Use of Pond Fish Farming Practices by the Farmers

A Thesis

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CERTIFICATE

This is to certify that the thesis entitled **"USE Of POND FISH FARMING PRACTICES BY THE FARMERS"** submitted to the department of Agricultural Extension and Information System, Faculty of Agriculture, Sher-e- Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka in partial fulfillment of the necessities for the degree of Master of Science(M.S.)in Agricultural Extension, embodies the result of a piece of bona fide research work carried out by **ASIF SIDDIQUE, Registration No. 18-09256** under my supervision and guidance. No part of the thesis has been submitted for any other diploma or degree.

I further certify that any facilitate or source of information, as has been availed of throughout the course of this investigation has been punctually acknowledged by the Author.

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DEDICATED
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List of Abbreviations and Glossary

AEIS   Agricultural Extension & Information System

BBS   Bangladesh Bureau of Statistics

BFTI   Bangladesh Foreign Trade Institute

DoF   Department of Fisheries Under MoFL

FAO   Food and Agriculture Organization

FRSS   Fisheries resources survey system

GDP   Gross Domestic Product

MT   Metric Ton

RDRS   Rangpur Dinajpur Rural Service

NGOs   Non-Government Organization

SPSS   Statistical Package for Social Science

UFO   Upazila Fisheries Officer

ABSTRACT

The continuous growth of the aquaculture sector has motivated numerous empirical studies investigating the use of pond fish farming practices. The main purpose of this research study was to identify use of pond fish farming practices by the farmers. The study was conducted in 4 villages of Panchbag union of Mymensingh district. The populations of pond farmers in these villages were 301, from which 101 samples were drawn by using sample size formula. An interview schedule was used for data collection during the period from February to March, 2021. Simple and direct questions with different appropriate scales were used to obtain information. Descriptive statistics such as mean, standard deviation, percentile and Pearson's Product Moment coefficient of correlation (r) was used for data analysis. The Majority (62.38%) of the farmers had medium practices for pond fish farming, whereas 23.76 percent farmers had high practices and 13.86 percent had low practices for fish farming. Out of ten selected characteristics, level of education, experience in fish farming, land possession, pond size, annual income from pond fish farming, commercialization of fish farming, training exposure and extension contact for fish farming had significant positive relationship with their use of pond fish farming practices. On the other hand, age and family size had no significant relationship with their use of pond fish farming practices. More research may be conducted by selecting other characteristics of the pond farmers to observe the relationships with their use of pond fish farming practices.

CHAPTER 1

INTRODUCTION

1.1 General Background

The fisheries sector is one of the most dynamic industries which have an incredible potentiality for future development in the agrarian economy of Bangladesh. Bangladesh is highly suitable for fisheries because of its climate and vast water resources (Shamsuzzaman et al., 2017). Bangladesh's fish sector has confirmed that poverty reduction and rural development is possible without major development plans and infrastructure projects. The fisheries sector in Bangladesh is generally divided into two sectors- inland fisheries and marine fisheries. Inland fisheries cover an area of 47.12 lakh ha, which has two sub-sectors, i.e. inland capture and inland culture (DoF, 2019).

Inland open water includes beel, river and estuary, Kaptai lake, flood plain and inland closed water comprises a pond, baor, pen culture, cage culture, shrimp/prawn farm, crab ,seasonal cultured water body covering approximately 3.89 and .82 million ha respectively but the total fisheries production was 1.23 and 2.48 million metric tons (MT) respectively which indicates inland open water body is about 4.75 times more than the inland closed water body but the total culture fisheries production is double than the inland capture fisheries production (DoF, 2019). Inland capture and culture fisheries shared to the overall fish production about 62.59 and 15.53 percent in 1983-84 respectively; whereas in 2018-19, inland capture and culture fisheries share to the overall fish production were 28.19 and 56.76 percent, severally (DoF, 2019).

As an agro-based country, the contribution of fisheries to the national economy has invariably been essential and as the primary source of animal protein, employment opportunities, food security, foreign earnings and socio-economic development (FRSS, 2017). In 2018-19, fisheries sector contributes 3.50% to the national GDP and more than one-fourth (25.72%) to the agricultural GDP (DoF, 2019). Last twelve years the average growth performance of this sector is almost 5.01% and consistent average aquaculture growth of around 8.59 percent. Bangladesh has ranked 3rd in the world in inland open water capture production and 5th in aquaculture production and 11th in marine fish production in 2018 (FAO, 2018). Presently Bangladesh ranks 4th in tilapia production in the world and 3rd in Asia. Bangladesh is currently self-sufficient in

fish production and has started to get global recognition as one of the biggest fish producers among the countries (FRSS, 2017). Fisheries sector also can contribute to the pro-poor goals directly by providing employment (as fishers and other connected trade) and a source of livelihood. The entire fisheries sector supports the livelihoods of more than 12 percent of the 165 million population of Bangladesh directly and indirectly (DoF, 2019). Freshwater fish farming plays an important role in the livelihoods of rural people in Bangladesh (Mazid, 2002). There are about 1.4 million women depend on the fisheries sector for their livelihoods through fishing, farming, fish handling & processing (BFTI, 2016). Additionally this sector has a high potential for the perspective of the economic development of the country. There is a close affiliation between agriculture growth and economic development (Mohsin et al., 2015).

Fish is the second most precious agricultural crop in Bangladesh and its production contributes to the livelihoods of many individuals. The culture and consumption of fish therefore has necessary implications for national income and food security. Fish is recognized as one of the most essential food items in the world. Fish is the primary protein source in Bangladeshi diet contributing about 60% of total animal protein while per capita fish consumption in the country reaches 62.58 gm., that is higher than their daily protein demand (60 gm.) as per the report of the Bangladesh bureau of statistics (BBS, 2017). Bangladeshi people are popularly remarked as "Mache Bhate Bangali" or "fish and rice makes a Bengali".

Back within the day, individuals would bathe within the ponds, wash their garments and clean their utensils. Fish from the ponds met the daily wants of protein. Many drank the water too.

Things have changed. Most of the fish produced in the country are cultivated in ponds currently. There are about 2.4 million ponds in Bangladesh which covers about 4 lakh ha area (DoF, 2019). International Food Policy Research Institute (IFPRI) says, Bangladesh has set a singular precedent of fish farming in ponds. Fish farming in ponds, however, has increased rapidly in twenty four districts of the country. Among them, the best increase was in Bogura, Sirajganj, Rajshahi, Rangpur, Mymensingh, Gazipur and Netrokona. Fish cultivation in ponds in those districts has magnified at a rate of ten per cent a year. On the opposite hand, fish farming in 'ghers' or enclosures in the south-western part of the country has diminished by twenty four per cent in the past two decades. Pond fish farming is obtaining standard there.

Apart from direct self-employment opportunities from fish farming, pond fish farming offers numerous livelihood opportunities for operators and workers of hatcheries and seed nurseries and for seed traders and different intermediaries. Pond fish farming has been proved to be a more profitable business than rice cultivation. So many farmers in rural areas are converting their rice fields into aquaculture ponds. Pond contributes about 19.74 lakh MT (45.04%) in the fisheries sector in 2018-19 which is almost half of the inland Aquaculture.
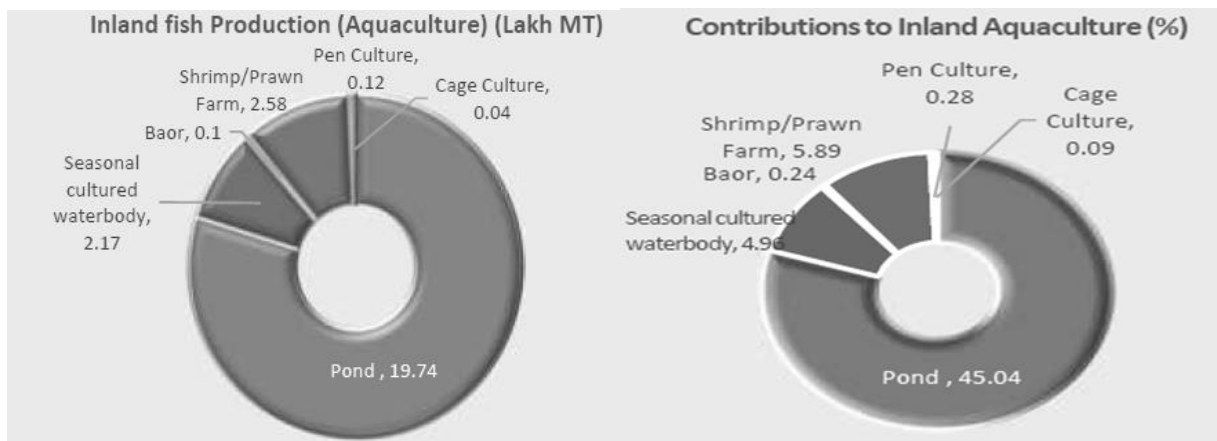
Figure 1: Pond contribution to inland aquaculture in 2018-19 (DoF, 2019)

Freshwater aquaculture contains mainly pond farming of carps (indigenous and exotic), pangas, tilapia, climbing perch and variety of different domesticated fish. Species-wise fish production of pond aquaculture in FY 2018-19 is shown within the following Figure 2:
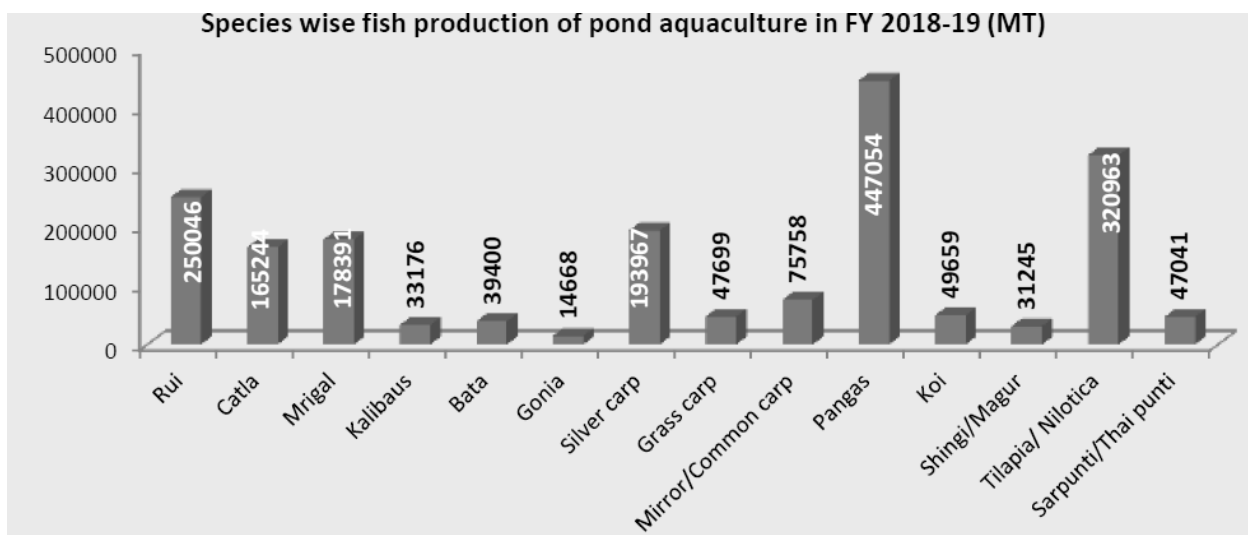
Figure 2: Species wise fish production of pond aquaculture in FY 2018-19 (DoF, 2019)

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In 2018-19 fiscal years Bangladesh exported around 4074.53 crore taka from fish and fishery products and shrimp aquaculture is notable in the export sector as it is a second export-oriented product in Bangladesh (DoF, 2019).

That means pond aquaculture contributes a lot to our economy and fulfills the nutritional demand of our extended population. Day by day the pond aquaculture sector expands in our country. In rural areas several pond fish farmers have taken fish farming activities as their secondary occupation and most of the individuals involved in fish farming improved their socio-economic condition through pond fish farming activities (Ahmed, 2003). Nowadays different scientific technology is applied in pond aquaculture for better fish growth and production. Fish production depends on farmers' practice on pond fish farming. There are also risks concerned in pond fish farming. The use of lime and different chemicals to wash the pond water is increasing. Then the quality of fish feed produced commercially in factories is also questionable. There's no assessment and monitoring of to what extent chemicals are employed in the ponds and also the fish feed. Making certain quality fish are a significant challenge, particularly once it involves exports. On these considerations, the present researcher felt the necessity to conduct this research on "Farmers' use of pond fish farming practices".

1.2 Statement of the Problem

In Bangladesh, the key constraints to extend fish production are lack of technical knowledge, practice, non-availability of credit and multi possession of ponds (Hussain, 1999). Fisher folks are thought as one of the most backward sections in our society. Information on the socio-economic framework of the fish farmers forms a good base for planning and improvement of the economically backward sector (Ofuoku et al., 2008). Lack of adequate and authentic information on socio-economic conditions of the target population is one of the serious impediments in the successful implementation of developmental programmes (Ellis, 2000). Aquaculture practice has become a promising and profitable methodology to realize self-reliance within the food sector and conjointly to alleviate poverty in developing countries like Bangladesh (Ahmed, 2003). A livelihood is sustainable when it can deal with and recover from stress and shocks and maintain to boost its capabilities and assets each currently and within the future (Chambers and Conway, 1992).

Considering the above fact, the study was designed to find out the following research questions regarding Farmers' use of pond fish farming practices.

❖ What is the extent of use of fish farming practices by the pond fish farmers?

❖ What are the characteristics of pond fish farmers?

❖ Is there any relationship between the selected characteristics of the pond fish farmers with their use of pond fish farming practices?

The questions indicate the need for conducting a research study entitled "Farmers' use of pond fish farming practices" in order to have an understanding of the practice of pond owners of pond fish farming. Such research information may be helpful to the pond owners, policy makers and government and non-government organizations dealing with fish production in this country.

1.3 Specific Objectives

1. To determine and describe selected characteristics of the pond fish farmer in the study area;
2. To assess the extent of use of fish farming practices by the pond fish farmers; and
3. To explore the relationship of each of the selected characteristics of the pond fish farmers with their use of fish farming practices.

1.4 Justification of the Study

To fulfill the need of time, dependency on culture fisheries, create employment opportunities, poverty alleviation of a massive number of peoples and foreign currency earning and pond aquaculture is developing to a great extent for that pond aquaculture is of greatest importance. For developing cultural system and future planning, the information regarding present aquaculture practices at the grass root level is absolutely important. The major focus of the study is to assess the practice of the farmers of pond fish culture. Different government and non-government organizations (NGOs) have been exerting efforts and allocating resources for production oriented research and also initiation and encouraging the rural people to increase pond fish culture. But research shows that most of the ponds in Bangladesh are not cultured in a scientific manner. Pond farmers' adoption of modern fisheries practices are necessary to plan and implement for pond fish production.

Considering the above findings, this study seeks to understand how fish farming leads to improve the status and practices of fish farming as well as improve their livelihood.

1.5 Assumption of the Study

The researcher had the subsequent assumptions in mind whereas endeavor this study:

❖ The respondents enclosed within the sample were capable of furnishing correct responses to the queries enclosed within the interview schedule.

❖ The responses furnished by the respondents were valid and reliable.

❖ The data collected by the researcher were free from any bias and they were normally distributed.

❖ Data were normally and independently distributed with their means and standard deviation.

❖ The researcher was well adjusted to himself with the social contiguous of the study area. Hence, the collected data from the respondents were free from favoritism.

1.6 Limitation of the Study

The study was undertaken with a view to having an understanding on farmers' use of pond fish farming practices. Considering the situation, time, cash and other resources available to the researcher and to create the study purposeful and manageable, it became necessary to impose certain limitations as noted below:

❖ The study was confined to a selected area i.e. one union of Gafargaon upazilla under Mymensingh district.

❖ There were many farmers within the study areas but only the farmers involved in fish production were selected.

❖ The characteristics of pond farmers within the study area were several and varied however only ten characteristics were chosen for investigation during this study as expressed within the objectives.

❖ For information about the study, the researcher relied on the data furnished by the selected respondents during data collection.

❖ For some cases, the researcher faced some unexpected interference from the over interested side-talkers while collecting data from the target populations. However, the researcher tried to overcome the problem as far as possible with sufficient tact and skill.

❖ There were embarrassing situations at the time of data collection. So, the researcher had to manage proper rapport with the respondents to collect maximum proper information.

❖ Lack of previous studies within the analysis area.

1.7 Definition of Important Terms

The terms which have been frequently used throughout the thesis are defined and interpreted below:

Farmers: The persons who are involved in different farming activities are called farmers. They participate in different farm and community level activities like crops, livestock, fisheries, other farming activities etc. In this study, pond fishers were treated as farmers.

Age: Age of the respondent defined as the period of his/her life, measured by years from his/her birth, usually marked by a certain stage or degree of mental or physical development to the time of interview.

Level of education: Level of education of an individual farmer was defined as the formal education received up to a certain level from an educational institute at the time of interview. Education was measured in terms of actual years of successful schooling.

Experience in fish farming: Experience in fish farming refers to the total number of years involved in fish farming by a fish farmer to the time of interview.

Family size: Family size of a farmer refers to the actual number of the members in the family who live in a fixed dwelling unit and eat from the same cooling arrangement.

Land possession: Land possession refers to the cultivated area either owned by the farmer or obtained from others on the borga system, the area being estimated in terms of full benefit and half benefit to the farmer respectively. The self-cultivated owned land and cultivated area taken as lease or mortgage from others was recognized as full benefit.

Pond size: Pond size of a pond owner refers to the total area of pond/ponds owned by him as owner or co-owner. The pond size is estimated in terms of actual benefit to the farmer. It was expressed by hectare.

Annual family income: Annual family income refers to the annual earnings of the entire family members from agriculture, livestock and fisheries and other sources (like service, business etc.) during a year. It was expressed in Thousand Taka.

Commercialization of fish: Commercialization of fish referred to the ratio of value of fish sold and total value of fish produced. It was expressed in percentage.

Training exposure: It was used to refer to the completion of an activity by the farmers which were offered by the government, semi-govt. or non-government organization (s) to improve the knowledge & skills of farmers for better performing an agricultural job. It was measured by the number of days of training received by the respondent.

Extension media contact: It referred to an individual exposure to or contact with different communication media and sources and personalities being used for dissemination of new practices among the farmers.

Practice: A practice is a technology or methodology that evolves through experience and research has proven reliable that leads to desired result. A commitment of using the practices in any field is a commitment of using all the knowledge and technologies at one's disposal to ensure success. The term is used frequently in the fields of health care, government administration, the education system, project management, etc.

CHAPTER 2

REVIEW OF LITERATURE

This Chapter is designed to briefly review the previous studies which are related to the present research. A good number of studies were carried out in the fisheries sector but a few studies were concerned with the topic of this research. Some related literatures on other allied species have also been reviewed. The researcher intensively searched internet, websites, available books, journals and printed materials from different sources of home and abroad. However, the author reviewed the related literature have been given below.

2.1 Literature related to Concept and Past Research of Farmers' Use of Pond Fish Farming Practices

Stanley (1975) indicated that pond means an area which filled with water, either natural or artificial, that is smaller than a lake.

Alam (2003) explicit that "Practice is also noted because the activities of a private that he/she performed followed by some directions so as to meet some needs that he/she required."

Rahman et al. (2017) narrated that fish culture had been practiced for thousands of years for regretting protein nutrition, recreational and commercial purpose and Day by day pond fish farming was getting importance in the fish production.

Ahmed (2003) stated that Fish farming practice or aquaculture practice had become a promising sector to attain food security as well as to alleviate poverty in developing countries like Bangladesh.

Islam et al. (2017) stated that aquaculture had been proved to be profitable business than rice cultivation and many farmers in rural areas are converting their rice field into aquaculture ponds for extra profit.

Ara (2005) explicit that the bulk of pond fish farmers in rural areas had taken fish farming activities as their secondary occupation and were concerned in fish farming to boost their socio economic status through pond fish farming activities.

Goswami et al. (2020) conducted a research on "Use of fish farming practices by the fish farmers", they found that 42.4 percent fish farmers had high use of fish farming practices whereas solely 4.3 percent fish farmers had low use of fish farming practices and thus, the overwhelming majority (95.7%) of the fish farmers had medium to high use of fish farming practices. Pond size, fish farming experience and extension contacts of the pond farmers had a significant positive relationship with their use of fish farming practices. But other selected variables namely age; education, family size, annual income, and knowledge on fish farming didn"t have any significant contribution with their use of fish farming practices.

Abdullah (2013) conducted a research on "Farmers' Knowledge and Practice on Pond Fish Farming", he observed that majority (61.4%) of the pond farmers had medium practice; while 27.7 percent farmers had low practice and only 10.9 percent farmers had high practice and he also found that pond size, commercialization and training exposure had positive significant relationship with farmers' practice on pond fish farming.

Ahamed et al. (2017) studied on Present Status of Pond Fish Farming: Evaluation from Small Scale Fish Farmer under Saidpur Upazila, Nilphamari district and observed that most of the farmer applied locally feed and about 30 % people did not found fish diseases, 55 % people told that diseases occurred occasionally and 15% found outbreaks of diseases in every year.

Zaman et al (2007) conducted a research on the current status of pond fishery resources and sustenance of the fish farmers at Mohanpur Upazila in Rajshahi District. In their research they observed that carp polyculture was mainly practiced in that area, about 53.3% fish farmers used lime and fertilizers in their ponds properly and supplementary feed was used by the farmers which were a good sign about the awareness of fish culture by the farmers.

Fatema et al. (2018) conducted a study on pond fish farming and socio-economic condition of fish farmers in Parbatipur upazila of Dinajpur district, Bangladesh. In their research they observed that all the farmers were involved in poly culture practice of carps (cyprinids) including major carps, non-native Chinese carps and other species because of availability of the fish seeds, easy production system, higher growth rate and market demand and they also observed that majority of the farmers use cow dung as organic fertilizer to increase the primary productivity of the ponds and most of the farmers used inorganic fertilizers irregularly at different rates. They

used lime in the culture system for the protection against various diseases and to improve the water quality of the pond. It was observed that fish farmers supplied various types of supplementary feeds such as rice bran, mustard oil cake, commercial pellet feeds, corn flour bran etc. both regularly and irregularly.

Pravakar et al. (2013) conducted a research on the current condition of Fish Farming and Sustenance of Fish Farmers in Shahrasti Upazila of Chandpur District, Bangladesh. In their study they observed that about 95% of the farmers applied supplementary feed like rice bran, mustard oil cake and commercially manufactured feed.

Sheheli et al. (2014) studied the present status and practices of fish farming in Trishal Upazila of Mymensingh District. They studied that Farmers of that upazila's used various types chemicals and toxic substances such as salt, lime, dipterex, KMnO4, methylene blue, copper sulphate, calcium hypochlorite, antibiotics and malachite green in the study area to control aquatic weeds, predators, pests and undesirable species and prevent different fish diseases and they mainly used 3 types of feed like loose, pellet and both (loose + pellet). Most of the farmers in that area did not know the actual recommended doses of these supplementary components that have harmful effects on human health and other animals. They determined that 75% farmers applied feed double in an exceedingly day, while 20% of farmers applied thrice and solely 5% applied feed once per day. The recommended feeding frequency is 2 or 3 times per day (DoF, 2009). 64% farmers practiced total harvest and 36% practiced partial harvest to get more benefit.

Das et al. (2018) conducted an exploration on current status, issues and prospect of fish farming at Gazipur Sadar upazila in Bangladesh. They observed that farmers were found to use organic fertilizers (compost, cow dung and chicken manure) and inorganic fertilizers (urea and TSP) and 40.91% farmers did not use any chemicals and drugs. It was observed that 49.09% fish farmers applied different kinds of commercial floating and sinking pelleted feed while 31.82% farmers used loose feed (non-pelleted feed, rice bran, wheat bran, mustard oilcake etc.) and most of the farmers were not well concern about the use of recommended amount of feed. In that area they observed the occurrence of diseases like fungal disease, epizootic ulcerative syndrome (EUS), argulosis, tail and fin rot and gas bubble disease during the culture. Most of the farmers were

found to take some preventative measures such as pond drying, liming, water exchange, removal of aquatic weeds and undesirable fishes to reduce disease outbreak.

Quddus et al. (2020) studied leased pond fish farming and livelihood status of farmers in Jamalpur district. In their study they found that farmers cultured several types of fish species together such as Indian major carp (Labeo rohita, Catla catla and Cirrhinus cirrhosus), exotic carps and mono sex tilapia (Oreochromis niloticus) to earn higher amount of profit from fish production and all of the surveyed farmers applied fertilizers and supplementary feed to expect higher fish production.

Sakib et al. (2014) conducted a research on farmers' knowledge on aquaculture practices in Bogura district of Bangladesh. They observed that majority of the fish farmers (90.90%) had medium to high knowledge on recommended dose of lime application into the pond for betterment of water quality and knowledge on "application of fertilizers", "harmful effect of contaminated water", "recommended pesticide for removing undesirable fish species", "components fish in carp polyculture" and "appropriate time to release fingerling" found medium to high similarly.

Ntsama et al. (2018) observed that Feeding practices are characterized by the use of locally formulated powdered feeds (31.7%), animal manure, chicken droppings (20.5%) and pig dung (18.7%) and Concerning fish health management, few farmers (24.3%) refer to a veterinarian for prescription and fifty one percent used agrochemical products like fertilizers, liming materials and veterinary medicine.

Jahan et al. (2018) investigated that 30% fish farmers used farm made feeds, 40% used commercial feeds and 30% used both farm made and commercial feeds, and the feed was applied manually twice in a day by most of the farmers (95%) and all of the farmers in the selected regions practiced polyculture systems.

Sarwer et al. (2016) found that polyculture of Indian major carps and exotic carps had been practiced by most of the farmers in the selected area.

Hossen et al. (2020) observed that most of the farmer (94%) preferred poly-culture system where small portion of farmer (6%) were practiced monoculture of tilapia in the study area and 88% farmers were depended on supplementary feed where 12% farmers was depended on natural feed.

Siddiqua et al. (2019) found that majority (90%) of the fish farmers practiced polyculture system in their research area and 77% fish farmers applied commercial pelleted feed produced by different feed company where 23% fish farmers used homemade feed. They indicated that about 49% fish farmers used both organic and inorganic fertilizer while 26% used inorganic fertilizer, 19% used organic fertilizer and only 6% used no fertilizer into their fish farm. In that area, 15% of fish farmers sold their fish to the consumer directly in the local market whereas 79% sold their fish to retailers or wholesalers and only 6% sold to other fishermen or neighbors.

Rahman et al. (2017) in their study discovered that almost all of the fishermen cultivated Rui, Catla, Mrigel (locally referred to as "Bangla fish"), Tilapia, Silver carp, Pangus etc. and most of the fishermen concerned in fish farming as their primary occupation and sixty five percent involved in fish farming as their main occupation.

Sarker and Ali (2016) reported that 40% of the ponds were seasonal and 60% perennial, of which 85% with single ownership and 15% accompanied by multiple ownership in the study area. The ponds were prepared using lime, cow dung, urea and TSP and most of the farmers practiced a polyculture system. To maintain natural food production the majority of the farmers used cow dung and only a few farmers used poultry droppings as organic fertilizer. To maintain suitable water quality they used lime in the pond. They recorded that forty five percent of the farmers applied farm made supplementary feed prepared with rice bran and mustard oil-cake (80% and 20% ratio) and fifty five percent farmers used artificial pellet feed. They found that 55% farmers provided feed twice a day, while 25% of farmers supplied thrice a day and 20% applied feed once daily in the study area. They reported that 95% of fishes were sold by the farmers to the local agent and the remaining 5% were consumed by the household and given to the relatives.

Mondal et al. (2018) indicated that most of the farmers (56%) practiced tilapia culture, some practiced pangas, carp, shrimp /prawn. Most of the farmers (58%) used balanced feed and 42%

farmer used the supplementary feed. They did not use commercial feed due to high cost. Farmers did not use commercial feed due to high cost. They stated that 77% farmers practiced their feeding in the morning, 11% farmers in the evening and 12% practiced their feeding both morning and the evening.

Rahman (2007) and Hassanuzzaman (1997) found in the Rajshahi district that the majority of the farmers used supplementary feed.

Belton (2011) found that farmers did not maintain any scientific method to prepare balanced feed for fish.

Hossain and Islam (2014) observed that farmers used urea and Triple super phosphate for fertilizer and they used lime to neutralize acidity in the soil and water of pond. They used various kinds of artificial feed items for fish production such as rice bran, oil cake, and green grass.

2.2 Review concerning the relationship between selected characteristics of the farmers and   their use of pond fish farming practices

2.2.1 Age and use of pond fish farming Practices

Abdullah (2013) found that age of the pond farmers had no significant relationship with their practice on pond fish fanning in his study.

Goswami *et al*. (2020) found that majority (43.4 percent) of the fish farmers were middle aged and the study showed that fish farming in the study area is being managed by comparatively younger fish farmers and they found that age had no significant relationship with their practice on pond fish fanning in his study.

Rashed (2018) observed that the age of farmers had no significant relationship with their use of best management practices.

Sakib *et al*. (2014) observed that age of the respondents had a positive and significant relationship with the knowledge of the respondent about the aquaculture practice.

Jahan *et al.* (2018) observed in their studies that more than half of the farmers (55.80 percent) were found in the 41-60 years age group, while 16.70 and 27.50 percent of farmers felt into the age groups 20-40 and above 60 years, respectively.

Sana (2003) stated that the age of the pond farmers had a negative relationship with their practice on shrimp culture in his study.

Hossain (2006) conducted research on use of Integrated Pest Management Practices in Rice fields by the farmers in Tapodhan union under Rangpur District. He found that the age of the farmers had no significant relationship with their use of IPM practices.

Mazumder (2018) conducted a research on use of Integrated Crop Management (ICM) Practices by the Farmers of Pirojpur District and found that age of the farmers had no positive significant relationship with their use of ICM practices.

Ahamed *et al.* (2017) found that the majority of the fish farmers were 30-50 years in his study area who practiced pond fish farming.

Sarker (1997) found that there was no significant contribution between ages of the farmers with their use of improved potato cultivation practices.

Zannth (2011) observed that most of the farmers (43%) belong to the age group 41-50.

Kaiya *et al.* (1987) reported that fish culture efficiency varied with the age and number of owners of ponds.

2.2.2 Level of education and use of pond fish farming Practices

Abdullah (2013) stated that education of the pond farmers had no significant relationship with their practice on pond fish farming in his study.

Goswami et al. (2020) found that the level of education of the farmers had no relationship with their use of fish farming practices.

Mazumder (2018) found that education of the farmers had a positive significant relationship with their use of ICM practices.

Sakib et al. (2014) observed that education of the respondents had a positive and significant relationship with the knowledge of the respondent about the aquaculture practice.

Hossain (2003) observed that education of the farmers had a significant and positive relationship with their use of modern Boro rice cultivation practices.

Aurangozeb (2002) observed that there was a positive relationship between education and use of integrated homestead farming technologies.

Sarker (1997) conducted a study to find the relationship between education of potato growers and potato cultivation practices in 5 villages of Cumilla District. He found that the education of potato growers had a significant relationship with their use of improved potato cultivation practices.

Ahamed et al. (2017) found that about 40% farmers had primary education in their study area.

Sarwer et al. (2016) stated that 15% respondents had no education, 19% had primary level (up to 5 class), 31% had secondary level (6–10 class), 14% had SSC level (10 class pass), 12% had HSC level and9% had bachelor level of education in their study area.

2.2.3 Experience in pond fish farming and use of pond fish farming Practices

Goswami et al. (2020) found that fish farming experiences of the farmers had significant positive contribution with their use of fish farming practices.

Kabir and Rainis (2015) found that experience had a positive significant effect with Integrated Pest Management.

Sarwer et al. (2016) reported that 75% of the farmers gained experience by self-study followed by friends (9%), NGOs (6%), and DoF and relatives (5% each) in Subarnachar, Noakhali.

Sheheli et al. (2014) reported that fifty percent of farmers acquired fish farming experience from friends and neighbors.

2.2.4 Family member and use of pond fish farming Practices

Goswami et al. (2020) found that family size of the farmers had no relationship with their use of fish farming practices.

Jahan et al. (2018) found that family size is very important for fish production because fish production is labor intensive activity.

Ahamed et al. (2017) found that the majority of farmers' family size was small in their study area who practiced pond fish farming.

Zaman et al (2007) found small family sizes in their study area.

Fatema et al. (2018) reported that the highest percentage (40%) was obtained in the 4–5 members and 2–3 members (15.7%), 6–7 members (15.7%) and above 7 members (28.6%) in family categories.

2.2.5 Land possession and use of pond fish farming Practices

Abdullah (2013) found that land possession of the pond farmers had no significant relationship with their practice on pond fish farming in his study.

Rahman (2006) found that land possession had a significant and positive relationship with practice of prawn culture.

Khan (2005) found that land possession had no relationship with the practice of maize cultivation. Sakib *et al*. (2014) observed that farm size of the respondents had a positive and significant relationship with the knowledge of the respondent about the aquaculture practice.

Sarwer et al. *(2016)* stated that the average land area of pond owners had 2.21 hectare in Subarnachar upazila ata union where homestead area 0.53 ha, cultivated land 1.41 ha and pond area 0.27 ha.

Rahman et al. (2017) reported that about 50% farmers were their own land and 7% farmers were their land leased from the others and about 43% fishermen were both (own and lease) types of land for fish culture and other purposes.

2.2.6 Pond size and use of pond fish farming Practices

Abdullah (2013) indicated that pond size of pond farmers had a significant positive relationship with their practice on pond fish farming in his study.

Goswami et al. (2020) found that pond size of the farmers had significant positive contribution with their use of fish farming practices.

Islam (2010) observed that pond size of fish farmers had significant positive relationship with their use of selected polyculture practices.

Das et al. (2018) found that the majority of the cultured ponds (60%) were smaller (1-4 Decimal) whereas solely 17.27% ponds were comparatively bigger (>8 Decimal) in size.

Khan (1986) stated that fish culture efficiency relied on waterbody size.

Pravakar et al. (2013) reported that pond size was an important factor for fish farming because all management steps were planned considering the pond size and they found that average pond size was 0.24ha.

Sakib et al. (2014) observed that the fish farming area of the respondents had a positive and significant relationship with the knowledge of the respondent about the aquaculture practice.

2.2.7 Annual income from pond fish farming and use of pond fish farming Practices

Abdullah (2013) stated that annual family income of the pond farmers had no significant relationship with their practice on pond fish farming in his study.

Siddiqua et al. (2019) found that about 37 (46%) fish farmers earned their annual income as 50,001-1,50,000 BDT per year where 18 (22%) fish farmers earned less than 50,000 BDT per year, 19 (24%) fish farmers earned 1,50,001-2,50,000 BDT per year and solely 6 (8%) fish farmers earned 2,50,001-3,50,000 BDT per year.

Pravakar et al. (2013) reported that the highest percentage (34%) of fish farmers earned BDT 75,000-1, 00,000 per year in Shahrasti upazila of Chandpur district.

Khan (1986) reported that family income is an essential economic factor affecting utilization of pond fish farming practices.

2.2.8 Commercialization of fish products and use of pond fish farming Practices

Abdullah (2013) found that commercialization of pond farmers had a significant positive relationship with their practice on pond fish farming in his study.

Sakib et al. (2014) observed that commercialization of the respondents had a positive and significant relationship with the knowledge of the respondent about the aquaculture practice.

2.2.9 Training exposure and use of pond fish farming Practices

Abdullah (2013) found that training exposure of pond farmers had a significant positive relationship with their practice on pond fish farming in his study.

Mazumder (2018) found that training exposure of the farmers had a positive significant relationship with their use of Integrated Crop Management practices.

Rahman (2006) found that training exposure had a significant and positive relationship with practice of prawn culture.

Khatun et al. (2013) observed that about 14 – 18% pond fish farmers received formal training on fish culture in the Noakhali area of Bangladesh.

Das et al. (2018) found that most of the farmers (80%) do not take any kind of scientific fish culture training, solely 12.73% farmers took training from DoF and 7.27% farmers took training from different Non-Govt. Organizations (NGO).

Sarwer et al. (2016) found that only 18% farmers received formal training from DoF.

2.2.10 Media contact for fish farming information and use of pond fish farming Practices

Abdullah (2013) stated that extension contact of the pond farmers had no significant relationship with their practice on pond fish farming in his study.

Goswami et al. (2020) found that extension contacts of the farmers had a significant positive contribution with their use of fish farming practices.

Rashed (2018) observed that extension contact of respondents had significant contribution with their use of best management practices.

Islam (2010) observed that extension media contact of fish farmers had a significant positive relationship with their use of selected polyculture practices.

Mazumder (2018) observed that extension media contact of the farmers had a positive significant relationship with their use of Integrated Crop Management practices.

Sana (2003) stated that extension contact of the pond farmers had a significant and positive relationship with their practice on shrimp culture in his study.

Roy (2006) found that extension contact had a positive significant relationship with the practice of Boro rice cultivation.

Sakib et al. (2014) observed that use of information sources of the respondents had a positive and significant relationship with the knowledge of the respondent about the aquaculture practice.

2.3 Conceptual Framework of the Study

This study is concerned with the farmers' use of pond fish farming practices. Thus the practice was the main focus of the study and 10 selected characteristics of the farmers' were considered as those that might have a relationship with practice. Farmers' practice for pond fish farming may be influenced and affected through interacting forces of many independent factors. It is not possible to deal with all the factors in a single study. Therefore, it was necessary to limit the independent variables, which included age, education, land possession, pond size, family size, experience, annual income from pond fish farming, commercialization of fish product, training exposure and extension contact for fish culture information. The conceptual framework of the study has been presented in Fig. 3

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┌─────────────────────────────────────────────────┐
│  Some Selected Characteristics of Pond Fish Farmers  │
└─────────────────────────────────────────────────┐
                                                    ╲
  • Age                                              ╲        ┌──────────┐
  • Education                                         ╲       │   Use    │
  • Land possession                                    ╲      │          │
  • Pond size                                           ╲     │   of     │
  • Family size                                          ╲    │          │
  • Annual family income from pond fish                  ╲   │  Pond    │
    farming                                               ╲  │          │
  • Experience                                            ╱   │  Fish    │
  • Commercialization                                    ╱    │          │
  • Training exposure                                   ╱     │ Farming  │
  • Extension contact                                  ╱      │Practices │
                                                      ╱       │   by     │
                                                     ╱        │  The     │
                                                    ╱         │ Farmers  │
                                                              └──────────┘
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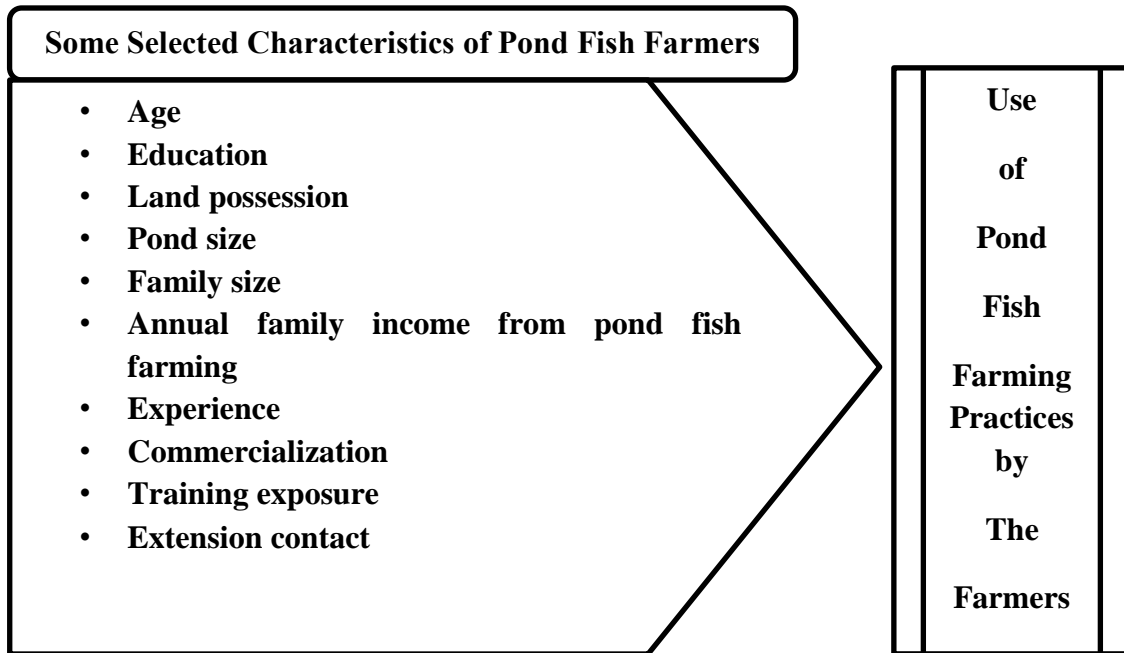
Figure 3: The Conceptual framework of the study

CHAPTER 3

METHODOLOGY

For conducting a research work successfully, methods and procedures are the key factors, validity and reliability of any research depends largely upon the methods and procedures following in conducting a research. Appropriate methodology enables a researcher to collect and analyze the information purposefully. Research procedures followed in this study have been discussed in this chapter. The methodology includes the selection of research area, identify target groups, sampling, data collection and selection of analytical methods.

The present study is based on a field survey where primary data were collected from the pond owners. The word "survey" refers to a method of study in which an overall picture is obtained by a systematic collection of available data on the subject (Efferson, 1953). The major advantage of this method is that it is less expensive and its coverage is much wider. But one of the major defects of this method is that the investigation has to depend solely upon the memory of the respondents.

3.1 Locale of the Study

The locale of the study was randomely selected four villages of Panchbag union of Gaffargaon upazila under Mymensingh district. Gafargaon Upazila (Mymensingh district) area was 401.16 sq km, located in between 24°15' and 24°33' north latitudes and in between 90°27' and 90°39' east longitudes. Four villages were randomly selected from 20 villages of Panchbag union. The selected villages were: Khurshid Mahal, Chouka, Uttar Harina, Dakkhin Harina. Selected villages were situated just near the old Brahmaputra River. A map of Gaffargaon upazila showing the study union is presented in Figure 4.

Figure 4: A Map of Gaffargaon upazila showing the study union

3.2 Population and Sample

The pond fish farmers of selected four villages under Gaffargaon upazila of Mymensingh district were considered as the population of the study. A list of pond fish farmers who are presently growing fish and fish fry in their pond was prepared with the assistance of Upazila Fisheries Officer and his field staff. The number of pond fish farmers of the selected four villages was 301 which constituted the population of the study.

There are many strategies for determining the sample size. Sample size of the study was determined by applying the subsequent formula (Arkin, 1963):

$$n=\frac{N\,z^2\,P\,(1\text{-}P)}{z^2\,P\,(1\text{-}P) + Nd^2}$$

Where,

        n = Sample size

        N = Population size = 301

        d = The level of precision = 8%

        z = The value of the standard normal variable given the chosen confidence level (e.g.

        z = 1.96 (with a confidence level of 95 %)

        P = The proportion or degree of variability = 50%;

Thus, the total sample size stood at 101. Moreover, a reserved list of 12 pond fish farmers was prepared by taking 3 for each village for use when the pond fish farmers under sample were not available during data collection. These 101 pond fish farmers were selected by simple random sampling from the population of 4 villages.

The distribution of the selected pond owners with reserve list of the selected villages is shown in the Table 1.

Table 1: Distribution of population and the sample of pond farmers in the study area

Name of village	Total no. of pond farmers	Sample	Reserve list
Khurshid Mahal	101	35	3
Chouka	35	11	3
Uttar Harina	83	28	3

Dakkhin Harina	82	27	3
Total	301	101	12

3.3 Variables and Their Measurement

In descriptive research, the measurement and selection of the variables constitute a crucial task. Consistent with D'Amato (1970) variables may be defined as those attributes of objects, events, things and beings, which may be measured. It usually contains a minimum of two important variables; viz. Independent variable and dependent variable. An independent variable is that factor which is manipulated or chosen by the researcher in his/her attempts to ascertain its relationship to an observed phenomenon. A dependent variable is the factor which seems, disappears, or varies because the researcher introduces, removes or varies the independent variable (Townsend, 1953).

Ten selected characteristics of the respondents were age, education, fish farming experience, family size, land possession, pond size, annual income from fish farming, commercialization, training exposure and extension contact constituted the independent variables of this study. These chosen characteristics were measured by applicable measurement techniques. Use of fish farming practices by the fish farmers was the dependent variable. Fifteen fish farming practices were identified through field survey and consultation with fish farmers and upazila fisheries officers of study area to operationalize the variable.

The use of pond fish farming practices by the pond farmers was the main focus of the study. Measurement of all the factors of the pond farmers and their use of pond fish farming practices are discussed in the subsequent subsections:

3.3.1 Age

Age of a respondent referred to the period of time from his/her birth to the time of interviewing. A unit score was assigned for each year of farmer's age. It was expressed in terms of complete years. Example, a man of 50 years old, obtained an age score of 50. This variable appears in question no 1of the interview schedule as presented in Appendices.

3.3.2 Level of education

Level of education was measured as the ability of an individual farmer to read and write or the formal education received up to a certain standard. A farmer who did not know how to read and write, his/her education score was given as "0" (zero). A score of 0.5 was given to that farmer who could sign his/her name only. Score 1 was given to those who attend school for class one, 2 was given for class 2 and so on. If a pond owner did not go to school but studied at home or an adult learning center, his knowledge status was determined as the equivalent to a formal school student. This variable appears in item no 2 of the interview schedule as presented in Appendices.

3.3.3 Experience in pond fish farming

Experience in pond fish farming of the farmers was determined by the total number of year's involvement in fish farming. A score of one (1) was assigned for each year of pond fish farming. This variable appears in item no 3 of the interview schedule as presented in Appendices.

3.3.4 Family member

Family members were measured in terms of actual number of members in the family of a respondent. The family members included the respondent himself, his/her wife/husband, sons, daughters and other dependents. For example, if a respondent has four members in his/her family, his /her family scales were 4 including him. This variable appears in item no 4 of the interview schedule as presented in Appendices.

3.3.5 Land possession

The land possession of a pond owner refers to the total area of land on which his/her family carried out farming operations, the area being estimated in terms of full benefit to his/her family. The land possession was measured in hectares for each pond owners by using the following formula:

$$LP = A1 + A2 + 1/2 (A3 + A4) + A5$$

Where,

LP= Land possession

Al = Homestead area

A2= Own land under own cultivation

A3= Land given to others on borga

A4= Land taken from others on borga

A5= Land taken from others on lease

This variable appears in item no 5 of the interview schedule as presented in Appendices.

3.3.6 Pond size

Pond size referred to the total area of the pond, on which the farmer carried out fish farming operations. The pond size was estimated in consideration of the full benefit of the pond owner in terms of hectare. This variable appears in item no 6 of the interview schedule as presented in Appendices.

3.3.7 Annual income from fish farming

The term annual income from fish farming referred to the annual gross income of a respondent himself/herself and the members of his family by selling of fish and fish fry. The income was expressed in thousand ('000') taka. This variable appears in item no 7 of the interview schedule as presented in Appendices.

3.3.8 Commercialization

Commercialization of fish products score of a farmer was determined by the ratio of value of fish products sold out of the total value of fish products raised. It was expressed in percent. As developed by <u>Karim and Mahboob (1974)</u> and used by Ali (2008), the following formula was followed in computing the commercialization score of a pond farmer:

$$\text{Commercialization} = \frac{\text{Value of fish product sold}}{\text{Total value of fish product raised}} \times 100$$

Relevant market price was used in determining the value of fish products. Thus commercialization percent may vary from 0 to 100, while 0 indicating no commercialization and 100 indicating very high commercialization. This variable appears in question no 8 of the interview schedule as presented in Appendices.

3.3.9 Training exposure

It was operationalized by the number of days a respondent had received short-term training in his life up to the day of interview. The training was related to fisheries that were sponsored by government, non-government/NGO and other relevant organizations. A score of one (1) was

27

assigned for each day of training received. This variable appears in question no 9 of the interview schedule as presented in Appendices.

3.3.10 Media contact for fish farming information

It was defined as one's extent of exposure to different communication media related to farming activities. An extension media contact score was computed for each respondent on the basis of his extent of contact with five selected media. Each respondent was asked to indicate the frequency of his contact with each of the five selected media. Each farmer was asked to indicate his nature of contact with five alternative responses like always, very often, sometimes, rarely and never basis and weights were assigned as '4', '3', '2', '1' and '0', respectively. Thus, extension contact in pond fish farming score of a respondent could range from 0 to 20 where '0' indicate no extension contact and 20 indicate highly extension contact in pond fish farming. This variable appears in question no 10 of the interview schedule as presented in Appendices.

3.4 Measurement of Use of Pond Fish Farming Practices

A good number of innovations are being practiced nowadays by the pond fish farmers for pond fish farming. Fifteen fish farming practices were identified through field survey, consultation with fish farmers and upazilla fisheries officer of the research area to operationalize the variable. These fifteen practices were to measure the extent of use of pond fish farming practices by the fish farmers. Use of fish farming practices by the pond fish farmers was measured by a five-point rating scale. The respondents were asked to indicate for each of the practices whether they 'always', 'very often', 'sometimes', 'rarely' and 'never' use with a corresponding score of '4', '3', '2', '1' and '0', respectively. The score against each of these fifteen practices were added together to obtain a total use score. Hence, scores of the respondents may vary from 0 to 60; where '0' indicating no use of pond fish farming practices wherever 60 indicating highest level of use of pond fish farming practices. This variable appears in question no 11 of the interview schedule as presented in Appendices.

3.5 Research Instrument and Data Collection

In order to collect relevant data for the study, a structured interview schedule was prepared keeping the objectives of study in mind. The questions and statements contained in the schedule were simple, direct and easily understandable to the respondent pond fish farmers. The schedule

contained both closed and open forms of questions. A draft interview schedule was ready earlier before using the same for assortment of data. The draft schedule was pre-tested with 20 respondents selected from the study area. This pre-test facilitated the researcher to identify faulty questions in the draft schedule and necessary corrections, addition and adjustment was made afterwards in the schedule on the basis of the pre-test results. During modification of the schedule, valuable suggestions were received from the research supervisors and relevant experts. Data were collected from the farmer through personal interviewing. The interview schedule was then printed in its final form and multiplied. A copy of the interview schedule in English version is placed in Appendices.

3.6 Statement of Hypothesis

According to Goode and Hatt (1952), "a hypothesis could be a proposition which will be put to determine its validity. It should appear contrary to, or in accord with sense. It should convince to be correct or incorrect but it leads to an empirical test in any event. Hypotheses are always in declarative sentence form and they are related, either generally or specifically from variables to variables. In broad sense hypotheses are divided into two categories:

(1) Research hypothesis and

(2) Null hypothesis

3.6.1 Research hypothesis
Research hypotheses are formulated which state anticipated differences between the variables. The following research hypothesis was put forward to know the relationships between each of the 10 selected characteristics of the pond fish farmers and their use of pond fish farming practices. "Each of the 10 selected characteristics of the pond fish farmers has a significant relationship with their use of pond fish farming practices."

3.6.2 Null hypothesis
A null hypothesis states that there is no relationship or differences between the variables. The following null hypothesis was formulated to examine the relationship between the selected characteristics of the pond fish farmers and their use of pond fish farming practices: "There is no significant relationship between each of the selected characteristics of the pond fish farmers and their use of pond fish farming practice."The selected characteristics were age, education,

experience, family members, land possession, pond size, annual income from pond fish farming, commercialization of fish products, extension contact and training exposure.

3.7 Collection of Data

Data were collected during the period of February to March, 2021. Data were collected personally by the researcher himself through face to face interviews from the selected pond farmers. But to familiarize researchers with the study area and to get local support, the researcher took help from the local leaders and the field staff of Upazila Fisheries Office. The researcher first establishes appropriate rapport with the respondents and clearly explains the objective of the study by using local language as far as possible. As a result the pond fish farmers could furnish proper response to the questions and statements without any hesitation. However, if any respondent failed to understand any question the researcher took care to explain the issue. Excellent cooperation was received by the researcher from the respondents and others concerned of the study area during the time of interview. Interviews were usually conducted with the respondent in their homes, in front of village shops, under big trees. No major issues were encountered throughout data collection.

3.8 Processing of Data

After completion of the field survey, the collected data were scrutinized and summarized carefully before the actual tabulation. All the data were coded, compiled and tabulated according to the objectives of the study. A number of data were collected into native units and then regenerated data into standard units. Initially, all collected data were rigorously entered in Access, exported to Microsoft Excel. Exported data were checked randomly against the original completed interview schedule. Errors were detected and necessary corrections were created consequently when exportation. Finally, data were exported from the program Microsoft Excel to SPSS/windows version 22.0, which offered statistical tools applied to social sciences. All the individual responses to questions of the interview schedule were transferred into a master sheet to facilitate tabulation, categorization and organization. In case of qualitative data, acceptable evaluation technique was followed to convert the data into quantitative form.

3.9 Statistical Technique Used

The data were scrutinized in accordance with the objectives of the study. Qualitative data were regenerated into quantitative data by means of appropriate evaluation technique where necessary. Various descriptive statistical measures such as range, number, percentile, mean and standard deviation were used for categorization and describing the variables. Correlation coefficient (r) was used for testing the relationship between the selected characteristics of the pond fish farmers and their use of pond fish farming practices. Five percent (0.05) level of probability was the basis for rejecting any null hypothesis throughout the study.

CHAPTER 4

RESULTS AND DISCUSSION

The aim of this Chapter is to narrate the findings of the present study. Filed observations have been presented in line with the objective of the study and finding outcomes have been discussed with supportable and incidental comments under this Chapter. These are presented in three sections according to the objectives of the study. The first section deals with the selected characteristics of the farmers, while the second section deals with the extent of farmers' use of pond fish farming practices. In the third section the relationship of farmers' selected characteristics with their use of pond fish farming practices have been discussed.

4.1 Characteristics of the Respondent Farmers

A person's behavior is largely determined by one's personal characteristics. Ten characteristics of the pond farmers were selected to find out their relationships with their practice of pond farmers on pond fish farming. The selected characteristics included their age, education, family size, experience, land possession, pond size, annual income from pond fish farming, commercialization, training exposure, and extension contact. These characteristics of the pond farmers are described in this section.

Results contained in the Table 2 express the key features of the characteristics of the pond fish farmers in order to have an overall picture of these characteristics at a glance.

Table 2: Key features of the respondent pond fish farmers with their characteristics (n=101)

Sl. No.	Characteristics	Unit of Measurement	Mean	SD
1	Age	Year	44.44	12.72
2	Level of education	Year of schooling	6.85	5.02
3	Experience in fish farming	Year	10.96	6.53
4	Family Size	No. of Family members	6.35	2.31
5	Land possession	Hectare	0.55	0.43
6	Pond size	Hectare	0.28	0.24

7	Annual income from fish farming	'000' Taka	68.34	58.28
8	Commercialization	Percent	67.96	7.52
9	Training exposure	No. of days	2.28	2.1
10	Extension contact	Score	5.98	3.52
11	Practice	Score	34.55	10.6

4.1.1 Age

The age of the pond fish farmers has been varied from 25 to 90 years with a mean and standard deviation of 44.44 and 12.72 respectively. Considering the recorded age, pond fish farmers are classified into three age groups namely "young", "middle aged" and "old". Their distribution according to the age of the pond fish farmers is shown in Table 3

Table 3: Distribution of the respondent pond fish farmers according to their age

Category according to age (Year)	Pond Farmers	
	Number	Percent
Young aged (up to 35)	32	31.68
Middle aged (36-50)	33	32.67
Old aged (Above 50)	36	35.65
Total	101	100.0

The highest proportion (35.65 percent) of the pond fish farmers were old aged compared to 31.68 percent of them being young aged and 32.67 percent old aged. Data also indicates that the young and middle aged category constitute almost 64.35 percent of total pond fish farmers. The young and middle aged pond fish farmers were generally more involved in pond fish farming than the older. Goswami et al. (2020) observed that fish farming in his study area were managed by middle aged to young aged. Jahan et al. (2018) found that more than half of the pond farmers (55.80%) were observed in the 41-60 years age group; while 16.70 and 27.50 percent of pond fish farmers were stumbled into the age groups 20-40 and above 60 years, respectively. The reasons of differential participation of farmers of diverse age-corporations in aquaculture

are in all likelihood to be non-public preference, ease of operation, bodily abilities, social interactions and many others (Mia *et al.* 2015).

4.1.2 Education

The average and standard deviation of pond fish farmer's education scores was 6.85 and 5.02 respectively ranging from 0 to 16. Based on their education scores, the pond fish farmers were classified into five categories namely can't read and write 0), can sign only or non-formally educated (0.5), primary education (1-5), secondary education (6-10) and above secondary education (above 10). The distribution of the pond fish farmers according to their education is shown in Table 4.

Table 4: Distribution of the respondent pond fish farmers according to their level of education

Category according to level of education (Year of Schooling)	Pond Farmers	
	Number	Percent
Can't read and write(0)	10	9.9
Can sign only(0.5)	19	18.81
Primary education(1-5)	14	13.86
Secondary education(6-10)	31	30.69
Above secondary(>10)	27	26.74
Total	101	100.0

Results shown in Table 4 indicate that pond fish farmers in the secondary education category have the highest proportion (30.69%), followed by above secondary education (26.74%) and primary education category (13.86%). On the other hand, can sign only (18.81%) and 9.9 percent of respondents can't read and write. Thus the data revealed that 71.29 percent of pond fish farmers are literate. Goswami et al. (2020) found that majority (46.7%) of the pond fish farmers had secondary level in his study area. It shows that educated people, even graduates, are being concerned in fish aquaculture within the current time as aquaculture is a worthwhile commercial enterprise (Jahan *et al.* 2018).

4.1.3 Experience of pond fish farming

The experience score of pond fish farmers for pond fish farming ranges from 1 to 30 with an average and standard deviation of 10.96 and 6.53 respectively. Based on the experience in pond fish farming scores, the respondent pond fish farmers were classified into three categories as shown in Table 5.

Table 5: Distribution of the pond fish farmers according to their experience in pond fish farming

Category according to experience in pond fish farming(Year)	Pond Farmers	
	Number	Percent
Low experience (Up to 5)	22	21.78
Medium experience (6-17)	60	59.41
High experience (Above 17)	19	18.81
Total	101	100.0

The Results show that the majority (59.41%) of the pond fish farmers felt in the medium experience category, 18.81 percent in the high experience category and only 21.78 percent in the low experience category. Thus, above three fourths (81.19%) of the pond fish farmers had low to medium pond fish farming experience. Goswami et al. (2020) found that three-fifth (77.2%) of the pond fish farmers had medium experience and overwhelming majority (91.3%) of the pond fish farmers had medium to high fish farming experience. Haque (2014) also observed comparable findings in his studies.

4.1.4 Family size

Family size scores of the pond fish farmers ranged from 2 to 13 with an average of 6.35 and standard deviation of 2.31. According to family size, the respondent pond fish farmers were classified into three categories as shown in Table 6.

Table 6: Distribution of the pond fish farmers according to their family size

Category according to family size (No. Of family Members)	Pond Farmers	
	Number	Percent
Small family (Up to 4)	22	21.78

Medium family (5-7)	52	51.49
Large family (Above 7)	27	26.73
Total	101	100.0

Information Contained in Table 6 indicates that the medium size family constitutes the highest proportion (51.49%) followed by the small size family (21.78%). Only 26.73 percent of pond fish farmers had a large family size. Thus, about (73.27%) of the pond fish farmers had a small to medium family. Goswami et al. (2020) found that majority (91.4%) of the respondent pond fish farmers had small to medium family size and his concept that the family size is closely related to earnings and the size of the family has a direct manage at the expenditure and profits patterns of the family. At the same time as the fish manufacturing is a labor-intensive activity hence family size impacts the fish manufacturing (Jahan *et al.* 2018).

4.1.5 Land possession

The land possession of the pond fish farmers ranged from 0.06 ha to 1.86 ha with a mean and standard deviation of 0.55 and 0.43, respectively. Based on pond area the pond fish farmers were classified into three categories as small pond, medium pond and large pond. The distribution of the pond fish farmers according to their land possession is shown in Table 7.

Table 7: Distribution of the pond fish farmers according to their land possession

Categories according to land possession (hectare)	Pond Farmers	
	Number	Percent
Small Upto 0.12	3	2.97
Medium0.13-0.97	81	80.20
Large Above 0.97	17	16.83
Total	101	100.0

Data presented in Table 7 reveal that 80.20 percent of the pond fish farmers had medium land possession while 16.83 percent of them had large land possession and 2.97 percent had small land possession. Thus, the overwhelming majority (83.17 percent) of the pond fish farmers had low to medium land possession. Abdullah (2013) found that majority (51.5%) of the farmers of the pond had medium commercialization. Sarwer et al. (2016) stated that the average land area of pond owners had 2.21 hectare in Subarnachar upazila ata union where homestead area 0.53 ha,

cultivated land 1.41 ha and pond area 0.27 ha. Rahman et al. (2017) reported that about 50% farmers were their own land and 7% farmers were their land leased from the others and about 43% fishermen were both (own and lease) types of land for fish culture and other purposes.

4.1.6 Pond size

The pond size of the pond fish farmers ranged from 0.03 ha to 1.01 ha with a mean and standard deviation of 0.28 and 0.24, respectively. Based on pond area the pond fish farmers were classified into three categories as small pond, medium pond and large pond. The distribution of the pond fish farmers according to their pond size is shown in Table 8.

Table 8: Distribution of the pond fish farmers according to their pond size

Category according to pond size(ha)	Pond Farmers	
	Number	Percent
Small pond (Upto 0.04)	5	4.95
Medium pond (.05-.51)	80	79.21
Large pond (Above 0.51)	16	15.84
Total	101	100.0

Data presented in Table 8 reveal that 79.21 percent of the pond fish farmers had medium ponds while 15.84 percent of them had large ponds and 4.95 percent had small ponds. Thus, the overwhelming majority (84.16%) of the pond fish farmers had a low to medium size pond. Goswami et al. (2020) found that half of the pond fish farmers had medium pond. Jahan *et al.* (2018) and Abdullah (2013) also found similar result.

4.1.7 Annual income from pond fish farming

Annual family income of the pond fish farmers ranged from Taka 8 thousand to 245 thousand with an average and standard deviation of 68.34 and 58.28 respectively. Based on the annual income from pond fish farming the respondents were classified into three categories as shown in Table 9.

Table9: Distribution of the pond fish farmers according to their annual income from fish farming

Category according to annual income from fish farming ('000' Tk)	Pond Farmers	
	Number	Percent

Low income(Upto 11)	13	12.87
Medium income(12-126)	73	72.28
High income(Above 126)	15	14.85
Total	101	100.0

Data presented in Table 9 reveal that 12.87 percent of pond fish farmers had low income, 72.28 percent had medium income and 14.85 had high income from their pond fish farming. Thus, the overwhelming majority (85.15%) of the pond fish farmers had low to medium income from their pond fish farming. Siddiqua et al. (2019) found that about 37 (46%) fish farmers earned their annual income as 50,001-1,50,000 BDT per year where 18 (22%) fish farmers earned less than 50,000 BDT per year, 19 (24%) fish farmers earned 1,50,001-2,50,000 BDT per year and solely 6 (8%) fish farmers earned 2,50,001-3,50,000 BDT per year in his study area. Pravakar et al. (2013) reported that the highest percentage (34%) of fish farmers earned BDT 75,000-1, 00,000 per year in Shahrasti upazila of Chandpur district. Khan (1986) found that family income is an essential economic factor affecting utilization of pond fish farming practices.

4.1.8 Commercialization

Commercialization percent of the respondent pond fish farmers ranged from 50 to 83, the mean being 67.9601 and standard deviation 7.5188. On the basis of their commercialization scores, the pond fish farmers were divided into three categories: "low" (up to 61), "medium" (62-75) and "high" (above 76). The distribution of the pond fish farmers according to their commercialization is shown in Table 10.

Table 10: Distribution of the pond fish farmers according to their commercialization

Category according to Commercialization(Percent)	Pond Farmers	
	Number	Percent
Low (Upto 61)	23	22.77
Medium(62-75)	62	61.39
High (Above 75)	16	15.84

Total	101	100.0

Majority (61.39%) of the fish farmers of the pond had medium commercialization compared to 15.84 percent of them having high and only 22.77 percent had low commercialization. Abdullah (2013) found that majority (51.5%) of pond fish farmers had medium commercialization. Sakib et al. (2014) observed that commercialization of the respondents had a positive and significant relationship with the knowledge of the respondent about the aquaculture practice.

4.1.9 Training exposure

The training exposure score of the pond fish farmers ranged from 0 to 7 with a mean of 2.2772 and standard deviation of 2.045. Based on the training experience scores, the pond fish farmers were classified into three categories: "low training experience" (Upto 1), "medium training experience" (2-4), "high training experience (above 5)". The distribution of the pond fish farmers according to their training experience is presented in Table 11.

Table 11: Distribution of the pond fish farmers according to their training exposure

Category according to training exposure (No. of days)	Pond Farmers	
	Number	Percent
Low training(Up to 1)	42	41.58
Medium training(2-4)	42	41.58
High training(Above 4)	17	16.84
Total	101	100.0

There are about 41.58 percent pond fish farmers had low training; only 16.84 percent pond fish farmers had high training. Thus, the overwhelming majority (83.16%) of the pond fish farmers had low to medium training exposure. Training improves consciousness and efficiency of the pond farmers in an earmarked subject affair. Gaining high training experience one can be more expert in performing in different farming activities. But the fact that the overwhelming majority of the pond farmers did not receive any training or received low training needs more attention from extension services (GOs and NGOs) authorities in the country. For increasing knowledge

and practice of pond farmers, the government should provide adequate training and appropriate subject matter to pond farmers. Das et al. (2018) observed that majority of the farmers (80%) do not get any kind of scientific fish culture training. Little or no initiatives to conduct training are arranged by the DoF of Bangladesh (Khatun et al. 2013; Rahman et al. 2015).

4.1.10 Extension contact

Score of extension contact of the pond fish farmers ranged from 0 to 13 with an average and standard deviation of 5.98 and 3.52, respectively. Based on the score, the pond fish farmers were classified into three categories as shown in Table 12.

Table 12: Distribution of the pond fish farmers according to their extension contact

Category according to extension contact (score)	Pond Farmers	
	Number	Percent
Low extension contact (Up to 3)	30	29.70
Medium extension contact (4-9)	54	53.47
High extension contact (Above 9)	17	16.83
Total	101	100.0

Information contained in Table 12 shows that the highest proportion (53.47%) of the pond fish farmers had medium extension contact, 29.70 percent had very low extension contact and 16.83 percent pond fish farmers had medium extension contact. Thus, the overwhelming majority (92.46%) of the pond fish farmers had low to medium extension contact. Goswami et al. (2020) found that highest (65.2%) proportion of pond fish farmers had medium extension contact. Abdullah (2013) and Rahaman (2010) also observed similar findings in their study.

4.2 Uses of pond fish farming Practices

Score of use of pond fish farming practices of the farmers ranged from 17 to 56 against the possible range of 0-60 with an average and standard deviation of 34.55 and 10.6 respectively. On the basis of pond fish farming practices scores, the pond fish farmers were classified into three

categories namely low, medium and high use of pond fish farming practices. The distribution of the pond fish farmers according to their use of pond fish farming practices is shown in Table 13.

Table 13: Distribution of the fish farmers according to their use of pond fish farming practices

Category according to pond fish farming practices (score)	Pond Farmers	
	Number	Percent
Low use(Up to 24)	14	13.86
Medium use(25-44)	63	62.38
High use (Above 44)	24	23.76
Total	101	100.0

Information contained in Table 13 reveals that the majority (62.38%) of the pond fish farmers felt under medium use of pond fish farming practices category, whereas 23.76 percent in high use and 13.86 percent felt under low use of pond fish farming practices category. Thus majority (76.24%) of the pond fish farmers had low to medium use of pond fish farming practices. Abdullah (2013) found that about 61.4 percent pond fish farmers had medium use of pond fish farming practices. Goswami et al. (2020) observed that half (53.3%) of the respondent pond fish farmers had medium use of pond fish farming practices and the result showed a vast opportunity for pond fish farmers in use of pond fish farming practices.

4.3 Relationship between the Selected Characteristics of the Pond Fish Farmers and Their Use of Pond Fish Farming Practices

The purpose of this section is to explore the relationships of the selected characteristics of the pond fish farmers with their use of pond fish farming practices. Pearson's Product Moment co-efficient of correlation (r) was used to test the null hypothesis concerning the relation between any two variables. for rejection of a null hypothesis five percent (0.05) level of probability was used as the basis. Results of the test of co-efficient of correlation between each of the selected characteristics and their use of pond fish farming practices are shown in table 14.

Table 14: Co-efficient of correlation (r) between selected characteristics and farmers' use of pond fish farming practices (n=101)

Characteristics of the pond fish farmers	Correlation co-efficient values (r)	Tabulated value of 'r' with 99 df	
		0.05 level	0.01 level
Age	-0.134	0.195	0.254
Level of education	0.651**		
Experience in fish farming	0.399**		
Family size	-0.125		
Land possession	0.303**		
Pond size	0.549**		
Annual income from fish farming	0.601**		
Commercialization	0.680**		
Training exposure	0.911**		
Extension contact	0.654**		

* Significant at 0.05 level of probability

** Significant at 0.01 level of probability

4.3.1 Relationships between age of the farmers and use of pond fish farming practices

The following observations were recorded about relationship between age of the pond fish farmers and use of pond fish farming practices on basis of correlation coefficient:

❖ The computed value of 'r' (-0.134) was smaller than the tabulated value (r=0.195) with 99 degrees of freedom at 0.05 level of probability as shown in Table 14.

❖ The null hypothesis could not be rejected.

❖ The relationship between the concerned variables was not significant.

The findings indicated that age of the pond fish farmers had no significant relationship with their use of pond fish farming practices. Abdullah (2013) and Rashed (2018) found that age of the pond farmers had no significant relationship with their practice on pond fish fanning in their study. Age of pond fish farmers is not an important factor in case of use of pond fish farming practices.

4.3.2 Relationships between level of Education of pond fish farmers and their use of pond fish farming practices

The following observations were recorded about level of Education of pond fish farmers and their use of pond fish farming practices on basis of correlation coefficient:

❖ The computed value of 'r' (0.651) was larger than the tabulated value (r=0.254) with 99 degrees of freedom at 0.01 level of probability as shown in Table 14.

❖ The null hypothesis was rejected.

❖ The relationship between the concerned variables was significant and showed a positive trend

The findings indicate that level of education of pond fish farmers had a significant positive relationship with their use of pond fish farming practices. Mazumder (2018) ,Sakib et al. (2014) and Hossain (2003) found that education of the farmers had a positive significant relationship with their use of farming practices.

So, Level of education of farmers is an important factor in case of their use of pond fish farming practices.

4.3.3 Relationships between experience in pond fish farming and their use of pond fish farming practices

The following observations were recorded about relationship between experience in pond fish farming and their use of pond fish farming practices on basis of correlation coefficient:

❖ The computed value of 'r' (0.399) was larger than the tabulated value (r=0.254) with 99 degrees of freedom at 0.01 level of probability as shown in Table 14.

❖ The null hypothesis was rejected.

❖ The relationship between the concerned variables was significant and showed a positive trend

The findings indicate that experience in pond fish farming had a significant positive relationship with their use of pond fish farming practices. Goswami et al. (2020), Kabir and Rainis (2015) found that fish farming experiences of the farmers had significant positive contribution with their use of fish farming practices. Experience in pond fish farming is an important factor in case of their use of pond fish farming practices. So, Higher the experience higher the use of pond fish farming practices.

4.3.4 Relationships between family size of pond farmers and their use of pond fish farming practices

The following observations were recorded about relationship between family size of the farmers and their use of pond fish farming practices on basis of correlation coefficient:

❖ The computed value of 'r' (-0.125) was smaller than the tabulated value (r=0.195) with 99 degrees of freedom at 0.05 level of probability as shown in Table 14.

❖ The null hypothesis could not be rejected.

❖ The relationship between the concerned variables was not significant.

The findings indicated that family size of pond farmers had no significant relationship with their use of pond fish farming practices. Goswami et al. (2020) observed that family size of the farmers had no relationship with their use of fish farming practices. Family size of pond fish farmers are not important factor in case of use of pond fish farming practices.

4.3.5 Relationships between land possession of pond farmers and practice of pond fish farming

The following observations were recorded about land possession of pond fish farmers and practice of pond fish farming on basis of correlation coefficient:

❖ The computed value of 'r' (0.303) was larger than the tabulated value (r=0.254) with 99 degrees of freedom at 0.01 level of probability as shown in Table 14.

❖ The null hypothesis was rejected.

❖ The relationship between the concerned variables was significant and showed a positive trend

The findings indicate that land possession of pond farmers had a significant positive relationship with their practice on pond fish farming. Rahman (2006) observed that land possession had a significant and positive relationship with practice of prawn culture. Farmers whose have large farm size they can utilize best use of pond fish farming practices.

4.3.6 Relationships between pond size of pond farmers and their use of pond fish farming practices

The following observations were recorded about pond size of pond fish farmers and their use of pond fish farming practices on basis of correlation coefficient:

❖ The computed value of 'r' (0.549) was larger than the tabulated value (r=0.254) with 99 degrees of freedom at 0.01 level of probability as shown in Table 14.

❖ The null hypothesis was rejected.

❖ The relationship between the concerned variables was significant and showed a positive trend

The findings indicate that pond size of pond farmers had a significant positive relationship with their use of pond fish farming practices. Abdullah (2013) and Goswami et al. (2020) found that pond size of the farmers had significant positive contribution with their use of fish farming practices.

4.3.7 Relationships between annual income from fish farming of pond farmers and their use of pond fish farming practice

The following observations were recorded about annual income from fish farming of pond fish farmers and their use of pond fish farming practices on basis of correlation coefficient:

❖ The computed value of 'r' (0.601) was larger than the tabulated value (r=0.254) with 99 degrees of freedom at 0.01 level of probability as shown in Table 14.

❖ The null hypothesis was rejected.

❖ The relationship between the concerned variables was significant and showed a positive trend

The findings indicate that annual income from fish farming of pond farmers had a significant positive relationship with their use of pond fish farming practices. Khan (1986) observed that family income is an essential economic factor affecting utilization of pond fish farming practices. Abdullah (2013) found that annual income had no relationship with their use of pond fish farming practices. But the findings indicate that higher income can increase use of pond fish farming practices.

4.3.8 Relationships between commercialization of pond farmers and their use of pond fish farming practices

The following observations were recorded about commercialization of pond fish farmers and their use of pond fish farming practices on basis of correlation coefficient:

❖ The computed value of 'r' (0.680) was larger than the tabulated value (r=0.254) with 99 degrees of freedom at 0.01 level of probability as shown in Table 14.

❖ The null hypothesis was rejected.

❖ The relationship between the concerned variables was significant and showed a positive trend

The findings indicate that commercialization of pond farmers had a significant positive relationship with their use of pond fish farming practices. Sakib et al. (2014) found that commercialization had a significant positive relationship with aquaculture practices.

4.3.9 Relationships between training exposure of pond farmers and their use of pond fish farming practices

The following observations were recorded about training exposure of pond fish farmers and their use of pond fish farming practices on basis of correlation coefficient:

❖ The computed value of 'r' (0.911) was larger than the tabulated value (r=0.254) with 99 degrees of freedom at 0.01 level of probability as shown in Table 14.
❖ The null hypothesis was rejected.
❖ The relationship between the concerned variables was significant and showed a positive trend

The findings indicate that training exposure of pond farmers had a significant positive relationship with their use of pond fish farming practices.
Sakib et al. (2014), Abdullah (2013) and Rahman (2006) found that training had significant positive relationship with their use of practices. Training is an important factor that can increase the use of pond fish farming practices.

4.3.10 Relationships between extensions contact of pond farmers and their use of pond fish farming practices

The following observations were recorded about extension contact of pond fish farmers and their use of pond fish farming practices on basis of correlation coefficient:

❖ The computed value of 'r' (0.654) was larger than the tabulated value (r=0.254) with 99 degrees of freedom at 0.01 level of probability as shown in Table 14.
❖ The null hypothesis was rejected.
❖ The relationship between the concerned variables was significant and showed a positive trend

The findings indicate that extension contact of pond farmers had a significant positive relationship their use of pond fish farming practices. Goswami et al. (2020), Rashed (2018) and Islam (2010) found that extension contact increased the use of farming practices. Extension contact can help a farmer to know proper use of farming practices.

CHAPTER 5

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of the Major Findings

The title of the study was "Farmers' use of pond fish farming practices," of Gafargaon upazilla under Mymensingh district. This study was undertaken to identify the common available farming practices being used by the pond fish farmers. The aim of the study was to determine and describe the extent of use of pond fish farming practices and to determine the relationship between the selected characteristics of the farmers with their use of pond fish farming practices. The study was conducted in four villages of Panchbag union under Gaffargaon Upazilla. Data were collected from 101 respondents selected randomly from an undated list of 301 farmers. For data collection a pre-tested interview schedule was used. The major findings are summarized in the subsequent sections.

5.1.1 Selected characteristics of the farmers

Ten individual characteristics of the pond fish farmers were selected for investigation under this study. The findings of ten characteristics of the fish farmers are summarized as follows:

Age: The majority (64.35 percent) of the pond farmers were middle aged to young. This means that fish farming in the study area is being managed by comparatively younger pond owners.

Level of education: Majority of the pond farmers (30.69%) had secondary education while 26.74 percent had above secondary education and 13.86 percent had primary education On the other hand, 18.81 percent can sign only and 9.9 percent of respondents can't read and write. Thus the data revealed that 71.29 percent of pond farmers are literate.

Experience in pond fish farming: Majority (59.41%) of the pond farmers felt in the medium experience category while 18.81 percent had high experience and only 21.78 percent had low experience. It means that above three fourths (81.19%) of the fish farmers had low to medium fish farming experience

Family size: The medium size family constitutes the highest proportion (51.49 percent) followed by the small size family (21.78 %). On the other hand 26.73 percent of farmers had a large family size.

Land possession: Majority (80.20 %) of the pond fish farmers had medium land possession while 16.83 percent of them had large land possession and 2.97 percent had small land possession.

Pond size: Majority (79.21%) of the pond farmers had medium ponds while 15.84 percent of them had large ponds and 4.95 percent had small ponds.

Annual income from pond fish farming: 12.87 percent of pond fish farmers had low income, 72.28 percent had medium income and 14.85 had high income from their pond fish farming.

Commercialization: Majority (61.39%) of the pond farmers had medium commercialization compared to 15.84 percent of them had high and only 22.77 percent had low commercialization.

Training exposure: About 41.58 percent people had low training; only 16.84 percent people had high training. Thus, the overwhelming majority (83.16%) of the pond fish farmers had low to medium training exposure.

Media contact for fish farming: The highest proportion (53.47%) of the pond fish farmers had medium extension contact while 29.70 percent had very low extension contact and 16.83 percent farmers had medium extension contact.

5.1.2 Use of pond fish farming practices

Score of use of pond fish farming practices of the farmers ranged from 17 to 56 against the possible range of 0-60 with an average of 34.55. Majority (62.38%) of the farmers felt under medium use of pond fish farming practices category, whereas 23.76 percent in high use and 13.86 percent felt in low use of pond fish farming practices. Thus, a proportion 76.24 percent of the pond fish farmers had low to medium use of pond fish farming practices.

5.1.3 Relationship of the selected characteristics of the farmers with their use of pond fish farming practices

Level of education of pond fish farmers had a significant positive relationship with their use of pond fish farming practices. Land possession of pond fish farmers had a significant positive relationship with their use of pond fish farming practices. Pond size of pond fish farmers had a significant positive relationship with their use of pond fish farming practices. Experience in fish farming of pond fish farmers had a significant positive relationship with their use of pond fish farming practices. Annual income from pond fish farming of fish farmers had a significant positive relationship with their use of pond fish farming practices. Commercialization of pond fish farming of fish farmers had a significant positive relationship with their use of pond fish farming practices. Training exposure of fish farmers had a significant positive relationship with their use of pond fish farming practices. Extension contact of fish farmers had a significant positive relationship with their use of pond fish farming practices. On the other hand, age and family size had no relationship with their use of pond fish farming practices.

5.2 Conclusions

Conclusion defines the final part of something. It is very much essential to have satisfactory clarification about the findings of the research study and to draw a series of consequential conclusions.

On the basis of the findings of the research and their logical interpretations of their meaning in light of other relevant facts, the following conclusions were drawn:

1. More than, two-thirds (76.24%) of the pond fish farmers had low to medium use of pond fish farming practices. These facts lead to the conclusion that there is scope to increase the use of fish farming practices by the pond fish farmers.

2. Level of education, experience, land possession, pond size, annual income from pond fish farming, commercialization of fish farming, training exposure and extension contact for fish farming of the pond fish farmers had significant relationship with their use of pond fish farming practices. It may be concluded that farmers' use of pond fish farming practices was dependent with their level of education, land possession, pond size, annual income from pond fish farming, commercialization of fish farming, training exposure and extension contact for

fish farming. Fish farmers having large pond sizes had more opportunity to use fish farming practices by them. Fish farmers having large land were found economically solvent, had more extension contact and more opportunity of using farming practices by them. Therefore it can be concluded that increase of level of education, experience, land possession, pond size, commercialization of fish farming, training exposure and extension contact of the farmers would increase the use of farming practices.

5.3 Recommendations

Recommendations are divided into two sub sections, viz. recommendations for policy implication and recommendation for additional study. Based on the findings and conclusions of the study, the subsequent recommendations were created. These recommendations are-

1. Majority (76.24%) of the farmers had low to medium use of pond fish farming practices. Therefore, it may be recommended that the concerned authorities should take proper steps by motivational campaigning, training and providing advisory service to increase the use of modern pond fish farming practices.

2. It is observed that the level of education of the pond farmers had a significant relationship with their use of pond fish farming practices. This means that the higher level of education of the pond fish farmers would be higher use of pond fish farming practices. Level of education helps an individual to increase his/her use of farming practices through reading fish farming related materials.

3. Experience in fish farming of the pond fish farmers had a significant relationship with their use of pond fish farming practices. This means that the higher experience of pond fish farmers the higher use of pond fish farming practices. Experience helps a pond fish farmer to do better use of pond fish farming practices.

4. Land possession of pond fish farmers had a significant relationship with their use of pond fish farming practices. That means higher land possession of pond fish farmers increase their use of pond fish farming practices.

5. Pond size of pond fish farmers had a significant relationship with their use of pond fish farming practices. Larger pond size of pond fish farmers increase their use of pond fish farming practices.

6. Annual income from pond fish farming had significant relationship with use of fish farming practices. Majority of the pond farmers had very low to medium income and therefore, extension authorities should design extension programmes for proper use of farming practices among the pond farmers in such a way that the very low to medium income farm families are given more emphasis.

7. Commercialization of pond fish farmers had a significant relationship with their use of pond fish farming practices. Hence, it may be recommended that Government organization should take proper steps to promote commercialization process.

8. Training exposure of pond fish farmers had a significant relationship with their use of pond fish farming practices. So, it can be recommended that Government organization, extension authorities should increase training programme about farmers' use of fish farming practices.

9. Extension media contact for fish farming had a significant relationship with their use of pond fish farming practices. Hence, it may be recommended that extension agencies, Government and non-government organizations should take proper steps to promote various extension programmes to increase the use of pond fish farming practices.

5.3.1 Recommendations for additional study

A small piece of study has been conducted that cannot give all information for the correct understanding of the overall situation. Therefore, the subsequent suggestions are made for further studies:

1. The present study was conducted in Panchbag union under Mymensingh district. So, similar attempts may be undertaken to verify the result and similar studies may be conducted in other parts of Bangladesh.

2. Age and family size had no relationship with their use of pond fish farming practices. So, further attempts can be undertaken to verify the result.

3. This study investigated the relationship of 10 characteristics of the pond farmers with their use of pond fish farming practices. Further research should be conducted by selecting other characteristics of the pond fish farmers to observe the relationships with their use of pond fish farming practices.

4. Farmers' use of pond fish farming practices has been investigated in this study. It is also necessary to study the pond farmers' use of other agricultural practice.

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Appendices

Department of Agricultural Extension & Information System

Sher-e-Bangla Agricultural University

Interview Schedule

(Confidentiality will be maintained and all information will be used only for study purpose)

Use of pond fish farming practices by the Farmers

Serial No:……………………………………………..

Name of the respondent:……………………………….   Contact No:………………………………………

Village:………………………………………………..   Union:…………………………………………….

Thana:……………………………………………………   District:…………………………………………..

Please answer the following questions. Give tick (✓) marks in the appropriate place)

1. Age
How old are you? …………………years.

2. Level of Education

Please mention your level of education.

a) I can't read and write
b) I can sign only (Non-formally educated)
c) I read up to class…………………
d) I have passed……………….……class.

3. Experience in pond fish farming
How many years have you been engaged with fish Culture? ………………years

4. Family Member

   Total Family member =

5. Land possession

Sl. No	Land type	Farm area (Decimal)
1	Own Cultivated area	
2	Homestead area	
3	Land given to others on borga	
4	Land taken from others on borga	
5	Land taken from others on lease	

6. Pond Size

Pond area: ………………decimal

7. Annual Income from Fish farming

Total income from fish farming=_____taka

8. Commercialization of Fish products

$$Commercialization = \frac{Value\ of\ fish\ product\ sold}{Total\ value\ of\ fish\ product\ raised} \times 100$$

9. Training Exposure

Do you have participated in any training relative to fish Culture?

1. Yes

2. No

Sl. No.	Subject of Training	Duration of Training (Days)

10. Media Contact for Fish Farming Information

Please state the extent of your contact with the following personnel

Sl. No.	Extension Contacts	Extent of Participation				
		Always	Very often	Sometimes	Rarely	Never
1	Model fish farming					
2	Input dealer					
3	NGO worker					
4	Field worker of fisheries department					
5	Upazila fisheries officer					

11. Use of pond fish farming practices

Please state the extent of the following information

Sl. No.	Statement	Extent of practice				
		Always	Very often	Sometimes	Rarely	Never
1	Pond Preparation					
	Weed management in pond					
	Using lime in pond					
	Using fertilizer in pond					
	Drainage management					
2	Selection of quality fingerling, species and their stocking density					
	Selection of quality Seed, species					
	Stock monitoring					
	Record keeping					
3	Water quality management					
	Checking water quality parameter					
4	Feed management					
	Applying supplementary feed in pond					
	Proper time of feed application					
5	Insects and diseases control					
	Identification of disease					
	Preventive measures of disease					
6	Harvesting, fish preservation and					

	marketing of product				
	Harvest proper time				
	Proper techniques of preservation				
	Using early marketing system				

Thank you for your kind co-operation.