively.

Belton (2012) survey that the thirty fish farmers were selected randomly and data were collected through questionnaire interview at the farm house or pond sites. Data analysis revealed that the average pond size was 0.83 ha with a range from 2.5 ha to 15 ha. Overall, 80% of the fish farmers practiced polyculture while only 20% farmers practiced monoculture.

Debnath *et al.* (2012) the production performance of white fish from traditional and modified traditional culture system of three upazila in Patuakhali district was compared. Average survival rate of traditional farming system was found as 62±6.21%, 65±5.25% and 61±11.25% respectively in Patuakhali sadar, Galachipa and Mirzaganj and that of improve traditional farming system was found as 76±5.16%, 80±4.97% and 77±5.87% respectively. The benefit cost ratio of traditional farmer: improve traditional farmer = 1:4.24. From the result it can be assumed that utilization of improve technology can increase the fish production two and half time more than that of current production.

Rahman *et al*. (2011) reported that fish farming has considerable contribution on household income of the farmers. They conclude that policy makers in the fisheries sector should consider the recognized factors for rapid growth of fish farming in rural Bangladesh.

Longoni (2011) 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.

Dey *et al.* (2010) survey that, the average production of a farm is 42 kg/year and the average yield is 1mt/ha/year. The annual production in small hold fish farms in Mozambique was estimated as 179mt in 2007 and multiplying the number of ponds with the average production of 25 kg/pond/year derived this number.

Gupta (2010) conducted that were interviewed for social characteristics, water quality, 64% were illiterate They used homemade feed prepared by mixing rice bran, mustered oil cake and wheat bran.

Shirajee (2010) in their study identified that, 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 favourable for the rapid expansion of aquaculture. This is mainly due to the recent rapid advances in seed and feed production.

Hossain *et al*. (2009) conducted a survey and they found that the average annual household income of the LO fishermen ranges from Tk. 77396-96888 whereas average annual household income of the LL fishermen ranges from Tk. 36407-37990 which is

much below the poverty line. Average fish consumptions for all types of farmers are 1.38 kg/capita/month.

Ali *et al.* (2009) survey 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 of 31 to 40 years and 45% household had family members 4 to 5, represented 57.5% nuclear and 42.5% joint family, average education level of 8.2 years schooling.

Pouomogne (2008) found that, annual fish production from earthen ponds was estimated at 950 tonnes, of which more than 90% is produced by small-scale farmers.

Njaya (2007) conducted on a group of 19 associations and 39 private fish farms with 218 ponds, stocked with *Oreochromis niloticus*. The fish farms are 200 - 600 m2. The production of about 4.000kg/year was achieved from small seasonal homestead ponds through integrated use of locally available biological resources.

Sarker *et al*. (2006) in their study identified that lack of technical knowledge on pond management, unavailability of credit, poor extension service and lack of information has been identified as the barriers of pond fish culture entrepreneurships. Findings of their study also show that there are negative significant relationships of education, income from pond fish culture, availability of information sources and knowledge on pond fish culture with the barriers of pond fish culture entrepreneurships. Age and family size have positive significant relationships with the barriers of pond fish culture entrepreneurships.

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, analysed and ranked on the basis of farmers' perception

Hossain (2006) in a study in Mymensingh area 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 pangas along with Indian major carps and exotic carps.

Zaman *et al.* (2006) stated**,** conducted a study in Mohanpur Upazila, Rajshahi to determine the pond fishery resources and the livelihood status of fish farmers for a period of nine months (August 2005-April 2006). Data were collected through personal visit and interviews following a detailed questionnaire. Pond sizes of the area 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. 50,000-1,00,000 and the rest 25% earned above Tk. 1,25,000 annually.

Ahmed (2003) conducted a study mainly to assess the different culture practices and to determine the relative profitability of pond fish production in Mymensingh district. He observed the average stocking density of carp fingerlings to be 9,537-10,445 ha-1. The average fish production cost was estimated at Tk 23,210- Tk 24,790 ha-1. While the net return was found to be Tk 59,119- Tk 56,484 ha-1 yr-1. 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 a survey of fisheries resources in Mymensingh, Jessore and Laxmipur region. Fish production was found 1-2 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 are 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) found that, the farmers of Trisal upazilla, 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.

Lewis (1997) Survey that, annual fish production from these waterbodies, which are mostly perennial (72%), is about 546 kg-ha -1. However yields of more than 3 t ha-1 year 1 can be achieved using low cost, semi-intensive technologies. This potential can be easily realized if stronger extension support is given to farmers owning and operating the existing small waterbodies. Moreover, promotion of fish culture in these waterbodies would not be difficult as 57% of these waterbodies do not need major investment and 89% of the farmers are willing to spend money in fish culture. Nevertheless, conflict amongst shareholders in multiple ownership ponds is still a major constraint. New

institutional arrangements need to evolve which can still retain joint access without compromising productivity.

Kanak (1997) found the highest gross production of fish (2623.02 kg/ha) over the period of 6 months in polyculture of Indian major carps, Chinese carps and *Pangasius sutchi* in the earthen ponds receiving supplementary feed (50% wheat bran, 45% mustard oilcake and 5% fish meal) at the rate of 3% the total body weight daily.

Hossain *et al*. (1997) obtained the average production of carp 2,133.3 kg ha^{-1} in 105 days in a mixed culture system using supplementary feed (rice bran and mustard oil cake 1:1) at the rate of 5% of total body weight.

Shohag (1996) studied in Nandail Thana of Mymensingh district and showed that pond fish production under supervised credit system was mainly based on stocking of fingerlings, use of fertilizers and artificial feed and human for different operation in the study area. The average annual fish production was 5,229.44 kg per hectare. Low product price, lack of water during dry season, and lack of desired fingerlings in proper time were identified as the dominant problems in pond fish production.

Rahman (1995) carried out a study in Netrokona Sadar, Purbadhala and Kendua of Netrokona district and found that ownership of pond, number of species and human labor had negative impact on pond fish production, while depth of pond water, farm size, fish seed, fertilizer and artificial seed are statistically significant in explaining the variation in fish pond production in study area. He found the yield per hectare yearly was 943 kg and average gross and net return were Tk. 49,515 and Tk. 39,412 respectively. He also observed that medium and small farmers had the highest gross and net returns because of using higher amount of inputs compare to large farmers.

Sharma and Thakur (1988) evaluated the performance of carp culture technology in India by included randomly selected 25 ponds. Analysis of data showed that production from village ponds (0.05-0.07ha) touched an average of 1,816.72 kg/ha indicating six-fold increase from the initial biomass-mark production average of 306.09 kg/ha.

Haque and Razzaque (1998) conducted a polyculture experiment maintaining the stocking density and ratio of rohu, catla, silver carp, mrigal, common carp and Thai sarputi at the rate of 8,000-1,000 ha^{-1} in the ratio of 16:12:15:12:15:30 and reported the yield of 18-20 kg $decimal^{-1}$ in 6 months (4,500-5,000 kg fish ha^{-1} in 6 months).

CHAPTER III

MATERIALS AND METHODS

CHAPTER III

MATERIALS AND METHODS

This chapter deals with the methodology which is an important part of scientific research. Proper methodology is crucial that enables the researchers to collect effective and reliable information and to analyze the information properly in order to achieve a decent conclusion. The methodology includes the selection of the research title and objectives, selection of research area; identify target groups, data collection and selection of analytical method.

3.1 Study period

The survey was conducted for period of October 2016- March 2017 to collect the data from the fish farmers of the selected villages of Birganj upazila of Dinajpur districts.

3.2 Selection of study site and farmers

A total of 67 small scale fish farmers were randomly selected from the three villages of Moricha Union Parishad of Birganj upazila. For this research work, Maricha union of Birganj upazila has been selected purposively because most of the people in that area are under a project funded by (NGO) Caritas Bangladesh, Dinajpur. Three out of 33 villages in maricha union named khamar khori kodom, Dabra Jineshori and shalbari Dabra were surveyed for this study (Fig. 3.1). Birganj is located "between 25°48' and 26°04' north latitudes and in between 88°29´ and 88°44´ east longitudes". Birganj upazila of Dinajpur district with an area of 413sq km, is bounded by Thakurgaon sadar and Debiganj upazilas on the north, Kaharole upazila on the south, and Khansama upazila on the east, Bochaganj, Pirganj on the west. The main rivers Atrai, Punarbhaba; paisa, lal and

chandraghorer beels are notable. Fish farmers were randomly selected that included a total of 67 female fish farmers.

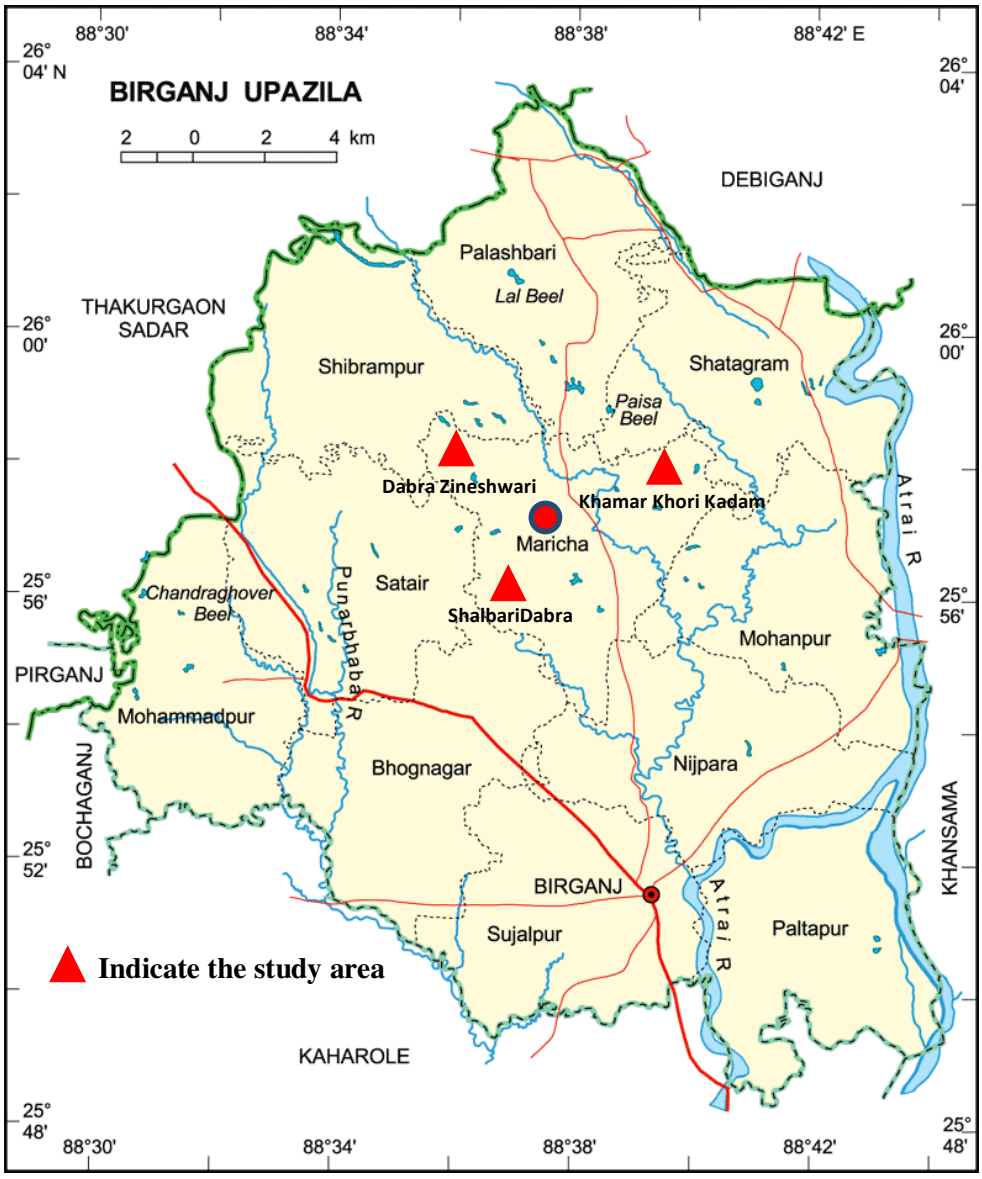

Figure 3.1 Map showing the study areas of Birganj Upazila, Dinajpur: Dabra Zineshwari, Khamar Khori Kadan and Shalbari Dabra villages of Moricha Union Parishad

3.3 Questionnaire preparation

The questionnaire was prepared emphasizing the objective mentioned above. Before finalization of the questionnaire, it was pre-tested through a field visit. Then the questionnaire was finalized and prepared for survey work. The final questionnaire accommodated information on of farmers genders, age, education, training exposure, pond area, water depth, availability of water throughout the year, species cultured, management strategies and production status by using the semi-structured questionnaire (Appendix 1). The questions were specific and were free from any kind of influence.

3.4 Data collection

The data were collected by survey method. For data collection, a reasonable size of samples was considered. Firstly, a survey schedule was prepared. The farmers were interviewed at their pond sites and each interview required about an hour (Fig. 3.2). To find out information about the socio-economic condition before involving in fish cultivation and after starting fish cultivation, as well as to identify problems and prospects of fish cultivation, data were collected through interview method.

Figure 3.2 Interviewing an women respondent during data collection

3.5 Analysis of Data

The collected data were cheeked and cross-checked for reliability and accuracy. All the collected data were edited, coded, entered into Microsoft Excel spread sheet. All the collected data were carefully summarized and scrutinized and finally analyzed the summarized data in tabular form. The qualitative data was converted in to quantitative numbers whenever required after processing, scaling and indexing of the necessary and relevant variables to perform subsequent statistical analysis for drawing inferences. The results presented in percentile, pie chart & bar graph were analyzed and drawn by using MS Excell 2007 and SPSS (Ver. 22).

CHAPTER IV

RESULTS

CHAPTER IV

RESULTS

4.1 Demographic information of the selected farmers

The socio-demographic characteristics included family size, age, educational qualification, experience of fish farming of the farmers.

4.1.1 Family size

The minimum and maximum family member's scores were 2 and 8 respectively. The average family members were 5. The highest family size (73.13%) consisted of 4-6 person in the family (Fig. 4.1). According to family members scores the respondents were classified into three groups categories like family member between 1-3 coded as1, family member between 4-6 coded as 2 and family members between 7-10 coded as 3.

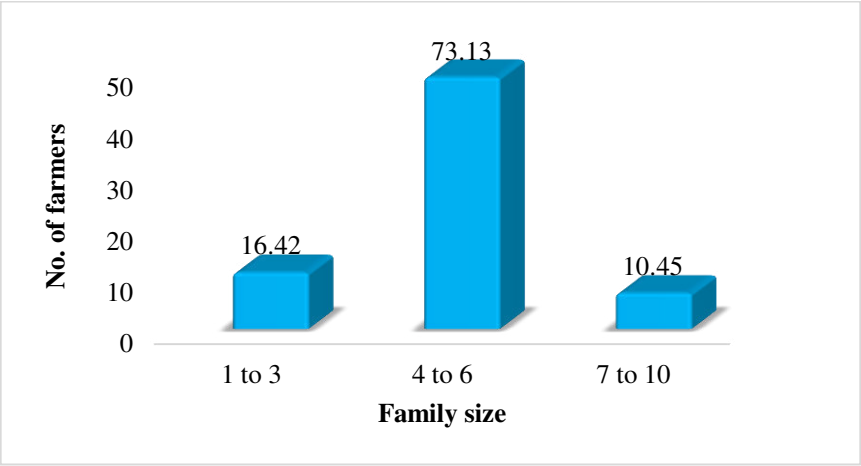

Figure 4.1 Family Size of the selected fish farmers

4.1.2 Age of farmers

The age of the respondent farmers varied from 22 to 68 years with a mean of 36.58 years. The respondent farmers were classified into five categories on the basis of their

age: age between 20-30 years coded as 1; age between 30-40 years coded as 2; and age above 40-50 coded as 3; age between 50-60 years coded as 4age between 60-70 years coded as 5. On the basis of the age, the respondents were distributed in Table (4.1). Field survey shows that 52.24 percent of the respondents belong to the age group of 30-40, which occupies the dominant portion. Second major group is 40-50, where 17.91 percent of the respondents belong to. Again 16.42 percent of the respondents belong to the age group of 20-30; 10.45 percent of the respondents are observed in the age group of 50-60 and 2.99 percent of the respondents are observed in the age group of 60-70. It is observed that 80 percent of the respondents' age in the study area is above 25 years.

Table 4.1 Age, frequency and percentages of the selected farmers in each category

Age of farmers (years)	Frequency (n=67)	Percent
20-30	11	16.42
30-40	35	52.24
40-50	12	17.91
50-60	7	10.45
60-70	2	2.99

4.1.3 Experiences of farmers in fish culture

The experiences of selected fish farmers in fish culture activities were presented in Table 4.2. The survey revealed that 36% fish farmers have no fish farming experience; 24 percent fish farmers have 1-5year fish farming experience; 19 percent fish farmers have 6-10 years fish farming experience; 16 percent fish farmers have 11-15 years fish farming experience; 5 percent fish farmers have above 15 years fish farming experience. In the survey area most of the fish farmers are non-experienced. It is important that 36% farmers were expecting training regarding fish farming.

Table 4.2 Experiences of selected fish farmers in fish culture

Experience in fish farming	Number of farmers(n=67)	Percentage (%)
Non Experienced	24	36
1-5 years	16	24
6-10 years	13	19
11-15 Years	11	16
15+ years	3	5

4.1.4 Educational qualification

The educational status of the fish farmers was also surveyed. The distribution of the respondents on the basis of their educational qualification has been presented in Figure 4.2. The educational qualification scores of the respondents were range from 1 to 4. Based on the educational qualification scores, the respondents were classified as 'illiterate (0)' 'primary (1)' 'secondary (2)' 'SSC (3)' and 'HSC (4)'. The highest number of farmers (25) 37% had complete primary education level, the lowest number of farmers had complete HSC level of education, and 15% farmer were illiterate.

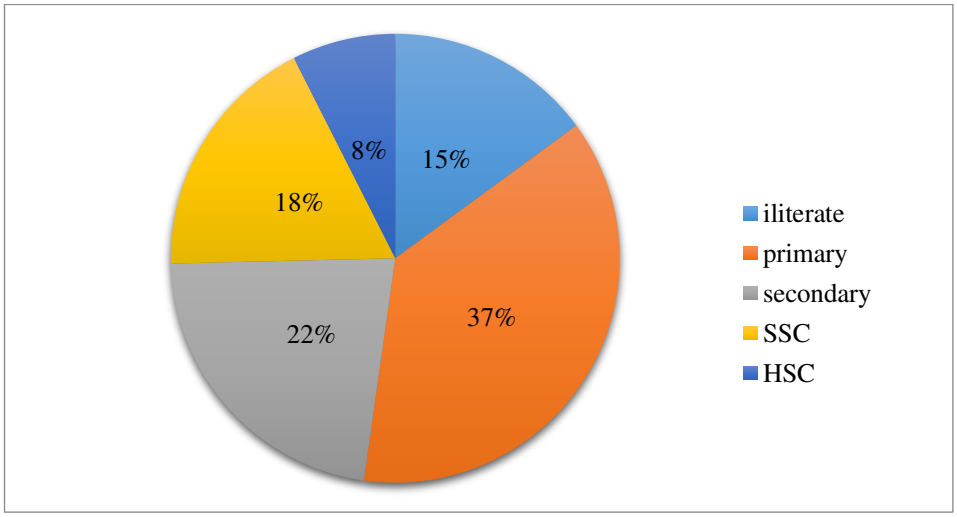

Figure 4.2 Level of educational qualification of the selected fish farmers

4.2 The characteristics of the pond

4.2.1 Area of ponds of the selected fish farmers

The area of the pond depends on the farmer demand. The area of the ponds is an important factor manipulating the use of inputs in the fish pond. A suitable pond size is required to minimize the production cost and maximize the profit. Small ponds are uneconomical in the sense that its operating costs are high, on the other hand, very large ponds often become unmanageable. An optimum pond size is, therefore, required to obtain the maximum yield. Optimum pond size may vary in different locations on the basis of physical and socio-economic conditions of a particular region. The survey showed that 31.34% farmers have pond size was less than 5 decimal; 52.24% farmers have ponds size belonged to 5 -10 decimal; 14.49% ponds size farmers belonged to 11 - 15 decimal and 1.49% farmers have pond size was above 15 decimals (Table 4.3). The highest 52.24% of the farmers have pond size 5 to 10 decimal (Table 4.3).

Table 4.3 Area of ponds in the study area

Area of ponds(decimal)	Number of farmer (n=67)	Percentage (%)
<5	21	31.34
5 to 10	35	52.24
11 to 15	10	14.93
>15	1	1.49

4.2.2 Depth of the pond

The majority of the pond 29.4% in the study area were 5 ft. Lowest number of pond 1.5% in the survey area was 1.5 ft depth (Table 4.4) and Figure 4.3 showed the depth of pond of the selected farmers.

Table 4.4 Depth of the ponds of the selected fish farmers

Depth of the pond (ft)	Number of pond n=67	Percentage (%)
1.5	1	1.5
2.5	2	2.9
3	15	22.1
4	18	26.5
5	20	29.4
6	6	8.8
7	4	5.9
10	1	1.5

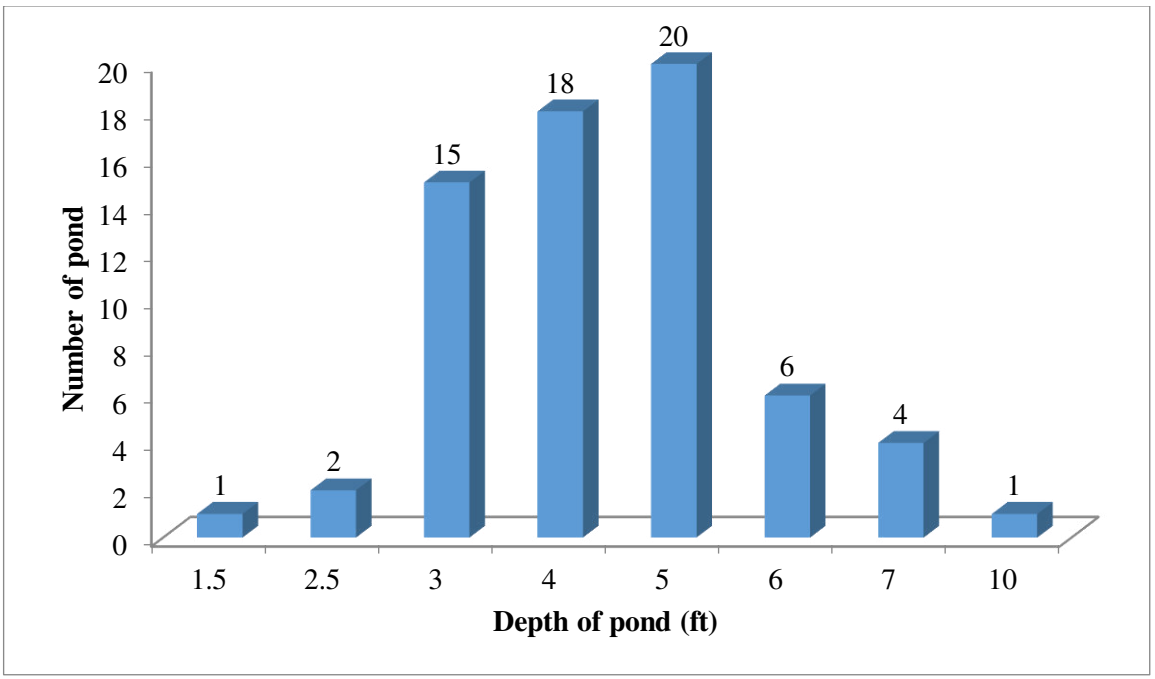

Figure 4.3 Distribution of ponds based on the depth of water

4.2.3 Availability of water

Availability of water is very important for fish culture activities. Success of pond aquaculture depends on the availability of sufficient amount of good quality water. Based on the availability of the water, the ponds were grouped into two categories; a) availability of the water throughout the year and b) seasonal ponds. 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 (Fig. 4.4).

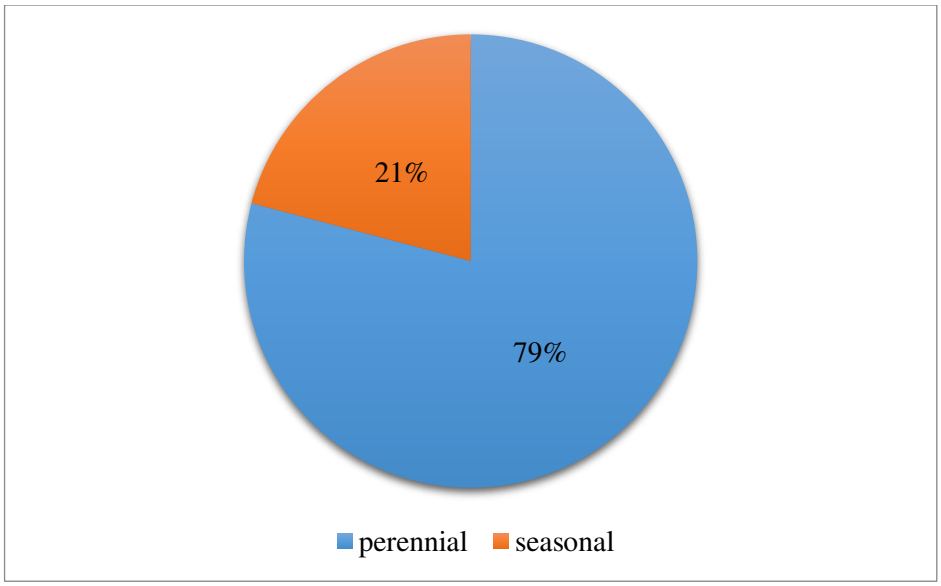

Figure 4.4 Availability of water in the selected ponds

4.2.4 Species preferences by the selected farmers

In the study area, a great diversity of the species was found to culture in the ponds. Mostly in the homestead aquaculture Indian Major Carps (IMCs) is dominated, but in this study it was found about 13 species were stocked. The species included Indian Major Carps and Small Indigenous Species of Fish (Table 4.5), where 63 out of 67 farmers stocked Tilapia in their ponds and followed by Rohu (44), Silver Carp (43), Common carp (41), mola (38), Thai sarpunti and Magur (35), Shing (34), Koi (33), Bighead carp (13), Catla (12), Bata (9) and Grass Carp (6).

Table 4.5 List of fish species are found to be cultured by the selected farmers

Local name	English common name	Scientific name	number of fish stocked
Mola	Mola Carplet	*Amblypharyngodon microlepis*	38
Tilapia	Indian Tilapia	*Oreochromis mossambicus*	63
Shing	Stinging catfish	*Heteropneustes fossilis*	34
Magur	Walking Catfish	*Clarias batrachus*	35
Koi	Climbing perch	*Anabas testudineus*	33
Sarpunti	Olive barb	*Puntius sarana*	35
Common Carp	Indian Major Carp	*Cyprinus carpio*	41
Bighead Carp	Indian Major Carp	*Hypophthamichthys nobilis*	13
Grass carp	Indian Major Carp	*Ctenopharyngodon idella*	6
Catla	Indian Major Carp	*Catla catla*	12
Bata	Bata	*Labeo bata*	9
Silver carp	Indian Major Carp	*Hypophthalmichthys molitrix*	43
Rui	Indian Major Carp	*Labeo rohita*	44

4.2.5 Number of species in individual farmer's pond for polyculture

All 13 species listed in the previous section were not found to be cultured by individual farmers, it was found that the polyculture system consisted for 3 to 10 species. Table 4.6 presented the number of species by selected fish farmers. Only 3% farmers stocked 10 species in her ponds and followed by 9 species (5%), 8 species (10%), 7 species (12%), 6 species (18%), 5 species (22%), 4 species (19%) and only 3 species (6%).

Table 4.6 Number of species stocked in the farmer's cultured ponds

Number of species	Frequency (n=67)	percentage
3	4	6
4	13	19
5	15	22
6	12	18
7	8	12
8	10	15
9	3	5
10	2	3

4.3 Pond management strategies

4.3.1 Water quality management

Water quality testing is an important part of environmental monitoring. When water quality is poor, it affects not only aquatic life but the surrounding ecosystem as well. These sections detail all of the parameters that affect the quality of water in the environment. These properties can be physical, chemical or biological factors. Physical properties of water quality include temperature and turbidity. Chemical characteristics involve parameters such as pH and dissolved oxygen. Biological indicators of water quality include algae and phytoplankton. These parameters are relevant not only to surface water studies of the ocean, lakes and rivers, but to pond water, groundwater and industrial processes as well. In the study area, the all farmer not managed water quality parameter.

4.3.2 Use of Feed

In the study area, it was perceived that the pond fish farmers used wheat bran, rice bran, helencha, malancha, mustard oilcake and molasses in their fish ponds. It was also noticed that some farmer used commercial feed which available in the local market. Study showed that 76% farmer used feed in their culture pond and remaining 24% farmer totally not used feed in their culture pond.

Table 4.7 Use of Feed by the selected fish farmers

Feed use	**Frequency (n=67)**	**percentage**
Yes	51	76
No	16	24

4.3.3 Purpose of fish production

In the survey area, most of the fish farmer's used the produced fish for consumption purposes to full-fill their nutritional demands. 92.5 % farmers use the fish only for consumption purposes, the remaining farmers (7.5%) used for both consumption and sales (Table 4.8).

Table 4.8 Use of produced fish by the selected fish farmers of the study area

Purpose of fish production	Frequency(n=67)	Percent
Consume	62	92.5
Sale + Consume	5	7.5

4.4 Harvesting of Fish

In the study area, most of fish farmers harvested their produced fish from their pond by using cast net, borsi, jhaki jal etc. All the farmers in the study area used to harvest fish partially from their cultured ponds. The harvesting was associated mostly with the need and availability of guest members in their home.

4.5 The fish production status

4.5.1 Production of fish

In the study area, the species wise percent fish production shown in (Figure 4.5) from the selected pond during the data collection. Among the fish production, Tilapia revealed highest production with 22% followed by silver carp (18%), rohu (13%), common carp and Thai sarpunti (11%), koi (6%), shing (4%), bighead carp, magur and mola (3%), and the least was catla, bata, and grass carp (2%), respectively.

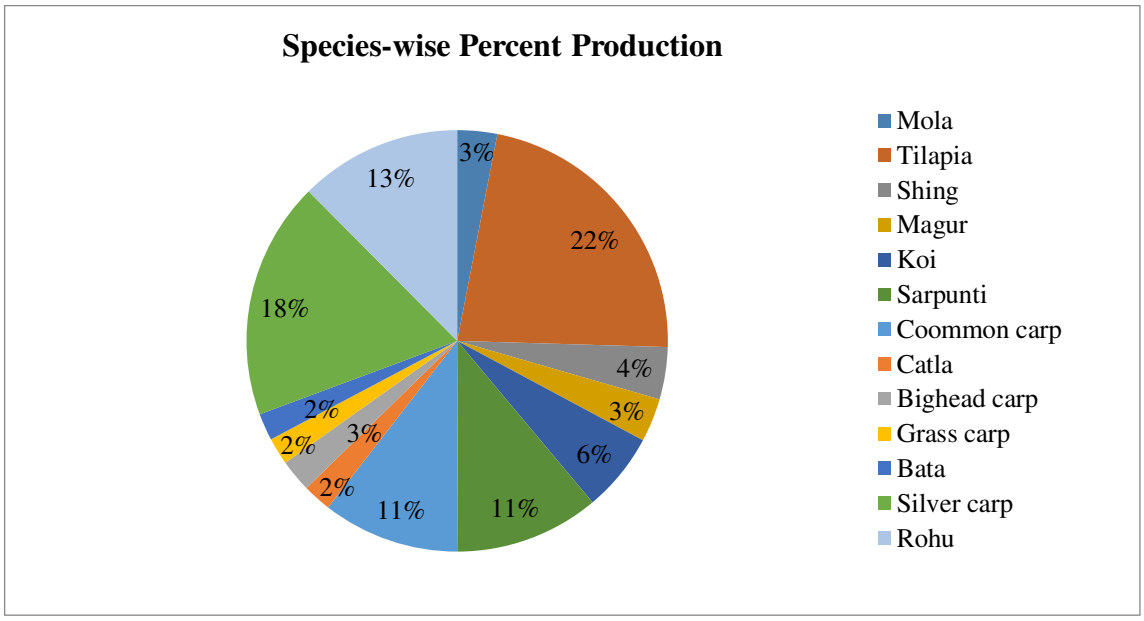

Figure 4.5 Species-wise percent fish production in the selected study area

4.6 Problems of fish farming

From the survey it was found that the fish farmers in the study area are facing a number of technical and social problems in fish farming. The main problems are lack of capital, high price of quality fish seeds and feeds, less protein in feed, poor technical knowledge, lack of social awareness about the benefits from aquaculture etc. However, the farmers reported some other problems, which are water quality deterioration with massive micro algal blooms, presence of aquatic vegetation, lower fish growth comparing to previous year. Some farmers also reported that, the fish stock destroyed by the flood and poaching.

CHAPTER V

DISCUSSION

CHAPTER V

DISCUSSION

Considering the objectives, three villages of Birgonj Upazila of Dinajpur District was purposively selected for the study. From the study area 67 fish farmers were randomly sampled. Using pre-tested interview questionnaire data were collected through face to face interview. The purpose of this chapter is to discuss the findings and comparison to other results with present findings of this study. The results obtained from the study are discussed as follows:

5.1 Family size

In the present study area, the average family size was 5. The total number of family members ranged from 2 to maximum 8. The highest 73.13% farmer have family size between 4-6 members. Olaoye (2013) reported that 68.5 population had household size between 4 to 7 members, which more or less same to the present study.

5.2 Age of farmers

The age of the respondents varied from 22 to 68 years with a mean of 36.58 years in the present study. The field survey shows that 52.24 percent of the respondents belong to the age group of 30-40. It was observed that 80 percent of the respondents' age in the study area was above 25 years. Rana (1996) found in his study in Sirajgonj district that 70% ponds farmers were in 18-45 age groups. Olaoye (2013) reported that, 37.8 percent of the respondents belong to the age group of 31-40, which was less than to the present study, because most of the fish farmer in the study area were young. Paul *et al.* (2013) revealed that most of the fishermen were belonging to the age groups of 35-40 years old (30%) in Birulia which also less than to the present study.

5.3 Experiences of farmers in fish culture

Fish farming experience is play significant role for higher level of fish production. If farmer wants to get higher fish production, fish farming experience is essential. The average fish farming experience was found 5.78 years. According to the survey 24% farmer highest fish farming experience belongs to 1-5 years. The lowest 5 percent fish farmers have above 15 years fish farming experience in the present study. Pandey (2014) survey that 69.16% farmer had highest fish farming experience 4-10 years. The lowest 12% percent fish farmers have fish farming experience above 10 years, which was more than present study. Olaoye (2013) survey that 40.5% farmer highest fish farming experience belongs to 11-15 years, on the other hand 8.1% percent fish farmers has more than 10 year fish farming experience, which was more or less similar to the present study. Nwosu and Onyeneke (2013) revealed that 18% of the farmers had 8-14 years of experience in fish farming, while only 12% of the fish farmers had over 15 years of experience.

5.4 Educational qualification

Educational qualification of farmers can play a significant role for the successful pond management strategies. From the present study it was found that majority (37%) of the fish farmers had complete primary education level, 22% of the fish farmers had secondary education level, 18% had SSC and very lowest 8% had HSC education while about 15% of the farmers was illiterate. Gupta (2010) survey that most of the adivasi farmers (64%) were illiterate, 15.3% had primary level, 19.3% had secondary level and only 1.3% had above secondary level of education. Olaoye (2013) study 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%.

5.5 The characteristics of the pond

5.5.1 Pond area

According to the present study, 31.34 percent ponds was less than 5 decimal; 52.24 percent ponds are 5 -10 decimal; 14.49 percent ponds are 11 to15 decimal and 1.49 percent pond above 15 decimals. In a previous study Pandey (2014) by who reported that the majority (46.66%) of fish farmers had medium size of ponds (1-2 ha), followed by small (43.34%) and large (10%). In a separate study Hossain *et al*. (1992-94) reported that 82% ponds of the farmers were up to 0.20 ha. According to BBS (1984) 80% ponds in rural areas are less than 0.13 ha. Khan (1986) stated that fish culture efficiency varied with the size of ponds.

5.5.2 Depth of the pond

In the study area, the mean depth of the pond 4.44 fit. The highest 29.4% pond depth in the study area are 5 fit. Lowest 1.5% pond depth in the survey area 10 fit. Khan (1986) stated that the average depth of pond in the study area was found 3.20 meter. According to DoF (2010) the average depth of ponds in Bangladesh is between 2 to 5 meter.

5.5.3 Availability of water in the selected pond

Water is an indispensable input in fish rearing. Fish need water to grow and that is one of the reasons why adequate and constant source of water is a must for every farmer that wants to achieve the best in terms of raising fish either for fingerling or table size. In the survey area most the farmers have perennial pond (79% pond) and rest seasonal (21% pond). The mean of the availability of water 1.2

5.5.4 Number of species in individual farmer's pond for polyculture

In the present study, only 3% farmers stocked 10 species in her ponds and followed by 9 species (5%), 8 species (10%), 7 species (12%), 6 species (18%), 5 species (22%), 4 species (19%) and only 3 species (6%). The highest 19% farmers were stocked 4 species.

5.5.5 Use of Feed in the culture pond

The present study showed that 76% farmer used feed in their culture pond and remaining 24% farmer were not used feed in their culture ponds. Fish farmers used wheat bran, rice bran, helencha, malancha, mustard oilcake and molasses in their fish ponds. Saha *et al.* (1995) also observed that the farmers used rice bran and oil cake in rice-fish farming. Akter (2001) observed that the total rate of feed used was 6,751 kg/ha which were separately given as rice polish (1,598 kg), wheat bran (870 kg), oilcake (2,540 kg), vitamin (41 kg) and fish meal (1,702 kg). In the study area most of the farmer was used domestic feed and sometime used commercial feed which not adequate information to the farmers.

5.6 Fish harvest

All the farmers in the study area used to harvest fish partially from their cultured ponds. The harvesting was associated mostly with the need and availability of guest members in their home. Parvin (2011) was found that about 43.33% farmers done partial harvest to sort out fish by size or weight and 56.7% farmers not followed partial harvest of fish. Ahmed (2003) stated the best harvesting season was April to July and found that 65% of farmers harvested their fish completely while only 35% of farmers were harvested their product partially. Rahman (2003) observed the best period of harvesting was from October to January.

5.7 Fish production

Among the species wise fish production, Tilapia showed highest production with 22% followed by Silver carp (18%), Rohu (13%), Common carp and Thai sarpunti (11%), Koi (6%), Shing (4%), Bighead carp, Magur and Mola (3%), and the least was catla, bata, grass carp (2%), respectively. Akter (2001) conducted a survey in Trishal upazila under Mymensingh district and found that average production of was 20,112 kg/ha. Rahman *et al* (1992) obtained 41.36 kg/decimal (9.97 t/ha) fish in a polyculture experiment with pangasius and carps. In a separate study by Shohag (1996) who reported that the average annual fish production was 5,229.44 kg.

CHAPTER VI

SUMMARY AND CONCLUSION

CHAPTER VI

SUMMERY AND CONCLUSION

The northern district-the greater Dinajpur is situated at higher level from the Bay of Bengal and also the dry part of Bangladesh. In this region more than half of the small ponds located close to homestead areas and beside farmers' fields had either been dug or renovated in recent times for the purpose of fish culture. Pond fish farming has been proved to be a profitable business than rice cultivation; so many farmers in rural areas are converting their rice field into aquaculture pond. Many pond fish farmers in rural areas have taken fish farming activities as their secondary occupation. In Birganj Upazila, fish are partially culture 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 necessary. Based on the above context, this research work is commenced on problem and constrains of small scale fish farming and its impact on the fish cultivators' families in three villages of Birganj Upazila. This study also seeks to understand how fish farming lead to improve the status and practices of fish farming as well as improve their livelihood.

The survey was conducted for period of October 2016- March 2017 to collect the data from the fish farmers of the selected villages of Birganj upazila of Dinajpur districts. A total of 67 fish small scale fish farmers were randomly selected from the three villages of Moricha Union Parishad of Birganj upazila. Fish farmers were randomly selected that included a total of 67 female fish farmers. The questionnaire was prepared emphasizing the objectives of the study. The final questionnaire accommodated information on age, education, training exposure, pond area, water depth, and availability of water

throughout the year, species cultured, management strategies and production status by using the semi-structured questionnaire. For data collection firstly, a survey schedule was prepared and the farmers were interviewed at their pond sites and each interview required about an hour. The collected data were cheeked, edited, coded, and entered into Microsoft Excel spreadsheet. The qualitative data was converted in to 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 revealed that the age of the respondent farmers varied from 22 to 68 years with a mean of 36.58 years. The highest family size (73.13%) consisted of 4-6 person in the family. The highest number of farmers (25) 37% had primary level of education, the lowest number of farmers had HSC level of education, and 15% farmer were illiterate. In terms of experience of fish farming, 36% fish farmers have no fish farming experience; 24% fish farmers have 1-5years fish farming; 19% fish farmers 6-10 years experience; 16% had 11-15 years fish farming experience; 5% had more than 15 years of fish farming experience.

The survey showed that 31.34% fish farmers had pond less than 5 decimal; 52.24% farmers had pond having the size range from 5 to10 decimal; 14.49% hand pond size with a range of 11 to15 decimal and pond size was larger than 15 decimals for only 1.49% farmers. In the study area, the mean depth of the pond was 4.44 with a standard deviation of 1.39. It was found that 79% ponds contained water throughout the year and 21% pond had water for a period of 6 to 8 months.

In the study area, a great diversity of the species was found to culture in the ponds. Mostly in the homestead aquaculture Indian Major Carps (IMCs) is dominated, but in

this study it was found about 13 species were stocked. The species included Indian Major Carps and Small Indigenous Species of Fish (Table 4.5), where 63 out of 67 farmers stocked Tilapia in their ponds and followed by Rohu (44), Silver Carp (43), Common carp (41), Mola (38), Thai sarpunti and Magur (35), Shing (34), Koi (33), Bighead carp (13), Catla (12), Bata (9) and Grass Carp (6). All 13 species listed in the previous section were not found to be cultured by individual farmers, it was found that the polyculture system consisted for 3 to 10 species. Only 3% farmers stocked 10 species in their ponds and followed by 9 species (5%), 8 species (10%), 7 species (12%), 6 species (18%), 5 species (22%), 4 species (19%) and only 3 species (6%).

Study showed that 76% farmer used feed in their culture pond and remaining 24% farmers totally did not use feed in their culture pond. None of the farmers were found to take any measures for maintaining proper water quality parameters in their ponds.

In the study area, most of fish farmers harvested their produced fish from their pond by using cast net, borsi, jhaki jal etc. All the farmers in the study area used to harvest fish partially from their cultured ponds. In the study area, species wise fish production was found highest in Tilapia with 22% followed by Silver carp (18%), Rohu (13%), Common carp and Thai sarpunti (11%), Koi (6%), Shing (4%), Bighead carp, Magur and Mola (3%), and the least was catla, bata, grass carp (2%), respectively. About 92.5 % farmers use the fish only for consumption purposes, the remaining farmers (7.5%) used for both consumption and sales.

The main problems are lack of capital, high price of quality fish seeds and feeds, adulterated feed, less protein in feed, poor technical knowledge, lack of social awareness on the benefits from aquaculture etc. Some farmers also reported that, the fish stock destroyed by the flood and poaching.

Recommendation

Based on the major findings of this study, the following suggestions are made to improve the fish production:

a) There is need for training to enhance farmer's skill about fish culture activities.
b) Training program should be arranged for the fish farmers in the study area with the help of govement and non-govement organization.
c) The pond side should high before be flooding in the area.
d) A numbers of hatcheries should be established for sufficient supply of fish fry.
e) Ensure food security; income and poverty alleviation programs in the study area.
f) Ensure to supply of high quality fish feeds
g) Apply lime to maintain water quality parameter like p^H
h) Ensure guards to reduce poaching and poisoning etc.
i) To ensure water quality management in the selected area.
j) Fisheries extension service should be strengthened to estimate the prospective growers and circulate booklets and pamphlets about update technologies of fish farming

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APPENDIX

APPENDIX

Questionnaire

1. Personal information of the farmer	
Name of the farmers :	Age of the farmer:
Number of dependents:	Experience of fish farming:
Number of beneficiaries :	Number of women associated:
Other sources of income (if any):	
Observation or comments (if any):	

2. Location of the pond	
District:	
Upazila:	
Locality	
Village:	
Walking distance between the home and fish pond	
Observation/comments (if any):	

3. Description of the fish pond	
1. Types of ponds:	
☐ Earthen closed pond	☐ Extensive open pond
2. Area of the pond:	Depth of the pond:
3. Availability of water	
☐ Throughout the year	☐ Perennial (In this case write the duration)
	If perennial then write the availability of water in each month (with depth)

4. Stocking of fish and management	
1. List of species stocked in the pond with number of each species stocked:	
2. Feeding of fish	
☐ Yes	☐ No
If yes then make a list of the provided feed:	
Duration of the feed provided:	
3. Observation and monitoring of water quality parameters	
☐ pH ☐ DO ☐ Temperature ☐ Transparency ☐ Ammonia ☐ Others If others, then write the name here:	
Observation:	

5. Harvesting and production	
Methods of harvesting:	
Mode of harvesting:	
☐ Partial harvest	☐ Total harvest
If partial harvest then write the number of harvest	
Quantity of harvest:	
Approximate size and weight of each fishes:	

Use of fish produced	
☐ Consumption	☐ Sales
Observation	

6. Technical Assistance			
1. Technical Assistance			
Have you received any technical assistance during pond preparation?			
☐ Yes		☐ No	
If yes, then write the source of the assistance:			
3. Frequency of the assistance			
☐ Monthly	☐ Quarterly	☐ Semi-annual	☐ Others
Observation/comments (if any):			

7. Environmental Aspects (If any)