FARMERS' KNOWLEDGE AND PRACTICE ON POND FISH FARMING

A Thesis

By

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This is to certify that the thesis entitled **"Farmers' Knowledge and Practice on Pond Fish Farming"** submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **Master of Science in Agricultural Extension and Information System**, embodies the result of a piece of bona fide research work carried out by **Md. Masum Abdullah**, Registration No. **06-02122** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

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

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DEDICATED
TO
MY BELOVED
PARENTS

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ABSTRACT

The major purpose of this research study was to determine farmers' knowledge and practice of pond fish culture and also to explore the relationships between 10 characteristics of the pond farmers and their knowledge and practice of pond fish culture. The study was conducted in 4 villages of Kaijuri union of Faridpur district. The populations of pond farmers in these villages were 253, from where 101 samples were drawn by using random sampling technique. An interview schedule was used for data collection. Knowledge and practice of pond fish farming was determined by a validated test. The data were collected during 20th March to 12th April 2013. Appropriate scales were developed in order to measure the variables. Descriptive statistics such as mean, standard deviation, range and percentage were used to describe the variables under consideration. Correlation test was used to ascertain the relationship between the concerned dependent and independent variables of the research work. The majority 44.6 percent of the pond farmers' possessed medium knowledge, 25.7 percent of the pond owners possessed high knowledge and only 16.8 percent of the pond owners had low knowledge and 12.9 percent of the farmers possessed very high knowledge. About 61.4 percent of the pond farmers had medium practice, while 27.7 percent farmers had low practice and only 10.9 percent farmers had high practice. Age, pond size, commercialization and training exposure of the pond farmers had positive significant relationship with farmers' knowledge on pond fish farming, while problem faced had negative relationship. In case of farmers' practice pond size, commercialization and training exposure had positive significant relationship and problem faced had negative relationship. The pond owners faced such major problems as: proper marketing facilities, poor communication system, natural calamities, shortage of pond water in dry season, insufficient credit and low price of pond fish in pick period.

CHAPTAR 1
INTRODUCTION

1.1 General background

Bangladesh is a south Asian country located in between latitude 20°34' and 26°39' north and longitude 80°00' and 92°41' east. The country is crisscrossed with hundreds of rivers. The climate of Bangladesh is unique for aquaculture and fisheries resources management. The Bay of Bengal is situated at the south of the country. Winter lasts only for about 2 months in the country. Temperature and rainfall ranges from 07° to 40°C and 1170 to 3400 mm respectively.

The country has an exclusive economic zone of 41,000 square miles (110,000 km^2), which is 73% of the country's land area. On the other hand, Bangladesh is a small and developing country overloaded with almost unbearable pressure of human population. In the past, people of Bangladesh were mostly dependent upon land-based proteins. But, the continuous process of industrialization and urbanization consumes the limited land area.

Fisheries are one of the major components of agricultural activities, playing a significant role in nutrition, employment, income generation, foreign exchange earnings and in the economy of Bangladesh as a whole.

Fisheries sector contributed 4.43% to national GDP and 22.21% to the agricultural GDP and 2.73% to foreign exchange earnings by exporting fish and fish products in 2010-11. Fish provides 60% of national animal protein consumption. Fisheries sector also plays an important role in rural employment generation and poverty alleviation (DoF, 2008).

In 2010-11 the total fish production was 30.62 lakh Metric Ton (MT). Average annual growth rate of fish production in last 3 years is 6.11%. The Production from closed water bodies is increasing very sharply due to dissemination of adaptive technologies and need-based extension services rendered by The Department of Fisheries. There are 260 freshwater and 475 marine fish species in the country. About 12 exotic species

are being cultured in the country. Of which 82 % was from inland fisheries and the rest 18% from marine fisheries. On the inland fisheries, 63 percent were from open water flood plains, river capture fisheries and the rest, 27 % were from closed water pond, tanks culture fisheries. However, now a days fish is becoming increasingly scarce and costly. Amongst the lower income groups, per capita consumption per annum is only about 4.4 kg, and for the poorest of the poor fish is simply unaffordable.

There are three categories of major fisheries resources, these are- Inland Capture (34%), Inland Culture (48%), Marine Capture (18%). Inland fisheries comprises of rivers, ponds, estuaries, beels, floodplains, haors, baors, brackish water etc. There are 260 fish and 24 prawn species in inland fresh water in the country. In early sixties inland fisheries contributed about 90% of total fish production of the country. Fish production from aquaculture has increased to a great extent but open water fish production is in slow progress. Now only about 34% of the total fish production comes from inland open water.

The Bay of Bengal is situated in the South of Bangladesh. There is a total of 166,000 sq. km. water area including Exclusive Economic Zone (EEZ). Fishing is only confined within 200-meter depth. About 158 trawlers, 45,377 mechanized and non-mechanized boats are engaged in fishing. Pelagic and deep-sea resources are still untapped. In the year 2010-11 total fish production from Marine source was 5.46 lakh metric MT.

Recently Bangladesh has got the right access 1.00lakh sq. kilometer water area in Bay of Bengal through International Tribunal for the Law of the Sea (ITLOS) by the visionary and pragmatic leadership of Honorable Prime Minister Sheikh Hasina. Department of Fisheries (DoF) has planned to access the fisheries resources in the Bay of Bengle for maximum sustainable yield. A research vessel is under process of procurement to conduct appropriate stock assessment. Vessel Tracking Monitoring System will also be developed.

Table 1.1: Fish production in Bangladesh (2006-2011)

Year	Source wise production (MT)			Total
	Inland open	Closed	Marine	
2010-2011	1054585	1460769	546333	**3061687**
2009-2010	1029937	1351979	517282	**2899198**
2008-2009	1123925	1062801	514644	**2701370**
2007-2008	1060181	1005542	497573	**2563296**
2006-2007	1006776	955812	487438	**2440011**

In fact, in a Country like Bangladesh where fish culture has a long tradition, pond fish culture can be expected to play an important role in supplying ever-increasing fish needs of the people. It is very important to increase the production in pond fisheries with controlled water bodies as ponds and tanks through the introduction of modern and intensive culture method. The total number of ponds in Bangladesh is estimated to be about 2 million (BBS: 2008). The Department of Fisheries of Bangladesh had classified all ponds into three categories; (i) Derelict pond (9.42%) (ii) Culturable pond (17.54%) and (iii) Cultured ponds (63%). The total fish production from ponds is around 1140485 metric tons (DoF). Department of Fisheries (DoF) is trying to disseminate fisheries innovation to the pond farmers. But no previous researcher had tried to find out the knowledge and practice of farmers regarding pond fish farming. On these considerations, the present researcher felt necessity to conduct this research on “Farmers’ Knowledge and Practice on Pond fish Farming”.

1.2 Statement of the Problem

Increase in fish production can be realized by tapping resources of rural Bangladesh and cultivate them with above- mentioned methods of fish culture. Hence, pond fish culture can also become a major income-generating element in rural development programmes and supplemented with crop production and animal husbandry, pond fish culture can generate employment as well. All these could in thus improve the quality of life of the rural poor in Bangladesh.

Analyzing the issues from farmers of pond fish culture, the study was designed to find out the following research questions regarding farmers' knowledge and practice of pond fish culture:

i. What is the extent of knowledge of farmers in pond fish culture?
ii. What is the extent of practice of farmers in pond fish culture?
iii. Is there any relationship between farmers' selected characteristics, and their knowledge and practice of pond fish culture?

The questions indicate the need for conducting a research study entitled "Farmers' knowledge and practice on pond fish farming" in order to have an understanding of the knowledge and practice of pond owners of pond fish farming. Such research information will 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 assess the following selected characteristics of the farmers:
    - Age
    - Education
    - Land possession
    - Pond size
    - Annual family income
    - Annual income from pond fish farming
    - Commercialization of fish
    - Training exposure
    - Problem faced in fish culture
    - Extension contact for fish culture information

2. To assess the extent of farmers' knowledge on pond fish farming

3. To assess the extent of farmers' practice on pond fish farming

4. To explore the relationship between farmers' knowledge and practice on pond fish farming

5. To explore the relationship of farmers' selected characteristics with their knowledge on pond fish farming

6. To explore the relationship of farmers' selected characteristics with their practice on pond fish farming

7. To compare the severity of the problems faced by the pond fish farmers

1.4 Justification of the Study

The major focus of the study is to assess the knowledge and practice of the farmers of pond fish culture. Pond fish farming should get adequate attention to meet the growing demand for fish for increased population of Bangladesh. Different government and non-government organizations (NGOs) are currently putting effort and allocating resources for production oriented research and also encouraging the rural people to undertake pond fish farming. 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. So, evaluation of knowledge and skill of the concerned pond owners is necessary.

Considering the above findings, the researcher became interested to undertake a study to determine knowledge and practice of pond fish farmers.

1.5 Assumption of the Study

The researcher had the following assumptions in mind while undertaking this study:

1. The selected respondents were competent enough to reply the queries made by the researcher.
2. The responses furnished by the respondents were valid and reliable.
3. Information furnished by the respondents included in the sample was the representative opinion of the whole population of the study area.
4. The researcher who acted as interviewer was well adjusted to social and environment condition of the study area. Hence, the data collected by him from the respondents were free from bias.
5. All the data concerning all the variables of the study were normally and independently distributed.

1.6 Limitation of the Study

Considering the time, money and other resources available to the researcher and to make the study manageable and meaningful, it became necessary to impose certain limitations as noted below:

1. The study was confined to one selected union of Sadar upazilla under Faridpur district.
2. The characteristics of pond farmers in the study area were many and varied but only ten characteristics were selected for investigation in this study as stated in the objectives.
3. The researcher relied on the data furnished by the pond owners from their memory during interview.
4. For some cases, the researcher faced 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.
5. Reluctance of pond farmers to provide information was overcome by establishing proper rapport.

1.7 Definition of Terms

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

Age

Age of a respondent was defined as the span of his/her life and was operationally measured by the number of years from his/her birth to the time of interview.

Education

Education referred to the development of desirable change in knowledge, skill, attitude and ability in an individual through reading, writing, working, observing and other related activities. It was operationalized by the formal education of pond farmers by taking into account of years he/she spent in formal educational institutions.

Land possession

Land possession referred to the cultivated area either owned by the farmer or obtained from others on 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

It referred to the area of pond of the farmers. It was expressed in hectare.

Annual family income

The term annual family income referred to the total earning of the respondent himself/herself from agriculture, livestock, fisheries and other accessible sources (business, service, daily labor etc.) during a year. It was expressed in Thousand Taka.

Annual income from pond fish farming

It referred to the earning of the respondent from selling of fish and fish fry and 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 contact for fish culture information

It referred to an individual's (farmer) exposure to or contact with different communication media, source and personalities being used for dissemination of new technologies.

Problem faced in fish culture

Problem referred to a difficult situation about which something to be done. It referred to the extent of problems faced by a respondent in fish culture in terms of social, technical, economical, marketing and psychological problems.

Knowledge on pond fish culture

It referred to the extent of basic understanding of the farmers in different aspects of pond fish cultures i.e. species, pond preparation, predatory fish, food availability, food preparation, diseases, fish harvesting, marketing etc. It includes the basic understanding of the use of different pond fish inputs and practices.

Practice of pond fish culture

It referred to the level of practices by the farmers in various aspects of pond fish cultures, such as counting fingerlings, application of cowdung, use of fertilizers, use of lime, application of suppl

CHAPTER 2
REVIEW OF LITERATURE

This chapter deals with the reviews of past works that relate to this investigation directly or indirectly. Despite frantic search, the researcher found only a few studies which were indirectly related to the present study. The researcher intensively searched internet, websites, available books, journals and printed materials from different sources of home and abroad.

However, the literatures have been organized into following five sections to set the context of the study:

First section : Concept and Past Research related to Knowledge and Practice.

Second section : Relationships between Selected Characteristics of the Respondents and Their Knowledge on Pond Fish Farming.

Third section : Relationships between Selected Characteristics of the Respondents and Their Practice of Pond Fish Farming.

Fourth section : Conceptual Model of the Study.

2.1 Concept of Knowledge and Practice and Past Research Findings related to Pond Fish Farming

Bhuiyan (2012) indicated that “Knowledge may be defined as the scientific fact of an idea which is experimentally or empirically verified.”

Andre Boudreau(1995) indicated “Human faculty resulting from interpreted information; understanding that germinates from combination of data, information, experience, and individual interpretation. Variously defined as, Things that are held to be true in a given context and that drive us to action if there were no impediments."

According to Wikipedia "Knowledge is a familiarity with someone or something, which can include facts, information, descriptions, or skills acquired through experience or education. It can refer to the theoretical or practical understanding of a subject. It can be implicit (as with practical skill or expertise) or explicit (as with the theoretical understanding of a subject); it can be more or less formal or systematic."

According to Oxford dictionary "facts, information, and skills acquired through experience or education; the theoretical or practical understanding of a subject."

Alam (2003) indicated that "Practice may be referred as the activities of an individual that he/she performed followed by some instructions in order to fulful some wants that he/she needed."

Karl Sweiby (2003) indicated that "Practice may be defined as a method, procedure, process, or rule used in a particular field or profession; a set of these regarded as standard."

According to Oxford dictionary "Practice is the actual application or use of an idea, belief, or method as opposed to theories relating to it."

Azad (2005) determined the impacts of Mymensingh Aquaculture Extension Project (MAEP) in relation to farmers' gain in knowledge, skill development and change of attitude on culture and management of fish ponds in Melandaha and Islampur upazilla under Jamalpur district. The personal characteristics of the fish farmers such as education, experience, training and organizational contact were positively correlated with farmers' acceptance of aquaculture training provided by MAEP was effective in enhancement and development of farmers' knowledge, skill and attitude on fish production under semi-intensive system of culture and management. After training, fish production of trained farmers was increased by 84percent over their initial production of 6.83 kg/dec/yr. Fish production of the trained farmers increased to a level of 10.0-18.0 kg/dec/yr averaging 12.55 kg/dec/yr. The selected farmers had favorable attitude towards semi-intensive aquaculture.

Khan (2005) studied on knowledge of maize cultivation and found that majority (68 percent) of the farmers had relatively low level of knowledge and 32 percent of the farmers possessed relatively high level of knowledge.

Sana (2003) studied farmers' knowledge of shrimp culture and showed that majority (61 percent) of them had medium level of knowledge, while 30 percent had low and rest 9 percent possessed high knowledge.

Hasan(2004) reported that the highest proportion of the respondents had medium knowledge on partnership extension approach (70.4 percent) followed by 16.9 percent had low knowledge an 13.3 percent had high knowledge.

Rahman (2004) found in his study that the highest proportion (62.22 percent) of the respondents had medium knowledge compared to 25.56 percent having low knowledge and only 12.22 percent had high knowledge on HYV boro rice cultivation practices.

Hussen (2001) found in his study on farmers' knowledge and adoption of modern sugarcane cultivation practices found that highest proportion (84 percent) of the farmers possessed medium knowledge, 13 percent high knowledge and lowest proportion (3 percent) possessed low knowledge.

Saha (2001) made an attempt on farmers' knowledge in improved practices of pineapple cultivation and found that the majority (62 percent) of the farmers possessed good knowledge, 33 percent poor knowledge and only 5 percent possessed excellent knowledge.

Khan (1996) conducted a research on the effectiveness of a farmer primer on growing rice in knowledge change of the farmers in Shaktipur Thana and found that 67 percent farmers had good knowledge at initial stage, where 21 percent had excellent knowledge and 12 percent had poor knowledge.

Parvene (1995) in her study found that 58 percent of the farm women had moderate knowledge while 35 percent had high and 7 percent had poor knowledge on the use of fertilizer, pesticides and irrigation water.

Abolagba *et al. (*2006) showed that a higher percentage of the farmers (42.1% and 36.8%) were hobby and part time farmers and the average age of the farmers was 47 years. About 94.7% of the farmers feed their fish using locally available feed ingredients; 89.5% and 26.3% of the farmers use poultry dropping and single super phosphate fertilizers, respectively to fertilize their ponds while 63.2% do not lime their ponds. The pond management practices were and can be generally considered as fair.

Akankali *et al.*(2011)showed in their articles reviews the fish pond management processes, stocking of ponds, feeding of fish, types of culture, fish farming combined with other branches of agriculture, rearing of fish for purposes other than food, other fish culture, types of fish used for fish culture in central east Africa, general biology of the species of value in fish culture and suitable combinations of fish for stocking to reawaken the minds of individuals, companies and government on the need to develop pond fish culture in Nigeria.

Islam (2002) found in his study that majority (87 percent) of the ecological farmers of Proshika had medium adoption while only one percent had low and 12 percent had high adoption of ecological agricultural practices. Considering extent of adoption, the mostly adopted ecological practices, as stated in descending order, were compost, mulching, inter and mixed cropping, multi layer crop, crop rotation, green manuring, mechanical control of pest, disease and pest resistant varieties and botanical pesticides.

Rabbany (2003) showed that only 31.37 percent of the farmers were high users of integrated pest management (IPM) practices, while 86.89 percent were medium and none was low users. Among 10 selected IPM practices “Agro-ecosystem Analysis (AESA) in every crop season” ranked first in the order while “collection and destroy of eggs and larvae by hand” ranked last.

2.2 Relationship between Selected Characteristics of the Farmers and Their Knowledge on Pond Fish Farming

2.2.1 Age and Knowledge on pond fish farming

After reviewing the related literature, it was found that some studies showed age having negative and some studies showed age having positive relationship with knowledge on pond fish farming or related matters, but some studies did not show any significant relationship.

Researcher And Year	Independent Variable	Dependent Variable	Relationship/ Contribution/effect
Rahman (2006)	Age	Knowledge on prawn culture	Significant & Negative relationship
Roy (2006)	Age	Knowledge on Boro rice cultivation	No significant relationship
Rahman (2005)	Age	Knowledge on Boro rice cultivation	No significant relationship
Rahman (2004)	Age	Knowledge on Boro rice cultivation practices	No significant relationship
Akhter (2003)	Age	Knowledge on agricultural activities	Significant relationship
Farhad (2003)	Age	Knowledge in using IPM in vegetable cultivation	Significant & Negative relationship
Saha (2003)	Age	Knowledge on poultry production	No relationship
Islam (2002)	Age	Knowledge on ecological agricultural practices	No significant relationship
Sarkar (2002)	Age	Farmers knowledge on BRRI Dhan-29	No relationship
Rahman (2001)	Age	Farmers knowledge on Alok 6201 hybrid rice	No relationship
Hossain (2002)	Age	Knowledge on Bina Dhan-6 technology	No significant relationship
Hanif (2000)	Age	Farmers IPM knowledge	Significant relationship

Some other researchers like Sarkar (2005), Kasem (1987), Hansara and Chopra (1986) also found negative and significant relationship between age and knowledge.

2.2.2 Education and Knowledge on pond fish farmin

It can be assumed from the studies that education has been one of the factors for spreading up knowledge on pond fish farming or related matters in most of the cases. It also showed a negative relationship in some studies.

Researcher and Year	Independent Variable	Dependent Variable	Relationship/ contribution/effect
Rahman (2006)	Education	Knowledge on prawn culture	Significant and positive relationship
Roy (2006)	Education	Knowledge on Boro rice cultivation	Significant and positive relationship
Islam (2005)	Education	Knowledge on IPM in crop production	Significant and positive relationship
Rahman (2004)	Education	Knowledge on Boro rice cultivation practices	Significant and positive relationship
Islam (2005)	Education	Knowledge on coping with flood	Significant and positive relationship
Akhter (2003)	Education	Knowledge on agricultural activities	Significant and positive relationship
Hossain (2003)	Education	Knowledge on modern Boro rice cultivation practices	Significant and positive relationship
Sarkar (2002)	Education	Farmers knowledge on BRRI Dhan-29	Positive relationship
Saha (2001)	Education	Knowledge on pineapple cultivation	Significant and positive relationship
Rahman (2001)	Education	Farmers knowledge on Alok 6201 hybrid rice	Significant and positive relationship
Alam (2001)	Education	Knowledge on agriculture	No significant relationship
Hossain (2002)	Education	Knowledge on Bina Dhan-6 technology	Significant and positive relationship
Hazarika et al. (1999)	Education	Knowledge in plain and hilly areas	Significant and positive relationship

2.2.3 Land possession and Knowledge on pond fish farming

Reviewing the related literature, it was found that some studies showed land possession having negative and some studies showed land possession having positive relationship with knowledge on pond fish farming or related matters, but some studies did not show

Researcher and Year	Independent Variable	Dependent Variable	Relationship/ contribution/effect
Rahman (2006)	Land possession	Knowledge on prawn culture	Significant relationship
Islam (2005)	Land possession	Knowledge on IPM in crop production	Significant and positive relationship
Islam (2005)	Land possession	Knowledge on coping with flood	Significant and positive relationship
Khan (2005)	Land possession	Knowledge on maize cultivation	No relationship
Rahman (2004)	Land possession	Knowledge on Boro rice cultivation practices	Significant and positive relationship
Akhter (2003)	Land possession	Knowledge on agricultural activities	Significant and positive relationship
Sana (2003)	Land possession	Knowledge on shrimp culture	No significant relationship
Shaha (2003)	Land possession	Knowledge on SRI activities	Significant and negative relation
Sarkar (2002)	Land possession	Farmers knowledge on BRRI Dhan-29	Positive relationship
Mannan (2002)	Land possession	Knowledge on food and nutrition	Significant and positive relationship
Hossain (2001)	Land possession	Knowledge on crop cultivation	Positive relationship
Hossain (2002)	Land possession	Knowledge on Bina Dhan-6 technology	No relationship
Khan (1996)	Land possession	Knowledge on rice cultivation	No significant relationship
Ali (1984)	Land possession	Knowledge on agricultural practices	Significant and positive relationship

any significant relationship.

2.2.4 Pond size and Knowledge on pond fish farming

No literature was found related to relationship between pond size and knowledge on pond fish farming.

2.2.5 Annual Family Income and Knowledge on pond fish farming

Reviewing the related literature, it was found that most of the studies showed annual family income having significant positive and some studies showed annual family income having significant negative or no relationship with knowledge on pond fish farming or similar practices.

Researcher and Year	Independent Variable	Dependent Variable	Relationship/ contribution/effect
Rahman (2006)	Annual family income	Knowledge on prawn culture	Significant positive relationship
Roy (2006)	Annual family income	Knowledge on Boro rice cultivation	Significant relationship
Islam (2005)	Annual family income	Knowledge on IPM in crop production	Significant relationship
Rahman (2004)	Annual family income	Knowledge on Boro rice cultivation practices	Significant and positive relationship
Shaha (2003)	Annual family income	Knowledge on SRI activities	No significant relationship
Alam (2001)	Annual family income	Knowledge on agriculture	No significant relationship

2.2.6 Annual income from fish farming and Knowledge on pond fish farming

No literature was found related to relationship between pond size and knowledge on pond fish farming.

2.2.7 Commercialization and Knowledge on pond fish farming

Reviewing the related literature, it was found that three studies showed commercialization having significant relationship with the knowledge on pond fish farming or related matters.

Researcher and Year	Independent Variable	Dependent Variable	Relationship/ contribution/effect
Islam (2002)	Commercialization	Knowledge on vegetable cultivation	Significant relationship
Marsh and Coleman (1995)	Commercialization	Adoption behavior	Significant relationship
Afrad (2002)	Commercialization	Attitude towards vegetable cultivation	Significant relationship

2.2.8 Training exposure and Knowledge on pond fish farming

Reviewing the related literature, it was found that four studies showed training exposure having significant positive relationship and two having no relationship with the knowledge on pond fish farming.

Researcher and Year	Independent Variable	Dependent Variable	Relationship/ contribution/effect
Rahman (2006)	Training exposure	Knowledge on prawn culture	No significant relationship
Islam (2005)	Training exposure	Knowledge on IPM in crop production	No significant relationship
Sana (2003)	Training exposure	Knowledge on shrimp culture	Significant and positive relationship
Hossain (2001)	Training exposure	Knowledge on crop cultivation	Significant and positive relationship
Karim and Hossain (1995)	Training exposure	Knowledge in sugarcane cultivation	Significant relationship
Rayapareddy and Jayarmiah (1989)	Training exposure	Knowledge on rice production technology	Significant and positive relationship

2.2.9 Extension contact and Knowledge on pond fish farming

Reviewing the related literature, it was found that most of the studies showed extension contact having significant positive and some studies showed extension contact having significant relationship with knowledge on pond fish farming.

Researcher and Year	Independent Variable	Dependent Variable	Relationship/ contribution/effect
Sana (2003)	Extension contact	Knowledge on shrimp culture	Significant and positive relationship
Nabdiwal, Pattel and Kalla (1999)	Extension contact	Knowledge and adoption level of farmers	Significant relationship
Kaur (1988)	Extension contact	Knowledge on selected program among rural women	Significant relationship
Roy (2006)	Extension contact	Knowledge on Boro rice cultivation	Significant and positive relationship
Islam (2005)	Extension contact	Knowledge on IPM in crop production	Significant relationship
Hossain (2001)	Extension contact	Knowledge on crop cultivation	Significant and positive relationship
Shaha (2003)	Extension contact	Knowledge on SRI activities	Significant relationship
Khan (2005)	Extension contact	Knowledge on maize cultivation	Significant relationship
Rahman (2004)	Extension contact	Knowledge on Boro rice cultivation practices	Significant and positive relationship
Akhter (2003)	Extension contact	Knowledge on agricultural activities	Significant and positive relationship

2.2.10 Problem faced and Knowledge on pond fish farming

Reviewing the related literature, it was found that four studies showed problem faced by the farmers having no relationship and two studies showed significant positive relationship with the knowledge on pond fish farming.

Researcher and Year	Independent Variable	Dependent Variable	Relationship/ contribution/effect
Saha (2001)	Problem faced	Knowledge on pineapple cultivation	Significant and positive relationship
Rahman (2001)	Problem faced	Farmers knowledge on Alok 6201 hybrid rice	Significant and positive relationship
Islam (2005)	Problem faced	Knowledge on IPM in crop production	No relationship
Shaha (2003)	Problem faced	Knowledge on SRI activities	No relationship
Sarkar (2002)	Problem faced	Farmers knowledge on BRRI Dhan-29	No relationship
Hossain (2001)	Problem faced	Knowledge on crop cultivation	No relationship

2.3 Relationship between Selected Characteristics of the Farmers and Their Practice of Pond Fish Farming

2.3.1 Age and Practice of pond fish farming

After reviewing the related literature, it was found that some studies showed age having negative and some studies showed age having no relationship with practice on pond fish farming or related matters.

Researcher and Year	Independent Variable	Dependent Variable	Relationship/ contribution/effect
Sana (2003)	Age	Practice on shrimp culture	Negative relationship
Rahman (2004)	Age	Practice on Boro rice cultivation	No significant relationship
Akhter (2003)	Age	Practice on agricultural activities	Significant relationship
Saha (2003)	Age	Practice on poultry production	No relationship

2.3.2 Education and Practice of pond fish farming

Reviewing the related literature, it was found that some studies showed education having negative and some studies showed positive relationship with practice on pond fish farming or related matters, but some studies did not show any significant relationship.

Researcher and Year	Independent Variable	Dependent Variable	Relationship/ contribution/effect
Rahman (2006)	Education	Practice of prawn culture	Significant and positive relationship
Roy (2006)	Education	Practice of Boro rice cultivation	Significant and positive relationship
Islam (2005)	Education	Practice of IPM in crop production	Negative relationship
Islam (2005)	Education	Practice of coping with flood condition	Significant and positive relationship
Rahman (2004)	Education	Practice of Boro rice cultivation	No relationship
Akhter (2003)	Education	Practice of agricultural activities	Negative relationship
Hossain (2003)	Education	Practice of modern Boro rice cultivation	Significant and positive relationship
Saha (2003)	Education	Practice of poultry production	No relationship

2.3.3 Land possession and Practice of pond fish farming

Reviewing the related literature, it was found that land possession having significant positive relationship with practice on pond fish farming and also showed no relationship with practice on pond fish farming or related matters.

Researcher and Year	Independent Variable	Dependent Variable	Relationship/ contribution/effect
Rahman (2006)	Land possession	Practice of prawn culture	Significant and positive relationship
Islam (2005)	Land possession	Practice of IPM in crop production	Significant and positive relationship
Islam (2005)	Land possession	Practice of coping with flood condition	No relationship
Khan (2005)	Land possession	Practice of maize cultivation	No relationship
Rahman (2004)	Land possession	Practice of Boro rice cultivation	Significant and positive relationship

2.3.4 Pond size and Practice of pond fish culture

No literature was found related to relationship between pond size and knowledge on pond fish farming.

2.3.5 Annual family income and Practice of pond fish culture

After reviewing the related literature, it was found that some studies showed annual family income having significant positive and some studies showed age no relationship with practice on pond fish farming or related matters.

Researcher and Year	Independent Variable	Dependent Variable	Relationship/ contribution/effect
Rahman (2006)	Annual family income	Practice of prawn culture	Significant and positive relationship
Roy (2006)	Annual family income	Practice of Boro rice cultivation	Significant relationship
Islam (2005)	Annual family income	Practice of IPM in crop production	Significant relationship
Rahman (2004)	Annual family income	Practice of Boro rice cultivation	No relationship

2.3.6 Annual income from fish farming and Practice of pond fish farming

No literature was found related to relationship between pond size and knowledge on pond fish farming.

2.3.7 Commercialization and Practice of pond fish farming

No literature was found related to relationship between pond size and knowledge on pond fish farming.

2.3.8 Training exposure and Practice of pond fish farming

Reviewing the related literature, it was found that three studies showed training exposure having significant positive relationship and one study showed no relationship with the practice on pond fish farming.

Researcher and Year	Independent Variable	Dependent Variable	Relationship/ contribution/effect
Rahman (2006)	Training exposure	Practice of prawn culture	Significant and positive relationship
Islam (2005)	Training exposure	Practice of IPM in crop production	No relationship
Hossain (2001)	Training exposure	Practice of crop cultivation	Significant and positive relationship
Sana (2003)	Training exposure	Practice on shrimp culture	Significant and positive relationship

2.3.9 Extension contact and Practice of pond fish culture

It was found that one study showed extension contact having negative relationship and four studies showed significant relationship with the practice on pond fish farming.

Researcher and Year	Independent Variable	Dependent Variable	Relationship/ contribution/effect
Sana (2003)	Extension contact	Practice on shrimp culture	Significant and positive relationship
Kaur (1988)	Extension contact	Practice of selected program among the rural women	Significant relationship
Roy (2006)	Extension contact	Practice of Boro rice cultivation	Significant and positive relationship
Islam (2005)	Extension contact	Practice of IPM in crop production	Negative relationship
Hossain (2001)	Extension contact	Practice of crop cultivation	Significant and positive relationship

2.3.10 Problem faced and Practice of pond fish culture

Reviewing the related literature, it was found that two studies showed problem faced by the farmers having no relationship and one study showed significant positive relationship with the practice on pond fish farming.

Researcher and Year	Independent Variable	Dependent Variable	Relationship/ contribution/effect
Saha (2001)	Problem faced	Practice of pineapple cultivation	Significant and positive relationship
Rahman (2001)	Problem faced	Farmers practice of Alok 6201 hybrid rice	No relationship
Islam (2005)	Problem faced	Practice of IPM in crop production	No relationship

2.4 A Conceptual Framework of the Study

This study is concerned with the farmers' knowledge and practice on pond fish farming. Thus the knowledge and practice were the main focus of the study and 10 selected characteristics of the farmers' were considered as those might have relationship with knowledge and practice. Farmers' knowledge and practice of pond fish culture 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, annual family income, annual income from pond fish farming, commercialization of fish product, training exposure, problem faced in fish culture and extension contact for fish culture information. The conceptual framework of the study has been presented in Fig. 2.1

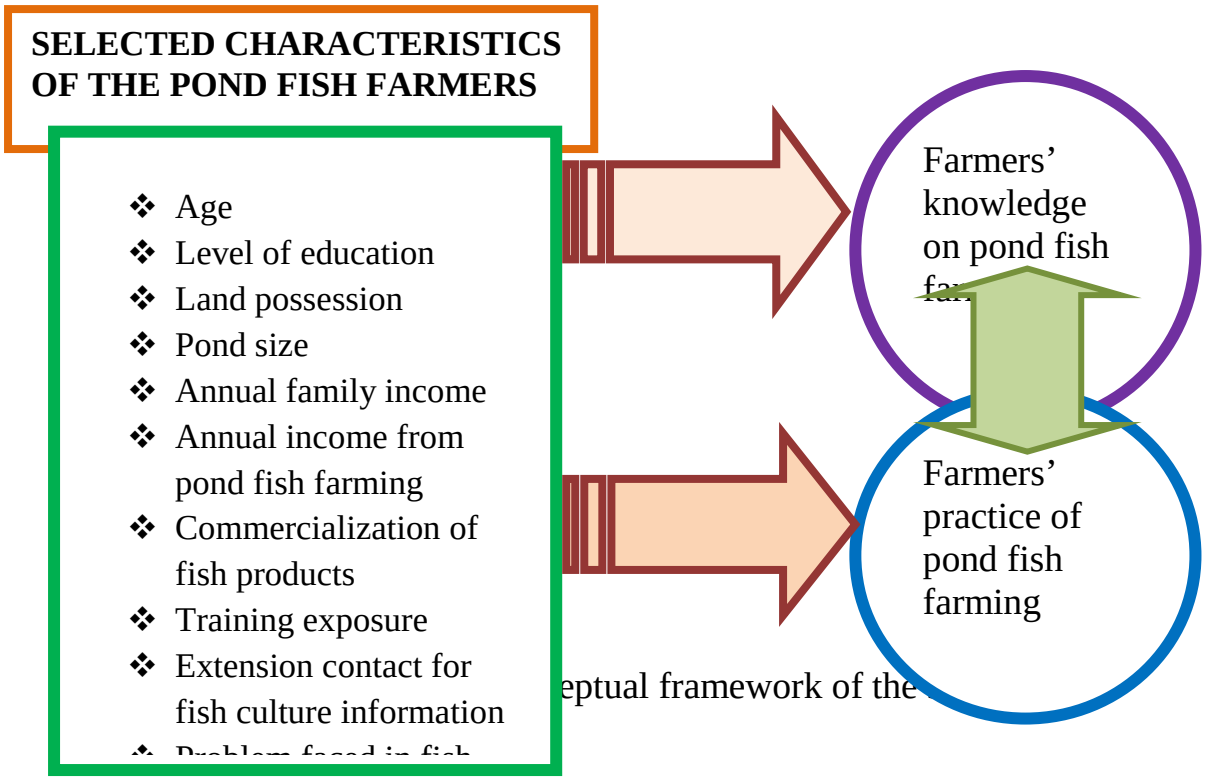

Fig. 2.1 The conceptual framework of the study

CHAPTER 3

MATERIALS AND METHODS

Methods and procedures used for collection and analysis of data are very important in any scientific research. It requires a careful consideration before conducting a study. The researcher has great responsibility to clearly describe as to what sorts of research design, methods and procedures he would follow in collecting valid and reliable data and to analyze and interpret those to arrive at correct conclusions. The methods and procedures followed in conducting this study have been discussed in this chapter. Further, the chapter includes the operational format and comparative reflection of some variables used in the study. Also statistical methods and their use have been mentioned in the later section of this Chapter.

3.1 The Locale of the Study

The study was conducted at Kaijuri union under Sadar upazilla of Faridpur district. Out of 15 villages of Kaijuri union, four were randomly selected. The selected villages were Mongolcot, Vatpara, Chor mongolcot and Loskarkandi. Selected villages were situated just near the Kumar River. A map of Faridpur sadar upazilla showing the study area is presented in Figure 3.1.

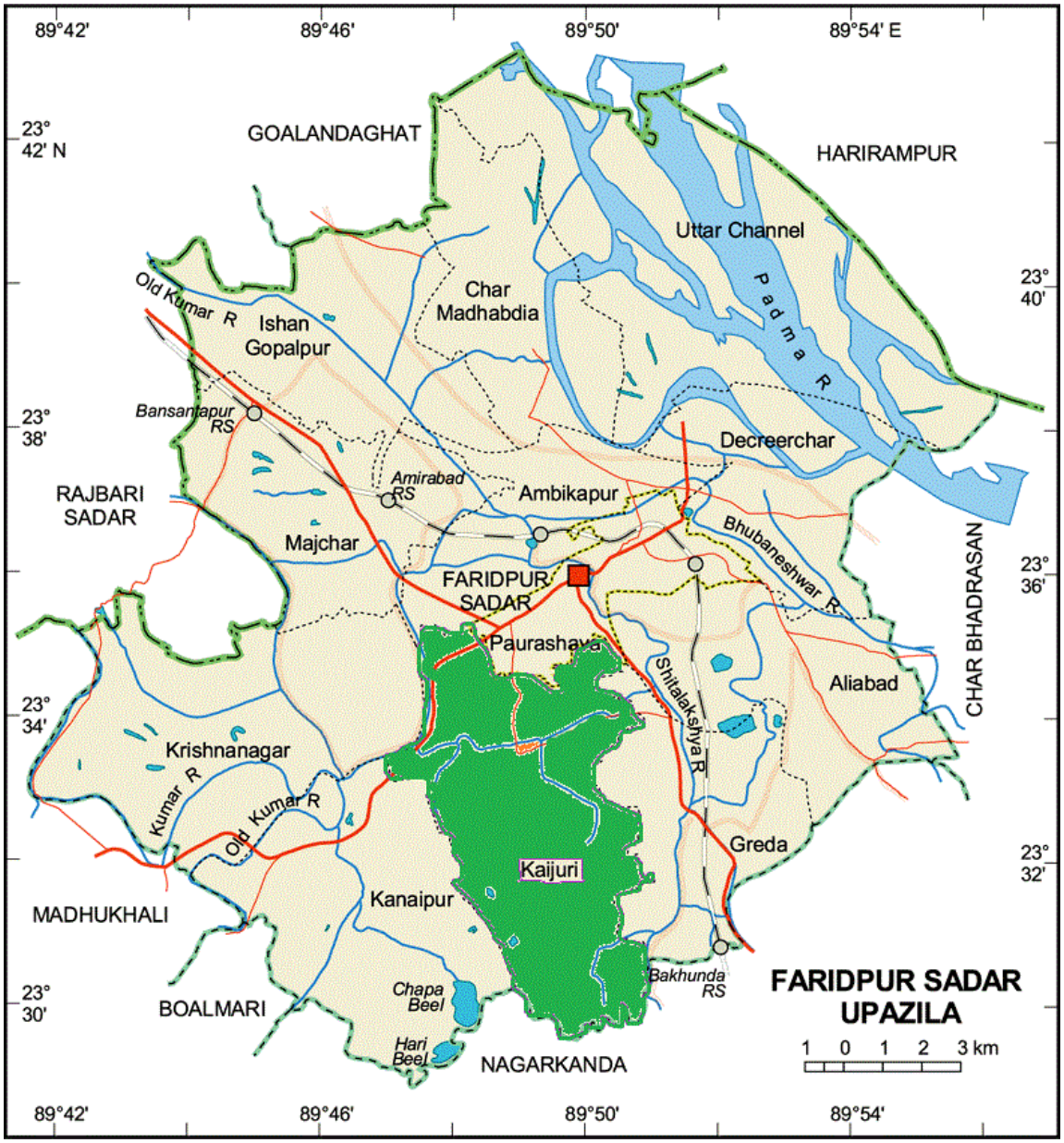

Figure 3.1: A map of Faridpur sadar upazilla showing the study area

3.2 Population and Sample

The pond owners of selected four villages under Sadar upazilla of Faridpur district were considered as the population of the study. A list of pond owners who are currently growing fish and fish fry in their pond was prepared with the help of Upazilla Fisheries Officer and his field staffs. The number of pond owners of the selected four villages was 253 which constituted the population of the study.

About 40 percent of the population was selected proportionally from the selected villeges as the sample by following random sampling method.

Thus, the total sample size stood at 101. Moreover, a reserved list of 12 pond owners was prepared taking 3 for each village for use when the pond owners under sample were not available during data collection.

The distribution of the selected pond owners with reserve list of the selected villages is shown in the table 3.1.

Table 3.1 Distribution of the sample of pond farmers in the study area

Name of village	Total no. of pond farmers	Sample	Reserve list
Mongolcot	68	27	3
Vatpara	56	22	3
Chor mongolcot	75	30	3
Loskarkandi	54	22	3
Total	**253**	**101**	**12**

3.3 Measurement of Variables

The various characteristics of the pond owners might have influence on their knowledge and practice on pond fish farming. These characteristics were age, education, land possession, pond size, annual family income, annual income from pond fish farming, commercialization of fish products, extension contact, training exposure and problem faced.

The knowledge and practice of pond owners on pond fish farming were the main focus of the study.

Measurement of all the factors of the pond farmers and their knowledge and practice on pond fish farming are discussed in the following sub sections:

3.3.1 Age

The age of a pond owner was measured by counting the actual years from his/her birth to the time of interview. It was expressed in terms of complete years.

3.3.2 Education

The education of a pond owner was measured by the number of years of schooling completed in an educational institution. A score of one (1) was given for each year of schooling completed. If a pond owner didn't t know how to read and write, his education score was zero, while a score of 0.5 was given to a pond owner who could sign his name only. If a pond owner did not go to school but studied at home or adult learning center, his knowledge status was determined as the equivalent to a formal school student.

3.3.3 Land possession

The land possession of a pond owner referred to the total area of land on which his/her family carried out farming operations, the area being in terms of full benefit to his/her family.

The land possession was measured in hectares for each pond owners using the following formula:

$LP=A_1+A_2+{}^1/_2\,(A_3+A_4)+A_5$

Where,

LP= Land possession

A_1 = Homestead area

A_2= Own land under own cultivation

A_3= Land given to others on borga

A_4= Land taken from others on borga

A_5= Land taken from others on lease

3.3.4 Pond size

Pond size referred to the total area of pond, on which the farmer carried out fish farming operations. The pond size was estimated on consideration of full benefit of the pond owners in terms of hectare.

3.3.5 Annual family income

Annual family income of a pond farmer was measured in Thousand Taka. The total yearly earning from agricultural (field crops, vegetables, fruits, spices, livestock and fisheries) and nonagricultural sources (service, business, and others) by the respondent himself and other members of his family was determined. Thus, yearly earning from agricultural and nonagricultural sources were added together to obtain annual family income of a pond farmer. A score of one was given for each Tk. 1,000 to compute the annual income scores of the respondents.

3.3.6 Annual income from pond fish farming

Annual income from pond fish farming was measured in Thousand Taka.

It refers to the earning of the respondent from selling of fish and fish fry. A score of one was given for each Tk. 1,000 to compute the annual income scores of the respondents.

3.3.7 Commercialization of fish products

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

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

Relevant market price was used in determining the value of fish product. Thus commercialization score could range from 0 to 100, while 0 indicating no commercialization and 100 indicating very high commercialization.

3.3.8 Training exposure

Training exposure of a pond farmer was measured by the total number of days he participated in different training programmes. A score of one (1) was assigned for each day of training received.

3.3.9 Problem faced in fish culture

This variable was measured by computing the extent of various problems of the respondents with 6 selected problems as obtained in response to item no. 8 of the interview schedule (Appendix A). Each respondent was asked to indicate the extent of his/her problem as severe problem, moderate problem, low problem and not at all problem and score was assigned as 3, 2, 1 and 0 respectively.

The problem faced score of a respondent was determined by summing up his/her scores for all the problems. Thus, possible score could vary from zero (0) to 18, where Zero indicated no problem and 18 indicated the highest level of problem.

3.3.10 Extension contact

This variable was measured by computing an extension contact score on the basis of a respondent's extent of contact with 5 selected media as obtained in response to item no.9 of the interview schedule (Appendix A). Each respondent was asked to indicate the frequency of his contact with each of the selected media.

With four alternative responses as 'regularly', 'occasionally', 'rarely' and 'not at all' basis and weights were assigned as 3, 2, 1 and 0 respectively.

The extension contact score of a respondent was determined by summing up his/her scores for contact with all the selected media. Thus possible extension contact score could vary from zero (0) to 15, where Zero indicated no extension contact and 15 indicated the highest level of extension contact.

3.3.11 Knowledge on pond fish farming

After thorough consultation with relevant experts and reviewing of related literature, 23 question regarding pond fish farming were selected and those were asked to the respondent pond owners to determine their knowledge on pond fish farming. Two (2) score was assigned for each correct answer and zero (0) for wrong or no answer. Score was also assigned for partially correct answer. Thus the knowledge on pond fish farming score of the respondent could range from o to 46, where zero indicating very poor knowledge and 46 indicate the very high knowledge on pond fish farming.

3.3.12 Practice of pond fish farming

A good number of innovations are being practiced now a day by the pond owners for pond fish farming. Based on pre-test experience and thorough consultation with relevant experts 13 innovations regarding pond fish farming were consider for this study. The respondent were asked to indicate their extent of practice of these 13 innovations with four alternative responses as Regularly, Occasional, Rare and never and weights were assigned to the alternative responses as 3,2,1 and 0 respectively. Practice on pond fish farming of the respondents were computed by summing up all the scores obtained by them from all the 13 innovations.

Thus the possible range of practice on pond fish farming score was 0-39, while 0 indicated no practice and 39 indicated highest practice on pond fish farming.

3.4 Instruments for Data Collection

In order to collect relevant data from the respondents an interview schedule was prepared in Bangla keeping the objectives of the study in mind. Both open and closed form questions were included in the schedule based on the measurement procedures discussed earlier in section 3.3.

Before finalization, the interview schedule was pre-tested with 20 pond owners of the study area. On the basis of the pre- test experiences necessary corrections, modifications and alterations were made before finalizing the interview schedule for final data collection. During modification of the schedule, valuable suggestions were received from the research supervisors and relevant experts. The interview schedule was then printed in its final form and multiplied. A copy of interview schedule in English version are placed in Appendix A.

3.5 Statement of Hypothesis

According to Kerlinger (1973), a hypothesis is a conjectural statement of the relation between 2 or more variables. Hypothesis are always in declarative sentence form and they relate either generally of specifically variables to sentence form and they relate either generally or specifically variables to variables. Hypothesis may be broadly divided into two categories, namely, research hypothesis and null hypothesis.

3.5.1 Research hypothesis

Research hypothesis states a possible relationship between the variables being studied or a difference between experimental treatments that the researcher expects to emerge. The following research hypothesis was put forward to know the relationships between each of the 10 selected characteristics of the pond farmers and their i) knowledge and ii) practice on pond fish farming. “Each of the 10 selected characteristics on the pond farmers will have significant relationship with their i) knowledge and ii) practice of pond fish farming.”

3.5.2 Null hypothesis

A null hypothesis states that there is no relationship between the concerned variables. The following null hypothesis was undertaken for the present study "There is no relationship between the selected characteristics of pond owners and their i) knowledge and ii) practice on pond fish farming." "The selected characteristics were age, education, land possession, pond size, annual family income, annual income from pond fish farming, commercialization of fish products, extension contact, training exposure and problem faced."

3.6 Collection of Data

Data were collected personally by the researcher himself through face to face interview from the selected pond farmers. But to familiarize researcher with the study area and for getting local support, the researcher took help from the local leaders and the field staff of Upazila Fisheries Office. Interviews were usually conducted with the respondent in their homes. While starting interview with any respondent the researcher took all possible care to establish rapport with him/her so that he/she did not hesitate to furnish proper responses to the questions and statements in the schedule. However, if any respondent failed to understand any question the researcher took care to explain the issue. He received excellent cooperation from the respondents and others concerned during the time of interview. The entire process of collecting data was completed within the period from 20th June to 12th July 2013.

3.7 Data Processing

After completion of field survey, all the data were coded, compiled and tabulated according to the objectives of the study. Local units were converted into standard units. All the individual responses to questions of the interview schedule were transferred in to a master sheet to facilitate tabulation, categorization and organization. In case of qualitative data, appropriate scoring technique was followed to convert the data into quantitative form.

3.8 Statistical Procedures

The data were analyzed in accordance with the objectives of the study. Qualitative data were converted into quantitative data by means of suitable scoring technique wherever necessary. The statistical measures such as range, means, standard deviation, number and percentage distribution were used to describe the variables. Pearson's Product Moment Coefficient of Correlation (r) was used in order to explore the relationships between the concerned variables. Five percent (0.05) level of probability was the basis for rejecting any null hypothesis throughout the study. The SPSS computer package was used to perform all these process.

CHAPTER 4

RESULTS AND DISCUSSION

The findings of the study and interpretations of the results have been presented in this Chapter. These are presented in seven sections according to the objectives of the study. The first section deals with the selected characteristics of the pond farmers, while the second section deals with knowledge of pond farmers on pond fish farming. In the third section deals with the extent of farmers' practice on pond fish farming. In the forth section relationships between knowledge and practice of pond farmers on pond fish farming have been discussed. After that the relationship of farmers' selected characteristics with their knowledge on pond fish farming have been discussed in fifth section. In sixth section the relationship of farmers' selected characteristics with their practice on pond fish farming have been discussed. The final section deals with the problem faced by the pond farmers in pond fish farming.

4.1 Selected Characteristics of Pond Farmers

Ten characteristics of the pond farmers were selected to find out their relationships with their i) knowledge and ii) practice of pond farmers on pond fish farming. The selected characteristics included their age, education, land possession, pond size, annual income, annual income from pond fish farming, commercialization, training exposure, problem faced and extension contact. These characteristics of the pond farmers are described in this section.

Data contained in the Table 4.1 reveal the salient features of the characteristics of the pond farmers in order to have an overall picture of these characteristics at a glance. However, for ready reference, separate tables are provided while presenting categorizations, discussing and /or interpreting results concerning each of the characteristics in this chapter.

Table 4.1 Salient features of the pond farmers with their characteristics (n=l01)

Sl. no.	Characteristics	Unit of measurement	Possible range	Observed range	Mean	SD	CV
1.	Age	Year	_	18-65	40.85	10.08	24.67
2.	Education	Level of schooling	_	0-18	7.56	4.13	54.62
3.	Land possession	Hectare	_	0.18-2.10	0.576	0.327	56.77
4.	Pond size	Hectare	_	0.07-0.76	0.206	0.172	83.49
5.	Annual family income	'000' Taka	_	40-600	139.15	93.95	67.51
6.	Annual income from pond fish farming	'000' Taka	_	10-250	60.37	44.86	74.30
7.	Commercialization	Score	0-100	52-95	76.00	12.00	15.78
8.	Training exposure	No. of days	_	0-14	1.46	2.83	193.83
9.	Extension contact	Score	0-15	1-9	3.80	2.23	58.68
10.	Problem faced	Score	0-18	2-15	6.47	3.11	48.06

4.1.1 Age

The age of the pond farmers ranged from 18 to 65 year, the average being 40.85 years and the standard deviation is 10.08. On the basis of their age, the pond owners were classified into three categories: “young” (up to 30), “middle aged” (31- 50) and “old” (above 50). The distribution of the pond owners according to their age is shown in Table 4.2.

Table 4.2 Distribution of the pond farmers according to their age

Categories according to age (years)	Pond farmers		SD	CV
	Number	Percent		
Young (upto 30)	21	20.8	10.08	24.67
Middle aged (31-50)	65	64.4		
Old (Above 50)	15	14.9		
Total	101	100		

The highest proportion (64.4 percent) of the pond farmers were middle aged compared to 20.8 percent of them being young and only 14.9 percent old. The overwhelming majority (85.2 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.

4.1.2 Education

The education score of the pond owners ranged from 0-18, with an average of 7.56 and standard deviation 4.13. Based on their education scores, the pond owners were classified into five categories namely illiterate (0), can sign only (0.5), primary education (1-5), secondary education (6-10) and above secondary (above 10). The distribution of the pond owners according to their education is shown in Table 4.3.

Table.4.3. Distribution of the pond owners according to their education

Categories according to education (schooling years)	Pond farmers (n=101)		SD	CV
	Number	Percent		
Illiterate (0)	6	5.9	4.13	54.62
Can sign only (0.5)	9	8.9		
Primary level (1-5)	12	11.9		
Secondary level (6-10)	60	59.4		
Above secondary level (above 10)	14	13.9		
Total	101	100		

It is evident from the Table that 5.9 percent of the pond farmers were illiterate, while 8.9 percent of them could sign only. The highest proportion (59.4 percent) of the pond owners had education up to secondary level compared to 13.9 percent of them having above secondary level education. The proportion of pond owners having primary level education was only 11.9 percent. Thus, the overwhelming majority (85.2 percent) of the pond owners had at least some education ranging from primary to above secondary level. The findings thus, indicate that the current literacy rate in the study area is higher than that of the national average of 63 percent (BBS, 2008).

4.1.3 Land possession

The land possession of the pond farmers ranged from 0.18 to 2.10 hectares and the mean was 0.576 hectares with standard deviation of 0.32. According to the land possession of the pond farmers, they were classified into four categories “Marginal (up to 0.2)”, “Small (>0.2-1.00)”, “Medium (>1.00-1.80)” and “Large (>1.80)”.

Four-fifths (84.2 percent) of the pond farmers possessed small land compared to less than one-fifth (13.9 percent) of them having medium land and only 1 percent had large land possession. The average land possession of the pond farmers was 0.576 hectares which was slightly lower than that of the national average (0.81 ha).

Table 4.4 Distribution of the pond farmers according to their land possession

Categories according to land possession (hectare)	Pond farmers (n=101)		SD	CV
	Number	Percent		
Marginal (up to 0.2)	1	1.0	0.327	56.62
Small (>0.2-1.00)	85	84.2		
Medium (>1.00-1.80)	14	13.9		
Large (>1.80)	1	1.0		
Total	101	100		

4.1.4 Pond size

Pond size of the pond farmers ranged from 0.07-0.76 hectares and the mean was 0.206 hectares with standard deviation of 0.172. Based on pond area the pond owners were classified into three categories as “small pond” (upto 0.1 ha), “medium pond” (0.11-0.5 ha) and “large pond” (above 0.5 ha).

Table.4.5 Distribution of the pond farmers according to their pond size

Categories according to pond size (hectare)	Pond farmers (n=101)		SD	CV
	Number	Percent		
Small pond	36	35.6	0.172	83.49
Medium pond	55	54.5		
Large pond	10	9.9		
Total	101	100		

Data presented in Table 4.5 reveal that 54.5 percent of the pond farmers had medium ponds while 35.6 percent of them had small ponds and 9.9 percent had large ponds. Thus, almost all (90.1 percent) of the pond owners had small to medium ponds.

4.1.5 Annual family income

Annual family income of the pond farmers ranged from Taka 40 thousand to 600 thousand, the mean being 139.15 thousand and standard deviation 93.95 thousand. On the basis of their annual income scores, the pond farmers were divided into three categories: “low income” (up to 100), “medium income” (101-250) and “high income” (above 250). The distribution of the pond owners according to their annual family income is shown in Table 4.6.

Table 4.6 Distribution of the pond farmers according to their annual family Income

Categories according to annual family income (‘000’ taka)	Pond farmers (n=101)		SD	CV
	Number	Percent	93.95	67.51
Low income (up to 100)	49	48.5		
Medium income (101-250)	44	43.6		
High income (above 250)	8	7.9		
Total	101	100		

About 48.5 percent of the pond farmers had low income compared to 43.6 percent of them having medium income and only 7.9 percent high income. Thus, the vast majority (92.1 percent) of the pond farmers had low to medium income, indicating that fish farming is usually practised by the pond farmers of comparatively lower economic standings.

4.1.6 Annual income from fish farming

Annual income from fish farming scores of the pond farmers ranged from taka 10 thousand to 250 thousand, the mean being 60.37 thousand and standard deviation 44.86 thousand. On the basis of their annual income scores, the pond farmers were divided into three categories: “low income” (up to 50), “medium income” (51-150) and “high income” (above 150). The distribution of the pond owners according to their annual family income is shown in Table 4.7.

Table 4.7 Distribution of the pond farmers according to their annual income from fish farming

Categories according to annual income from fish farming ('000' taka)	Pond farmers (n=101)		SD	CV
	Number	Percent	44.86	74.30
Low income (up to 50)	54	53.5		
Medium income (51-150)	43	42.6		
High income (above 150)	4	4.0		
Total	101	100		

About 53.5 percent of the pond farmers had low income compared to 42.6 percent of them having medium income and only 4 percent high income.

4.1.7 Commercialization

Commercialization scores of the pond farmers ranged from 52 to 95, the mean being 76.00 and standard deviation 12.00. On the basis of their commercialization scores, the pond farmers were divided into three categories: "low" (up to 60), "medium" (61-80) and "high" (above 80). The distribution of the pond owners according to their commercialization is shown in Table 4.8.

Table 4.8 Distribution of the pond farmers according to their commercialization

Categories according to commercialization (scores)	Pond farmers (n=101)		SD	CV
	Number	Percent	12.00	15.78
Low (up to 60)	13	12.9		
Medium (61-80)	52	51.5		
High (above 80)	36	35.6		
Total	101	100		

Majority (51.5 percent) of the farmers of the pond had medium commercialization compared to 35.6 percent of them having high and only 12.9 percent had low commercialization.

4.1.8 Training exposure

The training exposure score of the pond farmers ranged from 0 to 14 with a mean of 1.46 and standard deviation of 2.83. Based on the training experience scores, the pond farmers were classified into three categories: “no training experience” (0), “low training experience” (1-3) and “medium training experience” (above 4). The distribution of the pond farmers according to their training experience is presented in Table 4.9.

Table 4.9 Distribution of the pond farmers according to their training exposure

Categories according to training exposure (no. of days)	Pond farmers (n=101)		SD	CV
	Number	Percent	2.83	193.83
No training (0 day)	72	71.3		
Low training (1-3 days)	17	16.8		
Medium training (above 4days)	12	11.9		
Total	101	100		

About 71.3 percent of the pond farmers did not receive any training while the rest 16.8 percent of them received training for an average of 3 days and 11.9 percent had medium training exposure. Training increases knowledge and skills of the pond farmers in a specific subject matter area. Individuals who gain high training experiences are likely to be more competent in performing in different farming activities. But the fact that overwhelming majority of the pond owners who did not receive any training or received low training, needs attention of the authorities of extension services (GOs and NGOs) in the country. Providing adequate training on appropriate subject matter is likely to increase the knowledge and practice of the pond farmers.

4.1.9 Extension contact

The observed extension contact scores of the pond farmers ranged from 1 to 9 against the possible range from 0 to 15, the mean and standard deviation were 3.80 and 2.23, respectively. According to this score, the pond owners were classified into three categories: “very low extension contact” (up to 3), “low extension contact” (4-6) and “medium extension contact” (above 6). The distribution of the pond farmers according to their extension contact is shown in Table 4.10.

4.10 Distribution of the pond farmers according to their extension contact.

Categories according to extension contact (scores)	Pond farmers (n=101)		SD	CV
	Number	Percent	2.23	58.68
Very low extension contact (up to 3)	59	58.4		
Low extension contact (4-6)	25	24.8		
Medium extension contact (above 6)	17	16.8		
Total	101	100		

A proportion of 58.4 percent of the pond farmers had very low extension contact compared to 24.8 percent of them having low media contact. Only 16.8 percent of the pond farmers had medium contact.

Thus, majority 83.2 percent of the pond owners had very low to low extension contact. Extension contact is a very effective and powerful source of receiving information about various new and modem technologies. The status of no or having low and very low contacts might have significant impacts on the knowledge and practice of the pond farmers.

4.1.10 Problem faced

The problem faced score of the pond farmers ranged from 2 to 15 with a mean of 6.47 and standard deviation of 3.11. Based on the problem faced scores, the pond farmers were classified into three categories: “low problem” (upto 5), “medium problem” (6-11) and “high problem” (above 11). The distribution of the pond farmers according to their problem faced is presented in Table 4.11.

Table 4.11 Distribution of the pond farmers according to their problem faced

Categories according to problem faces (scores)	Pond farmers (n=101)		SD	CV
	Number	Percent	3.11	48.06
Low (upto 5)	41	40.6		
Medium (6-11)	51	50.5		
High (above 11)	9	8.9		
Total	101	100		

About 50.5 percent of the pond farmers had medium problem compared to 40.6 percent of them having medium problem and only 8.9 percent having high problem. Thus, the vast majority (91.1 percent) of the pond farmers had low to medium problem.

4.2 Knowledge of Pond Farmers on Pond Fish Farming

Pond farmers' knowledge scores could theoretically range from 0 to 46. But their observed knowledge scores ranged from 21 to 45, the mean being 32.36 and standard deviation 6.41. Based on the theoretical scores, the pond farmers were classified into four categories as: "low knowledge" (upto 25), "medium knowledge" (26 to 34), "high knowledge" (35 to 40), "very high knowledge" (above 40). The distribution of the pond farmers according to their knowledge level is shown in Table 4.12

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Table 4.12 Distribution of the pond farmers according to their knowledge on pond fish farming

Pond owners knowledge level (scores)	Pond farmers (n=101)		SD	CV
	Number	Percent		
Low knowledge	17	16.8	6.41	19.80
Medium knowledge	45	44.6		
High knowledge	26	25.7		
Very high knowledge	13	12.9		
Total	101	100		

Slightly more than two-fifths (44.6 percent) of the pond farmers possessed medium knowledge, 25.7 percent of the pond owners possessed high knowledge and only 16.8 percent of the pond owners had low knowledge and 12.9 percent of the farmers possessed very high knowledge. Thus, a proportion of 71.2 percent of the pond farmers had medium to high knowledge on various aspects of pond fish farming.

The knowledge of pond farmers was measured by using a total of 23 questions based on several common aspects of pond fish farming, such as pond preparation, release of fish fry , fish feed, fish diseases and fish harvesting and marketing. For getting a deeper insight into the knowledge level on different aspects, the researcher made a specific dimension-wise and/or specific question-wise analyses of the management knowledge of the pond farmers.

4.3 Practice of Pond Farmers on Pond Fish Farming

Pond farmers practice scores could theoretically range from 0 to 39. But their observed knowledge scores ranged from 4 to 19, the mean being 10.75 and standard deviation 3.62. Based on the theoretical scores, the pond farmers were classified into three categories as: “low practice” (upto 8), “medium practice” (9-15), “high practice” (above 15). The distribution of the pond farmers according to their practice level is shown in Table 4.13.

Table 4.13 Distribution of the pond farmers according to their practice on pond fish farming

Pond owners practice level (scores)	Pond farmers (n=101)		SD	CV
	Number	Percent		
Low practice	28	27.7	3.62	33.67
Medium practice	62	61.4		
High practice	11	10.9		
Total	101	100		

About 61.4 percent of the pond farmers had medium practice, while 27.7 percent farmers had low practice and only 10.9 percent farmers had high practice. Thus, a proportion of 89.1 percent of the pond farmers had low to medium practice on various aspects of pond fish farming.

4.4 Relationship between Farmers Knowledge and Practice on Pond Fish Farming

To find out the relationship between knowledge of farmers on pond fish farming and their practice of farmers of pond fish farming Pearson Product Moment Correlation was run.

The computed value of ‘r’ (0.426) was larger than the tabulated value (r=0.254) with 99 degrees of freedom at 0.01 level of probability and the relationship showed a positive trend. Hence, the concerned null hypothesis was rejected. It was concluded that knowledge and practice of pond farmers had significant positive relationship with each other. The result of ‘r’ between knowledge on pond fish farming and practice of pond fish farming may be seen in Appendix B.

4.5 Relationship between the Selected Characteristics of the Pond Farmers and Their Knowledge on Pond Fish Farming

The purpose of this section is to explore the relationships of the selected characteristics of the pond farmers with their knowledge on pond fish farming. Pearson's Product Moment co-efficient of correlation (r) was used to test a null hypothesis concerning the relation between any two variables. Five percent (0.05) level of probability was used as the basis for rejection of a null hypothesis. Results of the test of co-efficient of correlation between each of the selected characteristics of the farmers and their knowledge on pond fish farming are shown in table 4.14.

Table 4.14 Co-efficient of correlation (r) between selected characteristics and farmers' knowledge on pond fish farming (n=101)

Characteristics of the pond farmers	Correlation of co-efficient (r) with Knowledge	Table value significant at (df= 99)	
		0.05 level	0.01 level
Age	0.244*	0.195	0.254
Education	0.016		
Land possession	0.188		
Pond size	0.295**		
Annual family income	0.055		
Annual income from fish farming	0.091		
Commercialization	0.285**		
Training exposure	0.206*		
Extension contact	0.098		
Problem faced	-0.232*		

*Correlation is significant at the 0.05 level of probability
** Correlation is significant at the 0.01 level of probability

Age and knowledge on pond fish farming

The computed value of 'r' (0.244) was larger than that of the tabulated value (r=0.195) with 99 degrees of freedom at 0.05 level of probability as shown in Table 4.14 and the relationship showed a positive trend. Hence, the concerned null hypothesis was rejected and it was concluded that age of pond farmers had significant positive relationship with their knowledge on pond fish farming.

Education and knowledge on pond fish farming

The computed value of 'r' (0.016) was smaller than the tabulated value (r=0.195) with 99 degrees of freedom at 0.05 level of probability as shown in Table 4.14. Hence, the concerned null hypothesis could not be rejected. The findings indicated that education of the pond farmers had no significant relationship with their knowledge on pond fish fanning.

Land possession and knowledge on pond fish farming

The computed value of 'r' (0.188) was smaller than the tabulated value (r=0.195) with 99 degrees of freedom at 0.05 level of probability as shown in Table 4.14. Hence, the concerned null hypothesis could not be rejected. The findings indicated that land possession of the pond farmers had no significant relationship with their knowledge on pond fish fanning.

Pond size and knowledge on pond fish farming

The computed value of 'r' (0.295) was larger than the tabulated value (r=0.254) with 99 degrees of freedom at 0.01 level of probability as shown in Table 4.14, while the relationship showed a positive trend. Hence, the concerned null hypothesis was rejected. The findings indicate that pond size of pond farmers had a significant positive relationship with their knowledge on pond fish farming.

Annual family income and knowledge on pond fish farming

The computed value of 'r' (0.055) was smaller than the tabulated value (r=0.195) with 99 degrees of freedom at 0.05 level of probability as shown in Table 4.14. Hence, the concerned null hypothesis could not be rejected. The findings indicated that annual family income of the pond farmers had no significant relationship with their knowledge on pond fish farming.

Annual income from fish farming and knowledge on pond fish farming

The computed value of 'r' (0.091) was smaller than the tabulated value (r=0.195) with 99 degrees of freedom at 0.05 level of probability as shown in Table 4.14. Hence, the concerned null hypothesis could not be rejected. The findings indicated that Annual income from fish farming of the pond farmers had no significant relationship with their knowledge on pond fish farming.

Commercialization and knowledge on pond fish farming

The computed value of 'r' (0.285) was larger than the tabulated value (r=0.254) with 99 degrees of freedom at 0.01 level of probability as shown in Table 4.14. The relationship showed a positive trend. Hence, the concerned null hypothesis was rejected. The findings indicate that commercialization of pond farmers had a significant positive relationship with their knowledge on pond fish farming.

Training exposure and knowledge on pond fish farming

The computed value of 'r' (0.206) was larger than the tabulated value (r=0.195) with 99 degrees of freedom at 0.05 level of probability as shown in the Table 4.14 with a positive trend. Hence, the concerned null hypothesis was rejected. The findings indicated that training exposure of the pond farmers had a significant positive relationship with their knowledge on pond fish farming. Training is an important factor that contributes one's development in various fields including knowledge. Training on pond fish farming has contributed knowledge acquisition among the pond farmers in the innovation.

Extension contact and knowledge on pond fish farming

The computed value of 'r' (0.098) was smaller than the tabulated value (r=0.195) with 99 degrees of freedom at 0.05 level of probability as shown in Table 4.14. Hence, the concerned null hypothesis could not be rejected. The findings indicated that extension contact of the pond farmers had no significant relationship with their knowledge on pond fish fanning.

Problem faced and knowledge on pond fish farming

The computed value of 'r' (-0.232) was smaller than the tabulated value (r=0.195) with 99 degrees of freedom at 0.05 level of probability as shown in Table 4.14. Hence, the concerned null hypothesis was rejected. The findings indicate that problem faced of pond farmers had a significant negative relationship with their knowledge on pond fish farming.

4.6 Relationship between the Selected Characteristics of the Pond Farmers and Their Practice of Pond Fish Farming

The purpose of this section is to explore the relationships of the selected characteristics of the pond farmers with their practice of pond fish farming. Pearson's Product Moment co-efficient of correlation (r) was used to test a null hypothesis concerning the relation between any two variables. Five percent (0.05) level of probability was used as the basis for rejection of a null hypothesis. Results of the test of co-efficient of correlation between each of the selected characteristics and their practice of pond fish farming are shown in table 4.15.

Table 4.15 Co-efficient of correlation (r) between selected characteristics and farmers' practice of pond fish farming (n=101)

Characteristics of the pond farmers	Correlation of co-efficient (r) with Practice	Table value significant at (df= 99)	
		0.05 level	0.01 level
Age	0.096	0.195	0.254
Education	0.077		
Land possession	0.169		
Pond size	0.227*		
Annual family income	0.137		
Annual income from fish farming	0.148		
Commercialization	0.252*		
Training exposure	0.286**		
Extension contact	0.143		
Problem faced	-0.222*		

*Correlation is significant at the 0.05 level of probability
** Correlation is significant at the 0.01 level of probability

Age and practice of pond fish farming

The computed value of 'r' (0.096) was smaller than the tabulated value (r=0.195) with 99 degrees of freedom at 0.05 level of probability as shown in Table 4.15. Hence, the concerned null hypothesis could not be rejected. The findings indicated that age of the pond farmers had no significant relationship with their practice on pond fish fanning.

Education and practice of pond fish farming

The computed value of 'r' (0.077) was smaller than the tabulated value (r=0.195) with 99 degrees of freedom at 0.05 level of probability as shown in Table 4.15. Hence, the concerned null hypothesis could not be rejected. The findings indicated that education of the pond farmers had no significant relationship with their practice on pond fish fanning.

Land possession and practice of pond fish farming

The computed value of ‘r’ (0.169) was smaller than the tabulated value (r=0.195) with 99 degrees of freedom at 0.05 level of probability as shown in Table 4.15. Hence, the concerned null hypothesis could not be rejected. The findings indicated that land possession of the pond farmers had no significant relationship with their practice on pond fish farming.

Pond size and practice of pond fish farming

The computed value of ‘r’ (0.227) was larger than that of the tabulated value (r=0.195) with 99 degrees of freedom at 0.05 level of probability as shown in Table 4.15. The relationship showed a positive trend. Hence, the concerned null hypothesis was rejected and it was concluded that pond size of pond farmers had significant positive relationship with their practice on pond fish farming.

Annual family income and practice of pond fish farming

The computed value of ‘r’ (0.137) was smaller than the tabulated value (r=0.195) with 99 degrees of freedom at 0.05 level of probability as shown in Table 4.15. Hence, the concerned null hypothesis could not be rejected. The findings indicated that annual family income of the pond farmers had no significant relationship with their practice on pond fish fanning.

Annual income from fish farming and practice of pond fish farming

The computed value of ‘r’ (0.148) was smaller than the tabulated value (r=0.195) with 99 degrees of freedom at 0.05 level of probability as shown in Table 4.15. Hence, the concerned null hypothesis could not be rejected. The findings indicated that annual family income of the pond farmers had no significant relationship with their practice on pond fish fanning.

Commercialization and practice of pond fish farming

The computed value of ‘r’ (0.252) was larger than that of the tabulated value (r=0.195) with 99 degrees of freedom at 0.05 level of probability as shown in Table 4.15. The relationship showed a positive trend. Hence, the concerned null hypothesis was rejected and it was concluded that commercialization of pond farmers had significant positive relationship with their practice on pond fish farming.

Training exposure and practice of pond fish farming

The computed value of ‘r’ (0.286) was larger than the tabulated value (r=0.254) with 99 degrees of freedom at 0.01 level of probability Table 4.15 while the relationship showed a positive trend. Hence, the concerned null hypothesis was rejected. The findings indicate that training exposure of pond farmers had a significant positive relationship with their practice on pond fish farming.

Extension contact and practice of pond fish farming

The computed value of 'r' (0.143) was smaller than the tabulated value (r=0.195) with 99 degrees of freedom at 0.05 level of probability as shown in Table 4.15. Hence, the concerned null hypothesis could not be rejected. The findings indicated that extension contact of the pond farmers had no significant relationship with their practice on pond fish fanning.

Problem faced and practice of pond fish farming

The computed value of 'r' (-0.222) was smaller than the tabulated value (r=0.195) with 99 degrees of freedom at 0.05 level of probability as shown in Table 4.15. Hence, the concerned null hypothesis was rejected. The findings indicate that problem faced of pond farmers had a significant negative relationship with their practice on pond fish farming.

4.7 Comparative Problems Faced by Pond Farmers in Pond Fish Farming

The purpose of this section was to have an understanding on comparative problems faced by the pond farmers in pond fish farming. To compare among the problems, a rank order was made based on Problem Faced Index (PFI). PFI at each of the problem items were computed by using the following formula.

Problem Facing Index (PFI) = $P_s \times 3 + P_m \times 2 + P_l \times 1 + P_n \times 0$

Where,

P_s = Percent of respondent faced "severe problem"
P_m = Percent of respondent faced "moderate problem"
P_l = Percent of respondent faced "low problem"
P_n = Percent of respondent faced "no problem at all"

Problem facing index (PFI) of the farmers of the 6 problem items in pond fish culture ranged from 98 to 120 against a possible range of 0 to 303. According to the descending order of the PFI a rank order was made as shown in Table 4.16.

Table 4.16 Rank order of the problems faced by the farmers in pond fish farming with Problem Faced Index (PFI)

Sl. No.	Problem	Farmers N=101				Problem Facing Index	Rank order
		Very High (3)	High (2)	Low (1)	Not at all (0)		
01.	Lack of proper marketing facilities	18	18	30	34	120	1
02.	Poor communication system	10	14	46	30	104	2
03.	Natural calamities	10	17	39	34	103	3
04.	Shortage of pond water in dry season	6	18	45	31	99	4
05.	Insufficient credit	10	13	35	42	91	5
06.	Low price of fish in pick period	5	15	43	37	98	6

Data contained in Table 4.16 indicate that lack of proper marketing facilities ranked first severe problem. It was observed that there was no established fish market in the study area. The quality of fish transported to distant places often gets deteriorated and damaged.

Poor communication system ranked second, as most of the roads of the study area were still not in good condition.

Natural calamities mostly flood was a recurring phenomenon in the study area. Almost every year flood occurs and the ponds get over flooded. Although the pond owners try to protect their pond by net fencing, the fences do not move to be effective due various reasons. As a consequence of this the pond fishes get out of the ponds and washed away with flood water. For these reasons natural calamities ranked the third problem.

A certain level of water in the pond is necessary for fish farming. But there was a shortage of water in the pond in dry season. For this reason it ranked as the fourth problem.

Related to the financial problem, the pond owners face problems of acquiring various fishing equipments and inputs. High price of the inputs and equipments is experienced by them as a result they need credit. Due to this reason insufficient credit ranked the fifth problem.

Market price is an important factor for fish cultivation. If the market price is not stable throughout the seasons, desired profit cannot be achieved. But in reality the market price does not often remain stable. It fluctuates depending upon the supply and demand of fishes and artificial control of market by brokers and other vested interest groups. Pond owners after harvesting took the fishes in the market but he did not get good expected price thus, they became disheartened. However, low price of fish in pick period ranked the sixth problem.

CHAPTER 5
SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of the Findings

5.1.1 Selected characteristics of the pond farmers

Age: Overwhelming majority (85.2 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.

Education: Mean education of farmers was 7.56 years of schooling and the highest proportion of 59.4 percent of them had education up to secondary level. Thus, the overwhelming majority (85.2 percent) of the pond owners had at least some education ranging from primary to above secondary level.

Land possession: On an average of 0.576 hectare of land and four-fifths (84.2 percent) of the pond farmers possessed small land compared to less than one-fifth (13.9 percent) of them having medium land and only 1 percent had large land possession.

Pond size: A very high majority (90.1 percent) of the pond owners had small to medium ponds. Their average pond size was 0.206 ha and most of the pond owners (54.5 percent) had medium pond.

Annual family income: About half (48.5 percent) of the pond farmers had low income compared to 43.6 percent of them having medium income and only 7.9 percent high income. Thus, the vast majority (92.1 percent) of the pond farmers had low to medium income.

Annual income from fish farming: Slightly above half (53.5 percent) of the pond farmers had low income compared to 42.6 percent of them having medium income and only 4 percent high income.

Commercialization: Majority (51.5 percent) of the pond farmers had medium commercialization compared to 35.6 percent of them having high and only 12.9 percent had low commercialization with an average commercialization score of 76.18.

Training exposure: The pond farmers' average training exposure score was 1.46. The highest proportion (71.3 percent) of the pond farmers did not receive any training, while the rest 16.8 percent of them received training for an average of 3 days and 11.9 percent had medium training exposure.

Extension contact: A proportion of 58.4 percent of the pond farmers had very low extension contact compared to 24.8 percent of them having low extension media contact. Only 16.8 percent of the pond farmers had medium extension contact.

Problem faced: About 50.5 percent of the pond farmers had medium problem compared to 40.6 percent of them having medium problem and only 8.9 percent having high problem with an average of 6.47 score. Thus, the vast majority (91.1 percent) of the pond farmers faced low to medium problem.

5.1.2 Knowledge of the pond farmers on pond fish farming

The average knowledge score of the pond farmers was 32.36 against the possible range of 0 to 46. A proportion of 71.2 percent of the pond farmers had medium to high knowledge on various aspects of pond fish farming. Slightly more than two-fifths (44.6 percent) of the pond farmers possessed medium knowledge, 25.7 percent of the pond owners possessed high knowledge and only 16.8 percent of the pond owners had low knowledge and 12.9 percent of the farmers possessed very high knowledge.

5.1.3 Practice of the pond farmers on pond fish farming

The average practice score of the pond farmers was 10.75 against the possible range of 0 to 39. Slightly above three fifths (61.4 percent) of the pond farmers had medium practice, while 27.7 percent farmers had low practice and only 10.9 percent farmers had high practice. Thus, a proportion of 89.1 percent of the pond farmers had low to medium practice on various aspects of pond fish farming.

5.1.4 Result of hypothesis testing

Knowledge of the pond owners on pond fish farming had significant positive relationship with their practice on pond fish farming. **Out of ten selected** characteristics of the pond farmers, age, pond size, commercialization, training exposure of the pond farmers had significant positive relationship with their knowledge on pond fish culture, while problem faced by the pond farmers had significant negative relationship with their knowledge on pond fish culture. Rest five characteristics i.e. education, land possession, annual family income, annual income from fish farming and extension contact had no significant relationship with their knowledge on pond fish culture.

Practice of the pond owners on pond fish farming had significant positive relationship with their knowledge on pond fish farming. Pond size, commercialization and training exposure of the pond farmers had significant positive relationship with their **practice** on pond fish culture. Only problem faced by the pond farmers had significant and negative relationship with their practice on pond fish culture. Rest six characteristics i.e. age, education, land possession, annual family income, annual income from fish farming and extension contact had no significant relationship with their practice on pond fish culture.

5.2 Conclusions

It is very much important to have satisfactory clarification about the findings of the research study and to draw a series of meaningful conclusion.

The researcher studied the farmers' knowledge and practice on pond fish farming and put forward the following conclusions:

1. Knowledge is an important factor for pond fish farming but about three fourths (71.2 percent) of the pond farmers had medium to high knowledge on various aspects of pond fish farming. Their knowledge was particularly lower in such aspect of pond culture as fish disease management, fish harvesting and marketing and release of fish fry in ponds. These facts lead to the conclusion that the production of pond fisheries will not be possible to improve to a significant extent unless the concerned authorities take proper steps to improve their knowledge in overall management of pond and in particular the aspects in which their knowledge is poor.

2. Practice of pond fish farmers is also not up to mark. A proportion of 89.1 percent of the pond farmers had low to medium practice on various aspects of pond fish farming. Most of the farmers practice was particularly lower in such aspects of pond culture as applying fertilizer, applying supplementary food, applying compost, applying medicine and weed control in the pond. It may be concluded that the production of pond fish will not be possible to improve to a significant extent unless the concerned authorities take proper steps to improve farmers overall practices regarding pond fish culture.

3. Age of the farmers had no significant relationship with their practice of pond fish culture. It was thus proved that farmers' practice is independent with their education. In other words it may be concluded that the education of the farmers was not an important factor in practice of pond fish culture.

4. Education of the farmers had no significant relationship with their knowledge and practice of pond fish culture. It was thus proved that farmers' knowledge and practice is independent with their education. In other words it may be concluded that the education of the farmers was not an important factor in knowledge and practice of pond fish culture.

5. Land possession, annual family income and extension contact had no significant relationship with their knowledge and practice of pond fish culture.

It was thus proved that farmers' knowledge and practice is independent with their land possession, annual family income and extension contact.

6. Pond size, commercialization and training exposure had significant and positive relationship with their knowledge and practice of pond fish culture. It was thus proved that farmers' knowledge and practice is dependent with their pond size, commercialization and training exposure.

7. Problem faced by the farmers had significant and negative relationship with their knowledge and practice of pond fish culture. It may be concluded that farmers' knowledge and practice is dependent with their problem faced.

5.3 Recommendations

Based on the findings and conclusions of the study, the following recommendations were made.

5.3.1 Recommendation for policy implication

1. It is observed that 71.2 percent of the pond farmers had medium to high knowledge on various aspects of pond fish farming. So, it is strongly recommended that adequate technical support and training facilities be extended n to ensure application of scientific culture practices of pond fish farming.

2. Massive and relevant training programs should be conducted for pond farmers to upgrade their knowledge, practice, skills and ability. The concerned GOs and NGOs should be involved in the conduction of training programme for the pond farmers.

3. The pond farmers' literacy rate was quite high and it related to their knowledge gain. It is thus recommended that print media on culturing fish adequately to those who have fictional literacy. Also print media distribution mechanism is developed including price fixation.

4. As stated before that generally extension contact is much inadequate. The use of result demonstration and method demonstration could be more effective than mass media. But the fact that no such demonstration was found in the study area. It is thus, strongly recommended that a media campaign be launched involving all teaching methods in a balanced way.

5. Pond farmers faced considerable amount of problems in fish farming. It is therefore, recommended that concerned authorities should give due attention to the solution of the problems as soon as possible.

5.3.2 Recommendations for further study

1. The study was conducted of the pond farmers of selected area of Kaijuri Union of Faridpur district. Findings of this study need verification by similar research in other parts of the country.

2. Relationships of nine characteristics of the pond farmers and their knowledge and practice have been investigated in this study. Further research should be conducted to explore relationships of other characteristics of the pond owners with their knowledge and practice.

3. Age, pond size, training exposure, commercialization and problem faced of the pond owners were significant related with their knowledge and practice. So, further investigation may be undertaken to verify the result.

4. Farmers' knowledge and practice on pond fish culture has been investigated in this study. It is also necessary to study the pond farmers' knowledge and practice on other agricultural practices.

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Website 2: www.oxforddictionary.com

APPENDICES

Appendix - A

(English Version of the Interview Schedule)

Department of Agricultural Extension and Information System
Sher-e-Bangla Agriculrural University, Dhaka-1207

Interview schedule for collection of data to determine
FARMERS' KNOWLEDGE AND PRACTICE OF POND FISH CULTURE

Name of the respondent : ---------- Sl. No. ----------

Father's Name : ---------- Date : ----------

Village : Upazila :

Union : District :

Please answer the following questions

1. Age

What is your present Age?---------- Years.

2. Level of Education

a) Can not read and write: ----------

b) Can sign only: ----------

c) I read up to class: ----------

d) I passed ---------- class

3. Land Possession

Please indicate your area of lands according to use

Sl. No.	Use of land	Land possession	
		Local unit	Hectare
1	Homestead area (A_1)		
2	Own land under own cultivation (A_2)		
3	Land taken from others on borga system(A_3)		
4	Land given to others on borga system (A_4)		
5	Land taken from others on lease (A_5)		
	Total		

Total farm size = $A_1 + A_2 + {}^1/_2 (A_3 + A_4) + A_5$

4. Pond size

Please indicate your pond size

	Local unit	Hectare
Pond size		
Water area size		

5. Annual Family Income

Please state the income from different sources during the last one year

Sl. No.	Sources of income	Monthly income (Tk)	Annual income (Tk)
1	Agriculture		
	➢ Vegetables		
	➢ Fruits		
	➢ Livestock		
	➢ Poultry		
	➢ Nursery		
	➢ Crops		
2	Pond Fish Culture		
	➢ Selling fish		
	➢ Selling fish fry		
3	Business		
4	Service		
5	Others		
Total Income			

6. Commercialization of Fish Culture

Please mention the following information

	Total yield(kgs)	Unit price(tk./kgs)	Value of total yield(tk.)	Quantity of sold fish(kgs)	Value of sold fish(tk.)
Pond fish					
Total					

Commercialization: ……%

7. Training exposure

Do you have participated any training?

Yes …….. No. ……..

If yes, mention the following information

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

8. Problem Faced in Fish Culture

Please state the extent of the following problems faced in fish culture

Sl. No.	Problem	Extent of Problems			
		Severe	Moderate	Low	Not at all
1	Lack of proper marketing facilities				
2	Poor communication system				
3	Low price of pond fish in pick period				
4	Natural calamities				
5	Shortage of pond water in dry season				
6	Insufficient credit				

9. Extension Contact for fish culture information

Please state the extent of your contact with the following personnel.

Sl. No.		Extent of Participation			
		Regularly	Occasionally	Rarely	Never
1	Model fish farmer				
2	Input dealer				
3	NGO worker				
4	Field worker of fisheries department				
5	Upazilla fisheries officer				

Knowledge about Fish Farming:

Please answer the following questions

Questions	Full marks	Marks obtained
1. Mention two of the harmful effects of aquatic weeds in fish culture in ponds.	2	
2. Name two predatory fish.	2	
3. Mention the necessity of using lime in the pond.	2	
4. Mention the dose of lime application in ponds per decimal.	2	
5. Mention the advantage of applying cow dung in ponds.	2	
6. How will you examine if there is enough natural food in the pond water?	2	
7. What is the suitable time for releasing fry in ponds?	2	
8. Mention the harmful effects for releasing too many fry without proper estimation	2	
9. What are the main advantages of polyculture in ponds?	2	
10. Mention two ways of identifying good quality fish fry.	2	
11. Mention two natural fish feed.	2	
12. Mention 2 ingredients for preparing feed.	2	
13. How will you understand that gas has formed at the bottom of the ponds?	2	
14. How will you understand that there is lack of oxygen in pond water?	2	
15. Why is it necessary to netting a pond occasionally?	2	
16. Mention two fish diseases?	2	
17. Why disease occurs in fish?	2	
18. Mention two means of identifying diseased fish?	2	
19. What preventive measures are required be taken against fish disease?	2	
20. What curative measures are required be taken against fish disease?	2	
21. What is the suitable time of fish harvesting?	2	
22. Mention the disadvantages of harvesting all fishes at a time?	2	
23. Mention what matters are to be kept in mind while marketing fishes.	2	
Total	46	

Practice:

What is your level of practice for the following statement of pond fish culture?

Sl. No.	Statement	Extent of practice				Obtained score
		R	O	R	N	
1.	Counting the fingerlings before releasing in the pond.					
2.	Applying cowdung in pond.					
3.	Using lime in pond.					
4.	Using fertilizer in pond.					
5.	Applying supplementary feed in pond.					
6.	Eliminating the undesired and predatory fish from pond.					
7.	Controlling weeds from pond.					
8.	Preparing banana compost in pond.					
9.	Treating the fingerlings before releasing in the pond.					
10.	Sorting and grading of fish for better production.					
11.	Pulling the “harra” in pond.					
12.	Applying medicine if diseases attack the fish.					
13.	Keeping record of income and expenditure for fish culture.					
Total						

*R=Regularly, O= Occasional, R= Rare, N= Never

Thank you for your kind co-operation in data collection.

Signature of interviewer

Date: .....

Appendix - B

Variables	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	Y1	Y2
X1	-											
X2	**-0.438****	-										
X3	**0.169**	**0.219***	-									
X4	**0.073**	**0.224***	**0.824****	-								
X5	**-0.037**	**0.280****	**0.583****	**0.535****	-							
X6	**-0.056**	**0.207***	**0.139**	**0.130**	**0.099**	**0.191**	-					
X7	**0.076**	**0.034**	**0.261****	**0.194**	**0.311****	**0.261****	**0.025**	-				
X8	**-0.062**	**-0.076**	**-0.116**	**-0.158**	**-0.105**	**-0.170**	**-0.109**	**-0.135**	-			
X9	**0.145**	**-0.039**	**0.083**	**0.090**	**-0.017**	**0.019**	**0.172**	**0.103**	**0.034**	-		
Y1	**0.244***	**0.016**	**0.188**	**0.295****	**0.055**	**0.091**	**0.285****	**0.206***	**-0.232***	**0.098**	-	
Y2	**0.096**	**0.077**	**0.169**	**0.227***	**0.137**	**0.148**	**0.252***	**0.286****	**-0.222***	**0.143**	**0.426****	-

*Correlation is significant at 0.05 level of probability

** Correlation is significant at 0.01 level of probability

Tabulated value of 0.05 level = 0.195

Tabulated value of 0.01 level = 0.254

d.f = 99

Independent variables

X1= Age
X2= Education
X3= Land possession
X4= Pond size
X5= Annual family income
X6= Annual income from fish farming
X7= Commercialization
X8= Training exposure
X9= Problem faced by the pond farmers
X10= Extension contact of the pond farmers

Dependent variable

Y1= Knowledge of the pond farmers
Y2= Practice of the pond farmers