

**ASSESSMENT OF THE LIVELIHOOD CAPITALS AND PROBLEM
CONFRONTATION OF THE FARMER'S IN TILAPIA WITH CARPS
FARMING IN DINAJPUR DISTRICT**

A Thesis

By

NASRIN AKTER

Examination Roll No: 1605541

Registration No: 1605541

Session: 2016-2017

Semester: July-December, 2017

**MASTER OF SCIENCE
IN
FISHERIES MANAGEMENT**



**HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY
UNIVERSITY, DINAJPUR**

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Department of Fisheries Management

Hajee Mohammad Danesh Science and Technology University, Dinajpur

December 2017

DEDICATED
TO
MY BELOVED PARENTS

LIST OF ABBREVIATIONS

DoF	= Department of Fisheries
FAO	= Food and Agricultural Organization
HSTU	= Hajee Mohanimad Danesh Science and Technology
ha	= Hectore
m	= Meter
SD	= Standard Deviation
SPSS	= Statistical Package for Social science
PFI	= Problem facing index
MoFL	= Ministry of Fisheries and Livestock
GO	= Government organization
NGO	= Non-government organization
SL	= Sustainable livelihood
UFO	= Upazila Fisheries officer
DFID	= Department for international development

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ABSTRACT

The livelihood capitals and problem confrontation in Tilapia farming of Dinajpur district, Bangladesh were studied during July to October, 2017. Data was collected from randomly selected 100 tilapia fish farmers, 25 from each sub-district (Dinajpur Sadar, Birampur, Birganj and Biral) under Dinajpur district of Bangladesh through personal interview using a pre-tested well structured interview schedule. Livelihood capital was the focus variable. To measure the focus variable, five capitals (Human capital, Social capital, financial capital, Physical capital, Natural capital) were categorized in positive and negative statement about tilapia farming. The overall livelihood improvement score could be ranged from 30 to 150, where 30 indicating low livelihood improvement and 150 indicating high livelihood outcome. Total of 13 probable problems were selected to measure the extent of the problems and a four - point rating scale having category of “high”, “medium”, “low” and “not at all” was used. Therefore, the range of possible problem score of a respondent was 0-39. Results revealed that majority of the respondents (64 percent) had medium level of livelihood status compared to 34 percent of them having high leveled and 2 had low livelihood status. The findings indicated that majority of the respondents (41 percent) had high extent of problem confrontation compared to 46 percent of them had medium level problem confrontation and 13 had low problem confrontation. Among the problems, labor crisis on pick time and lack of security in fish farm was the most common problem in the study area. Out of eleven selected characteristics, six characteristics (i.e. age, farm size, total land area, annual income, aquaculture knowledge on tilapia with carps farming and training experience) showed significant positive relationships with their livelihood capitals in Tilapia with carps farming. Family size and problem confrontation level showed positive relationship with livelihood capitals. Education showed significant negative relationship with livelihood capitals.

Key words: livelihood capitals, problem confrontation, fish farming

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CHAPTER I

INTRODUCTION

1.1 Background of the Study

During recent decades aquaculture has gained a momentum throughout the world. Fishery plays a significant role for our country in supporting livelihoods. Fish culture in Bangladesh is categorized by the use of extensive, intensive systems and semi-intensive farming which started from 1993 onwards has produced on increasing in production (Mazid, 2002). The fisheries can be classified into three categories: inland capture fisheries, inland aquaculture and marine fisheries, of which the inland aquaculture sector is contributing more than 55% of the total production (DoF, 2017). About 18.5 million people of the country directly or indirectly involve in fishery activities (MoFL, 2017). Fisheries sector creates employment opportunity more than 11% of the total population in recent years (MoFL, 2017). Although aquaculture has been developed in Bangladesh for long time, but its development is not enough and equal all over the country, especially most of the districts of the northern part of the country.

A livelihood is a sustainable when it can cope with and recover from stresses and shocks and also can maintain its capabilities and assets both now and in future, while not undermining the natural resource base. Livelihood can be defined as the capabilities, the assets (natural, financial, human, physical and social capital), the activities and the accesses to these (mediated by institutions and social relations) that together determine the living gained by the individual household (Chambers and Conway, 1992). Natural capital refers to the natural resource base includes land, water, forests, marine resources, air quality, erosion protection, and biodiversity that yield products utilized by human populations. Human Capital includes education, skills, knowledge, health, nutrition, and labor power etc. Physical capital which includes roads, buildings, shelters, water supply and sanitation, energy, technology, communications etc. Financial capital includes savings (cash as well as liquid assets), credits (formal and informal), as well as monetary inflows (state transfers and remittances). Social capital refers to the social networks in which people participate and from which they can derive support that contribute livelihood by increase trust, ability to work together, access to opportunities, reciprocity, informal safety net, membership in organizations and so on.

The sustainable livelihoods (SL) approach borrows ideas from an ecological literature concerned with the sustainability of ecosystems or agro ecological systems (Conway, 1987). Sustainability is defined as-the ability of a system to maintain productivity in spite of a major disturbance, such as is caused by intensive stress or a large perturbation (Conway, 1985). For minimizing the growing gap between supply and demand of fish low-cost feed ingredients and fertilizers should be used for increasing production of fish. Mixed cultures can even show symbiotic effects, when one species improves the environmental conditions and food supply for others (Hossain *et al.* 1997). Introduction of tilapia farming is a long history in Bangladesh. In 1954 from Thailand the Mozambique tilapia (*Oreochromis mossambicus*) was introduced to Bangladesh (Rahman, 1985). However, for aquaculture activates this species was not accepted widely because of its prolific breeding and early maturation that leads overcrowding in ponds. But nowadays culture of these species plays a significant rule that contributes to increase income of fish farmers, livelihood improvement and poverty alleviation.

1.2 Statement of the Problem

Aquaculture has become a promising, dynamic and gainful approach to attain self-sufficiency in food sector by promoting food security and also to alleviate poverty in Bangladesh (Ahmed, 2003). Lack of adequate and authentic information on socio-economic conditions of the target populations is one of the serious impediments in the successful implementation of the development program (Ellis, 2000). In addition, various management problems are associated with fish farming. Fish farmers have less contact with technical media contact and in many cases they are less aware about necessary information towards fish farming. In Dinajpur, fish farming is one of the important sources of income generation and improving livelihood. Pravakar *et al.* (2013) found some major constraints such as fish disease, non availability of fish fry, pouching, insufficient water in dry season, poor technical knowledge, lack of quality feed and lack of money in *Shahrasti* Upazila of *Chandpur* District.

Rural fishery is now mainly depends upon pond or tank based that requires some financial and technical benefits from credit society and government agencies. If the fishing practice is managed properly by formation of co-operative society and financial investment and implementation of advanced techniques, this would impose a notable impact on livelihood status of this district. Decreasing fish production gradually in this area due to a number of reasons of which increased feed cost and improper management practices, large quantity

of supplemental feed, pond water receives high quantity of inorganic nutrients from the microbial decomposition of unused fish feed etc. It is clear that, most of the fish farmers were not continuing the aquaculture activities successfully in his/her farming. So, it is necessary to ensure modern aquaculture technologies in fish production for sustainable development among fishermen. Enough training facilities, financing support, technical and marketing support to fish farmers is necessary from different Government Organization (GO) and Non-Government Organization (NGOs).

However, few studies on socio-economic conditions of fishermen were carried out by Kostoni (2012), Flowra *et al.* (2009) and Joadder (2008) but all these studies could not explain properly about livelihood improvement. In this research, component of livelihood improvement were included with their common parameters. Recent studies (Rahman 2014; Raihan 2014) also indicated that the fishermen have little knowledge about the modern technique of fish farming. Rahman *et al.* (2011) reported that fish farming has remarkable contribution on household income of the fish farmers. They also conclude that in rural areas of Bangladesh, policy makers in the fisheries sector should consider the recognized factors for rapid growth of fish farming. Thus this study was conducted with some specific objectives with their improvement issues and their problem confrontation level.

1.3 Specific Objectives

The overall objectives of the proposal research are to measure the livelihood capital of the fish farmers through tilapia with carp culture. The specific objectives are:

- To measure some selective characteristics of the fish farmers.
- To assess the livelihood capitals of the fish farmers through tilapia with carps culture.
- To find out the problem confrontation of the fish farmers in mixed tilapia culture.
- To determine the relationship between livelihood capitals and the selected characteristics of the fish farmers.

CHAPTER II

REVIEW OF LITERATURE

Review of related literature is necessary for gathering more knowledge and information about respected researches. The purpose of this chapter is to review the researchers conducted in line of the objectives. This review of literature has been divided into three sections. The First section deals with the literature livelihood status of the fish farmers and the second section deals with the socio economic importance and third section deals with problem confrontation of fish farmer in aquaculture. The researcher tried to gather information related to concept of fish farming, farmers livelihood. There is some related activities are presented in below:

2.1 Livelihood Status of Fishermen

Sultana and Islam (2017) studied on livelihood status of the fisher's community in the chalan beel area (*Gurudaspur* upazila, *Natore* district) in Bangladesh. They represented the socio-economic position of the fishing communities on the basis of age group, family size, educational status, main and subsidiary occupation, fishing trends, daily income patterns, housing patterns, use of electricity, fuel use, credit supply, health, nutrition, sanitation etc. The results of this study was represented that 94% respondents were married, age varied between 30 and 45 years, 20-30 age groups were the major manpower of the community, most of the people of the community were illiterate (60%), among all of the school going children 58% were boys and 42% were girls. Some problems also found that most of the fishermen do not know the fishing law, although the law mostly made for the fishermen. In this study, educational, organizational, and technical credit support were very crucial to develop their better socio-economic conditions.

Sarwer *et al.* (2016) studied on pond farming and livelihood status of fish farmers in *Subarnachar*, Noakhali, Bangladesh. They observed that the highest percentage (34%) of fish farmers earned BDT 75,000-100,000 per year. They also found that among the fish farmers 15% was illiterate whereas 19, 31, 14, 12 and 9 percent were educated up to primary, secondary and higher secondary and bachelor level, respectively. In this study it was found that 42%, 22%, 18%, 8% and 10% of the respondents were related to agriculture, business, service, day labor and fish culture as their principal occupation. Some constraints also found that is lack of adequate fund (48%), lack of technical knowledge (26%) and multi-ownership (12%) were reported as major constraints in study area. They suggested that pond culture is a potential approach for their better livelihood.

Gogoi *et al.* (2015) studied on fishery based livelihood approaches and management of fishery resources in Assam, India. To focus the potentialities and possibilities of resource utilization as fishery based livelihood through diversified farming systems was the main objectives in this study. It was found that the potentials of these resources were still underutilized at that time. They also found that the sustainable utilization of available land and water resources by mass participation of farmers in aquaculture would be able to improve the socioeconomic condition of the farmers of the state.

Sheheli *et al* (2015) conducted a study on livelihood assessment of the fishermen community in the south west region of Bangladesh. They found that most of involved fishermen are in 16-30 years age group (45%) and about 75% of fishing community was illiterate and 24% was literate. Furthermore, it was reported that about 78% of the fishermen received treatment from village doctors. They also found that 61% house were *Kacha* (Made of mud and straw) while 37% house were semi-*pucca* (Tin shed building), only 2% house were *pucca* (Bricks Built house), about 23% of fishermen had ability to access electricity and others 77% had no access to electricity. In their study they also described that no vulnerable group feeding cards were provided by government, lack of proper knowledge, illiteracy not as much of governmental support was the major constraints.

Nadanasabesan (2015) explored the present situation of the coastal small-scale fishery in the Northern Province of Sri Lanka and to bring an overall picture of the coastal small-scale fishery. The objective of this study was to explore present situation of the coastal fishery of the Northern Province. The findings revealed the situation in terms of marine resources, fishing methods, fishing communities and fishery production trend. The study showed that the coastal fishery of the Northern Province is characterized by range of SWOT elements. Finally, he showed that intrusion of Indian fishermen, IUU fishing by the Northern fishermen, prolonged ethnic conflict and climate change are the threats for the sustainable development of the coastal fishery of Sri Lanka.

Moni and khan (2014) conducted a study to determine fish cultivation as a livelihood option for small scale farmers in southwestern region of Bangladesh. It also explores the importance of fish farming in the livelihood of small scale fish farmers. This study was found that fish cultivation is the main occupation for 56.67 percent of the farmers. The constraints faced by the fisherman in suffering from inadequate technical knowledge on pond management, pond extension service, and poor quality fish fry and fingerlings. It

was found one of the most important barriers of small scale fish cultivation in the study area is lower price of fish in the local market, which poses a threat to maintain fish farming as a sustainable livelihood option. Some constraint also found to explore this issue in detail due to inadequate time.

Md *et al.* (2014) demonstrated the livelihood status of Hilsa (*Tenualosa ilisha*) fishermen of greater Noakhali regions of Bangladesh. The aim of this study to elucidate the livelihood status of Hilsa (*Tenualosa ilisha*) fishermen at Lakshmipur and Noakhali Districts in Bangladesh during August, 2014 to January, 2015 through questionnaire survey method. They noticed that 85% fishermen were observed to use mechanized (5-40 HP; Horse Power) boats in the study areas. They also observed that Hilsa fishing was noticed mostly during October-November while such activities was almost absent during February-May (off period) which made fishermen to start migrating temporarily to the nearest urban areas for their livelihood. This study was also represented that an average daily net income of the fishermen during fishing period was 600 BDT whereas, their real field daily income through fishing supposed to be 1695 BDT.

Tipyan and Udon (2014) studied on dynamic livelihood strategies of fishery communities in ban don bay, suratthani, Thailand. The main objective of this study was to use the sustainable livelihoods framework in data analysis. It is found that traditional fishery tends to be a vulnerable group due to rapid changes in the environmental degradation affected by governmental policies, capitalization and natural disaster in this study. They revealed that future fishery communities need to develop suitable strategies in order to deal with more complicated situations and they will also need to share with neighboring communities the new solution they have gradually gained.

Chikopela (2014) in his study identify the livelihood strategies of small-scale farmers in nankanga camp of Kafue district, Zambia. This study examined those livelihood strategies of small-scale farm households, their food security status and the challenges they face to meet their livelihoods by using both qualitative and quantitative methods. The results showed that farmers also engage in non-agricultural or off farming season activities that are sources of income for their households. The study revealed that food security in that study area is a challenge, with about 87 percent reporting having food shortages during the year. He found some constraints such as high cost of the inputs, lack of draught power and lack of human labor. According to study findings, it is important that the government should improve farmer's access to financial capital through deliberate loan facilities.

Pravakar *et al.* (2013) studied on present status of fish farming and livelihood of fish farmers in *Shahrasti* Upazila of *Chandpur* District, Bangladesh. They observed that most of the fish farmers were belonged to the age groups of 41 to 60 years (44%), represented by 75% Muslims. They also explained that about 10% had no education while 16%, 48%, 16% and 10% had primary, secondary, higher secondary and bachelor level of education, respectively. The provision of training facilities was insufficient as only 34% of the fish farmers received formal training on fish farming. About 94% of the fish farmers reported their socioeconomic conditions were improved through fish farming.

Paul *et al.* (2013) livelihood status of the fishermen of the *Turag* River, Bangladesh. This study was conducted to assess the livelihood status of fishing community in *Turag* River area, Bangladesh. They revealed that most of the fishermen were belonging to the age groups of 35-40 years old (30%) in *Birulia* and 40-45 years old (56%) in *Boroibari*, majority featured by Hindus. They also found that about 63% fishermen in *Birulia*, 35% fishermen in *Boroibari* had a moderate annual income (30000-60000 Tk.), about 33% fishermen in *Birulia* and 65% fishermen in *Boroibari* had a high annual income (above 60000 Tk.). It was found from this study that the government does not provide any kind of supports for the betterment of the fishing community in both study area.

Mondal *et al.* (2012) in their study identified the assessment of aquaculture as a means of sustainable livelihood development in *Fulpur* upazila under *Mymensingh* district. The study was conducted to identify how aquaculture assists in developing sustainable livelihood to the fish farming community in rural Bangladesh during the period from January to December, 2009. They applied the Sustainable Livelihood Approach (SLA), a conceptual framework that aims to ameliorate poverty to understanding the role of aquaculture in the *Mymensingh* area of the North-central Bangladesh. They also used the SLA as a foundation or main basis of analytical tool to identify the means and ways to enhance the livelihood of fish farmers. They found how fish farmers can achieve positive sustainable livelihood through access to a wide range of livelihood assets. Lack of operating capital, vulnerability and insufficient institutional support were identified as major constraints to long term sustainability in this study.

Kabir *et al.* (2012) livelihood status of fishermen of the Old Brahmaputra River, Bangladesh. They showed that over 70% of the fishermen primary occupation was fishing, 20% was engaged in agriculture and 10% in daily activities, about 2% of the fishermen were only could write name while 88%, 10% and 0% of the fishermen were illiterate,

primary and secondary level of education, About 60% of the fishermen received health service from village doctors, 30% from upazila health complex and remaining 10% got health service from MBBS (Medicinae Baccalaureus, Baccalaureus Chirurgiae) doctor, About 60% of the fishermen used *kancha* while 10% used *semi-paka* and 30% of the fishers had no sanitary toilet facilities. There were also some constraints such as lack of scientific knowledge, illiteracy and lack of government support in this study.

Islam et al. (2013) studied livelihood of the fishermen in *Monirampur* Upazila of Jessore district, Bangladesh. They found that the mean age and fishing experience of fishermen were 35.22 ± 9.67 and 17.9 ± 7.12 years, respectively. Primary occupation for majority fishermen (90%) was fishing. they also explored that The mean monthly income of the household (HH) was BDT 9470 ± 4806.89 , only 2% fishermen were landless, 4% fishermen had training on fishing/fish culture, 46% fishermen involved in NGOs for loan and saving and 52% fishermen cultivated paddy during *boro* (summer) season whereas only 18% cultivated paddy during *aman* (rainy) season. The major HH expenditures were- food, education, health, furniture, cloths and others also described in this study. They also mentioned that all fishermen were vulnerable to *vabadaha*, a situation when water logging takes place during monsoon due to lack of sufficient water drainage system.

Yuerlita and Perret (2010) showed that livelihood features of small scale fishing communities in Singkarak Lake, West Sumatra, Indonesia. The objective of this research was to characterize fishing communities in this area by exploring their socio economic and fishing characteristics and also identify the problems, constraints confronted by those communities. They showed their result that fishing communities in this area have high level of homogeneity in term of their fishing activities which represent the highest in cash household income, but extreme diversity in portfolio of livelihood activities. It was showed that high labor productivity offered by alternative activities out of fishing.

Ali et al. (2008) conducted a study to assess the livelihood status of the fish farmers in Hamirkutsha and Kamarbari Unions of Bagmara upazilla under Rajshahi district. They found that most of the fishers were belonged to the age category of 31 to 40 years and average education level of 9.86 years of schooling, represented by 94% Muslims and 6% Hindus. Average annual incomes of majority of fish farmers were above Tk. 75,000 per annum and 62% of the farmers used semi-pacca sanitary, 28% used pacca sanitary while only 10% used *kancha* sanitary. About 62% of the farmers had electricity facilities while 38% did not have and 88% of the farmers used own tube-well, while 12% of the farmers

used neighbor's tube-well. Forty six percent of the farmers received health service from village doctor or kobiraj, 18% have access to upazila health complex, 14% went to district hospital, 20% consulted with MBBS doctor and 2% of the farmers do not take any treatment due to lack of money.

Karim (2006) studied the livelihood impacts of fishponds integrated within farming systems in *Mymensingh* District, Bangladesh. This research was carried out in view of the sustainable livelihood approaches of the Department for International Development, U.K. Participation of all levels of stakeholders was ensured in the first and last phase of the study. He showed that production of fish could be increased by a substantial level through increasing pond nutrient inputs rather than stocking an additional species (tilapia), although this may be related to the 'improved' nutrition used by farmers still being well below the level required for optimal tilapia performance. He found some constraints of this study such as Lack of knowledge was a particular problem for farmers growing fish, vegetables in the rural areas, Fish disease, high price of input, lack of money were also identified by fish producers. The Significant differences of this research were observed between locations and well-being categories for the percentage of fish retained for consumption and that sell.

Hoq and Kohinoor (2005) demonstrated the livelihood and consumption of small indigenous species (SIS) in fishing community of two upazila viz., Trisal and Ishwarganj under Mymensingh district. Forty-eight of the surveyed fishers were between 41-45 age groups. Family size of 76% was larger (6-8 persons) than the national average. No woman was found to be participating in fishing operations. The fishers were permanent settler, everyone has at least own house. Among respondents, 46% had no cultivable land. More than 50% had 0.08-0.16 has homestead and 26% had less than 0.20 ha agricultural land. Only 28% had pond in their homestead. Most of the fisher folk of the study areas belong to resource poor section of the society living below the poverty level. Majority of the fisher households consumed SIS three to four days a week. The fisher households of *Trisal* upazila consumed more small fish than those of *Ishwarganj* upazila.

Quddus *et al.* (2000) observed that about 34% of the total ponds were under joint ownership, 54% were under single ownership and the rest 1-2% ponds were public or organizational property in *Demra*, Dhaka in Bangladesh. They stated that about 95% of the pond owners showed their interest in fish culture in this study area, only 28% were found to become flooded every year and 21% were found rarely flooded. They also

described that 51% of the ponds found to be never flooded, Per hectare yields of extensive, improved extensive and semi-intensive categories of culture were 1300, 2120 and 4000 kg, respectively and their net return were Tk. 46,000, Tk. 63,000 and Tk. 9,2000, respectively were estimated in this study area.

Biswas *et al.* (2000) found that pond fish culture of BRAC was highly profitable in their study area. The average total cost of pond fish production $\text{ha}^{-1}\text{year}^{-1}$ was Tk. 59,813.57 while gross income and net return were Tk. 14,532.67 and 85,511.10, respectively for all locations were found. Cobb-Douglas production function analysis revealed that material inputs such as fingerlings, feed, fertilizer and manure had positive impact on pond fish production in their study.

2.2 Socio Economic Importance

Reza *et al.* (2015) conducted a research on socio-economic and livelihood status of fishermen around the *Atrai* and *Kankra* Rivers of *Chirirbandar* upazila under Dinajpur District. This study showed that 60% respondent's primary occupation were fishing, majority of them were middle age group (31-45 yrs) and mostly were landless or marginal land holders, About 88% fishermen were married, average size of middle household (56%) was more than the national average (4.4%), 64% family was nuclear, 44% fishermen were illiterate and 36% can only sign, The fishermen used different type of fishing gears such as jakhi jal (68%), current jal (48%), lift net (16%), ber jal (40%) and only 40% used boat for fishing, 88% respondent sold their catch directly to the consumer, 8% to the retailer and rest to the other fishermen and the majority (72%) of the respondent's annual income was BDT 15,000-25,000 which was lower than national per capita income. They also revealed some constraints that the river bed siltation, depletion of fish stock, lack of financial ability, inadequate credit facilities, lack of training, low fish price and vandalism were the major constraints of fishing in the study area. The study also revealed that only 20% fishermen managed to improve their livelihood status through fishing activities.

Ghosh *et al.* (2015) studied on the socio-economic conditions of the fishermen in Teknaf. They showed that among interviewed 59.25% were below 30 years, 29.62% were between 30 and 39 years, and the remaining 11.11% were more than 40 years old, and their literacy level was 62.96% illiterate, 18.51% can write their names, 14.81% had received education up to primary level and 3.70% had received secondary education. This study revealed that

sanitary conditions of the fishermen were very poor that 25% fishermen have semi-constructed and 10% of the fishermen had no sanitary facilities. They suggested that there is a clear need to legalize fishing profession and their settlement as well as traditional fishing communities should be given priority in getting necessary supports from all concerns.

Jacobi (2013) in his study identified the potential of fish farming to improve the livelihoods of farmers in the Lake Victoria Region, Kenya. This study showed that livelihoods of ESP supported farmers in Kenya's Lake Victorian region have indeed improved in terms of increased protein consumptions. It was found that there was a possibility of high risk, if pond productivities are not increased, aquaculture practices may be discontinued having negative consequences on the farmers livelihoods.

Khatun *et al.* (2013) carried out a study on the socioeconomic status of pond fish farmers of Charbata, Noakhali, Bangladesh. Most of the fish farmers were belonged to the age groups of 36 to 50years (46%), represented by 82% Muslim. About 18% had no education while 16%, 42%, 14% and 10% had primary, secondary, higher secondary and bachelor level of education, respectively. About 6% and 36% of fish farmers were involved in fish farming as their primary and secondary occupation, respectively. About 74% the of fish farmers received health service from village doctors and remaining 22% and 4% got health service from upazila health complex and MBBS (Bachelor of Medicine, Bachelor of Surgery) doctors, respectively. The provision of training facilities were insufficient as only 14% of the fish farmers received formal training on fish farming. About 94% of the fish farmers reported, their socioeconomic conditions were improved through fish farming.

Ali *et al.* (2010) studied fish production under supervised credit in Tarakanda upazila of Mymensingh district. They found that average education level of 8.2 years schooling, while 85% Muslims and 15% Hindus, 90% of the farmers used their own money for farming, while 10% received loan. They also described that about 62.5% of the farmers were used semi-pacca sanitary and 12.5% used pacca while 25% used kancha sanitary. In this study some estimation also found that forty percent of the farmer's received health service from village doctors or kobiraj, 45% have access to upazila health complex, 12.5% went to MBBS doctor and 2.5% of the farmers do not take treatment due to lack of money.

2.3 Problem Confrontation of Fish Farmer in Aquaculture

Ekramuddin (2017) described an impact of small scale fish farming on socio-economic growth in *Birbhum* district, West Bengal, India. It revealed that majority of fish farmers are males and most are not educated beyond class 10 level. He also represented that the respondents have an average household size ranges between 3-6 persons. The result of this study is there is a significant impact of small scale fishery enterprise on rural economy.

Rahman *et al.* (2015) studied on potentialities of pond fish farming in *Kalikapur* upazila under Gazipur District, Bangladesh. They found that about 41.67% monoculture farmers were middle age (36-45 years). About 100% monoculture farmer and 90.09% polyculture farmer was male. Religious status of fish farmer was 95% Muslim and 5% Hindu. Family size of monoculture farmer (36.66%) was medium size (6-9 members) and 10% family of polyculture farmer was small size. About 56.67% farmer received fish farming as their main occupation and also found 10% service, 20% business, 13.3% agriculture as their main occupation. Among the respondent a major portion (23.33%) had no educational background that they were illiterate and the highest portion (25%) had only secondary level of education. They found that 68.33% fish farmers had no own land and sanitary facilities of the farmers were very poor.

Rashid *et al.* (2015) describes on community dependence on fish farming and its role in uplifting the socio-economic condition of fish farmers in Sylhet District. This survey was conducted to investigate farmer's dependency on fish farming for their livelihood in three upazilas of Sylhet district namely *Kanighat*, *Gowainghat* and *Golabgonj* from July to December 2013. This study showed that in all farming systems middle aged farmers were found the highest percentage (58.3%). About 55% families of integrated farmers had 6-above members while lowest 35% in semi intensive farmers. The highest illiterate (40%) was found in extensive farmers and the lowest 15% each in semi-intensive and integrated farmers. About 36.67% of the respondents had tin shed house, 18.33% had *kacha*, 31.67% had half-building and only 13.33% had building. On The livelihood outcomes found positive and 76.67% farmers viewed that they have improved their socio-economic conditions. They suggested that necessary training on scientific fish culture, establishment of hatchery by GOs and NGOs to ensure quality fingerlings and massive extension work can mitigate the problems of fish culture in that study area. Main constraints of their study were inadequate supply of quality fingerlings (26.67%), high production cost (21.67%) and the low quality feed (18.33%).

Rahman (2014) conducted a study on problems faced by fish farmers in pangus culture. He revealed that the largest proportion (91.4%) of the farmers had moderate level

problem, 0 percent had low level problem and 8.6 percent farmers had severe problems faced in culturing pangus. From Problem Facing Index (PFI), it may be seen that high price of pangus feed was highest faced problem, lack of investment for culture was the second highest faced problem. And others moderate problems were lack of quality pangus seed, lack of labor, lack of technology for the management practice of pangus, lack of training facilities, lack of water exchange capacity, lack of marketing facilities and lack of security. Disease controlling, high price of necessary inputs also severely affects fish growth.

Raihan (2014) conducted a study on problems faced by rural youth in commercial fish farming in *Maderganj* Upazila under Jamalpur District. The study revealed that largest portion (54.8%) of the respondents faced medium problem, 45.2 percent faced high problem and no one faced low problems in commercial fish farming. He concluded that the fish farmers faced high problem in lack of necessary land for fish farming, followed by moderate problems of lack of enough capital to invest, high price of fry, feed, fertilizer and other inputs, lack of more effective and low cost method of disease control, lack of preservation technology after harvesting, lack of technological knowledge, lack of good quality fry & feed, lack of skilled worker, lack of proper training, lack of transportation facilities and security problems, unavailability of extension support, water crisis in dry season, fluctuation of market price also severely affects fish growth.

Hill (2005) described livelihoods in an artisanal fishing community and the effect of ecotourism. The study was conducted by quantitative and qualitative methods to examine the role of marine resources in the livelihoods of the local communities in order to better understand the consequences of ecotourism development for marine resource use and conservation. Main limitations in this study was indicated that the limited time and extended illness of the author. The results are presented in the form of the livelihood framework given by Smith *et al.* Resource use, a livelihood outcome, was evaluated using the quantitative data from the household surveys. Resource use was compared between households to determine the consequences of employment by a member of the household.

CHAPTER III

METHODOLOGY

Methodology plays an essential role in any scientific research activities. It is a foundation on which the process of research rest upon. This chapter explains the methodological strategies, the study area, sampling design, and procedures used for data collection. Different variables and their measurement procedures also used for data analysis.

3.1 Methodological Approach and Research Design of the Study

A comprehensive plan of the research study is research design. It is that conceptual structure, within which research is conducted. A map of Dinajpur district showing four Upazila which is given in Figure 3.1 and the Satellite image of four Upazila of Dinajpur district is given in Figure 3.2. This study contained both primary and secondary data collection method in order to get a comprehensive view of the livelihood status of fish farmers on tilapia with carp culture. The steps followed in the research are given in Figure 3.3.

3.2 Study Area

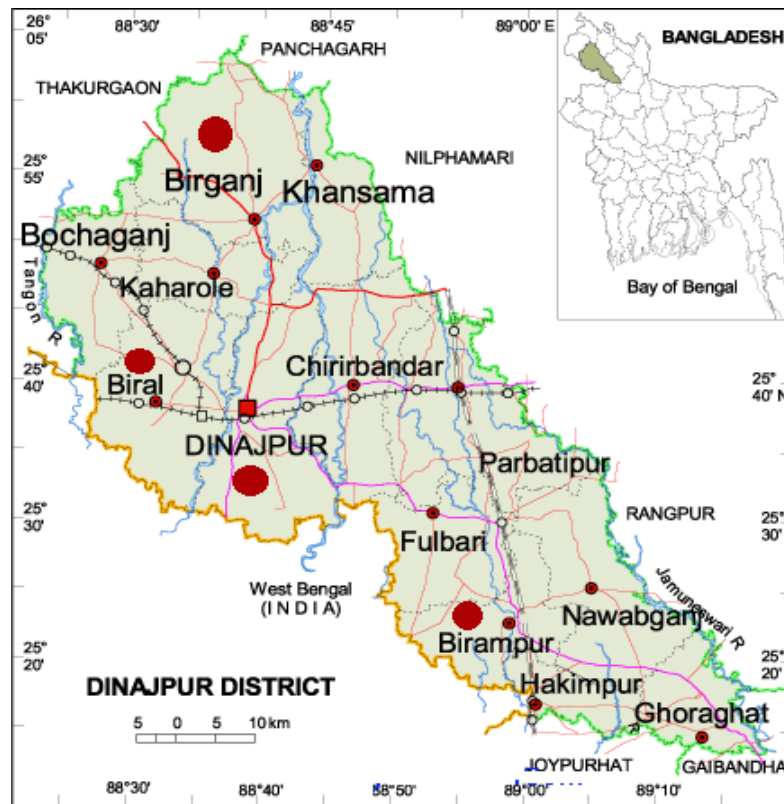


Figure 3.1: Map of Dinajpur district

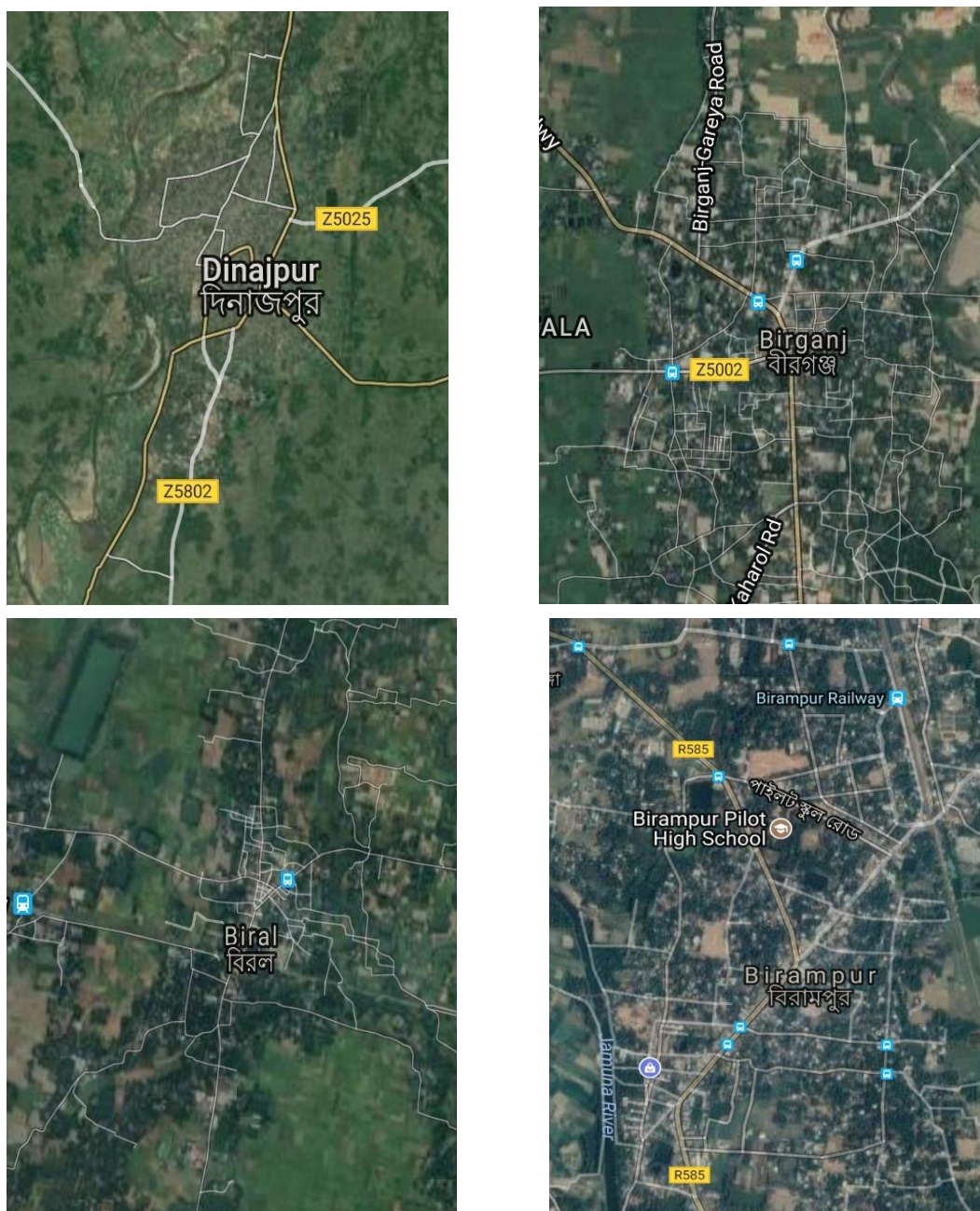


Figure 3.2 Satellite image of four Upazila of Dinajpur district

3.2.1 Rationale for the research site

The study was conducted at 4 Upazila (Dinajpur Sadar, Birampur, Birganj, Biral) under Dinajpur district of Bangladesh. The study areas were selected purposively for investigation, because a large number of farmers have been practicing tilapia with carps farming in those locations. The selection was made on the basis of suggestions made by Upazila Fisheries Officers (UFO) and other relevant officers of Dinajpur Upazila.

3.2.2 Layout of the research

At first updated lists of all the fishermen were collected from the Upazila Fisheries Officer (UFO) of the selected four Upazilas of Dinajpur. From the given list 25 fishermen were selected randomly as sample.

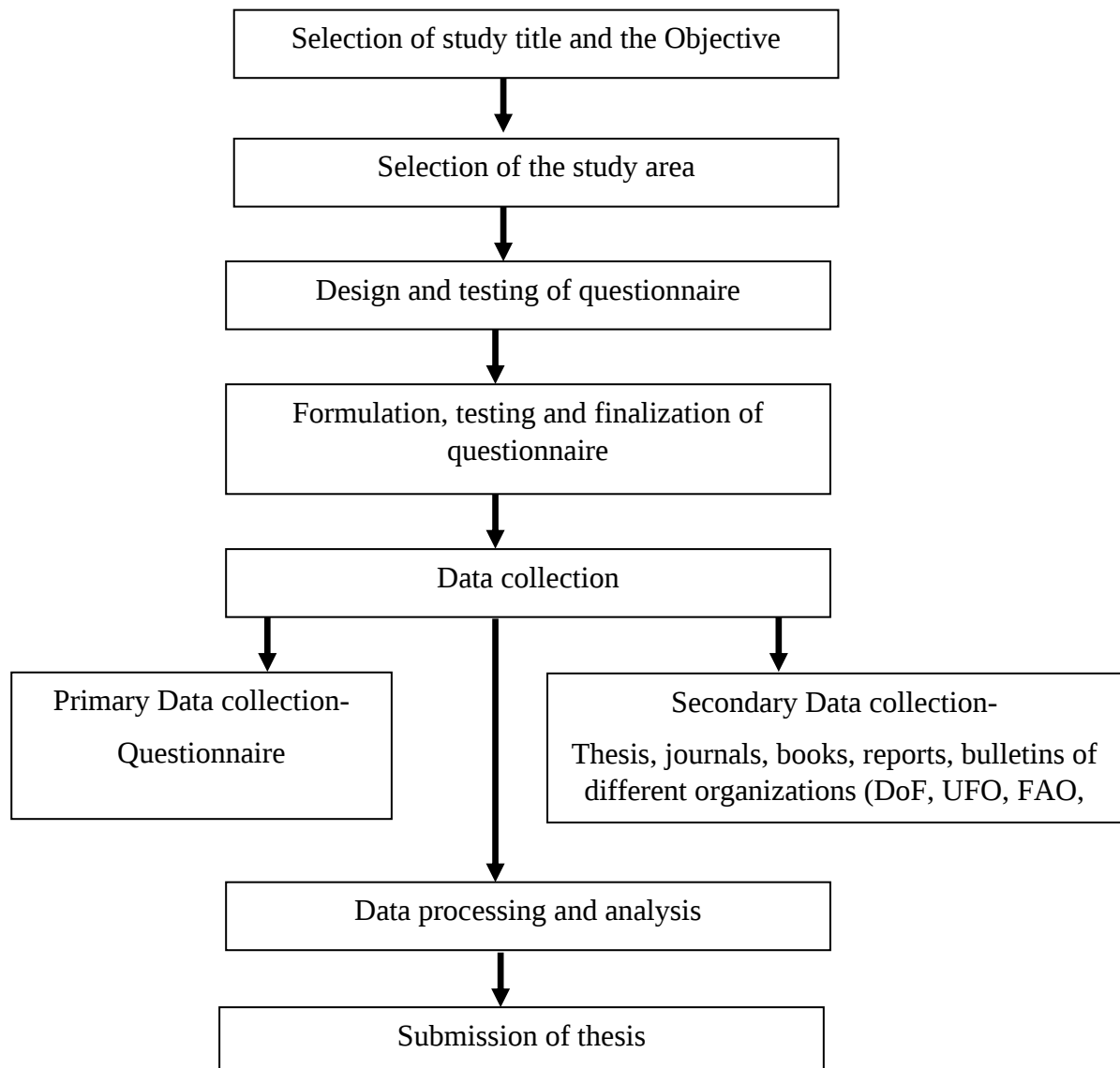


Figure 3.3 Flow diagram of the research

Table 3.1 Distribution of the sample fish farmers according to Upazilas of Dinajpur District

Name of the Upazila	Number of fishermen(n)
Dinajpur Sadar	25
Birganj	25
Biral	25
Birampur	25
Sample	100

3.2.3 Data collection instruments

A structured interview schedule was prepared according to the objectives of the study. The questions and statements were simple, direct and easily understandable for the farmers. To prepare an effective questionnaire on livelihood capitals of fish farmers, a number of contacts were accomplished with the UFO of different Upazilas. These contacts and subsequent discussion were very helpful for understanding the research issues. It was pre-tested with 15 fish farmers of the study area. Based on the pre-test experience, necessary information, corrections, modifications and additions were made in the interview schedule.

3.2.4 Data collection

The survey was conducted from July to October, 2017. The researcher clearly explained the objectives of the study by using local language as far as possible. If the respondents felt any difficulty in understanding any question, the researcher took utmost care to explain and clarify the question properly.

3.2.4.1 Primary data

The primary data were collected through field survey at the farm level by using a well structured questionnaire. In order to understand the macro-level factors that influence the livelihood system, the social, economic, environmental and infrastructural information was collected and analyzed.



Plate 3.1 Primary Data collection from fish farmer

3.2.4.2 Secondary data

In this research, secondary data was collected from the fisheries officers of selected upozillas of Dinajpur district. Some information was obtained from reports, journals and books from the library of Hajee Mohammad Danesh Science and Technology University, Dinajpur, Bangladesh in both published and unpublished articles. Additional information was also collected from some previous works. Finally some data was gathered from Sustainable Livelihood Approach from Department for International Development (DFID).

3.2.5 Measurement of the variables

The characteristics of fish farmers i.e. age, formal education, family size, annual family income, training experience on fish farming, and knowledge of fish culture were variables of this study. The main variable of this study was livelihood capitals by the farmers in tilapia with carps farming.

3.3 Measurement of Selected Characteristics of the Fish Farmers

Procedures of measuring these characteristics are described below:

3.3.1 Age

Age of a respondent was measured by the period of time from his/her birth to the time of Interview and it was measured of complete years on the basis of his/her response. Each year of age was assigned by scoring one (1).

3.3.2 Education

Formal education of a respondent was measured in terms of years of schooling which was completed any educational institutes. Besides, a respondent got actual score for every year of schooling i.e. 1 for- class one, 2 for class two and so on.

3.3.3 Family size

Family size of a fish farmer was determined by the total member in his/her family including himself/herself, his/her wife/husband, sons, daughters and others fully and partially dependent on him/her. Total number of family members was considered as the family size score of a respondent. For example, if a respondent has 4 members in his/her family, his/her family size score was 4.

3.3.4 Farm size

The farm size was measured for each respondent in terms of decimal by using the following formula:

$$\text{Total farm size} = \{1 + 2(1/\text{share no.}) + 3(1/\text{share no}) + (4 \times 1/2)\}$$

Where,

1 = own pond

2 = pond taken from others as lease

3 = land taken from others as barga

4 = land given to others as barga

3.3.5 Total land area

Land holdings of a respondent referred to the total area of land on which family carried out for their livelihood. Total land area was measured for each respondent in terms of decimal by using following formula:

$$\text{Total land} = 1+2+3+4$$

Where,

1 = Homestead area

2 = Pond size

3 = Own land under own cultivation

4 = Land taken from others as lease

3.3.6 Annual income

Annual income was measured on the basis of the total yearly earning by a fisherman himself and his family members from aquaculture activities and other sources (service, business etc.). All the earnings of a respondent's family from aquaculture activities and other sources were added to determine his total annual income. By multiplying the quantity of those productions with its prevailing market price per unit quantity, the annual income was measured in taka.

3.3.7 Training experience

Training exposure was determined by total number of days of training received by a respondent from different organization. If a farmers took 1 day training on aquaculture activity from GO's, NGO's or any other organizations then his training received score was 1 and so on.

3.3.8 Aquaculture knowledge

For measuring knowledge on fish farming of a respondent, the researcher asked series of questions related to basic aspects of the fish farming especially on tilapia fish culture. It contained 32 questions which were summed up to get total knowledge score of a

respondent. The assigned score was 68 against 32 questions. Assigned score were distributed according to the question.

3.3.9 Organizational participation

On the basis of nature and duration of respondent's participation in various organizations and institutions referred to organizational participation. Organizational participation score of a respondent was calculated by multiplying the score of his participation status with the corresponding duration (in year) in all the organizations and then summated together to get the total organizational participation score.

3.3.10 Livelihood capitals

Livelihood capitals were measured on five dimensions namely, human capital, social capital, financial capital, physical capital and natural capital (DFID, 2000). A five-point likart type scale was used for measurement of the statements related to the capitals and a score was assigned for "strongly agree", "agree", "neutral", "disagree" and "strongly disagree" as 5, 4, 3, 2 and 1 respectively for the positive statements. The scoring technique is reverses for the negative statements. Three positive and three negative statements were considered for each capital. Thus, the total score for each capital ranged from 6-30 and the overall livelihood capital scores ranged from 30-150, where 30 indicating low livelihood capitals possessed and 150 indicating very high livelihood capitals possessed by the farmers.

3.3.11 Measurement of problem confrontation

The problems confronted by the fish farmer on tilapia with carps fish culture were identified by using closed form of question. The fish farmers were asked to give their opinion on the selected problems. The extent of problem confrontation of identified problems was determined by using a rating scale such as, "high (3)", "medium (2)", "low (1)" and "not at all (0)". The possible range of problem score could be '0' to '39' where, a total score of '0' indicated no problems confronted and '39' indicated highest problem confronted.

3.4 Data Processing and analysis

Collected data was accumulated, grouped, summarized, arranged, coded, compiled, categorized, tabulated and analyzed according to the objectives of the study. Qualitative

data were converted to numerical data by means of suitable scoring techniques and local units were also converted into standard units. Finally arranged data were analyzed by the SPSS (Statistical Package for Social Sciences) computer program, and then interpreted according to the objectives. Various statistical measures such as range, mean, number, percentage, and standard deviations were used to describe the selected characteristics of the respondents. Pearson's Product Moment Correlation Co-efficient (r) was computed for testing the relationship between characteristics of fish farmers and focus issue (livelihood

CHAPTER IV

RESULT

A detailed and logical discussion on the findings of the study has been presented in this chapter. This chapter is divided into five sections namely (1) selected characteristics of the tilapia with carps fish farmer (2) Livelihood capital the fish farmers (3) Problems Faced in tilapia with carps culture system (4) Comparison among the individual problems according to problem facing index (PFI) and (5) Relationship between the selected characteristics of the fish farmers and their livelihood capitals of fish farmers.

4.1 Characteristics of the Fish Farmers

Eleven characteristics involved fish farmers were selected to describe and to find out the relationship with the problems in tilapia with carps culture. These selected characteristics were age, education, family size, farm size, total land area, annual income, training exposure, aquaculture knowledge, organizational participation, and livelihood capitals and problem confrontation. The salient features of the eleven characteristics of fish farmers who involved in tilapia with carps culture have been presented in Table 4.1.

4.1.1 Age

The age of fish farmers ranged from 30 to 60 years. The mean age was 42.31 ± 7.36 years. On the basis of their age, the fish farmer were classified into three categories, such as young (up to 35), middle (36-50), and old (above 50). The distribution of the fish farmers according to their age is shown in (Table 4.1). About 94% young fish farmer were involved in tilapia with carps farming.

4.1.2 Education

The education of the respondent's farmers of the study area ranged from 1 to 14 year of schooling. On the basis of scores obtained, the respondents were grouped in 3 numbers of categories. The average education level was 8.33 ± 3.50 . About 34% fish farmers were completed their primary education.

4.1.3 Family size

Maximum levels of medium family size were observed in this study. Family size of the respondents under this study was ranged from 2 to 10 and the mean was 5.74 ± 1.61 . On the basis of their size, the fish farmers were classified into three categories, such as small family (2-4), medium family (5) and large family (>6) has been shown in (Table 4.1). In the study area, second majority of the respondent had medium to large sized family.

4.1.5 Farm size

Average pond size was 59.56 ± 29.39 pond area of fish farmer was ranged from 10-150 decimal. On the basis of area under tilapia with carps farming, the respondents were classified into three categories as small (up to 40 decimal), medium (41-100) and large (above 100) have been shown in Table 4.1. Data showed that 31 percent of the respondents had small sized farm, 61 percent had medium sized farm and 8 percent had large sized farm.

4.1.4 Total land area

Total farm size of the respondents was ranged from 40-250 decimal and the average farm size was 107.42 ± 46.34 . Based on their land size, the fish farmers were classified into 3 categories. Data in the Table 4.1 showed that the majority of the respondents (49 percent) had small sized farm, 43% percent had medium and 8% percent had large sized farm.

4.1.7 Annual income

Annual income of the respondents scored from 30-148.38 (1=1000 Tk) with an average of 67.78 ± 24.89 (1=1000 Tk). On the basis of annual income score, the respondents classified into three categories as low (up to 50), moderate high (50-80) and high (above 80) have been shown in Table 4.1 (1=1000 Tk). Data showed that 52 percent of the respondents had moderate annual income, 24 percent had high annual income and 24 percent had low annual income.

4.1.6 Training experience

Training exposure score of the respondents was ranged from 0 to 60 days and the average value was 13.09 ± 14.01 . Based on training exposure, the respondents were classified into four categories as no training (0), weekly (1-7), monthly but more than weekly (8-30) and long-term (above 30).

Table 4.1 Distribution of the fish farmer characteristics of livelihood aspiration scores (n=100)

Characteristics	Scoring method	Range		Categories	Respondents		Mean	SD
		Possible score	Observed		Freq.	%		
Age	No. of year	Unknown	30-60	Young (up to 35)	26	26	42.31	7.36
				Medium (36-50)	68	68		
				Old (above 50)	6	6		
Education	Year of schooling	Unknown	1-14	Primary (1-5)	34	34	8.33	3.50
				Secondary (6-10)	38	38		
				Higher secondary (above 10)	28	28		
Family size	No. of Member	Unknown	2-10	Small (2-4)	20	20	5.74	1.61
				Medium (5-6)	48	48		
				Large (above 6)	32	32		
Farm size	Decimal	Unknown	10-150	Small (up to 40)	31	31	59.56	29.39
				Medium (41-100)	61	61		
				Large (above 100)	8	8		
Total land area	Decimal	Unknown	40-250	Small (up to 100)	49	49	107.42	46.34
				Medium (100-180)	43	43		
				High (above 180)	8	8		

Characteristics	Scoring method	Range		Categories	Respondents		Mean	SD
		Possible score	Observed		Freq.	%		
Annual income	Taka (in "000")	Unknown	30-148.38	Low (up to 50)	24	24	67.78	24.89
				Moderate (50-80)	52	52		
				High (above 80)	24	24		
Training experience	Day	Unknown	0-60	No training (0)	39	39	13.09	14.01
				weekly (1-7)	0	0		
				Monthly but more than weekly (8-30)	57	57		
				Long (above 30)	4	4		
				No participation	79	79		
Organizational participation	Year	Unknown	0-12	Low (1-4)	11	11	0.92	2.26
				Medium (5-8)	8	8		
				High (above 8)	2	2		
Aquaculture knowledge	Score	0-68	25-58	Low (up to 36)	8	8	44.2	6.88
				Medium (37-47)	61	61		
				High (above 48)	31	31		

4.1.7 Organizational participation

Organizational participation of the respondents scored from 0 to 12. The mean was 0.92 ± 2.264 . On the basis of attaining scores, the respondents were classified into four categories: no organizational participation (0), low organizational participation (1-4), medium organizational participation (5-8) and high organizational participation (above 8) have been shown in (Table 4.1.)

4.1.8 Aquaculture knowledge on fish farming

The scores of knowledge of tilapia with carps farming of the respondents ranged from 0-68. The mean was 44.2 ± 6.88 . On the basis of the scores, the fish farmers were classified into three categories as low (up to 36), medium (37-47), high (above 48) are shown in Table 4.1.

4.2 Livelihood Status of the Fish Farmers in Tilapia with Carp Culture

4.2.1 Human capital

Human capital represents the skills, knowledge, ability to work and good health that together enable people to pursue their livelihood strategies and achieve their livelihood objectives (DFID, 1999). The observed value was ranged from 13-25 of human capital. On the basis of their scores, the fish farmers were classified into three categories as low (up to 17), medium (18-21), high (above 21) are shown in Table 4.2. According to this report 26% farmers have low, 53% farmers have medium, and 21% have high level of opinion about their improvement.

4.2.2 Social capital

Social capital in the form of networks, connectedness, cultural norms and others social attributes have significantly helped in exchanging experiences, sharing of knowledge and cooperation among rural households (Fine, 1999, Stirrat, 2004). Social capital also divided into 3 categories such as low (up to 15), medium (16-20), and high (above 20). The observed value of social capital was 10-25. According to the Table 4.2, about 7% farmers had low, 63% had medium and 30% had high level of opinion about their social status.

Table 4.2 Distribution of fish farmer based on their different dimensions of livelihood capitals (n=100)

Livelihood improvement	Range		Respondents		Mean	SD
	Possible	Observed	Category	Percent		
Human capital (idea, knowledge, skill, etc)	6-30	13-25	Low (up to 17)	26.0	19.02	2.60
			Medium (18-21)	53.0		
			High (above 21)	21.0		
Social capital (social network, cultural norms, social attributes etc)	6-30	10-25	Low (up to 15)	7.0	19.17	2.80
			Medium (16-20)	63.0		
			High (above 20)	30.0		
Financial capital (income, savings, investment etc)	6-30	13-27	Low (up to 18)	57.0	17.82	2.41
			Medium (19-22)	41.0		
			High (above 22)	2.0		
Physical capital (transport, road, market etc)	6-30	12-26	Low (up to 17)	37.0	18.52	2.95
			Medium (18-21)	51.0		
			High (above 21)	12.0		
Natural capital (availability of land, water, fry etc)	6-30	9-23	Low (up to 13)	7.0	16.67	2.49
			Medium (14-18)	75.0		
			High (above 18)	18.0		

4.2.3 Financial capital

Financial capital denotes the financial resources that people use to achieve their livelihood objectives and status such as incomes, savings and credit. Financial capital also divided into 3 categories such as low (up to 18), medium (19-22), and high (above 22). The observed range of financial capital 13-27. About 57% farmers have low, 41% have medium and 2% have high level of opinion about their status in case of financial capital (Table 4.2).

4.2.4 Physical capital

Transport, road, market, electricity, water supply, sanitary and health facilities are the physical capital of fish farming. Physical capital also divided into 3 categories such as low (up to 17), medium (18-21), and high (above 21). The observed range of physical capital 12-26. About 37% farmers have low, 51% have medium and 12% have high level of opinion about their status in case of financial capital (Table 4.2).

4.2.5 Natural capital

Natural capital in the form of cultivable land, water, wild fry and wider environmental goods are critical for farmers in fish farming. A fisherman relies on rainfall, ground water and sometimes canal water for fish farming. In Table 4.2 natural capital also divided into 3 categories such as low (up to 13), medium (14-18), and high (above 18). The observed value of Natural capital was 9-23. About 7% farmers have low, 75% have medium and 18% have high level of opinion about their status in case of natural capital (Table 4.2).

Table 4.3 Distribution of different categories of fish farmer based on their overall livelihood capitals

Range		Categories	Frequency	Percentage	Mean	SD
Possible	Observed					
		Low (up to 78)	2	2		
30-150	63-108	Medium (78-93)	64	64	91.2	7.07
		High (above 93)	34	34		

4.3 Problems Confrontation in Tilapia with Carp Farming

The purpose of this section is to have clear understanding about the problems faced by the fish farmers on tilapia with carps farming. As many as 13 problems in connection with tilapia culture were included in problems confrontation scale. Fish farmers gave their responses as high, medium, and low against each problem included in problem confrontation scale. The respondents' problems facing scores in all 13 selected problems could range from up to 10 low problems faced, range 11-20 indicating medium problem faced and range 21-30 indicating very high problem faced. The observed range of fish farmer was from 13-29 with an average of 22.71 ± 3.59 . Based on their possible problem scores the respondents were classified into three categories as shown in Table 4.4.

Table 4.4 Categorization of respondents on the basis of their overall problems faced in Tilapia with Carps farming (n=100)

Categories	Growers		Possible range	Observed range	Mean	SD
	Number	Percent				
Low problem faced (up to 10)	13	13				
Medium problem faced (11-20)	46	46	0-39	13-29	22.71	3.59
High problem faced (21-30)	41	41				

4.4 Comparison among the Individual Problems According to PFI (Problem Facing Index)

In order to get better concept about the extent of problems in mixed tilapia culture, it was necessary to get an idea about the comparative problem facing for 13 selected problems. For 100 respondents, the total score received for each problem issue could range from 0 to 300 (100×0 to 100×3). Problem Facing Index (PFI) was calculated with the formula has given in below.

PFI for each 20 selected problems was measured by using the following formula:

$$\text{Total score received} = (P_h \times 3) + (P_m \times 2) + (P_l \times 1) + (P_n \times 0)$$

Where,

P_h = Number of respondents indicating high problem

P_m = Number of respondents indicating medium problem.

P_l = Number of respondents indicating low problem.

P_n = Number of respondents indicating problem not at all.

$PFI = \text{Total score received} \div \text{Maximum total score or highest possible range no.} \times 100$

Table 4.5 Problem confrontation in fish farming activities

Sl. No.	Problem	Extent of problem				PFI	Rank
		High (3)	Medium (2)	Low (1)	Not at all (0)		
1.	Lack of good quality fingerling	3	55	33	9	152	11
2.	Problem regarding water management	0	47	40	13	134	13
3.	Mortality of fingerling	14	47	31	8	167	9
4.	Lack of technical knowledge on feed application	19	48	24	9	177	5
5.	Lack of technical knowledge on fertilizer application	22	36	34	8	172	7
6.	High price of artificial fish feed	29	41	30	0	199	3
7.	Lack of knowledge on species selection	15	45	34	6	169	8
8.	Lack of money for pond management	9	38	39	14	142	12
9.	Lack of marketing facilities	20	52	11	17	175	6
10.	Lack of contact with fisheries extension workers	20	35	35	10	165	10
11.	Labor crisis on pick time	38	47	13	2	221	1
12.	Unavailability of information regarding diseases	24	40	32	4	184	4
13.	Lack of security in fish farm	32	50	18	0	214	2

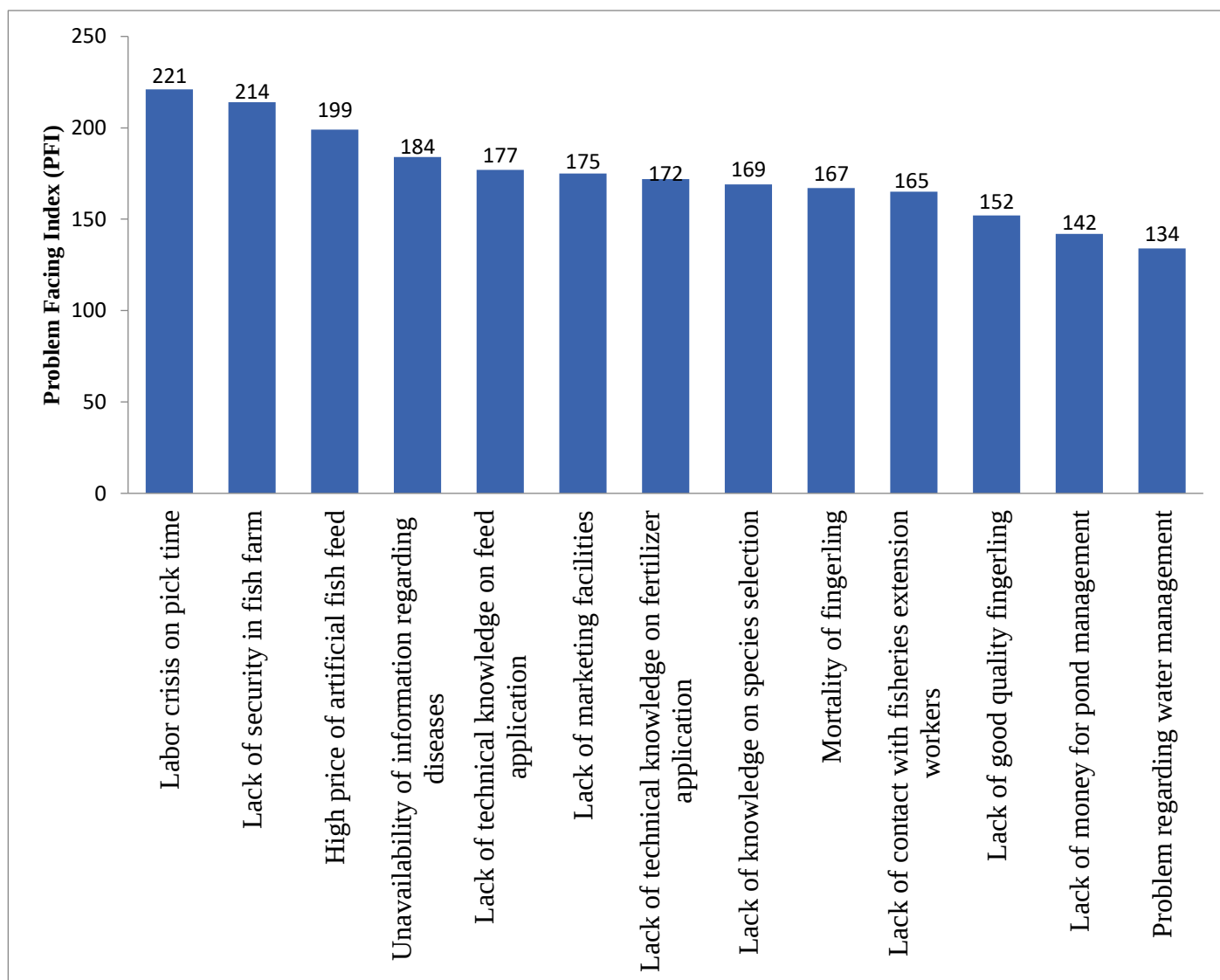


Figure 4.1 Problem confrontation level in graphically

Table 4.6 Correlation coefficients of the selected characteristics of fish farmer and their livelihood capital

Dependent variable	Independent variables	Computed values of 'r' with 98 df.	Tabulated value of 'r'	
			0.05 level	0.01 level
Livelihood capital	Age	0.272**		
	Education	-0.241*		
	Family size	0.131		
	Farm size	0.389**		
	Total land area	0.420**	±0.197	±0.257
	Annual income	0.277**		
	Training experience	0.212**		
	Aquaculture knowledge	0.269**		
	Organizational participation	-0.018		
	Problem confrontation	0.181		

*Correlation is significant at the 0.05 level and

** Correlation is significant at the 0.01 level.

4.5 Relationship between the Selected Characteristics of the Fish Farmers and their livelihood capital tilapia with carps farming

The eleven select characteristics of the fish farmers were the explanatory variables of the study. These variables were age, education, family size, farm size, total land area, annual income, organizational participation, training exposure, knowledge on use of aquaculture practices and problem confrontation. Livelihood capitals of tilapia with carps fish farmers was the focus variable of this study.

The purpose of this section is to explore the relationships of the selected characteristics of the fish farmers with their livelihood capital. Pearson's Product Moment Coefficient Correlation (r) was used to explore if there was statistically significant relationship between the selected characteristics of fish farmers and livelihood capital of tilapia with carps farming. The results of the correlation analysis between the concerned variables have been presented in Table 4.6.

4.5.1 Age and livelihood capital

The computed value of 'r' (0.272**) was found greater than that of the tabulated value (0.257) with 98 degrees of freedom at 0.01 level of probability as shown in table 4.6.

4.5.2 Level of education and livelihood capital

The computed value of 'r' (-0.241*) was greater than that of the tabulated value (0.197) with 98 degrees of freedom at 0.05 level of probability as shown in table 4.6.

4.5.3 Family size and livelihood capital

The calculated value of 'r' (0.131) was smaller than the tabulated value (0.197) with 98 degrees of freedom at 0.05 level of probability as shown in Table 4.6. Based on the above findings, the researcher concluded that family size of fish farmers had no significant relationship with their livelihood capital.

4.5.4 Farm size and livelihood capital

The computed value of 'r' (0.389**) was larger than the tabulated value (0.257) with 98 degrees of freedom at 0.01 level of probability as shown in table 4.6. It can be concluded that farm size of the fish farmers had a significant and positive relationship with their livelihood status.

4.5.5 Total land area and livelihood capital

The computed value of 'r' (0.420**) was larger than the tabulated value (0.257) with 98 degrees of freedom at 0.01 level of probability as shown in table 4.6. It can be concluded that total land area of the fish farmers had a significant and positive relationship with their livelihood capital.

4.5.6 Annual income and livelihood capital

The computed value of 'r' (0.277**) was larger than the tabulated value (0.257) with 98 degrees of freedom at 0.01 level of probability as shown in table 4.6. It can be concluded that annual income of the fish farmers had a significant and positive relationship with their livelihood capital.

4.5.7 Training experience and livelihood capital

The computed value of 'r' was (0.212*) larger than the tabulated value (0.197) with 98 degrees of freedom at 0.05 level of probability as shown in Table 4.6. It was concluded

that training experience of the fish farmers had a significant and a positive relationship with their livelihood capital.

4.5.8 Organizational participation and livelihood capital

Between organizational of the farmers and livelihood status by the fish farmers in tilapia with carps, the computed value of correlation co-efficient (r) was -0.018 as shown in the Table 4.6. Based on this 'r' value, the relationship between the concerned variables was negative and non-significant.

4.5.9 Aquaculture Knowledge and livelihood capital

The computed value of 'r' (0.269**) was larger than the tabulated value (0.257) with 98 Degrees of freedom at 0.01 level of probability as shown in Table 4.6. It could be indicated that knowledge on use of aquaculture Practices of the fish farmers had a significant positive relationship with livelihood capital.

4.5.10 Problem confrontation and livelihood capital

The computed value of the co-efficient of correlation (r) between problem confrontation of the farmers and their livelihood capital was found to be 0.181 as shown in the Table 4.6. Based on the computed 'r' value, the relationship between the concerned variables was positive and non significant.

CHAPTER V

DISCUSSION

5.1 Selected Characteristics of the Fish Farmer

Among the 100 fish farmers most of the fish farmers was middle aged group. Baki *et al.* (2015) found that the highest percentage of middle age (31-40 years) farmers was 48%, young (below 30) was 32% and old (41-60) years was the lowest (20%) among all fish farmers of Turag-Buriganga river, Dhaka, Bangladesh. Ghosh *et al.* (2015) was also found that 65 fish farmers (59.25%) were below 30 years old, 34 fish farmers (29.62%) were between 30 and 39 years, and the remaining fish farmers (11.11%) were more than 40 years old of the fish farmers in Teknaf, Bangladesh. Ali *et al.* (2009) noticed that most of the fish farmers (50%) belonged to age group of 31 to 40 years in Mymensingh district

of Bangladesh. Middle-aged farmers were aggressive and energetic people who were more willing to adopt new technology than older fish farmers (Gupta and Dey, 2014). These middle aged people may be highly interested in tilapia culture technique and they abstain from fishing activities.

Education enhances the power of understanding and develops the abilities of analyzing facts and situation in order to take correct decision in right time. It was good to observe that the respondent fish farmers possessed relatively better education. Among the 100 fish farmers most of the fish farmers were completed their primary and secondary education level. Akter *et al.* (2016) found that the highest 53.33% farmers belonged to the secondary level education of Kaharole Upazila, Dinajpur, Bangladesh. Mohammad *et al.* (2016) found that out of 40 interviewed fish farmers, 35% had primary (up to class 5), small portion (5%) of them can read only, 10% Illiterate, 10% can only write their name, 10% are literate to SSC level and the most important thing is that secondary education (up to class 8) completed fish farmers was 30% Noakhali regions of Bangladesh. Rahman *et al.* (2012) reported that among 100 fish farmers, 66.66% were illiterate while 16.66% had primary education and another 16.66% can sign only in the *Nijhum* Island under *Hatiya* upazilla of Noakhali district in Bangladesh. An educated farmer is more likely to adopt new technology and ultimately creates a new impact (Meena *et al.* 2002). Level of education for a fish farmer helps to know about fish farming techniques. From this study education also might be supportive for fish farmers to accept and understand new technologies related with fish farming.

Among the 100 fish farmer's joint family was predominant in the study area which also corresponds well with the findings of Baki *et al.* (2015) mentioned that most families had only (46%) members 5-6 as medium family and 36 % had members 2-4 as small family among all fish farmers of Turag-Buriganga river, Dhaka, Bangladesh. It was also found that, about 60% fish farmers lived with nuclear families and 40% fish farmers lived with joint-families (Baki *et al.* 2015). Paul *et al* (2013) found that 60% fish farmers in *Birulia* and 57% in *Boroibari* had medium family size with 4-7 members, 36% in *Birulia* and 46% in *Boroibari* had large, above 7 family members and only 4% fish farmers in *Birulia* had small with 2-4 family members. As the fish production is a labor intensive

activity hence large family size also cooperative in fishing activities (Gupta and Dey, 2014). Labor crisis is a major problem in this study area. To overcome this type of problem, some people might be involved in farming activities who are fish farmer's family member.

Average farm size in this present study is 59.56 decimal (0.24). Sarwer *et al.* (2016) found that pond size 0.27 ha (66.66 dec) in *Subarnachar*, Noakhali, Bangladesh. Provakar *et al.* (2013) stated that average pond size of that area is 0.24 ha. (59.46 dec). Ali *et al.* (2008) described that the average pond size in that study area was found to be 0.15 ha (37 decimals) in some selected areas of *Bagmara* upazilla under Rajshahi district. Khan (1986) stated that fish culture efficiency varied with the size of ponds. Medium level of farm size is easy to manage in time of farming activities. Easily manageable farm size may be highly preferable for fish farmers in this study area.

In this present study average land area (total) is 107.42 decimal. Islam *et al.* (2013) found that average land size (total) was 1.21ha (298.507dec) in practicing semi-intensive climbing perch (*Anabus testubineus*) Farming. Sarwer *et al.* (2016) found that total land size is 0.53ha (130.76 dec) in *Subarnachar*, Noakhali, Bangladesh. The productivity of land with profitable aquaculture practices are related to high land prices (Ahmed and Toufique 2014). The increase in the value of land has also resulted in an increase in land disputes and social conflicts (Ahmed and Toufique 2014).

Maximum fish farmers in this study area had a moderate level of income from fish farm. Paul *et al.* (2013) found about 63% fish farmers in *Birulia* and 35% fish farmers in *Boroibari* had a moderate annual income (30000-60000 tk) of the fish farmers of the Turag river, Bangladesh. Reza *et al.* (2015) found 16% fish farmers had a medium income between BDT 25,001-35,000 of fish farmers around the *atrai* and *Kankra* Rivers of *Chirirbandar* upazila under Dinajpur district, Bangladesh. Yeasmin *et al.* (2013) found maximum number of fisherman had Medium (61000-150000 tk) level of annual income of the fish farmers on integrated fish farming in Mymensingh district. Kabir *et al.* (2012) described that about 30% fish farmers had moderate (507.26-652.17) level of annual income of Fish farmers of the Old *Brahmaputra* River, Bangladesh (1 US\$ @) 69BDT). Khatun *et al.* (2013) described that annual income of fish farmers were varied from 24,000 to 1,00,00 bdt of pond fish farmers of *Charbata*, Noakhali, Bangladesh. Ali *et al.* (2008) categorized income levels in 1st, 2nd, 3rd and 4th of Tk. 25,000-50,000; Tk. 51,000-75,000;

Tk. 76,000-1,00,000 and > 1,00,000 respectively of the fish farmers in some selected areas of *Bagmara* upazilla under Rajshahi district. Farmers have improved their income through increased profitability in fish production (Ahmed and Toufique 2014). Income may provide an opportunity to enhance household security for coping with uncertain situation, such as illness and natural disasters.

Training exposure is an important factor, which enhance the level of knowledge on aquaculture practices and improve skills on various aspects of aquaculture technologies. A well trained integrated fish farmers able to ensure more fish production (Yeasmin *et al.* 2013). Among the 100 fish farmer's maximum number of farmers has aquaculture training at monthly or more than weekly in this present study. Islam *et al.* (2013) found that among 105 fish farmers the highest 75.24% had no training experience, 19.05% had low level (up to 3), 0.96% had medium level (4-6) and 4.76% has high level (above 6) of training experience in practicing semi-intensive climbing perch (*Anabus testubineus*) farming. Yeasmin *et al.* (2013) stated that among 95 fish farmers 40% had training experience in long term (above 15), 38.9% had in short term and 21.1% had long term of training experience on integrated fish farming in under *Muktagacha* upazila (sub-district) of Mymensingh district. Due to lack of knowledge and sufficient information about the expected activities, the respondents logically felt frequent training season on integrated fish farming on integrated fish farming of Mymensingh district (Yeasmin *et al.* 2013). Some fisherman doesn't want to continue any longer based training season. For these reason fish farmers in this study may be more interested in medium level of training season.

Among the 100 fish farmers, maximum number of fish farmers has no participation in any organization. Yeasmin *et al.* (2013) explain that among 95 fish farmers 100% had low level (up to 7) of organizational participation on integrated fish farming in under *Muktagacha* Upazila (sub-district) of Mymensingh district, Bangladesh. Organizational participation is necessary because from this participation they become more aware of their training needs (Yeasmin *et al.* 2013). It can be said that majority of the respondent had no organizational participation because of unconsciousness. Most of fish farmers are only involved in their farming activity that's why they have less time to participate any organization.

Increase of knowledge in aquaculture practices of the farmers would ultimately increase the use of the aquaculture practices by the fish farmers. In this study area aquaculture knowledge of fish farmers is medium. Islam *et al.* (2013) found that among 105 fish farmers the highest 44.76% had aquaculture knowledge at medium level (13-18), 19.05% had low level in aquaculture knowledge (up to 12) and 36.19% has high level (above 18) of aquaculture knowledge in practicing semi-intensive climbing perch (*Anabus testubineus*) farming. Farmers who have acquired knowledge on fish farming were more likely to adopt it than those who had not acquired knowledge (Gupta and Dey, 2014). Knowledge about aquaculture activities are acquired by effective training experience. Medium level of training season in this study may be helpful to know about aquaculture practice and new techniques related with fish farming.

5.2 Problem Confrontation of the Fish Farmers in Tilapia Farming

Problems of fish farmers in culturing tilapia fish were measured by placing the problematic items in rank order. The farmers were asked to mention the extent of problems they confronted in fish farming where farmers mentioned the extent of confrontation of the each problem. For determining the extent of problem confrontation level, rank order was made by computing Problem Facing Index (PFI).

From the result labor crisis on pick time was ranked first in the rank order with highest PFI -221. Labor facilities are still needed in communities of Ban Don Bay, Suratthani (Tipyan and Udon, 2014). Labor is not available and sufficient in this study area because most of the people may be engaged in their own working schedule.

Lack of security in fish farm was ranked in second position with PFI-214. Jealous people often throw poison into ponds at night; Poaching fish is also a problem (Ahmed and Toufique 2014). Farmers, who do not hire guards or sleep at their ponds at night, might be faced by security problem in this present study.

High price of artificial fish feed (PFI-199) was ranked in third position. Fish farmers in remote area may not get enough artificial feed for fish because of their transportation problem.

Unavailability of information regarding diseases (PFI-184) was ranked in fourth position. Ali & Rahman, (1986) reported that attack of fish disease is one of the major problems in pond fish culture in Bangladesh. Most of the fish farmers in this area are not properly aware about infected diseases of fish because they still are following traditional culture system.

Lack of technical knowledge on feed application (PFI-177) was placed in fifth position. Lack of acceptance of proper training session fish farmers cannot aware about feed application. Some fish farmers in this area may be still following in traditional way in feed application.

Lack of marketing facilities (PFI-175) was placed in sixth position. Marketing facilities are fluctuating, for this reason farmers are in a weak position (i.e., low bargaining power on price) in relation to intermediaries in the fish marketing systems (Ahmed and Toufique 2014). Marketing channel may also be increasing day by day that's why marketing system are also affected in this study area.

Lack of technical knowledge on fertilizer application (PFI-172) was ranked in seventh position. Fish farmers can know about different techniques related culture system by experiencing training session. Lack of proper knowledge about aquaculture practice might be responsible for this type of problem among fish farmers.

Lack of knowledge on species selection (PFI-169) was placed in eighth position. Mortality of fingerling (PFI-167) was ranked in ninth position. Ali & Rahman, (1986) reported that mortality of fish fry is one of the major problems in pond fish culture in Bangladesh. Because of transportation problem in this area rate of mortality of fry and fingerling may be increasing.

Lack of contact with fisheries extension workers (PFI-165) was ranked in tenth position. Fisheries extension workers can help fish farmers to know about farming technique. Some fish farmers in rural area may be not communicated with extension media contacts because of their unconsciousness.

Lack of good quality fingerling (PFI-152) was ranked in eleventh position. Ali & Rahman, (1986) reported that non availability of good quality fish fry is one of the major problems in pond fish culture in Bangladesh. Good quality fingerling is another problem in aquaculture because some fish farmers are not properly aware about the quality of fry and

fingerling. Lack of knowledge about fry and fingerling may be prime reason for this problem in this area.

Lack of money for pond management (PFI-142) was ranked in twelfth position. Farmers are unable to exchange water in spite of poor water quality because of unplanned construction of ponds (Ahmed and Toufique 2014). Absence of proper knowledge about pond management might be causes of these types of problem in this present study.

Problem regarding water management (PFI-134) was ranked in thirteenth position. Climate 2change including flood, drought and rainfall variation has had negative impacts on aquaculture management (World Fish Center, 2009). Natural disasters (flood, drought etc) is another main problem that's why some time pond water are increases and some time enough water is available in culture pond. These types of problems might be faced by fish farmers in this study area.

According to Islam *et al.* (2013), lack of labor on pick time and Lack of security in the fish farm was ranked at 6th and 19th respectively in the rank order from Mymensingh district. According to them lack of marketing facilities was ranked at 1st with PCI-290. Islam (2010) found that lack of marketing facilities was one of the most important constraints for fish production in their study in Jamalpur District. The another problem i.e. low market price of climbing perch ranked second in the rank order with PCI 289 which is also important aspect of increasing production of fishes Islam (2010). Rahman (2010) found that high price of fish feeds and high price of chemicals and drugs for disease control were the major problems faced by the farmers. Haider (2008), in his study found that 62% of the respondents reported high price of inputs (fertilizers and feeds) is a constraint for fish rearing. Parvez (2009) found that high price of fertilizer, feed and other inputs was ranked third top problem in a rank order of fifteen selected constraints as faced by the farmers in small scale aquaculture.

The findings indicate that majority of the farmers (87%) confronted medium to high problems in the study area concerning tilapia fish farming. According to Islam *et al.* (2013), the highest proportion of the respondents (56%) had medium problem in practicing semi-intensive climbing perch farming, while 31% and 13% of them had high and low problem, respectively that is similar to present study. The fish farmers are faced different

problem for lacking of necessary land for fish farming, enough knowledge and technology, enough capital to invest and high price of fry, feed, fertilizer and other inputs (Raihan, 2014). Lack of suitable communication and technological support, fish farmers in this area are facing in these types of problems.

5.3 Livelihood Capitals of the Fish Farmers in Culture System

Human capital is very important in fisherman livelihood. Human capitals represent the skills, knowledge, nutritional status and training facilities that enable people to improve their livelihood strategies. In this present study, maximum number of the fish farmers gave their positive opinion in case of exchanging ideas with others and improving knowledge in production technology. Inadequate training facilities are also observed among most of the fish farmers in this present study. According to Tipyan and Udon (2014), labor force is still needed in communities of Ban Don Bay, Suratthani, Thailand. Institutional and organizational supports, extension services, more fish farming knowledge and exchanging ideas are needed for sustainable livelihoods (Sarwer *et al.* 2016). In case of remote area some fish farmers cannot directly attached with communication system easily. In this study area communication and exchanges their ideas among fish farmers may be a prime reason for their skills, knowledge about aquaculture.

Social Capital is very important to fish farmers in their livelihood status. In this study social capitals represent social network, social status, social constraints and ownership problems. Result showed that most of the fish farmers are agreed that their social network and social status are increasing day by day by improving tilapia cultivation technologies. Estimation also showed that a huge number of farmers are agreed with the ownership problem and social constraints in tilapia culture system. Ali *et al.*, (1982) and Ali & Rahman, (1986) reported that lack of scientific knowledge, multiple ownership of ponds and non availability of good quality fish fry are a major problems in pond fish culture in Bangladesh. Tipyan and Udon (2014) showed that more cooperative relationship is present in communities in Ban Don Bay, a network of Ban Don Conservation group drives the community to have sustainable livelihood without severe obstacles. Multiple ownership of pond is also a common problem for aquaculture because of non-cooperation by pond

owners (Ahmed and Toufique 2014). The multiple ownership is a problem for fish culture because the shareholders may be usually unable to arrive at a same decision in respect of fish farming in this study.

Financial capital that people use to achieve their livelihood improvement those capitals are savings, alternate earning, family income, regular remittances and investment. Study showed that maximum numbers of farmer are affected because of irregularity of market price. Most of the fish farmers given positive response that rate of borrowing credit(s) from NGOs, local money lender for tilapia cultivation is not sufficient. Most of the fish farmers and fish farmers have no access to formal sources of credit that's why loan or credit is necessary from different GOs and NGOs. Although production costs have increased significantly, the price of fish in markets has not increased to a similar degree (Ahmed and Toufique 2014). Since production decisions (e.g., investments and profits) are made on the market price, any downward fluctuation in the market will affect the profitability (Ahmed, Young, Dey & Muir 2012). Study showed that production cost of fish farming is increasing day by day but the market price is in irregular shape. For this reason sufficient financial support may be necessary for fish farmers in rural area.

Physical capital includes basic infrastructures such as housing condition, land, shelter, pond environment, housing facilities and production equipment that enable people to pursue their livelihoods livelihood improvement. Study showed that maximum number of farmers given their positive opinion that housing condition and housing facilities are developing.

Darwis *et al.* (2015) found that physical assets in the initial conditions did not differ between fishing households are still poor and successful households moving out of poverty on the island of Bengklais, Riau Province, Indonesia. From this study household condition, land condition and pond environment are developing before initial condition of fish farmers.

Natural capital in the form of water body, natural calamities, pond fertility, and natural vegetation around pond side and aquaculture environment are explained in this present study. Study showed that maximum number of farmers express their positive response that pond are damaged due to natural calamities. In this present study most of the fish farmers expressed their opinion that natural vegetation around pond side is eradicating immediately by the fish farmers. In recent years, climate change including flood, drought and rainfall variation has had negative impacts on aquaculture (World Fish Center 2009).

Environmental concerns associated with the escape of exotic fish can be manifold, including threats to aquatic ecosystems and biodiversity, habitat destruction, risk to native fish, transfer of pathogens and parasites, and genetic diversity (De Silva, Nguyen, Abery & Amarasinghe 2006). Pond damage because of natural calamities is occurred frequently. This reason might be responsible for high construction in this study area.

5.4 Relationship between Livelihood Capitals and Selected Characteristics of the Fish Farmers

Pearson's product moment co-efficient of correlation (r) was used to ascertain the relationships between the selected characteristics of the fish farmers and their livelihood capital in fish farming. The findings indicate that age, farm size, total land area, aquaculture knowledge and training experience had significant relationship with livelihood capitals. Islam *et al.* (2013) showed a relationship between characteristics of fish farmers and problem confrontation level and observed a significant relationship of age, educational level, annual income, fish farming experience, communication exposure, training exposure and knowledge on climbing perch farming. In this study age of the fish farmers showed a significant relationship with livelihood capital because farming experience also creates a positive effect with livelihood capitals. Education showed negative relationship with livelihood capitals. Findings showed that educated fish farmers has less experience in fish farming that's why they may not much knowledge in farming activities (personal communication). Level of family size creates a positive impact in case of physical capital and social capital. Training experience and aquaculture knowledge showed a significant relationship with livelihood capitals. By gaining training experience farmers can know about human capitals, social capitals and natural capitals. By practicing aquaculture, farmers may increase their knowledge about fish farming and that also help to know about livelihood capitals.

CHAPTER VI

SUMMARY, CONCLUSION AND RECOMMENDATION

6.1. Summery and Conclusion

This study was conducted to know the livelihood status of the fish farmers, associated problems with tilapia fish culture and relationship between livelihood status and some

selective characteristics. The research work was done in 4 Upazila under Dinajpur district. This study was carried out during July to October, 2017 through questionnaire interview with 100 respondents from Dinajpur district.

In the study, it was found that there are three categories of age groups in tilapia with carp fish farmers. Most of the fish farmers are belonged to middle age group and maximum farmers were completed primary and secondary level of education.

In the study area, among 100 fish farmer's maximum numbers of joint families was found in this study area. And their maximum farm size was in medium level but most of them had their total land area were in small level. Maximum farmers in this study area had a moderate level of income from fish farm. Income from aquaculture encourages farmers to engage in other income generating activities, including agriculture, petty business, poultry farming and livestock rearing.

Present study showed that training experience was found into four categories as highest time duration of their training experience was in monthly but more than weekly. Some of them had no training experience. In this study organizational participation of tilapia fishermen was found into 4 categories but maximum numbers has no participation in any organization. Medium level of aquaculture knowledge of tilapia with carps farming of the respondents was showed in this study area.

Fish farmers were showed positive and negative response towards livelihood capitals (Human capital, Social capital, financial capital, physical capital and Natural capital). In human capitals, social capitals, physical capital and natural capital, maximum farmers were showed positive response. But in financial capitals maximum farmers showed some problems such as irregularity of market price in Dinajpur district.

In tilapia with carp culture system problem confrontation level was found medium to high among fish farmers. There was showed problem facing index (PFI) among 13 possible problems in Dinajpur district. Labor crisis on pick time in tilapia farming was the highest ranked problem (PFI=221). Lack of security in fish farm (PFI=214), high price of artificial fish feed (PFI=199), Unavailability of information regarding diseases (PFI=184), Lack of technical knowledge on feed application (177), lack of marketing facilities (PFI=175), Lack of technical knowledge on fertilizer application (PFI=172), Lack of knowledge on species selection (PFI=169), mortality of fingerling (PFI=167), Lack of contact with fisheries extension workers (PFI=165), Lack of good quality fingerling (PFI=152), Lack of money

for pond management (PFI=142), problem regarding water management (PFI=134) was categorized 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, 9th, 10th, 11th, 12th and 13th respectively.

Pearson's product moment co-efficient of correlation (r) was showed a significant positive relationships between the selected characteristics (Age, farm size, total land area, Annual income, aquaculture knowledge and training experience) of the fish farmers and their livelihood capitals in tilapia with carps farming. Education showed negative relationship with livelihood capitals in tilapia with carps farming.

6.2 Recommendations for Policy Implication

On the basis of the findings of the present study, the following recommendations were made.

- Educated farmers don't have much experience about tilapia farming so they need a support from organizations such as DoF and other NGOs to improve their knowledge on fish farming. An experience farmer is more advanced than educated farmers.
- Proper training facilities should be provided for increasing knowledge about farmer's human capital, social capital, financial capital, physical capital and natural capital in tilapia farming. By increasing this knowledge fish farmers can develop their livelihood status.
- Labor saving activities should be increased for pick season.
- Necessary steps to minimize those problems. Bank and other financial organizations should increase the availability of credit with low interest and easy terms.
- In the study area, most respondents complained that labor crisis on pick time and lack of security problem was major issue which hindered the progress of fish culture. Fish farmers should hire guards at their ponds for night for solving security problem.
- Proper training with technological knowledge of fish farming, necessary extension support from govt. and NGOs can reduce farmer's problem. Short time but effective training facilities should be provided to the Tilapia fish farmers.

- Market integration should be developed for increasing road, transport and communication facilities.

6.3 Recommendations for Further Study

- The present study was conducted in four Upazila under Dinajpur district. This kind of study would be conducted in other parts of the country, where Tilapia with carps farming is possible in pond. This study may help to get a clear picture of problems faced by fish farmers practicing Tilapia with carps farming.
- This study investigates the eleven characteristics of the fish farmers. Further research should be undertaken considering other characteristics of the fish farmers.
- In this study relationship was considered among livelihood capitals and others characteristics. Further study may be conducted by considering a relationship among different factors.

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Appendix-A

Correlation matrix showing the relationships among the variables

Variables	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	X ₁₀	X ₁₁
X ₁	1										
X ₂	0.272 **	1									
X ₃	- 0.241 *	- 0.274 **	1								

X₄	0.131	0.251 *	- 0.349 **	1							
X₅	0.389 **	0.097	- 0.095	0.297 **	1						
X₆	0.420 **	0.269 **	- 0.227 *	0.181	0.560 **	1					
X₇	0.277 **	0.031	- 0.002	0.214	0.743 **	0.366 **	1				
X₈	0.212 *	- 0.118	- 0.260 **	- 0.170	- 0.158	- 0.248 *	- 0.005	1			
X₉	- 0.018	0.027	- 0.135	- 0.108	- 0.269 **	- 0.018	- 0.230*	0.089	1		
X₁₀	0.269	0.024	0.283 **	0.042	- 0.031	- 0.096	0.087	0.285 **	0.075	1	
X₁₁	0.181	- 0.004	- 0.157	0.064	0.078	- 0.218	0.46	0.148	0.032	0.284 **	1

Note: ** Correlation at 0.01 (2- tailed)

*Correlation at 0.05 (2- tailed)

X₁ = Livelihood capital

X₂ = Age

X₃ = Education

X₄ = Family size

X₅ = farm size

X₆ = total land area

X₇ = Annual income

X₈ = training experience

X₉ = Organizational participation

X₁₀ = Aquaculture Knowledge

X₁₁ = problem confrontation