

**CURRENT STATUS OF OXBOW LAKE (BAOR) FISHERIES
ANDBARRIERS TOITS MANAGEMENT: CASES FORM
SOUTH-WESTERN BANGLADESH**



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CERTIFICATE

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Dedicated to my beloved

Parents

**Whose affection, inspiration and encouragement, love and prays
make me able to get such success**

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Abstract

Oxbow lake (*baor*) is one of the important freshwater fisheries resources in Bangladesh which supports livelihoods of about 70,000 people. This study assessed the current status of two *baors* (*Jhapa baor* and *Perkhajura baor*) fisheries and identifies the barriers to their management in Jessore in the south-western Bangladesh in 2015. This study used primary data collected using a combination of quantitative and qualitative methods including household interviews, key informant interviews, focus group discussions (FGDs) and oral history interviews as well as secondary data. Results of this study did not show improved socio-economic conditions of the *baor* fisheries dependent households. Their incomes were less than the national average. Most households had single earning member and many of them relied on micro-credit organizations for credit. Most did not have land except homestead and their houses were earthen made. Although most of them had access to safe drinking water, few had access to quality health services and sanitary latrine. Their education levels were very low – 70% fishers had no or below primary level education. Although currently most of their children are school going (72% in *Jhapa* and 62% in *Perkhajura*) and their percentage is increasing gradually. This study also found that both aquaculture and capture fisheries are present in both *baors*. Only lease holders had access to culture fish harvesting while anyone was eligible to catch the capture fish as common property resources. This study further found a range of climatic, social, institutional and economic barriers to *baor* fisheries management. Key climatic barriers were flood, changes in rainfall pattern and siltation. Main social barriers were poaching, restriction to fishing, conflicts between fishers and leaseholders, and lack of education. Main institutional barriers were unfavorable *baor* leasing system, high leasing money and negligence of local fisheries officers. Finally low income of fishers' households was identified as the main economic barrier. To overcome these barriers a multi-sectoral approach needs to be taken.

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LIST OF ABBREVIATIONS

BBS	Bangladesh Bureau of Statistics
BDT	Bangladesh Taka
GIS	Geographic Information Service
DoF	Department of Fisheries
ed.	Edition
e.g.	Example
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
FRSS	Fisheries Resources Survey System
GDP	Gross Domestic Product
GNP	Gross National Product
GO	Governmental Organization
GOB	Government of the People's Republic of Bangladesh
i.e.	That is
IPCC	Intergovernmental Panel on Climate Change
KII	Key Informant Interview
km	Kilometer
mm	Millimeter
NGO(s)	Non-governmental organization(s)
SIS	Small Indigenous Species
sq.km	Square kilometer
SPSS	Scientific Package for Social Sciences
UNFCCC	United Nations Framework Convention on Climate Change
UNDP	United Nations Development Programme
WHO	World Health Organization
WMO	World Meteorological Organization
%	Percentage
°C	Degree Celsius

CHAPTER 1: INTRODUCTION

1.1 Background

In the last five decades global fish production has grown steadily. In 2012, total world fish production was 158 million tons of which inland capture and culture productions were 11.6 and 41.9 million tons respectively (FAO, 2014). World per capita apparent fish consumption increased from an average of 9.9 kg in the 1960s to 19.2 kg in 2012 (FAO, 2014). In 2012, about 58.3 million people find a source of income and livelihood in the fisheries and aquaculture sector. Of these, 37% were engaged as full time, 23 % part time and the remainder are either occasional fishers or of unspecified status (FAO, 2014).

In many developing countries including Bangladesh, a majority of the people is dependent on water-related natural resources such as aquatic resources and floodplains for their livelihood. Bangladesh is one of the top ten countries in aquaculture (FAO, 2013) and 4th inland waters capture fisheries producing countries in the world (FAO, 2014). At present the fisheries sector in Bangladesh, playing a very vital role in poverty alleviation, generating employment opportunities, producing animal proteins, earning foreign currency and increasing Gross Domestic Product (GDP) and Gross National Product (GNP) (Ahmed, 1997). The total fisheries production of Bangladesh was 3,548,115 metric tons where inland capture and culture production was 2,952,730 metric tons (FRSS, 2015). The market value of 77,328 metric tons export fish and fishery products was BDT 48.98 billion (DoF, 2015). Fisheries contribute 3.69% in national GDP as well as 22.60% in agriculture sector and 2.01% in total export earnings (DoF, 2015). About 80% of rural households in Bangladesh catch fish for food or to sell (BBS 1997) and fish contribute about 60% of animal protein consumed (DoF, 2014).

Fisheries are often available in remote and rural areas where other economic activities are limited, thus can be an important source for economic growth and livelihood in rural areas with few other economic activities (FAO, 2005). Fishing is not just a livelihood activity but

a way of life which determines the social identity and relationships (Coulthard *et al.*, 2011). Besides direct dependency, fisheries provide other economic activities generated by the supply of fish like (processing, packaging, manufacturing, transport, distributions etc.) (FAO, 2005). It also provides supporting activities such as (boat building, net and gear making, engine manufacture and repair, ice production and supply, supply of services to fisherman and fuel to fishing boats etc.) (FAO, 2005). In Bangladesh, fisheries sector supports the livelihoods of about 17.8 million (more than 11% of the total population) people directly and indirectly (DoF, 2015).

Bangladesh comprises numerous habitats for fisheries resources including rivers, lakes, ponds, *haors*, *baors*, etc. In total 34% area (4.9 million hectare) of Bangladesh occupied by inland water body (Miah *et al.*, 2010). The 4.9 million ha of inland water body in Bangladesh are among the world's one of the richest and most complex fisheries. The rivers, *beels* (permanent and seasonal lakes and wetlands), *boars* (oxbow lakes), *Haors* (large deeply-flooded depressions), and floodplains support some 260 fish species. Total fish production from inland water area in the year 2013-14 was 2.95 million metric ton, which was 83.22% of the total catch (DoF, 2015). Among the inland water resources *baors* were one of the important fisheries sector which discuss in below.

1.2 Ox-bow lake (*baor*) fisheries of Bangladesh

The most successful example of culture-based fisheries that has been accomplished in Bangladesh is in oxbow lakes located in the south-west Bangladesh (Hasan *et al.*, 1999). Oxbow lake is semi-closed water bodies, which is occupied by the dead channels of the river in the moribund delta of the Ganges (Abdullah-Bin-Farid *et al.*, 2013). Locally it is called *baor* resembled as “horse-shoe” and thus it is named as “Ox-bow” lake. About six hundred natural *baor* covering 5,488 hectares (created out of dying or changing course of rivers/creeks) exist in south-western districts of Bangladesh (Khulna division: Jessore, Jhainadah, Chuadanga and Kushtia districts and Dhaka division: Faridpur) with a significant potential of cultural fish in those lakes (DoF, 2013, Hasan, 1990). Total fish production of *baor* was 6,146 metric ton in 2012 -13 and production rate was 1,120 kg per hectares.

It also considered as the natural habitat and breeding ground of different indigenous fishes other than major carps (Abdullah-Bin-Farid *et al.*, 2013). Non-stocked indigenous fishes available in oxbow lakes consist mainly of clupeids, catfishes, goby, perches, minor carps, minnows, snakeheads, mullets, pipe fishes, loaches, eels, freshwater prawns etc. (Haque *et al.*, 1999; Hasan and Talukder 2004). Beside that three species of Indian major carps (rohu, catla and mrigal) and three Chinese carps (silver carp, grass carp and common carp) were regularly stocked and harvested from *baor*(Hasan *et al.*, 1999).

Baors were the properties of Landlords (*Jomindar*) during the British colonial days (1757-1947) and became government property after the abolition of the Landlords (*Jomidari*) system through a land settlement act in 1951(Hasan, 2001). They were leased to private individuals or cooperatives through open auctions. To increase fish production Government has taken initiative program through inland culture fisheries. Six oxbow lakes were brought under culture-based fisheries management (CBFM) during 1978-1985 Phase I of the Oxbow Lakes Development Project (OLP I) (Hasan, 2001). There were six *baors* under the OLP-1 project named *Baluhar Baor (Kotchandpur)*, *Joydia Baor (Kotchandpur)*, *Fatehpur Baor (Moheshpur)*, *Kathgora Baor (Moheshpur)*, *Morjat Baor (Moheshpur)* and *Bergobindopur Baor (Chougacha, Jessore)*(Abdullah-Bin-Farid *et al.*,2013).The OLP II successfully transferred and institutionalized the fisheries management to the fishers themselves by ensuring their participation in the management process, through guaranteeing long-term security of tenure and by developing appropriate institutions for implementation of the biological and social tools within 22 *baors* during 1988 to 1997 (Middendorp *et al.*, 1996; Apu *et al.*, 1999; Hasan *et al.*, 1999). “Oxbow Lake Project-1 (OLP-1)” and “Oxbow Lake Project-2 (OLP-2)” were implemented for increasing the fish production and uplift the socio economic condition of the fishers entitled “World Bank funded project”(Hasan, 2001). During this period, some steps were taken for developing infrastructure which also added new technology for fish culture. Under the project, hatchery and nursery ponds were added new technology for fish culture. Under the project, hatchery and nursery ponds were constructed to produce fry and fingerlings through artificial breeding. OLP-2conducted within 22 *baors* during 1988 to 1997(Hasan, 2001).

Baors contribute a big part in inland fish production and a big portion of fisher's livelihood. It is generally estimated that around 14000 fishers (2.5 fishers/ha water body) are directly involved and nearly 70000 rural people are the direct beneficiaries of *baor* fishery (Hasan 2003). Livelihood of *baor* fishers' totally or partially depended on *baor* fisheries resources. Regional socio-economic analysis are fundamental to proper understanding of present conditions, define chances and risks of future developments and indicate possibilities to minimize negative impacts on human life quality (Than, 2011). It was important to estimate the socioeconomic conditions of *baor* fishers' household, which were the parameters of, appraise of the fishers' in society. Some studies of socioeconomic status of fishers of Bangladesh have given Appendix 1.

In 2008-2009 fiscal years total recorded yield from *baors* was 5038 metric ton, which increased to 8727 metric ton in 2009-2010. The production then decreased to 5186 metric ton in 2011-2012. Experiences from other fisheries indicate several potential limits and barriers resulting the inconsistent production of *baor* fisheries. Barriers in fisheries management are described below.

1.3 Barriersto Inland fisheries management

Barriers are considered as obstacle to access maximizes wellbeing.Limits and barriers to adaptation restrict people's ability to identify, access, and manage risks in the way that maximizes their wellbeing (IPCC, 2007; Adger *et al.*, 2009; Moser and Ekstrom, 2010; IPCC, 2012). Here the term fisheries barrier refers to the restriction on utilization of fisheries resources. Limits and barriers both are obstacles where limits are absolute (Adger *et al.*, 2007) and barriers are mutable (Adger *et al.*, 2009). Limits are those obstacles that cannot recover but barriers are obstacles that may recover. Barriers to adaptation can prevent the development and implementation of adaptations from taking place (Adger *et al.*, 2007). Limits and barriers to adaptation can be natural, technological, economic, social or formal institutional. Natural limits range from ecosystem thresholds to geographical and geological limitations. High adaptive capacity does not necessarily translate into successful adaptation due to the presence of barriers (O'Brien *et al.*, 2006).

Adger *et al.*, (2007) and Jones and Boyd (2011) suggested that many limits and barriers are interrelated and combine to constrain adaptation. Biswas *et al.*, (2009) reported that, lack of developed management system and uncontrolled harvesting, poaching, low production due to availability of quality fingerlings, lack of adequate market facilities and lack of fund for *baor* are hindering from obtaining the productive potential of *baors*. There was apprehension that proper management, such as introduction of large-scale stocking of carps in the oxbow lakes might have imbalanced the lake ecosystem and lake biodiversity leading to an adverse impact on non-stocked indigenous fish (Ali, 1997). Besides them climate change was also consider a major barriers of fisheries as well as *baor* fisheries. Impact of climate change in fisheries in Bangladesh has given below.

1.4 Climate change and fisheries

The change of climate over time as a result of natural variability or human activity is referred as climate change (IPCC, 2007). United Nation Framework Convention on Climate Change (UNFCCC) defines climate change as a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. World Meteorological Organization (WMO) referred climatic averaging period is 30 years. Temperature fluctuation, changes in precipitation, increase in flooding, changes in storms and cyclones, increase in drought, changing in seasonal variability and rise in sea level considered as climatic issue (IPCC, 2007) which have impacts on natural system. Higher precipitation will flood but least precipitation may risk of drought (IPCC, 2007).

Bangladesh is very sensitive on climatic parameters due to her location and according to the Global Climate Risk Index it ranked 6th most vulnerable country among 170 countries due to climate change from 1994 to 2013 (annual averages) (Kreft *et al.*, 2014, UNDP, 2004). This is visible in the form of temperature increase, change in the rainfall pattern and frequency and severity of extreme events. 98% flood depends on the South Asian monsoon for its rainfall which is expected to increase, leading to more floods (Dastagir, 2015). Analysis of

past flood records indicates that about 21% of the country is subjected to annual flooding and an additional 42% is at risk of floods with varied intensity (Ahmed and Mirza, 2000). More than three fifths of the land submerges as a severe flood occurs in every four or five years during the monsoon season (GOB, 2009). In Bangladesh, 1.3°C temperature rise is predicted by 2030 (over mid-20th century levels) and 2.6°C by 2070 (Agrawala *et al.*, 2003). On the other hand precipitation is predicted to decrease in winter and much increase in summer (Agrawala *et al.*, 2003).

Fisheries sector along with agriculture is the largest consumer of water, is highly vulnerable due to its direct dependence on climate parameters (Allison *et al.*, 2005). Bangladesh is one of the most vulnerable countries due to climate change which has effect on fisher's socio-economic sector or livelihood of others (Selvaraju and Bass, 2007). Climate change in fish physiology may result in fluctuation of fish production in Bangladesh (Ahmed *et al.*, 2002). Climate change has both direct and indirect impacts on fish stocks. Direct effects act on physiology and behavior and alter growth, reproductive capacity, mortality and distribution. Indirect effects alter the productivity, structure and composition of the habited ecosystems on which fish depend for food (Beaugrand *et al.*, 2002). Any changes in habitat temperatures, pH or salinity will significantly influence metabolism and hence, growth rate, total production, reproduction seasonality and possibly reproductive efficacy, and susceptibility to diseases (Alam, 2009). Tremendous impacts on fishing assets, infrastructure and ultimately on the livelihood of fishing communities may be exerted from cyclones and associated floods (Islam *et al.*, 2014). In 2050s the economy of Bangladesh will be amongst the most vulnerable to climate change which affects fisheries (Allison *et al.*, 2009).

That why climate change poses significant risks for aquaculture, yet the core elements of its vulnerability is primarily contextual. So, it is a burning issue now to consider the climate change in aquaculture in Bangladesh which has impact on management policy of fisheries. Management policy of inland fisheries of Bangladesh has described below.

1.5 Inland fisheries management of Bangladesh

Fisheries management draws on fisheries science in order to find ways to protect fishery resources so sustainable exploitation is possible. Modern fisheries management is often referred to as a governmental system of appropriate management rules based on defined objectives and a mix of management means to implement the rules, which are put in place by a system of monitoring control and surveillance. According to the FAO, there were "no clear and generally accepted definitions of fisheries management". However, the working definition used by the FAO and much cited elsewhere was

“The integrated process of information gathering, analysis, planning, consultation, decision-making, allocation of resources and formulation and implementation, with enforcement as necessary, of regulations or rules which govern fisheries activities in order to ensure the continued productivity of the resources and the accomplishment of other fisheries objectives”.

Inland fisheries of Bangladesh has recently controlled by the “National *Jalmahal* policy 2009”. There were over 12 000 *Jalmohal* (inland water bodies generating government revenue) in Bangladesh. There was a long history of Bangladesh inland fisheries management. The National Water Policy (MOWR, 1999) has emphasized reserving wetlands for fish in a reversal of past trends. However, past fisheries policies (before 1986) have discouraged local institutions for fisheries protection and sustainable management. They have been leased to the highest bidder with a preference for fisher cooperatives but very often, either directly or by bidding through a cooperative, control came into the hands of rich and influential lessees. It has been widely believed that fishers suffer not only from declining catches but also from exploitation under this leasing system. Lessees usually sublease to agents on condition of receiving a profit (a share of the resource rent) or allow fishing by as many fishers as were willing to pay user fees set to ensure a profit beyond the lease cost and their operating costs (Ullah, 1985; Naqi, 1989; Mcgregor, 1995). Toufique, (1999) has argued that fishers have failed to gain fishing rights under the leasing system mainly because they have high transaction cost and are less able to enforce property rights

than are socially-powerful lessees who can prevent unauthorized fishing by threat and by social pressure.

Introduction

In 1986 in response to these problems and lobbying by the national fishers association, the Government of Bangladesh initiated a New Fisheries Management Policy (NFMP) and responsibility for nearly 300 Water bodies was transferred by the Ministry of Land (MOL) to the DOF (Ahmed *et al.*, 1997). Under this arrangement DOF was to operate a licensing system for individual “genuine fishers” (those whose livelihood depended on catching and selling fish). This policy aimed to save fishers from exploitation by influential middlemen and to ensure proper conservation of fishery resources whereby DOF would limit the number of fishers to ensure maximum sustainable catches (Ahmed *et al.*, 1997).

In practice NFMP brought some recognition of fishers’ right at least through licenses but there were a number of limitations. Fishers were unable to exclude outsiders including past lessees and middlemen and in many cases continued to depend on them to help fund license payments. The DOF found it easier to deal with a few fisher leaders in arranging collection of revenue, rather than with many individual fishers and fishing teams in each water body. DOF also found it difficult to enforce fishing only by a fixed number of license holders. Unlike the lessees, who could hire an army of enforcers if needed, DOF staff cannot easily mobilize magistrates to catch or fine unauthorized fishers. Moreover, the yearly licenses with the possibility, but no guarantee of indefinite renewal did not give poor fishers the secure user rights that the NFMP hoped to provide. Licensing retained the revenue orientation of fishery management because a condition of the policy was that the total revenue would rise by 10% per year from the earlier level, so no assessment of appropriate levels of taxation was made.

Fishery administration has become more complex since 1995. In September, 1995 open waters were declared free of revenue collection and open access. Consequently revenue collection from flowing rivers ceased and they are no longer leased out. Leasing in other water bodies has continued. However, leasing of Proceedings of the International Workshop on Fisheries Co-management 3 closed water bodies of up to 20 acres (8 ha) were handed

over to the Local Government Division from 1996 and then transferred to the Ministry of Youth and Sports in October 1997.

Introduction

Still water bodies under DOF were used for projects with a fixed increment of 10% each year. In these cases revenue is usually collected through licensing under the NFMP framework.

1.6 Rationale

Over the last few decades a major change has occurred in the floodplain environments, as many typical wetland areas as well as grazing pasture lands have been converted into rice fields (Nuruzzaman, 1998). Mismanagement of water resources was mainly responsible for the convert of wetland. In Bangladesh some studies have been conducted on socioeconomic conditions of fishers in rivers, *beels* or coastal areas (Kostori, 2012; Alam *et al.*, 2009; Abdullah-Bin-Farid *et al.*, 2013; Flowra *et al.*, 2009; Haider, 1995; Das and Hossain, 2004; Hossain 2007; Halder *et al.*, 2011; Saha, 2004; Dutta, 1893; Sarkar *et al.*, 2008; Bhaumik and Pandit, 1999; Bhaumik and Saha, 1994; Podder, 2005). Few studies have also been carried out on the barriers to the management of fisheries resources in rivers, *beels* or coastal areas. So far only few studies report the impact of the stocking and related management measures on the environment and biodiversity of oxbow lakes and floodplains (FRI, 1996; Haque *et al.*, 1999; Hossain *et al.*, 1999), but no studies have found about barriers of *baor* fisheries management. Among the studies of *baor* fisheries, most of them coverage OLP implemented *baor*. Further there has been an indication that in many of the oxbow lakes, brought under culture-based fisheries during OLP-II, institutional management (e.g., leadership rotation, share of the cost and benefits among the fishers) were not effectively working as envisaged (Hasan *et al.*, 2004). But there is very little scientific research about the institutional arrangement; proper culture management and livelihood of fishers of *baor* most of them were under OLP no evidence founded other *baors* rather than OLP *baor*. Only 28 *baors* were included in OLP (OPL-1 and OPL-2) but most of the *baors* which were directly controlled by ministry of land needed to be studied.

Considering the above mentioned circumstances this study on socio-economic status of *baor* fishers and estimate the limits and barriers of *baor* fisheries management in selected area would provide a pathway towards better livelihood and fishing status of *baor* fisheries as well as overcome the management barriers of *baor* fisheries. It is not only important for the local population but has significant impact on the ecosystem services, supplied for the whole south-west region of Bangladesh as well as other similar part of south-east Asia.

1.7 Aim and objectives

The aim of this study was to assess the current status of two ox-bow lake (*baor*) fisheries in Jessore and barriers to their management. The specific objectives of this study were-

- to find out the socio-economic conditions of the *baor* fisher households;
- to assess the fisheries and aquaculture conditions of the *baors*; and
- to identify the different barriers to *baor* fisheries management.

CHAPTER 2: MATERIALS AND METHODS

The study was conducted using primary and secondary data collected through literature review and field survey. Both quantitative and qualitative methods were applied for data collection. An overview of the methodologies used in the present study is presented in the Figure 1.

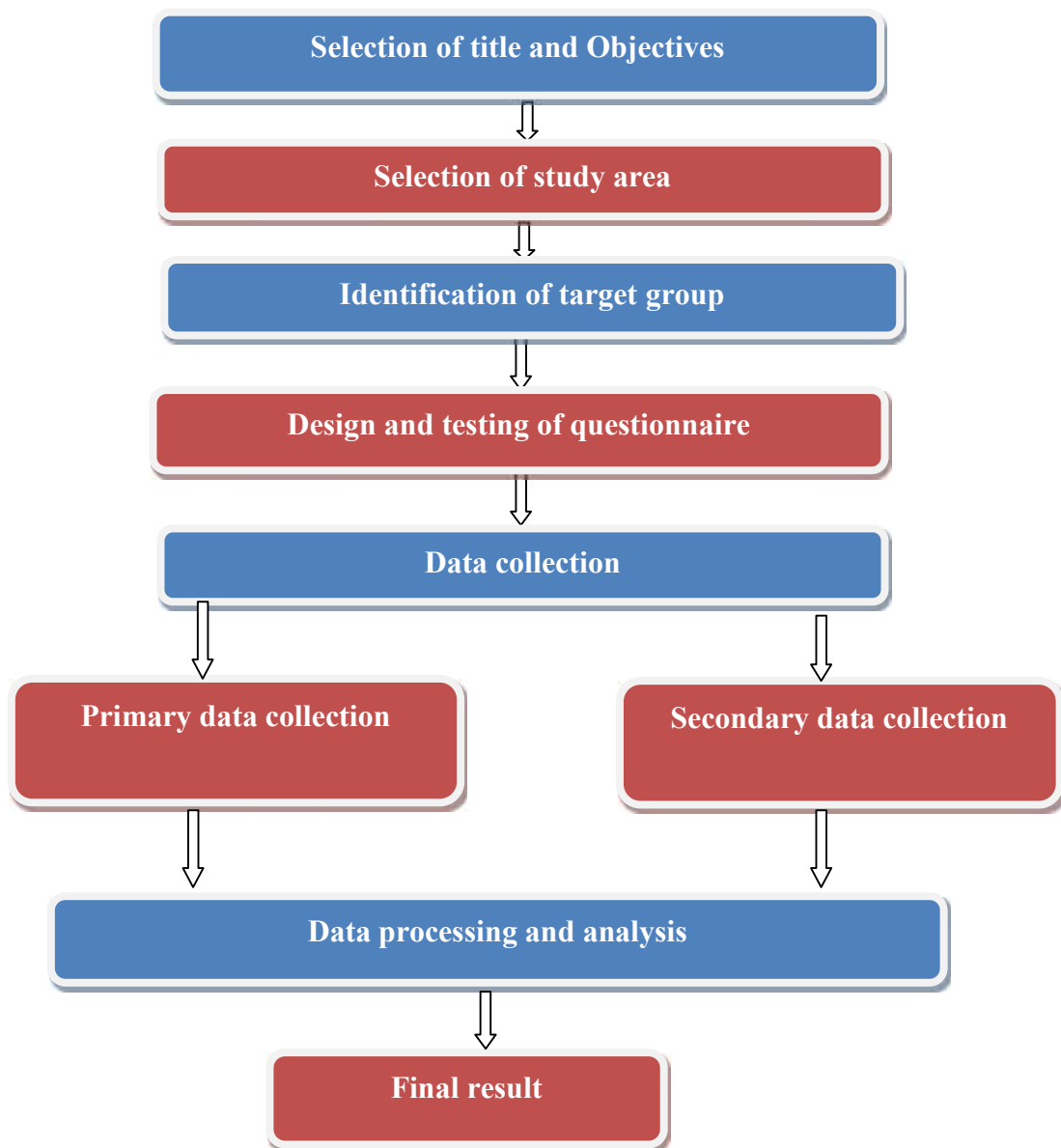


Figure 1: Aflowchart of the methodologies used in the study

Materials and methods

2.1 Selection of Study sites

The study was conducted into two *baors*, ‘*Jhapa baor*’ and ‘*Perkhajura baor*’ at Monirampur upazila (sub-district) of Jessore district. Both *baors* were located south-west region of Monirampur upazila (Figure 2). Total area of Monirampur upazila is 444.7 km² which is second largest upazila in Bangladesh with a population size of 382465 (BBS, 2001). GPS Coordinate of the Monirampur upazila is 23, 0167 ° N, 89, 2333° E. *Jhapa baor* and *Perkhajura baor* are two largest freshwater sources of this region. The villagers use this water body for different purposes including fishing, irrigation and domestic needs. Rain is the main water source of the *baor* sometimes river water get intrusion into the *baors*. The both *baors* are de-functioned part of *Kapotakkho* river.



Figure 2: Location (in circle) of the two study sites (*Jhapa baor* and *Perkhajura baor*)

In Bangladesh there were three kinds of *baor* management system mentioned above (OLP-1, OPL-2 and management by ministry of land). OLP-1 and OLP-2 *baors* were under controlled of DoF. There was very little study about *baor* fisheries management in Bangladesh among them most of the study were included OLP*baors*. Here the selected *baors* for the study were maintained by Ministry of land. The primary criterion for the selection was to identify the socio-economic status of fishers and management barriers of the *baors* which was controlled beyond DoF. On the other hand those *baors* has large biodiversity and huge no of fishers were involved with that. Beside fish culture this water body was also an important source for paddy culture, industries, transportation and other activities in the surrounding area. Local poor fishers were fishing small indigenous fish from here all around the year and their livelihood totally depended on the *baors*.

2.1.1 Jhapa baor

The *Jhapa baor* (22°59'1.34"N, 89° 9'36.39"E, 22°59'1.34"N) was located 10 km southwest from the Monirampur upazila (Figure 2). It is surrounded by 5 villages under 3 unions, namely, Chaluahati, *Jhapa* and Maswimnagar. The names of the villages were *Mobarakpur*, *Komolpur*, *Jhapa*, *Rajbari* and *Rampur*. *Jhapa* was the village surrounded by the *Jhapa baor*. Total area of *this baor* was 605 acre which was one of the biggest water bodies of this area. Water remains almost all the year round but in rainy season the area increases. More than 3000 people directly or indirectly depended on this *baor* such as in fish culture, fish business, fish marketing, agriculture, transport and other occupation. In this *baor* Community Based Fisheries Management (CBFM) is practiced for fish culture by a local fishers association named “*Jhapa Matsajibi Somobay Samiti Ltd*”. There were 180 members of “*Jhapa Matsajibi Somobay Samiti Ltd*” who were the shareholder and fully dependent on the *baor*.

2.1.2 Perkhajura baor

Perkhajura baor (22°56'56.18"N, 89° 8'56.84"E) was located 11 km south-west from the Monirampur upazila (Figure 2). It was surrounded by four villages named *Hakimpur*, *Maswimnagar*, *Sahapur* and *Perkhajura* under *Maswimnagar* Union *parisad*. *Perkhajura* was

the village surrounded by the *baor*. Total areawas 230 acre. Among this area 164.5 acre areawas under private ownership and 65.5 acre was under fisheries community named “*Maswimnagor Matsajibi Somobay Samiti Ltd*”. Private ownership has gone by taking lease from the former landlord of this region at 1950s. The duration of this lease is 61 years and it will be end at 2021. Approximately 2000 people directly or indirectly

Materials and methods

2.2 Selection of respondents

A large number of fishers were engaged in two boars. There are five villages around the *Jhapa baor* and four around *Perkhajura baor*. Respondents were selected from those villages to determine socio-economic status of *baors fishers*. To identify barriers respondents were selected among the local fishers as well as *baor* resources stakeholder, local leaders, regional fisheries office, NGOs, and other organization which were involved with *baor* fisheries.

2.3 Data collection

Mixed method approach of data collection was followed for this study. Data were collected using face-to-face semi-structured interviews with the fishers. Data were also collected using oral history interviews, focus group discussions (FGDs) and key informant interviews. The data were collected between April and November 2015. Quantitative methods (e.g., semi-structured household interviews) were used mainly for collecting data on context, whereas qualitative methods (e.g., oral history interviews, key informants interviews and FGDs) were used to get rich, detailed and contextually grounded data (Nightingale, 2003). In semi structure questionnaire there were also some open handed questions for qualitative data. Summary of data collection method is given next.

Table 1: Summary of key methods used to address the objectives

Research aim and objectives	Methods for primary data collection	Methods for data analysis
To find out the socio-economic conditions of	<ul style="list-style-type: none"> Semi-structured household 	<ul style="list-style-type: none"> Cluster analysis

the <i>baor</i> fisher households.	<ul style="list-style-type: none"> questionnaires • Key informant interviews (KIA) • Focus group discussion (FGDs) 	<ul style="list-style-type: none"> • Descriptive statistics (Mean, standard deviation) for quantitative data • Content analysis (by coding) for <i>Materials and methods</i> • Qualitative data
To assess the fisheries and aquaculture conditions of the <i>baors</i> .	<ul style="list-style-type: none"> • Oral history interviews (checklist) • Key informant interviews • FGDs 	<ul style="list-style-type: none"> • Descriptive statistics for quantitative data • Content analysis (by coding) for qualitative data
To identify the different barriers to <i>baor</i> fisheries management.	<ul style="list-style-type: none"> • Oral history interviews (checklist) • Key informant interviews • FGDs 	<ul style="list-style-type: none"> • Descriptive statistics for quantitative data • Content analysis (by coding) for qualitative data

2.3.1 Primary data collection

Primary data were collected from *baor* fishery-dependent households across the communities. Fishery-dependent households included any level of fishers (full-time, part-time or occasional), stakeholder, people who built or repaired boat or fishing gear were selected for interview for first objective through a semi structured questionnaire. A sampling frame for the fishery-dependent households was prepared in each community before data collection. In order to obtain objective 1 primary data were collected through fisher's household survey using semi-structured questionnaire. Fishers' household head was interviewed for the survey. Interviews were taken near *baor* site and by visiting the households. Primary data were also collected by oral history interviews, focused group discussions and key informant interview for objective 2 and objective 3.

2.3.1.1 Fisher's household survey*Materials and methods*

Individual interviews were employed to collect data on household characteristics family size, age status, earning members, educational status, income, income from *baor*, expenditure for each family, land ownership status, house ownership status, access to electricity/light sources, water sources, health facilities, sanitary facilities, fish harvesting status, fish marketing status. The questionnaire also subjected present status of credit access and co-operative organization access, climatic variables impact, culture practice system, management practice, biodiversity and socio-demographic variables of the surrounding area.

Design and formulation of questionnaire

Questionnaire was designed according to De Vaus (2002) which adaptive to the context of the study objectives. Both qualitative and quantitative data were required so the questionnaire was semi structured there were some open ended questions (e.g. Loan purpose, organization type involve of fishermen, activities during fishing banned period etc.) and some close ended questions (e.g. Family size, age status, religious status, earning members, educational status, income, income from *baor*, expenditure for each family, land ownership status, house type etc.). A draft questionnaire was developed and pre-tested in the study area. The questionnaire was then modified and rearranged following a pilot test. The final questionnaire was constructed in English. The final questionnaire (Appendix 2) then developed in logical sequences so that the fishers' could answer chronologically.

Selection of respondents for questionnaire interview

To choose respondents for this study the stratified random sampling method was applied. Single member from each household were selected. All of the members were male who are involved with fishing or *baor* fish business. Male respondent were selected to getting better information about fishing because they were directly involved with fishing. For better information almost all of the selected respondents were household head because household

head have a good /sense of the household's vulnerability, security and livelihoods (Jansen *et al.*, 2006).

Materials and methods

Sample size

Sample size was determined according to Kortlik *et al.*, (2001) and Handerson *et al.*, (1982) as below:

$$n_0 = \frac{Z^2 pq}{d^2}$$

Here, n_0 = Desired sample size

Z = Standard normal deviate usually set at 1.96 which correspond to the 95% confidence level

p = Assumed proportion in the target population estimated to have a particular characteristic

q = Assumed proportion in the target population estimated to not have a particular characteristic. Where $p + q = 1$

d = Allowable maximum error in estimating population proportion

In this study $Z = 1.96$ at 95% confidence level

$P = 92.5\%$ responses = 0.925

$q = 0.075$ and

d = level of significance = 5% = 0.05

So the sample size for this study was

$$n_0 = \frac{Z^2 pq}{d^2} = \frac{1.96^2 \times 0.925 \times 0.075}{0.05^2} = 106.60 = 107 \text{ (approximately)}$$

Considering this calculation total sample size for the study has taken 110. According to the key informant interviews about 600 household of *Jhapa baorarea* and 500 household of

Perkhajura baor area were dependents on *baors*. Further calculating the fishers' household ration in the study area total sample size has distributed between *Jhapa baor* and *Perkhajura baor* area. So finally 60 fishers household from *Jhapa baor* and 50 fishers household from *Perkhajura baor* were selected for face to face interview.

Materials and methods

Distribution of respondents

Interviews were conducted with 110 respondents in two *baors* area. Percentage distribution of the respondents in *Jhapa baor* area was *Jhapa* 20%, *Komolpur* 21.7%, *Mobarokpur* 15%, *Rajbari* 30%, *Rampur* 10% and *Hanuair* 3.3% from six villages (Figure: 3A). The people of *Hanuair* were less involved in *Jhapa baor* so few respondents were taken from there.

Similarly from *Perkhajura baor* 50 respondents were selected randomly for interview from surrounding four villages. Percentage distribution of the respondents in *Perkhajura baor* area according to the village was *Hakimpur* 28%, *Maswimnagor* 24%, *Perkhajura* 34% and *Sahapur* 8% (Figure: 3B). In the *Perkhajura baor* area *Sahapur* was the smallest village so fewer respondents were selected from there.

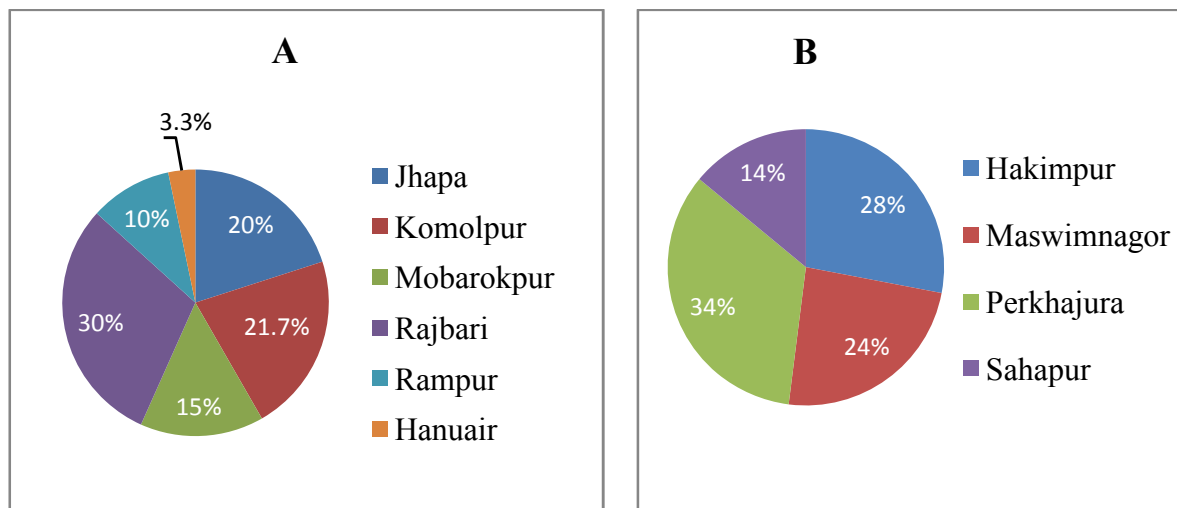


Figure 3: Respondents distribution of *Jhapa baor* (A) and *Perkhajura baor* (B) area in surrounding villages

Conducting the interviews

Interviews were conducted during family visits by personal communication at fisher's house. All the questions were asked in the same way and in the same order, which enabled collection of a set of comparable answers on which statistical analysis could be performed. Interviews were written instantly and some interviews were voice recorded with the permission of the respondents. The length of surveys was not restricted but generally lasted between thirty minutes to one hour. Questionnaire was constructed into English but translated to Bengali during face to face interview.

2.3.1.2 Oral history interviews

Oral histories provide a more detailed perspective of social processes and can provide key insights into the lives of people which structured questionnaires cannot elicit (Mather, 1996). Based on the literature reviews, information and experiences from the reconnaissance study, semi structured household questionnaires and informal discussions with stakeholders and checklist for oral history interviews was prepared before the interviews were conducted(Appendix3). The second objective of this study to assess the fisheries and aquaculture conditions of the *baors* partially and third objective to identify the characteristics of limits and barriers for *baor* management fully estimated on the basis of oral history interview. The checklist included limits and barriers of *baor* management, climatic shocks and adaptation strategy.

A total of 15 oral history interviews were conducted across the study area. Local experienced fishers, *baors* stakeholders, upazila and district and relevant authority fisheries

officers were selected as respondent. The location of interview was important as it could have an effect on the power relationship between the researcher and the participants and the interview were conducted at respondent house and their convenient location.

Materials and methods

2.3.1.3 Focus group discussions (FGDs)

FGD has become increasingly popular as a qualitative research method in participatory data collection in social science (Burgess, 1996; Goss, 1996; Longhurst, 2003). Like other participatory method FGD also has direct interaction with the participator. The stories that are shaped in FGDs better reflect the social nature of knowledge than a collection of individual accounts obtained from individual interviews (Goss and Leinbach, 1996). In data collection FGD method has some drawback such as time consuming, costly, local power influence and limitation in generalizability from context-specific information (Martin and Sherington, 1997). But it is helpful in scene local community provides information directly and researcher can reach deeper of the study. Then during the main data collection period, the FGDs were conducted to gather the data on livelihood vulnerability, climate variability and change and limits and barriers of *baor* management. Before started FGDs a list of topics and possible questions for the participants were developed to ensure some structure and direction in the discussions (Appendix 4). More emphasis was given to clarifying issues which seemed unclear from the oral history interviews. Each FGD session was conducted within 3 hours and about 6-8 issue discussed. For an FGD, a group of 8-10 (Powell and Single, 1996) household heads and stakeholder were selected. Homogenous group were insured to freely express their opinion. Suitable environment also provided for the participators. During FGDs there was no interfering of participators lecture. Overall the FGD sessions were run ensuring that the focus was kept, momentum maintained and that there was real participation and closure on questions (Coldwell and Herbst, 2004). In this study total 3 FGDs were conducted where homogenous groups were also ensured during conducted FGDs. Two FGDs were conducted during data collection and one was conducted after data analysis to verify result.

2.3.1.4 Key informant interviews

Materials and methods

A key informant interview is another approach of data collection for social science. For this study two stages were followed for this study. One is Key informant interviews and other stage is data collection for measuring *baor* management barriers. Key informant interview was conducted with the fisher's community (e.g. fisher's leader, stake holder, experienced fishers etc.) and other *baor* fisheries relevant authority (e.g. Upazila and district fisheries officers, NGO, district commissioner office etc). During the reconnaissance study, the goals of key informant interviews were to develop the research objectives and methodology by exploring the research context and issues, introduced with local people and identify working facilities. Total 8 and 15 key informant interviews were conducted respectively during data collection and after data collection. All the key informant respondents were the local experienced fishers.

2.3.2 Secondary data collection

Secondary data were collected by literature review, various policy reports, and commune's annual reports and from literature. The secondary information also collected from fisheries office, SSS (Society for Social Service) and various NGO (Non-governmental organization), district commissioner office, meteorological department of Bangladesh and other relevant organization. They included information about *baor* management system, geographical and administrative distribution of the commune, types of main economic activities, settlement patterns, types of natural resources, and demographic information of the two *baors*.

2.4 Data Processing and Analysis

All the collected data were summarized and scrutinized carefully and recorded. Finally, relevant Tables were prepared in accordance with the objectives of the study. Data were prepared through SPSS software (Scientific Package for Social Sciences)version 20.

2.4 .1 Quantitative data analysis

Quantitative data were coded as if MS Excel (Version 2007) and Predictive Analytic Software (formerly Scientific Package for Social Sciences –SPSS) enable to appropriate statistical analysis. Data were analyzed in Predictive Analytic Software using descriptive statistics and compared means (Kinneer and Gray, 2012). Quantitative data were analyzed in two stages. Data were presented in the form of graphs and Tab' *Materials and methods* representation to the data.

2.4.2 Qualitative data analysis

The qualitative data were collected using open-ended questions of semi-structured interviews, al history interviews, FGDs and key respondents interviews. Analysis of qualitative data consisted of three steps: preparing and organizing the data for analysis, reducing the data into themes through a process of coding and condensing the codes, and finally representing the data in Tables or as part of a discussion (Creswell, 2007). When all the transcripts were ready, codes were leveled on the text to assign units of meaning (Miles and Huberman, 1994). Pencils and highlighters of different colours were used for this purpose. Codes were attached to “chunks” of varying size – words, phrases, sentences or whole paragraphs of interest (Miles and Huberman, 1994).

2.5 Ethical considerations

Any survey is shaped by three broad sets of considerations: technical, practical and ethical. Technical considerations involve ensuring that matters such as sample design, questionnaire construction etc. Practical considerations mean that the survey design must take account of realities such as budgets, deadlines and the purpose of the research. Ideally a survey will be technically correct, practically efficient and ethically sound (De Vaus, 2002).

This study was approved by the Department of fisheries, University of Dhaka. The ethical considerations were necessary to safeguard research participants, the research process and the credibility of the research findings (Flick, 2009). Broadly, five main ethical issues were considered for data – participants’ voluntary participation, informed consent, no harm,

privacy and confidentiality anonymity (De Vaus, 2002). Information sheets were given to participants that sufficiently explained the purpose and the nature of this study. They were given the opportunity to ask questions before signing the consent form and assured that the information would be used for research purposes only. They were recruited voluntarily, were not compensated assured no harm and privacy and their names were not revealed. They also had the option to withdraw from the research at any time if they not fell free. The data (both hard and electronic copies) were not shared with anyone except the research team to comply with confidentiality. Electronic data were stored on encrypted memory sticks and password protected computers. Participants were also assured that their names would always be kept anonymous for their safety.

2.6 Activities framework

The activities schedule of the study is showed by the following Table.

Table 2: Activity time-frame of the study

Activity	Months (April 2015-December 2015)										
	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Literature review	■	■	■	■	■	■	■	■	■	■	■
Reconnaissance visit	■										
Key informants interviews		■	■								
Individual questionnaire survey				■	■	■			■		
Focus group discussions					■				■		
Oral history interviews									■	■	
Data analysis						■	■	■	■	■	
Thesis writing				■	■	■	■	■	■	■	■
Report submission											■

CHAPTER 3: RESULTS AND DISCUSSION

3.1 Socio-economic conditions of *baor* fishers' households

3.1.1 Fishers age distribution and gender

All the respondents of the study were male and household head. The mean age of the fishers at *Jhapa baor* area was 42.88 ± 10.90 (mean \pm sd) years where the age ranges of fishers between 23 to 70 years. It was found that 12% of fishers' age was below 30 years; 40% were 31-40 years, 24% were 41-50 years and 22% were 51-60 years and 2% more than 60 years (Figure 4).

Similarly in *Perkhajura baor* the mean age of the fishers was 42.16 ± 10.71 year (23 to 70 years) where it was found that 12% of fishers were up to 30 years; 38% up to 31-40, 30% up to 41-50 and 16% up to 51-60 and 4% more than 60 years (Figure 4).

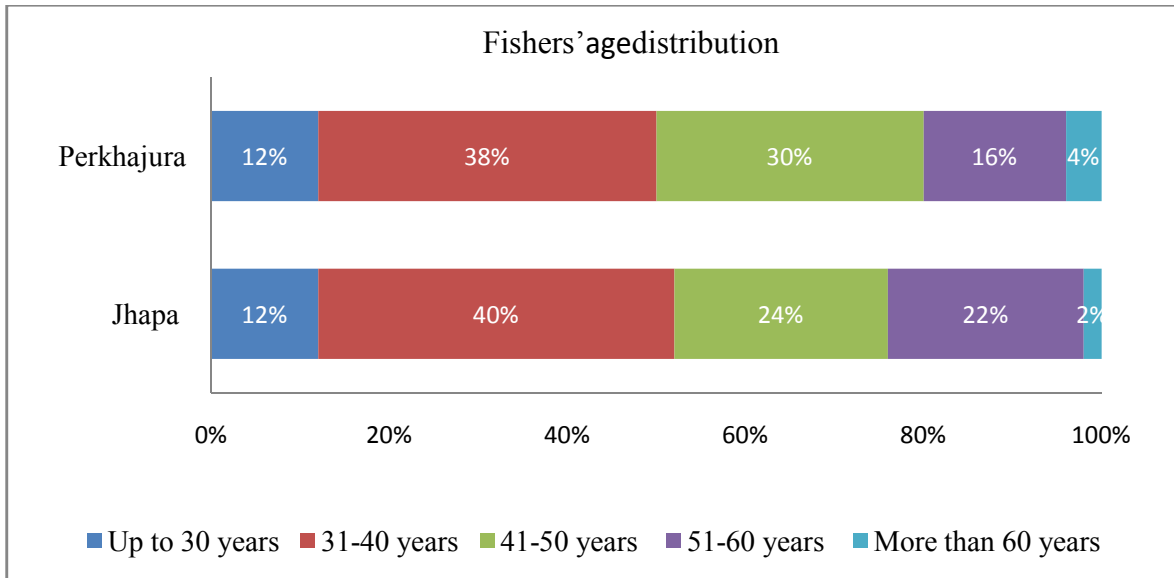


Figure 4: Distribution of fishers (%) according to age at *Jhapa baoran* *Results and discussion*

In the Figure4 both *baors* showed similar result in age distribution and age range 31-40 showed the height result which was the most fruitful age of life. In both *baors* female were generally not involved in fishing or other activities on *baor*. Islam *et al.*, (2013) reported that the mean age of the fishers in Monirampurupazilawas 35.22 ± 9.67 years (20 to 80 years) which was lower than the present study area. In another study Halder *et al.*, (2011) reported that most of the fish retailers (54.17%) were belonging to the age group 31 to 40 years which also support the present study where the dominated age group was 31-40 years.

3.1.2 Religion status

In both *baors* community based fisheries management is used for culture management under local fishers association. Most of those fishers belonged lower caste Hindu community (*Rajbonsi, Malo, Barmon, Halder* etc) who were by-born fisherman and they lived surrounding the *baors*. In *Jhapa baor* 65% Hindu fishers are benefited from *Jhapa baor* and 35% Muslim fishers are benefited from the *baor* (Figure 5). On the other hand in *Perkhajura baor*, 70% of the fishers were Muslim and 30% were Hindu (Figure5). This study showed a big variance in age distribution between two *baors*. The higher rates of Hindu fishers in *Jhapa baor* area caused more traditional Hindu fishermen lived surrounding the *Jhapa baor*.

The entire leaseholders of *Jhapa* and *Perkhajura baor* were Hindu. In *Perkhajura baor* a large portion of *baor* was under private ownership that owners were Muslim.

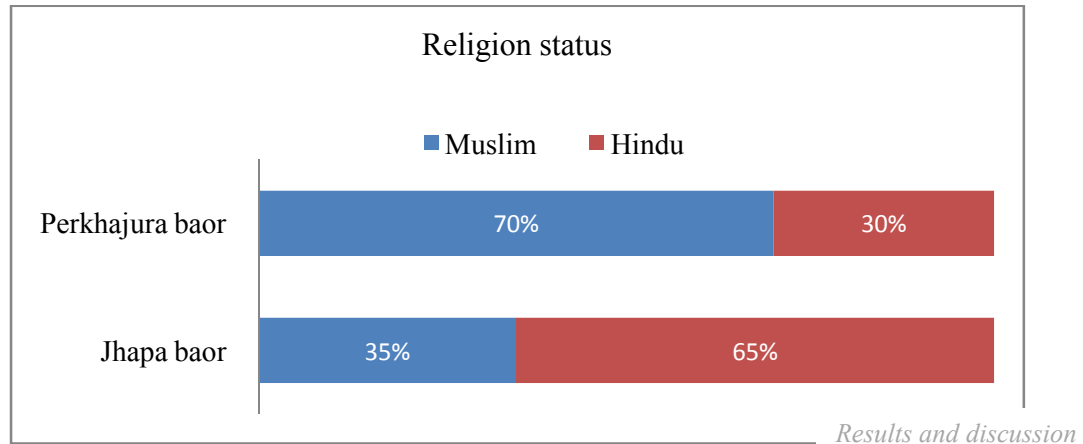


Figure5: Fishers religious status at the study area, *Jhapa baor* and *Perkhajura baor*. BBS 2011 showed that in Bangladesh 89.7% people were Muslim and 9.2% people were Hindu. Here this study showed higher involvement of Hindu community in fishing in the study area. Another study of Sarkar, *et al.*, (2008) conducted at *Mokash beel* in *Kaliakoir* Upazila of *Gazipur* district reported that 66% of fishers were Muslims and the rest 34% were Hindus with no Buddhists or Christians. On the other hand it was found that all of the fishers were belonging to the Hindu religion in the *Baluhar Baor, Jhenaidah* (Abdullah-Bin-Farid *et al.*, 2013). The involvement of Hindu community was high in this sector because fishing was a traditional job for lower caste Hindu community in Bangladesh.

3.1.3 Educational status

At first the educational status was divided into 4 categories (Illiterate, Primary level, Secondary level, higher-secondary level or above) to measure the educational status of fishers. Illiterate referred the fishers who could not sign. In *Japhabaor*, 41.7% fishers were illiterate, 35% fishers have knowledge of primary level and 23.3% fishers have knowledge of secondary level (Figure 6). In *Perkhajura baor* 34% fishers were found illiterate, followed by primary level 34%, secondary level 26% and only 6% higher secondary or above (Figure 6).

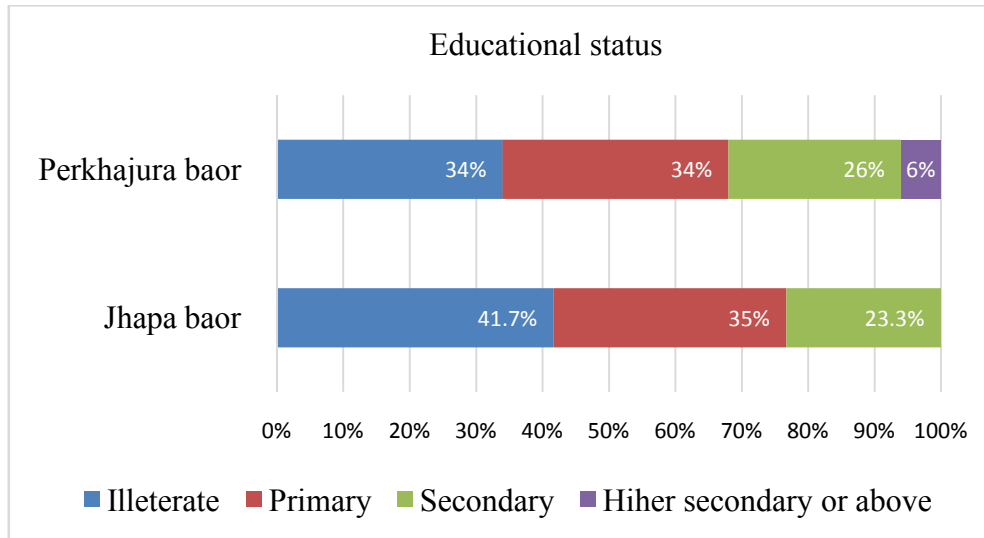


Figure 6: Fishers educational status at the study area, *Jhapa baor* and *Perkhajura baor*
Results and discussion

BBS 2001 showed 51.04% of village people in Monirampur were illiterate. Islam *et al.*, (2013) reported that 48% illiterate followed by secondary level (20%) in Monirampur upazila fishers. In the study area it was found that at *Jhapa baor* 41.7% of fishers and at *Perkhajura baor* 34% of fishers were illiterate which was little better than the national level. Further studied by Mahbubur (2001) reported that 68% of *Haor*fishers were illiterate, 28% up to primary level and 4% had only secondary level. On the other hand Shahriar *et al.*, (2010) did not find a single fisherman from higher secondary education category or above in the Morgangi *Beel* area. The education policy of government and the leading NGOs should take this issue into account so that a proper strategy could be made. Unfortunately, the non-formal education facilities provided by different NGOs in other parts of the country were not found in these fishing communities.

3.1.4 Fishers household members

The mean family members of *Jhapa baor* were 4.67 ± 1.654 (2 to 12) in each household (Table 3). It was found that 50% of the households has up to 4 family members (nuclear family), followed 48.3% households has 5-8 members and more than 8 members contained in only 1.7% household (Figure 7)

On the other hand the mean family members of *Perkhajura baor* were 4.22 ± 1.07 (2 to 6) (Table 3) where 66% household contained up to 4 members and 34% household contained 5-8 (Figure 7).

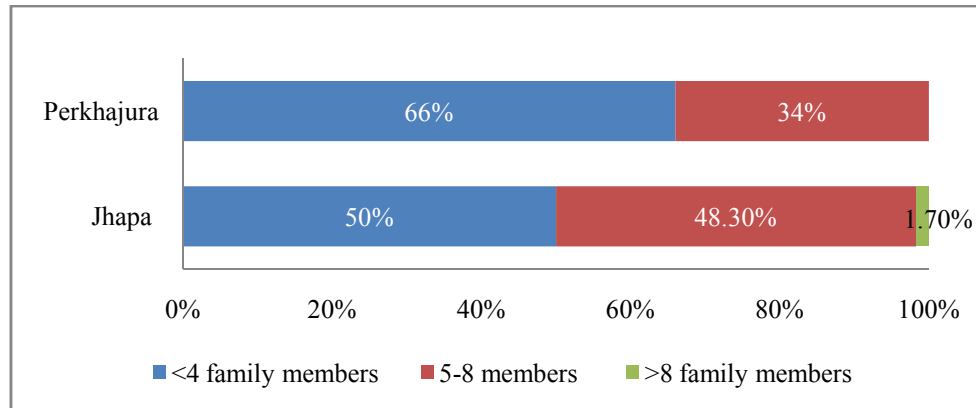


Figure 7: Percentage distribution of fishers based on family member at *Results and discussion*
Perkhajura baor

The two *baors* showed the similar result at household size. Nuclear family was dominated result in the study area. BBS 2011 reported that national mean family size was 4.4 members in Bangladesh specifically 4.2 members in Jessore district which was similar with this results. Where Islam *et al.*, (2013) reported that the mean family members were 3.60 ± 1.34 (2 to 8) in each fisher's household in Monirampurupazila. Almost similar results were also reported by Halder *et al.*, (2011) and Kostori (2012) while working with fish traders and fishers of the *Chalan beel* respectively. Dutta (1893) found that (51.11 %) fishers' families were nuclear at *Rajshahi* and *Pabna* districts which were similar to *Jhapa baor*.

3.1.5 Fishers household earning members

Household earning members have influence in total household income. The mean household earning members of *Jhapa baor* area were $1.62 \pm .985$ (1 to 5) (Table 3). Where 60% household has single earning member, 26.7% household earning member number was 2 and more than 2 earning members found in only 13.3% household (Figure 8).

On the other hand mean household earning members of *Perkhajura baor* area were 1.32 ± 0.713 (1 to 5) (Table 3). Where 76% household has single earning member, 20% household

earning member number was 2 and more than 2 earning members found in only 4% household (Figure8).

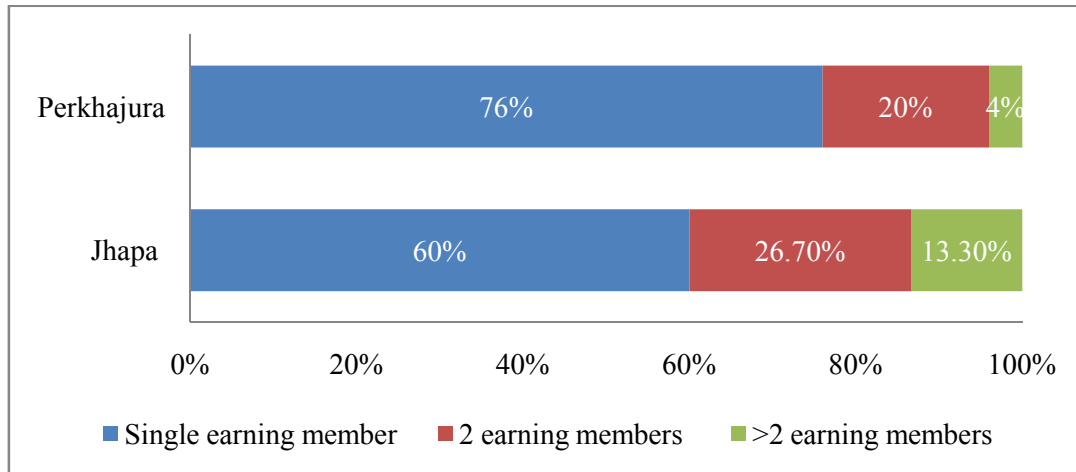


Figure8: Percentage distribution of fishers based on earning family r *Results and discussion*
and *Perkhajura baor*

3.1.6 Household income of Fishers

Mean monthly income of *Jhapa baor* fisher's household was BDT $8,930 \pm 4,638.39$ (3,500 to 23,700)(Table 3). Result showed that in *Jhapa baor*, 11.7% fishers household monthly income less than BDT 5000, 65% fisher's household monthly income BDT 5,000-10,000 and 23.3% fishers household monthly income more than BDT 10000 (Figure9).

In *Perkhajura baor* monthly mean household income of fishers was BDT $7,880 \pm 3,372.39$ (4,000 to 25,000)(Table 3), where 6% fishers household monthly income less than BDT 5,000, 76% fisher's household monthly income BDT 5,000-10,000 and 18% fishers household monthly income more than BDT 10,000 (Figure9).

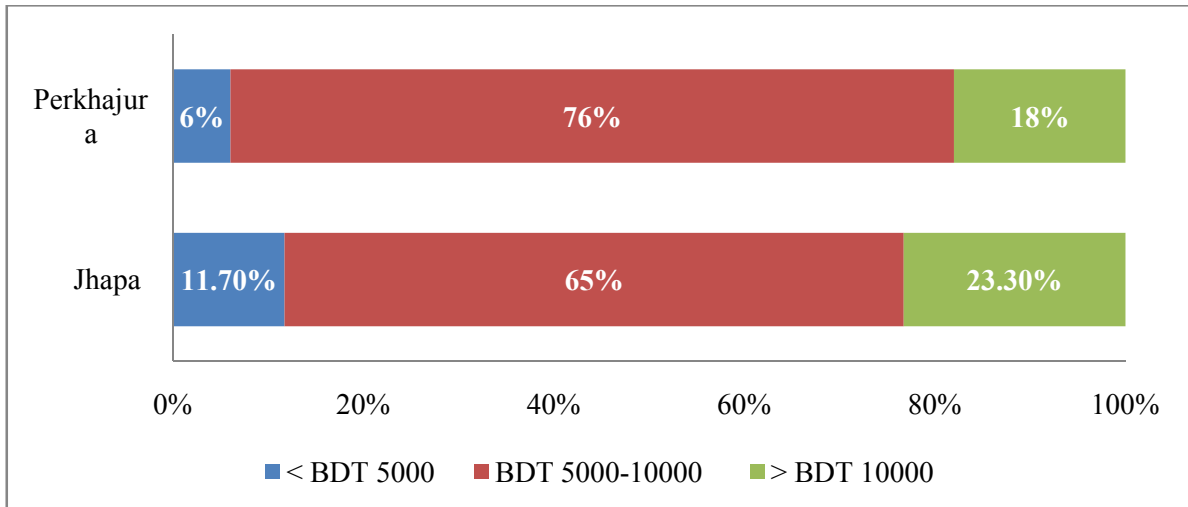


Figure 9: Percentage distribution of fishers based on household income at *Jhapa baor* and *Perkhajura baor*

In both *baors* about 50% fishers' household monthly incomes ranged was BDT 5,000-8,000. There were various source of household income except fishing, a small portion of traditional household received from the women who webbing net at home and the income range was BDT 200-3,000 per month (Figure 10). Transportation in *baor* also a income source for fishers in the study area.

Results and discussion



Figure 10: Women webbing net in the study area (A), boar used as transportation root (B)

In Bangladesh fifteen percent of women were employed where the highest percentages employed in factory or blue collar (25 percent) and semi-skilled services (22 percent) (BBS 2011). But in the study area there was no women's participation in household income permanently only 10% household of *Jhapa baor* found women involvement in household income by webbing net as part time job.

Islam *et al.*, (2013) reported that the mean monthly income of the household in this same upazilawas BDT $9,470 \pm 4,806.89$ which is higher than both baors areafishers. Another study, Kostori (2012) stated that at the time of peak fishing, majority fishers (50%) earn BDT 200-250 per day at *Chalan beel*. Total household income was lower than national average income where the national average income of people of Bangladesh was BDT 13,016 (BBS; 2011). So the average income of fishers household member was very poor than the national level. Most of the household of both *baors* were single earning member and educational status was also poor (Table 3) which influence in low household income. On the other hand high restriction of fishing in *baor* imposed by the leaseholder and natural disaster (flood) were also responsible for low household income.

Results and discussion

3.1.7 Household income of fishers from *baor*

Fishers of surrounding *Jhapa and Perkhajura baor* highly depended on the *baors*. In *Jhapa baor* total 73.11% household income of fishers came from the *baor* similarly 75.60% household income of fishers came from *baor of Perkhajura baor* which was very significant for their livelihood (Figure 11). In *Jhapa baor* monthly mean income of fishers household came from *baor* was BDT $6,209.16 \pm 3,286.56$ (500 to 20,000) (Table 3). Similarly in *Perkhajura baor* monthly mean income of fishers household came from *baor* was 5560 ± 2093.81 BDT (500 to 20,000). This result showed that largest portion of income of fishers came from the *baors* of the study area so both *baors* have significant influence in fishers' livelihood.

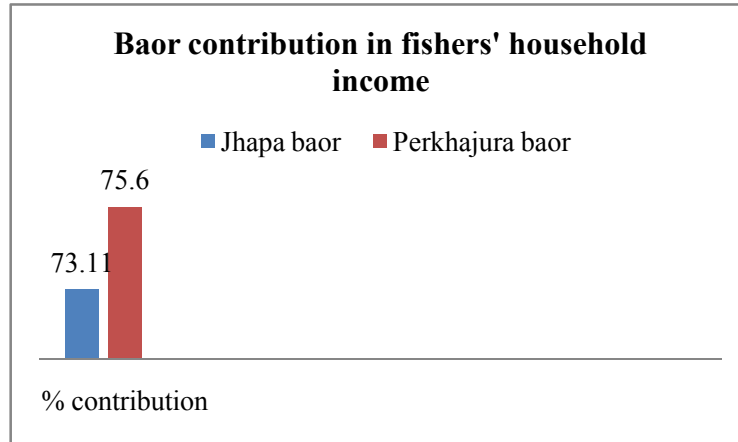


Figure 11: *Baor* contribution in household income in the study area, *Jhapa baor* and *Perkhajura baor*

3.1.8 Household expenditure of fishers

Most of the fisher's households were lived hands to mouth. Monthly mean expenditure of *Jhapa baor* fishers was BDT $7,510 \pm 2,652.96$ (3,500 to 15,000), where the monthly mean expenditure of *Perkhajura baor* fishers was BDT $6,630 \pm 2,017.29$ (2,500 to 15,000) (Table 3). In *Perkhajura baor* area fishers have low expenditure as well as with low income. This result reflects a lower socio-economic status of fisher's livelihood and could not fulfill their basic need. Monthly mean expenditure of both *baors* was less than the national monthly household expenditure was BDT 12240 (BBS 2011) which reflected the poor socioeconomic condition.

Table 3: Overall general socioeconomic status of fishers and fisher's household at *Jhapa* and *Perkhajura baor* area

Name of the <i>baor</i>	<i>Jhapa baor</i>		<i>Perkhajura baor</i>	
Fishers general information				
Mean age of fishers (Year)	42.88 \pm 10.90		42.16 \pm 10.71	
Religion status of fishers	Muslim	35	Muslim	70
	Hindu	65	Hindu	30
Educational status of fishers (%)	Illiterate	41.7	Illiterate	34
	Primary	35.0	Primary	34

	Secondary	23.3	Secondary	26
	Above	0	Above	6
Mean household (HH) member of fishers	4.67 ± 1.654		4.22 ± 1.07	
Mean HH earning members of fishers	1.62 ± .985		1.32 ± 0.71	
Fishers HH income (BDT)	8,930 ± 4,638.39		7,880 ± 3,372.39	
Fishers HH income came from <i>baor</i> (BDT)	6,209.16 ± 3,286.56		5,560 ± 2,093.81	
<i>Baor</i> contribution in fishers HH income (%)	73.11		75.60	
Fishers HH expenditure (BDT)	7,510 ± 2652.96		6,630 ± 2,017.29	

3.1.9 Fisher's land ownership status

Total land area can be divided into three categories (agriculture land, homestead and water body). In both *baors* all of the fisher's household have own homestead (Figure 12) area but the area was very small. In *Jhapa baor* the mean homestead area of the fishers was 12.63 ± 13.27 decimal (2 to 60) and in *Perkhajura baor* the mean homestead area of the fishers was 8.31 ± 6.01 decimal (2 to 23) (Figure: 13).

Results and discussion

In both *baors* area 60% fishers have no agriculture land (Figure 12). Among the rest 40% in *Jhapa baor* area mean agriculture land of fishers' was 72.08 decimal where the mean agriculture land of fishers was 38.35 decimal in *prekhajura baor* (Figure 13). Furthermore there was a terrific problem of flooding. Most of the agriculture land and water body remains over flooded 6-8 months of the year. On the other hand 98.3% and 94% of fishers respectively *Jhapa baor* and *Perkhajura baor* area have no pond (Figure: 12) area rest fishers have water body area of 3 decimal and 13.66 decimal respectively (Figure 13).

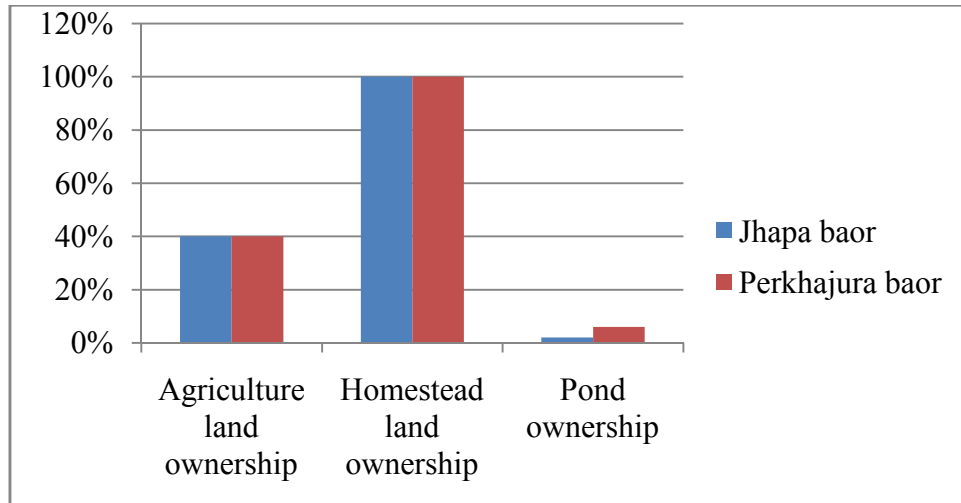


Figure12: Percentage distribution of fishers based on land ownership at *Jhapa baor* and *Perkhajura baor*

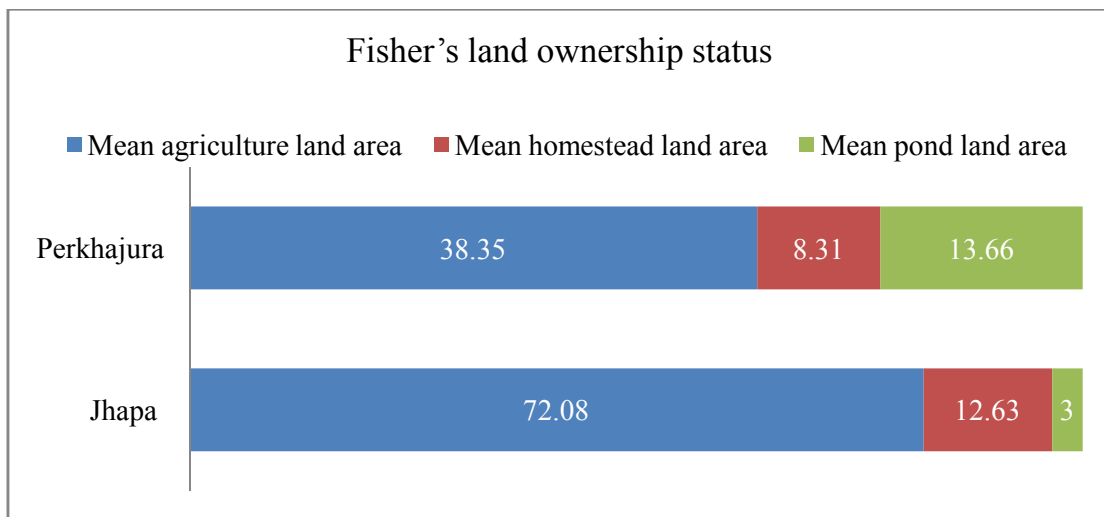


Figure 13: Among the land owner, mean la *Results and discussion*
baor area and *prekhajura baor* area of fishers (decimal)

The poor land area ownership status denoted that the *fisher's* families highly dependent on *baor* fisheries. Mean agriculture land area of *Jhapa baor* fishers was little higher than *Perkhajura baor* area fishers. So the dependency of *Perkhajura baor* area fishers' was higher than *Jhapa baor* fishers' household. In the result it was found that *baor* contributed 73.11% in *Jhapa baor* fishers' household and 75.60% in *Perkhajura baor* area (Table 3). Agriculture

land area has impact on fisher's household income. In the study area *Jhapa baor* fishers household income was little higher than *Perkhajurabaor* area (Table 3).

Islam *et al.*, (2013) also reported only 2% fishers of Monirampur upazila were landless but this study showed that but in this study area all of the fishers have homestead land but 60% fishers household have no agriculture land. The mean land owned by the fishers was 0.24 ± 0.36 ha (0.02 to 1.57 ha) reported by Islam *et al.*, (2013). Flowra *et al.*, (2009) stated that majority fishers had no land in *Dahia beel* area under Natore district. BBS 2001 showed that in Monirampur upazila 66.79% village household has agriculture land which is higher than the fishers' status of the study area.

3.1.10 Housing condition

To measure the housing condition houses of fishers were of three main types: (i) earthen (earthen) (ii) Semi Concrete (tin shed, concrete wall and earthen floor) and (iii) Concrete (totally Concrete). In the study area all of the fishers have own house but housing condition was dominated by earthen. In *Jhapa baor* area 63.3% fishers' household was earthen and followed by semi Concrete house 35% and only 1.7% lived in Concrete house (Figure: 14).

Housing condition also dominated by earthen in *Perkhajurabaor* area 78% and 22% fishers' lived in semi Concrete house. No Concrete house of the fishers was found among the respondent in the study area (Figure 14).

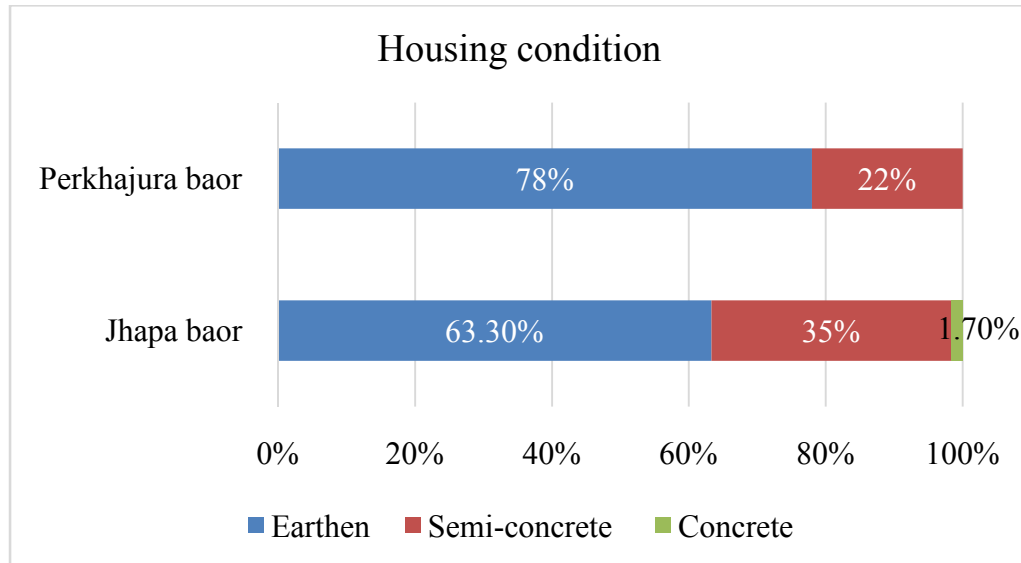


Figure14: Percentage distribution of fishers based on housing condition at *Jhapa baor* and *Perkhajura baor*

The overall housing condition of the study area was poor which has reflected the result of low income (table 3). This result was similar with other study of fishers by Sarkar *et al.*, (2008) who reported that 62% of housing structures were earthenwhile 34% were semi-Concreteand only 4% were Concreteat *Mokash beel*in *Kaliakoir* Upazilaof *Gazipur* district he also reported it as a poor condition.

3.1.11 Drinking water or other water facilities

This study showed that drinking water facilities was satisfactory in the studied area.100% household fishers used tube-well for drinking water. Among them 68.3% household used deep tube-well water and 31.7% people used shallow tube-well in *Jhapa baor*area. In *Perkhajura baor* area62% people used deep tube-well and 38% people used shallow tube-well for drinking water (Figure 15). Overall in Bangladesh 89.1% people used tube-well water for drinking (BBS 2011).

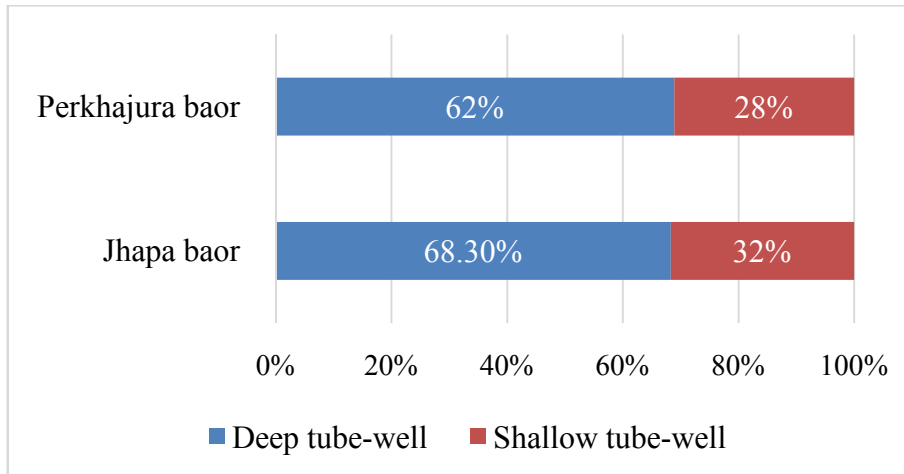


Figure15: Percentage distribution of fishers based on drinking water source at *Jhapa baor* and *Perkhajura baor*

In *Jhapa and Perkhajura baor*, there were 95% and 92% fisher’s household had own tube-well respectively. Those people who have no tube-well used government provided deep tube-well for drinking. But fishers randomly used surface water for others daily activities. The result showed that 93.3% fisher’s household of *Jhapa baor* area and 92% household of *Perkhajura baor* area used *baor* surface water for their daily activities except drinking (Figure16). Rest fishers household used shallow tube-well for those activities.

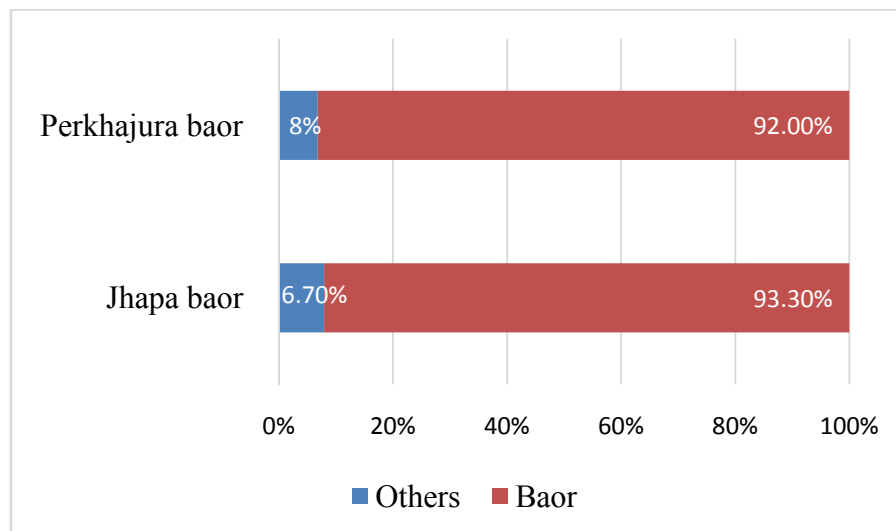


Figure16: Percentage distribution of fishers based on household activities water source at *Jhapa baor* and *Perkhajura baor*

Abdullah-Bin-Farid *et al.*, (2013) reported that household (HH) of 100% fishers used tube-well water for drinking and among them, 96% HH used owned tube well, and remaining 4% used tube-wells belonging to others.

3.1.12 Sanitary facilities

Sanitary condition of the fisher’s household was very poor. Three types of toilet were found to be used by fishers: (i) earthen/open (made of bamboo with leaf shelter and inadequate drainage disposal), (ii) ring/ slab (made of brick with leaf or in tin shelter and inadequate drainage disposal) and (iii) sanitary/paka (made of brick with good drainage disposal). In the study area maximum toilets were earthen.

It was found that 38.3% of toilets were earthen/open while 50% and 11.7% was ring/ slab and sanitary/paka respectively in *Jhapa baor* area. In *Perkhajura baor* area it also found open toilet dominantly, 78% of toilets were earthen/open while 22% were ring/ slab and no sanitary/paka toilet (Table: 17).

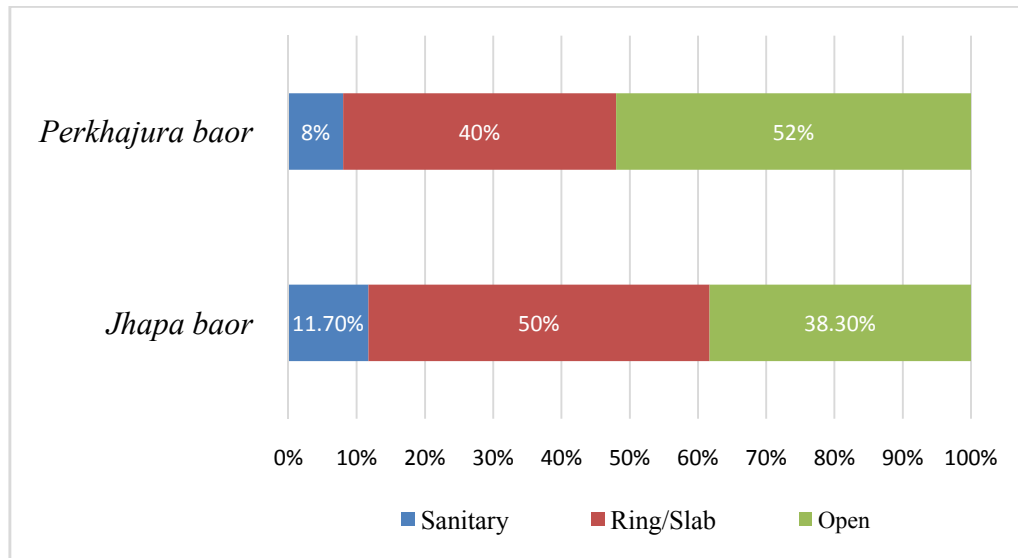


Figure 17: Percentage distribution of fishers based on household sanitary status at *Jhapa baor* and *Perkhajura baor*

This result of sanitary status of both *baors* was not satisfactory as a lot of fishers used to unhygienic sanitary facility which was dangerous for their health. BBS 2011 showed that in Bangladesh 27.8 people used Sanitary with water seal Toilet Facilities followed by 33.8 Sanitary without water seal 31.4 Non-sanitary/earthen and Open Space 7.0 %. Beside that the result showed that the sanitary facilities of *Perkhajura baor* area fishers household worsen than the *Jhapa baor* area. Respondent of the area reported that lower household income of fishers was responsible for that.

This result was similar with the finding of Abdullah-Bin-Farid *et al.*, (2013) who reported that 78% toilets were earthen at *Baluhar baor* area at *Jhenaidah*. BBS 2001 showed that 24.69% household use sanitary latrine, 42.49% household use other ring slab and rest 32.82% household open or no latrine facilities in Monirampur upazila. So the sanitary facilities of fishers were poor in comparison with national perspective.

3.1.13 Children educational status

Almost every fisher wants to educate their children in both *baors* surrounding area. It was found that in *Jhapa baor* 71.7% household children used to go to school and in *Perkhajura baor* 62% household children used to going school (Figure: 18). It resulted that a large portion of children (28.3% in *Jhapa* and 38% in *Perkhajura baor* area) are deprived from education. Poverty was the main cause behind that problem. Most of the children were not going to school for supporting their family income.

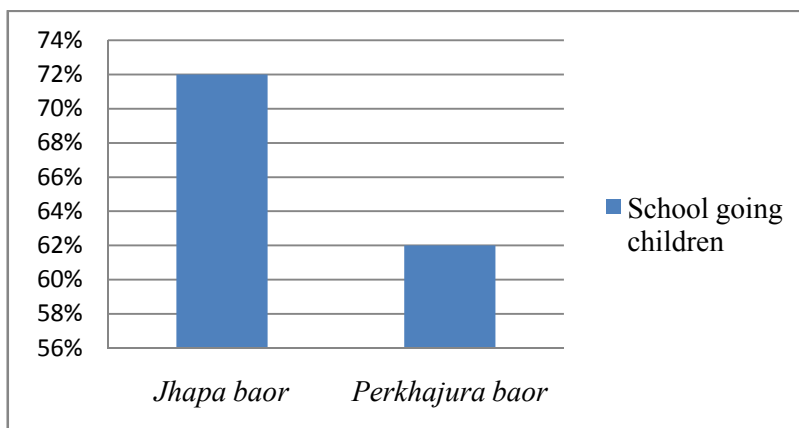


Figure 18: School going children amount (%) of *Jhapa baor* and *Perkhajura baor* area

In Bangladesh overall household, school attendance rate of children was 83.7 where in rural area it was 84.2. It was found those children of 71.7% household of *Jhapa baor* and 62% household of *Perkhajura baor* were going to school. This result still showed that the school attendance percentage lower than the overall national level of Bangladesh.

3.1.14 Health facilities

Among the other socioeconomic status health status of fishers was worse. Health service status was categorized into three groups: local village doctors, upazila health complex or MBBS doctors and others. Generally majority fishers receive health suggestions from village doctor, mostly unskilled. The highest proportion (above 90%) of fisher's household of both *baor* area depended upon local village doctors and rest fishers' family took service both from local village doctor and upazila health complex (Figure: 19).

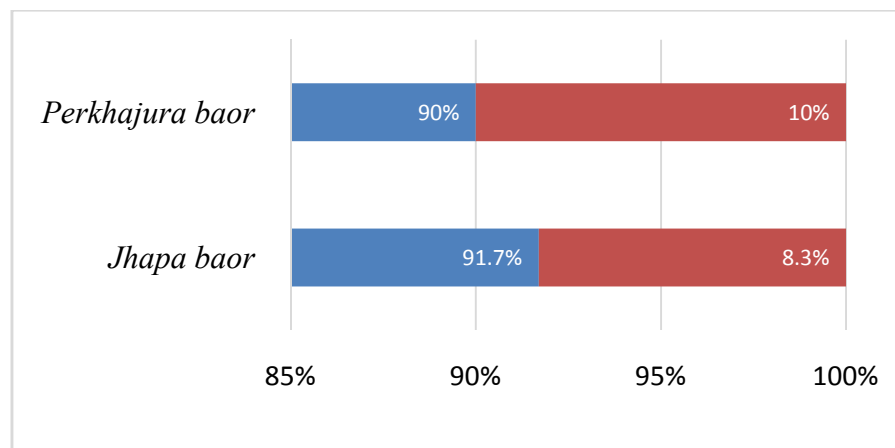


Figure 19: Household medical facilities status of *baor fishers* in the study area

The health conditions of fishers in studied area were very nuisance and worsen than many other areas. Shahriar *et al.*, (2010) found in the Morgangi *beel* area that health facilities of the fishers were better than this *baor* area where 64% of the fishers' household was dependent on village doctors, 24% of the fishers got health service from upazila health complex. Fisher's household income and literacy rate has a great influence on health facilities of them. There were some governmental medical facilities in Bangladesh at lower cost but fishers couldn't

undergo those facilities due to their unconsciousness and lack of knowledge. The fisher's entire household reported that they only received higher health service when the patient's condition became very serious. Otherwise local village doctor was all in all.

3.1.15 Light/energy source facility

In the studied area electricity was not available everywhere but light facilities status was better than national level. In *Jhapa baor* area 73.3% people can use electricity and *other* 26.7% people use kerosene as light or other power source. In *Perkhajura baor* about 62% fisher's household can use electricity and 36% used kerosene and only 2% fishers used solar lamp for light source (Figure 20)

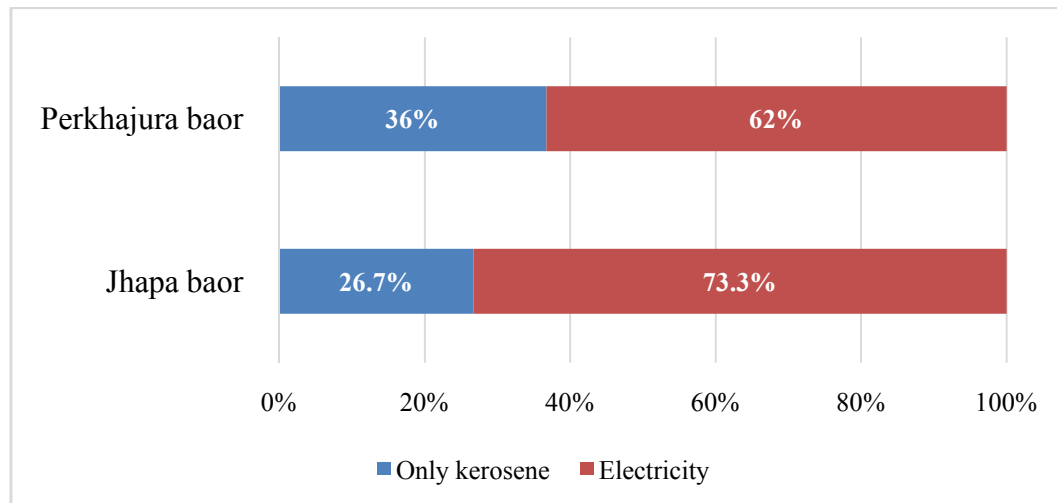


Figure 20: Fisher's household light source facilities in the study area

BBS 2011 also reported source of Light, Electricity 56.6 Solar energy 3.3, Kerosene 39.5 59.93 84.73 and Bio-gas 0.1% in Bangladesh. Considering the national situation electricity facilities was better than others area. Another study of Abdullah-Bin-Farid *et al.*, (2013) at buluhar *baor* Jheneidha reported that 92% fishers connected with electricity line and only 8% fishers were not connected with electricity line which was better than the study area. Kostori (2012) reported 48% fishers had no electricity facility in a community of *Chalan beel* under Tarash Thana in Sirajganj district.

Table4: Overall household status of fishers of *Jhapa baor* and *Perkhajura baor* area

Name of the <i>baor</i>	<i>Jhapa</i>			<i>Perkhajura</i>		
HH characteristics						
Fishers HH land ownership	Type of land	% of ownership	Mean area (Dec)	Type of land	% of ownership	Mean area (Dec)
	Agriculture	40	72.63	Agriculture	40	38.38
	Homestead	100	12.8	Homestead	100	8.31
	Pond	1.7	3	Pond	6	12
Housing condition (%)	Earthen	63.3		Earthen	78	
	Semi Concrete	35		Semi Concrete	22	
	Concrete	1.7		Concrete	0	
Drinking water facilities (%)	Deep tube-well		68.3	Deep tube-well		62
	Shallow tube-well		31.7	Shallow tube-well		38
	Surface (<i>baor</i>)		0	Surface (<i>baor</i>)		0
Water facilities for other activities (%)	Surface (<i>baor</i>)		93.3	Surface (<i>baor</i>)		92
	Others		6.7	Others		8
Tube-well ownership (%)	95			92		
Sanitary facilities (%)	Sanitary		11.7	Sanitary		0
	Ring/slab		50	Ring/slab		22
	Open/ earthen		38.3	Open/ earthen		78
Light facilities (%)	Electricity		73.3	Electricity		62
	Kerosene (only)		26.7	Kerosene only		36
	Others		0	Others		2
HH School going children	72%			62%		
Health facilities (%)	Local village doctor		91.7	Local village doctor		90
	Health complex		0	Health complex		0
	Both		8.3	Both		10

3.1.16 Loan or credit and savings

A vital portion of the studied fishing community (65% of *Jhapa baor* area and 70% of *Perkhajura baor* area) was involved with credit organization. They took loan from those organizations and deposit their savings. 92.30% fishers of *Jhapa baor* area and 88.57% of *Perkhajura baor* area received loan from there (Table 5). They are mainly involved with 7 credit organizations (BRAC, SUS, Jagoroni Chakra, Grameen Bank, ASHA, Samadhan, and GO). Some of them are involved with more than one credit organization (1 to 4). Among the whole fisher's household of *Jhapa baor* area 30% are involved with BRAC, 5% with SUS (Satkhira Unnaio Sanastha), 21.7% with Jagoroni Chakra, 26.7% with Grameen Bank, 18.5% with ASHA, 25% with Samadhan and 6.7% with GO. In case of *Perkhajura baor*, 30% fishers are involved with BRAC, 20% with SUS (Satkhira Unnaio Sanastha), 6% with Jagoroni Chakra, 40% Grameen Bank, 6% ASA, 8% Samadhan and 10% with GO (Figure 21).

The mean loan amount of *Jhapa baor* area fishers was BDT 34,305.55 ± 25,027.77 (BDT 5,000 to 100,000). The mean loan amount of *Perkhajura baor* area fishers household was BDT 22,093.75 ± 17,952.19 (BDT 3,000 to 94,000) (Table 5).

Fisher's household of *Jhapa baor* area are used to receive loan from different organizations. 20% of them receive loans from BRAC, 5% from SUS, 20% from Jagoroni Chakra, 21.7% from Grameen Bank, 15% from ASA, 16.7% from Samadhan and 5% from GO. In case of *Perkhajura baor*, 20% fishers receive loans from BRAC, 10% from SUS, 4% from Jagoroni Chakra, 32% from Grameen Bank, 2% from ASA, 6% from Samadhan and 10% from GO (Figure 22). They use this credit for many purposes. In *Jhapa baor*, 25% used for poverty or paid previous loan to people, 18.3% for buying fishing gear or boat, 3.3% for agriculture, 1.67% for household children education and 11.7% for others such as health, buying transport, occasion etc. In *Perkhajura baor*, 46.87% for poverty or paid previous loan to people, 18.75% for buying fishing gear or boat, 15.62% for agriculture, 6.25% for household children education and 12.5% for others such as health, buying transport, occasion etc (Table 5). Islam *et al.*, (2013) also reported the mean loan amount of

Monirampurupazilafisherswas BDT 9,856.52 ± 10,826.56 (BDT 1,000 to 55,000). Similar result found by similar trend in taking loan from NGOs was also reported by Kostori (2012), Halder *et al.*, (2011). But this study reveals higher mean amount of loans. Low income, flood, high restriction to fishing and less fishing from *baor* were responsible for higher dependency on credit organization.

Table5: Overall credit status of fisher’s household at *Jhapa baor* and *Perkhajura baor* area

Name of the <i>baor</i>	<i>Jhapa baor</i>		<i>Perkhajura baor</i>	
HH credit and saving status				
HH no. involvement with credit organization (%)	65		70	
Credit organization type (%)	NGOs	92.30	NGOs	90.63
	GO	0	GO	6.25
	Both	10	Both	3.62
Among member receive loan (%)	92.30		88.5	
Mean amount of loan (BDT)	34,305.55 ± 25,027.77		22,093.75 ± 17,952.19	
Purpose of loan (%)	Poverty	25	Poverty	46.87
	Fishing	18.3	Fishing	18.75
	Agriculture	3.33	Agriculture	15.62
	Education	1.67	Education	6.25
	Others	11.7	Others	12.5
HH number of saving (%)	31.7		26	

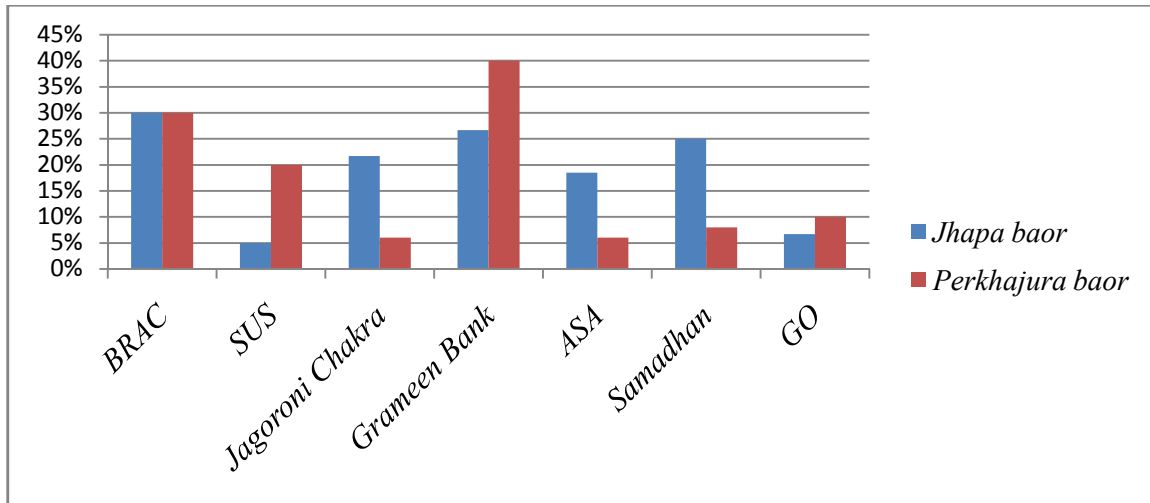


Figure21: Percentage amount of fishers household involved in various credit organizations at *Jhapa baor* and *Perkhajura baor* area

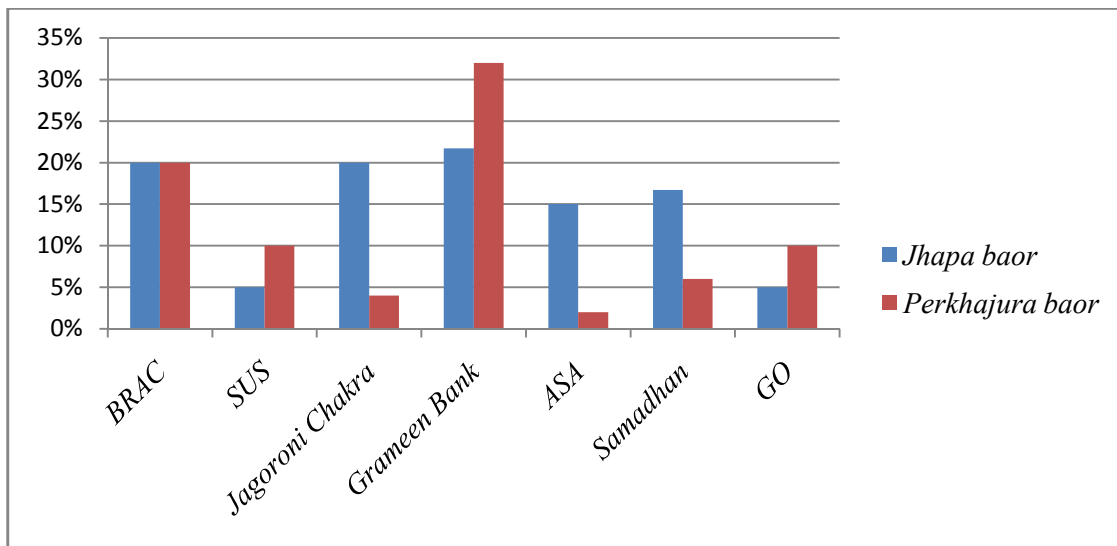


Figure22: Percentage of loan receiver fishers from credit organization at *Jhapa baor* and *Perkhajura baor* area

In spite of high interest of the NGO fishers of both *baors* were satisfied with the loan because it was available. Fishers took loan from the credit organization when necessary or emergency.

3.1.17 Fishers membership in fisher’s co-operative organization

From the studied area we found that some local co-operative organization such as “*JhapaMatshajibi Somobai Somiti Ltd*”, “*Maswimnagor Matshajibi Somobai Somiti Ltd*”, others such as agricultural association, voluntary association etc is highly active. Among the respondent in *Japhabaor* area 48.3% fishers were member of “*Matshajibi Somobai Somiti Ltd*” and 34% were in *Perkhajurabaor* area(Figure23).

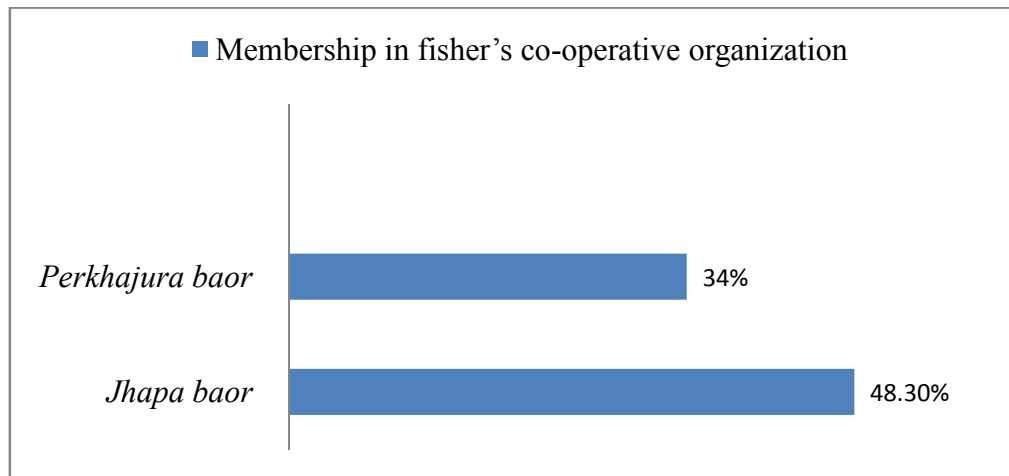


Figure 23: Fisher’s membership status in fisher’s co-operative organization of both *baors*

Both of the organizations were local fishers association. But no member from other organization was found. In *Jhapa baor*, fishers have a relationship with World Fish Center. They provide training program, 24 cages and money for tilapia culture. But the project period was over during the study and culture being stopped due to flood.

The fishers who were associated with the “*Matshajibi Somobai Somiti Ltd*” they have more opportunities than the general fishers because they can get lease or can be a member of leasing committee. This membership in cooperative organization thus directly influence in fishers household income. This study showed that in *Jhapa baor* area, fisher’s household was higher as their involvement with fishers association was higher.

3.2 Fisheries and aquaculture conditions in baors

According to the key informant studies about 35% household in *Jhapa baor* area and 40% household in *Perkhajura baor* area were involved with fish harvesting from baors as per time or full time. Both of these *baor* have free access for the local people and no fisherman had any fishing license. So there was no way to identify the real fishermen from the study area.

3.2.1 Fishing duration

In *Jhapa baor* mean duration of fishing is 9.52 ± 2.33 months (3 to 12 months) where in *Perkhajura baor* mean duration of fishing is 10.16 ± 2.42 months (4 to 12 months). It was found that in *Jhapa baor*, 88.3% fishers' harvested fish more than 6 months of a year and they were called as full time fishers. Rest 11.7% fishers are part-time or seasonal fishers (Figure 24). In *Perkhajura baor* 96% fishers harvested fish more than 6 months of a year and they are called as full time fishers. Rest 4% fishers' were part-time fishers (Figure 24).

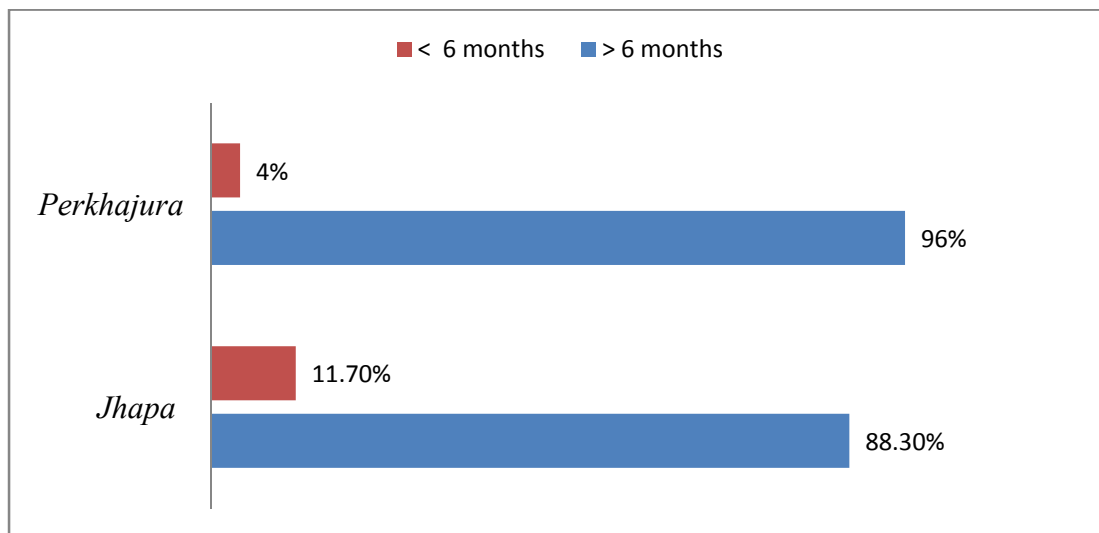


Figure 24: Percentage distribution of fishers according to fishing duration at *Jhapa baor* and *Perkhajura baor*

Here the result showed that most of the fishers were full time fishers and fished more than 6 months. This result denoted that household socio-economic status of them fully depended on

the *baor* and their livelihood influenced by the *baor*. This result of higher amount of full time fishers reflected the result of *baor* contribution (about 75%) in household income of the fishers.

3.2.2 Fishing type

Both *baors* were abundant of cultured and small indigenous fish but local fishers have no permission to harvest cultured fish. But fishers caught cultured fish to get commission 20% of total market price in *Jhapa baor* and 25% of total market price in *Perkhajura baor*. On the basis of harvested fish types, fishers divided into three groups 1) harvested only cultured fish 2) harvested only bycatch and 3) harvested both. In *Jhapa baor*, 8.3% fishers harvested cultured fish, 41.7% bycatch and rest 50% harvested both cultured fish and bycatch. In *Perkhajura baor*, 2% fishers harvested cultured fish, 78% bycatch and rest 10% harvested both cultured fish and bycatch. (Figure 25) showed the Distribution of fishers on the basis of harvested fish type.

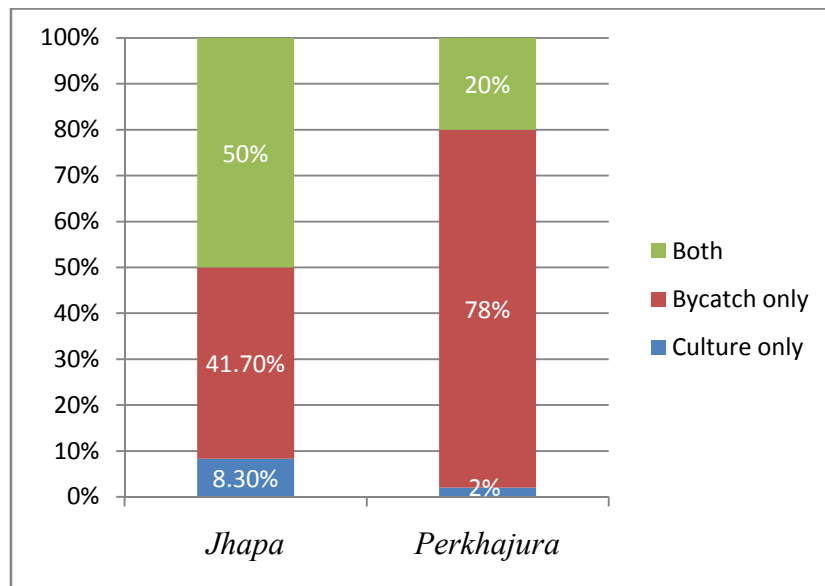


Figure 25: Distribution of fishers (%) based on the fishing type in the *Jhapa and Perkhajura baor*, Jessore



Figure 26: Harvested fishes from baor (A bycatch, B culture fish)

In both *baors*, it was found that fishers used two types of gears. 1) Net (Seine net/Ber jal, Chitki jal, Dharma jal, Current jal, Thela jal etc) and 2) Trap (Char, Doair, Ghuni, Borsi, Bair, Darki, Spear, etc). In *Jhapa baor*, 76.7% fishers used net for harvesting of fish and 23.3% fishers used both net and trap. In *Perkhajura baor*, 20% fishers used net for harvesting, 22% used trap and 58% fishers used both net and trap for harvesting of fish (Figure 27).

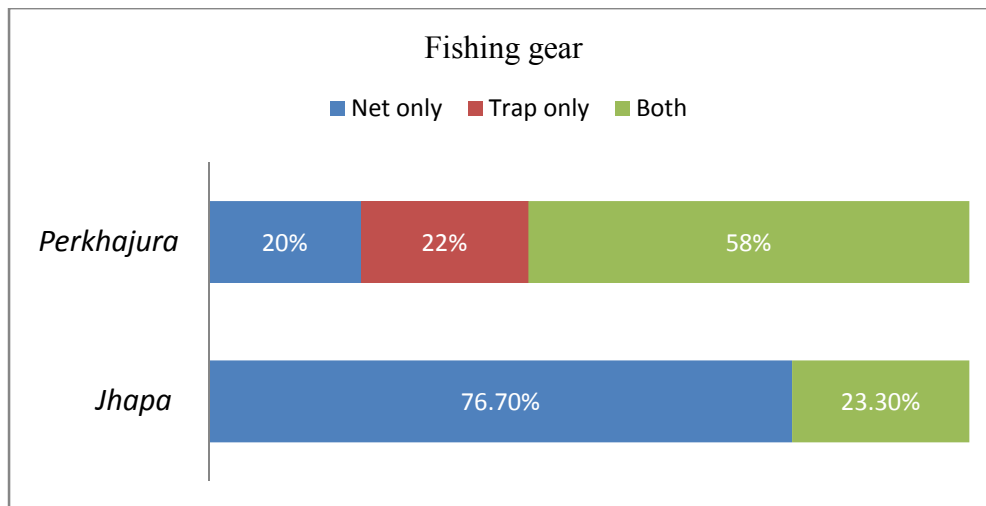


Figure 27: Distribution of fishers (%) based on the fishing trap in the *Jhapa and Perkhajura baor*, Jessore

In the study area, it is found that more fishers were involved with harvesting culture fish in *Jhapa baor*. Fishers get 25% commission by harvesting cultured fish from *baor*. *Jhapa*

baor was bigger than *Perkhajura baor* and more fishers were involved in harvested culture fish so their household income was higher. On the other hand *Perkhajura baor* was smaller and 73% share of the *baor* maintained by the private ownership so the involvement of fishers were less in culture fish harvesting so their family income were lower.

3.2.3 Fishing purpose

Fishers harvested fish for sale, household consumption or for both. This study showed that in *Jhapa baor*, 5% fishers' harvested fish only for household consumption, 5% for only sale and 90% for both sale and household consumption. On the other hand in *Perkhajura baor* 8% fishers harvested fish only for household consumption and 92% for both sale and household consumption (Figure 28).

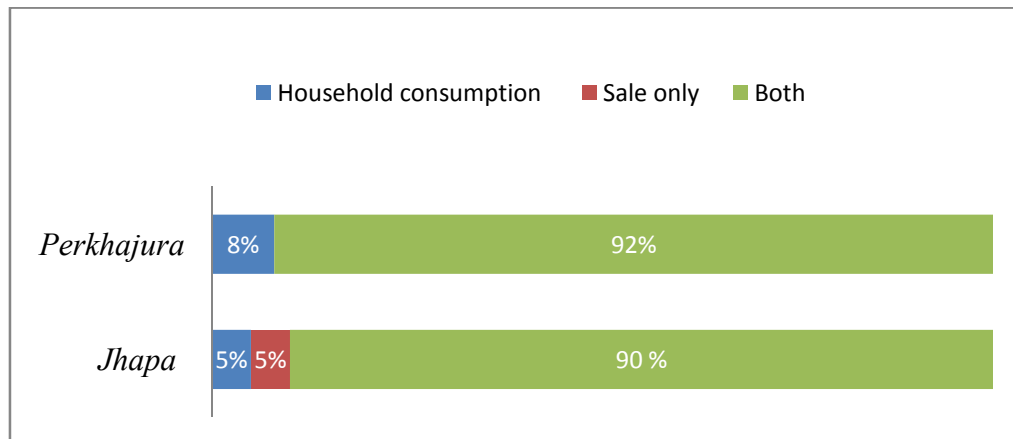


Figure 28: Fishing purpose of fishers in the study area

3.2.4 Marketing place

It was found that a highest portion of fishers harvested fish for sale. Among the fishers, about 63.15% harvested fish were sold in retail market, 26.31% to *Arathdar*, and 8.77% to *Bapari* and 1.75% to nearest neighbor in *Jhapa baor*. And in *Perkhajura baor* area, 41.30% in retail market, 2.17% to *Arathdar*, and 26.52% to *Bapari* (Figure 29).

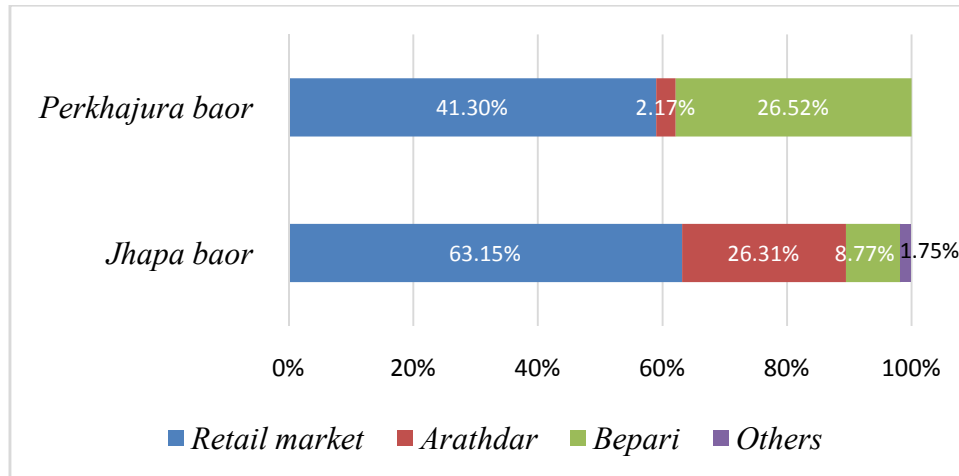


Figure 29: Marketing place of harvested fish of *Jhapa and Perkhajura baor*

In this area all of the fishers received proper price and satisfied with the price they received and there were very less influence of middleman.

3.2.5 Ownership of boat

In *Jhapa baor* area 70% fishers and in *Perkhajura baor* areas 78% fishers have own boat (*Khosa nowka* and *Dingi nowka*). Mean ownership number of boat in *Jhapa baor* area was $1.02 \pm .154$ (1 to 2) and *Perkhajura baor* area was $1.08 \pm .48$ (1 to 4) (Table 6).

Among the boat holder, 59.52% fishers have *Khosa/Chandi nowka* and used to harvest both cultured fish and bycatch and 40.48% fishers have *Dingi nowka* for harvesting bycatch. On the other hand at *Perkhajura baor* area 17.95% fishers have *Khosa nowka* and 82.05% fishers have *Dingi nowka* (Figure: 30). In *Jhapa baor* 97.61% boat were used for fish harvested and 2.39% for transportation or other activities and in *Perkhajura baor* area 94.86% boat were used for fish harvested and 5.14% for transportation or other activities.

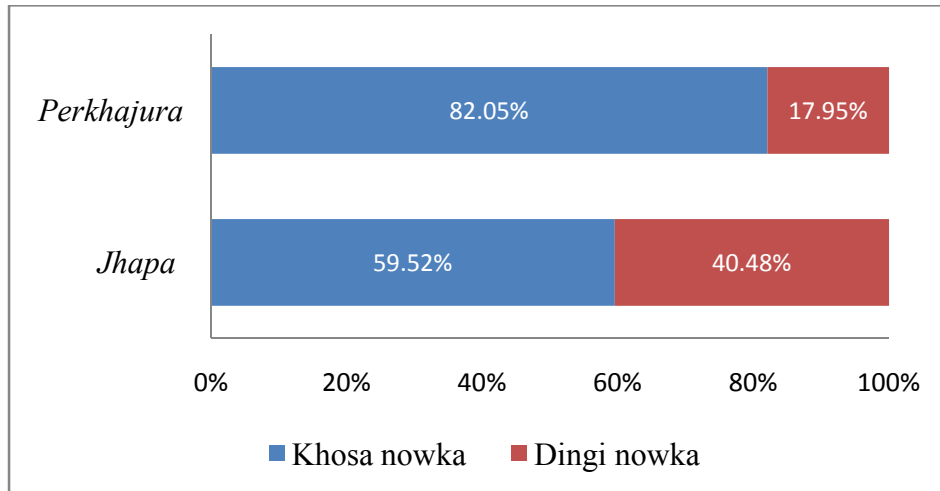


Figure 30: Amount of various type of boat used at *Jhapa baor* and *Perkhajura baor* area

Ownership and type of fishing boat have impact on fishers’ household income. In *Jhapa baor* fishers household income was higher (Table 3) caused the big type (*Khosa*) boat ownership percentage were higher. Fishermen could harvest more fish with big boat beside they got rent money for boat during harvesting cultured fish from the *baor* authority.



Figure 31: Type of boat used for fishing in the study area, Dingi (A), Khosha(B)

Table6: Overall fishing status of fishers in *Jhapa baor* and *Perkhajura baor*

Name of the <i>baor</i>	<i>Jhapa baor</i>		<i>Perkhajura baor</i>	
Fishing characteristics				
% of fishery-dependent households	About 35		About 40	
Mean duration of fishing(months)	9.52 ± 2.33		10.16 ± 2.42	
Fishers amount basis on harvested fish type (%)	Cultured fish	8.3	Cultured fish	2
	Bycatch	41.7	Bycatch	78
	Both	50	Both	10
Fishing gear used by fishers (%)	Only net	76.7	Only net	20
	Only trap	0	Only trap	22
	Both	23.3	Both	58
Fishing purpose of fishers (%)	HH consumption	5	HH consumption	8
	Sale	5	Sale	0
	Both	90	Both	92
Fishers' percentage basis on fish sale (%)	Retail market	63.15	Retail market	41.30
	<i>Arathdar</i>	26.31	<i>Arathdar</i>	2.17
	<i>Bapari</i>	8.77	<i>Bapari</i>	26.5
	Others	1.75	Others	0
Fishers' amount used boat (%)	70		78	
Mean amount of boat	1.02 ± .154		1.08 ± .48	
Type of boat used (%)	<i>Khosa nowka</i>	59.52	<i>Khosa nowka</i>	17.95
	<i>Dingi nowka</i>	40.48	<i>Dingi nowka</i>	82.05
Purpose of boat (%)	Fishing	97.61	Fishing	94.86
	Others	2.39	Others	5.14

3.3Barriersto baorfisheries management

The oral history interviews and FGDs revealed the major barriers of *baor* fisheries resources and *baor* management were flood, rainfall pattern, siltation, poaching, restriction on fishing, conflict between fishers and stakeholder, illiteracy, *baor* leasing system, high leasing money, local fisheries officers neglect, low income and high interest rate of loan (Figure 29).

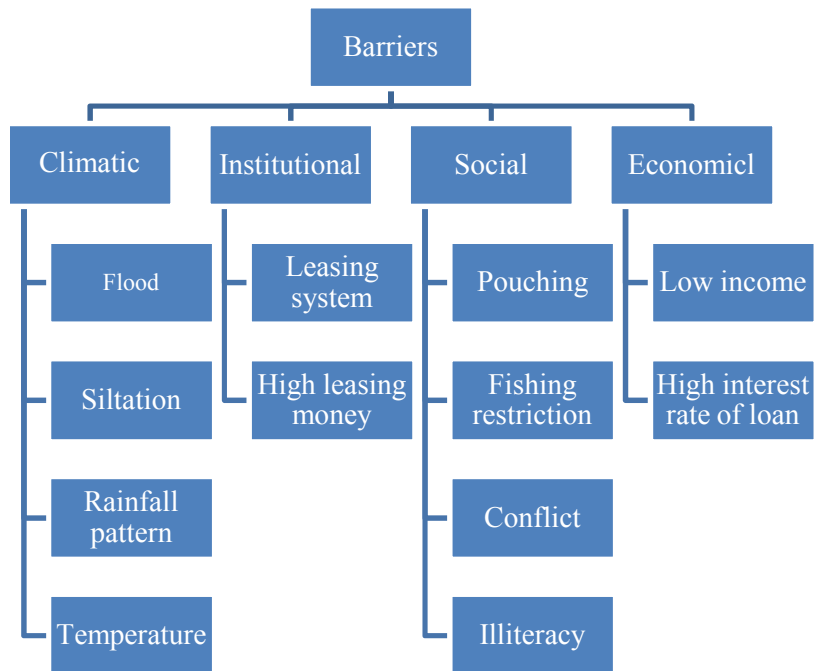


Figure32: Flowchart of barriers to *baor* management

3.3.1 Climatic barriers

3.3.1.1 Flood

Results and discussion

Among the other barriers, flood was the main problem in the study area. Flood was the main obstacle for fish culture and other livelihood activities of the fishers on the *baors* region. There were some serious negative impacts on *baor* fisheries management and fishers livelihood for flood in the study area. The entire respondents reported that before the year 2000, there was no evidence of chronic flooding situation in the study area. . Before 2000 the enmity of flood was present but the durability was short. Maximum cases within seven –

fifteen days reported by the respondent and the condition became repose because the river navigability or sluice system was better.

Degree of floods was not equal for every year. But some year its fearfulness was beyond control such as 2000, 2005, 2008, 2015 it was deluged. Normally flood breakdown at the month mid-August but in 2015 it was flooded earlier. It was flooded at early July and heavy rainfall was the main reason behind it. Flood had impact on *baor* management and interferes on the livelihood of the fishers because most of the fisher's livelihood of the area depends on *baor*.

3.3.1.1.1 Reasons of flood

Siltation

Both *baors* were de-functioned part of “*Kapotakkho*” river and located almost same area. There were two joints at the end of the *baor* with river at both sides of the *baor* to discharge water from *baor*. But the joints were worthless as then navigability of the river had been loosed totally due to high siltation. In the year 2000 there was a destructive long lasting flood due to heavy rainfall and discharged water of India (30% respondent reported). 20% respondents reported that the water came from India contain more silt. The long lasting destructive flood of 2000 collected more silt and settled on river bed which stopped the water sluice system and lost the navigability of the river. That situa *Results and discussion* following years and created a dangerous flooding situation every year.

On the other hand due to long time regencies upper stream of the river was filled with silt and river navigability totally loosed. People of the study area reported that the river bed of *Kapotakkho* River has risen more at the area of *Patkelghata* to *Chapatola* which were located 25 km southern to beside *Chapatola* respectively. So the study area had become lower than the lower stream of the river. The river bed at *Patkelghata* area was higher and the river slope was toward upstream *Chapatola*. This condition has prevented to flow the upstream (study area) water toward the way to Bay of Bengal. Rather lower stream water created pressure to

flow toward upstream (in the study area) during monsoon when the water pressure was high in river. For this reason every year after the year 2000 flood has occurred in the study area.

River regime

River regime was also responsible for flood. Construction of dam was another significant cause for flood. Local musclemen mainly the local powerful political leader commanded riverbank or river and built dam for fish culture. That was the reason the river became narrower and water discharge capacity has decreased. When discharge capacity has decreased, the siltation rate has increased and the river has lost its navigability and the terrestrial area became flooded.

During this study one respondent reported that in 2002, a bridge was constructed on the *Kapotakkho* River by building dam on the river. Those activities prevented the water flow of the river and increase the siltation rate. After the bridge construction, the dam was released but it huge silt already coagulated. During the study there was still some part of dam which was not released clearly after completed the bridge. On the other hand, the flood control plans built dam in south-western reason which also decreased water discharge capacity in the study area. This dam prevented flood in lower part of south-western reason in Bangladesh but increased water pressure in the study area. So when the water could not be flooded in lower part of the river then it flooded the upper part of the study area.

Surface runoff

Traditionally the surface runoff of the area had fallen in the river through the *baor* during rainy season. The amount of the surface runoff water was huge and it covered about 3 kilometer far area from the *baor*. This water came to *baor* through canals and finally fallen into *Kapotakkho* river. There were about 14 small and big canals which discharge water in *Jhapa baor* from the surrounding terrestrial area. But it could not discharge through the river for that reason river lost its navigability.

3.3.1.1.2 Impact of flood

Impact of fisheries

When the area flooded the dam of the *baor* at the joint part of the river broke down and the water of river entered into the *baor* which was the totally opposite phenomenon of natural occurrence. After entering the river water, the bank of *baor* immersed and *baor* water entered into the crowd. Most of the stocked fish escaped away and it was found that local land owner harvested them freely. Most of the cases *baor* management authority stocked fish in *baor* from January to mid-March and harvested fish in August. But the flood has come before it and caused a huge financial loss. Beside that fish diseases and mortality has increased due to flood. Due to flood a lot of polluted water came into *baor* which increased fish mortality.

Fish poaching in this season has increased due to higher poverty and unemployment. Conflict between management authority and local fishers was common matter during flood. *Baor* management authority reported that poor fishers harvested their cultured fish species from the *baor* bank which was illegal and resulted financial loss. On the other hand fishers claimed that they have harvested fish from terrestrial area which came from their submerged pond. They also reported that *baor* management authority snatched their boat, net and other fishing gear during fishing from *baor* bank or catching by catch.

Fishers also reported that flood also destroyed the breeding ground of indigenous fish species. They reported that generally fish has spawned below the water bush or dense aquatic weed. Fish has also spawned under the distressing. But the consecutive flood has destroyed these breeding places by destroying the natural ecosystem. In the study area there were very few distressing but the fishers reported that before flood which was more. They also reported that *baor* stakeholder also eradicated these for fish culture but it hampered the indigenous fish mainly in breeding season. Almost the entire respondent reported that many indigenous fish species has extinct due to flood such as *Channa*, *Puntius*, *Mastacembelus*, *mystus*, *Colisa* etc. species.



Figure 33: Net used to protection from flood by enclosing the *baor*

Impact on agriculture

Beside fisheries, huge destruction has occurred in agriculture land which remained under water in flooding season so the livelihood of the surrounding area people hampers a lot. People reported that before the year 2000 there was 15 meter wide lands both side of the *baor*. Before the year 2000 that land only flooded during rainy season but during winter people had been used that land for cultivation rice (*Boro*), vegetable etc. But after 2000 that land has submersed permanently and became a part of *baor*. As flood has increased the water body it was good for fish production was harmful for agriculture. This submerged land was not public property but now it considered as a *baor* property. The *baor* management authority sown that area although they didn't pay for that to the government. People reported that about 2 kilometer away of the *baor* became flooded during rainy season. Beside this agricultural lose people reported that fruit and other trees were also died for flood which was huge economical lose for the *baor* surrounding people.

Impact on baor management

Flood was one of the major barriers of *baor* fish culture management. Both *baors* were jointed with *Kapotakkho* River at two end point and water entrance into the *baor* controlled

by dam. During flooding period the traditional old type dam made by sand bag, mud and bamboo had broken down and river water entered into the *baor*. Every year management authority stocked fish in mid-March and that has prepared to harvest in the mid-August. But flood has occurred before the fish harvesting period. So the cultured fish have escaped away to the locality. Management authorities have tried to protect fish escaping by enclosing the *baor* with net. But the *baor* are very large so enclosing the *baor* was very costly and ineffective. Fish diseases, fish poaching, conflict with local poor fishers are common phenomenon during flood. Management authority reported that fish mortality has increased due to viral disease, gill rotten diseases after the flood has started.

3.3.1.1.3 Flood preventing measure

Dredging of river

As the main cause of flood was siltation or navigability loses of river, dredging of river was the absolute solution to protect flood of the study area. Government of Bangladesh has started dredging *Kapotakkho* River but the flooding situation was not improved because dredging rate was insufficient. Dredging of river was continuous and people of the study area were optimistic for better situation. As the *Kapotakkho* river was totally death so the river should dredge along the river and ensure slope toward southern Bay of Bengal. More and better dredging of river may be a permanent solution of flood of the river bank area as well as the *baor* area. Beside river both *baor* were connected with small channel. Dredging of channel, improved the water discharge capacity of the *baor* and flood control may be improved.

Baor embankment

Baor embankment was also necessary to control flood of the *baor* and the *baor* adjacent locality. Embankment mainly in the low laying western side of the *baor* can prevent small scale/ primary level flood. This embankment of *baor* can prevent the primary level flood. Local administration took a step to construction a road to better communication as well as

prevent flood but the action was not dynamic. Local land owner on the bank of the *baor* were not agree to provide land to construct *baor* embankment. So government should provide enough compensate to the landowner to take the land for constructing embankment.

Sluice gate at the joint

Both *baors* had joint with *Kapotakkho* River at two end points. During flooding period the old type dam of the joint point has broken up and river water entered. So to control the situation it was necessary to construct Concrete sluice gate at the end point of the *baor* where it joint with the river. Beside it, construction of sluice gate at the point where *baor* joint with the channel to improve the situation and prevent the *baor* from flooding.

Road construction

Road construction on the western side of both *baor* may be a better complementary to prevent flood. Local administration took a step to construction a road for better communication as well as to prevent flood but the action was also not dynamic.

3.3.1.2 Rainfall

People reported that rainfall was not a major problem for flood and *baor* management. If the navigability of river and the sluice system is good then the rain water can discharge properly. From the analysis of rainfall data it was found that the degree of rainfall was similar from 1980 to 2014 at the study area (Figure 34). The slope of the graph was constant so there was no change in degree of rainfall.

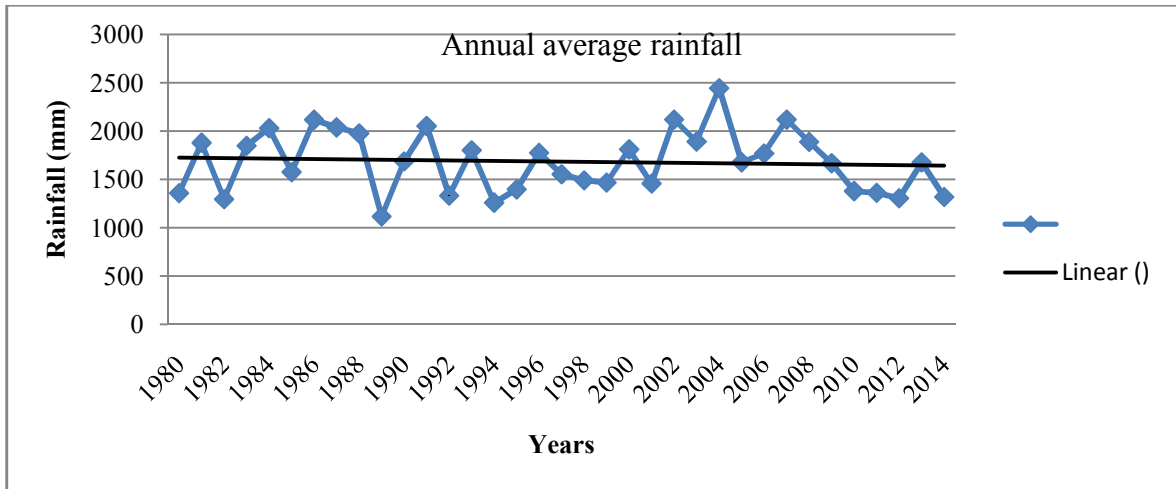


Figure 34: Annual average rainfall from 1980 to 2014 in the study area, Jessore

Here the graph resulted that the average annual rainfall rate was similar from 1980 to 2014. After the year 2000 there were no significant increase of rainfall amount than before. So rainfall was not a major problem for *baor* management. So the navigability of river should recover to control the flood.

Another analysis of average monthly rainfall from 1980 to 2014 has showed that the degree of rainfall was height in June to mid-September (Figure35). So *baors* were vulnerable to flood during these months. Some fishers reported that flood started from June immediate after heavy rainfall.

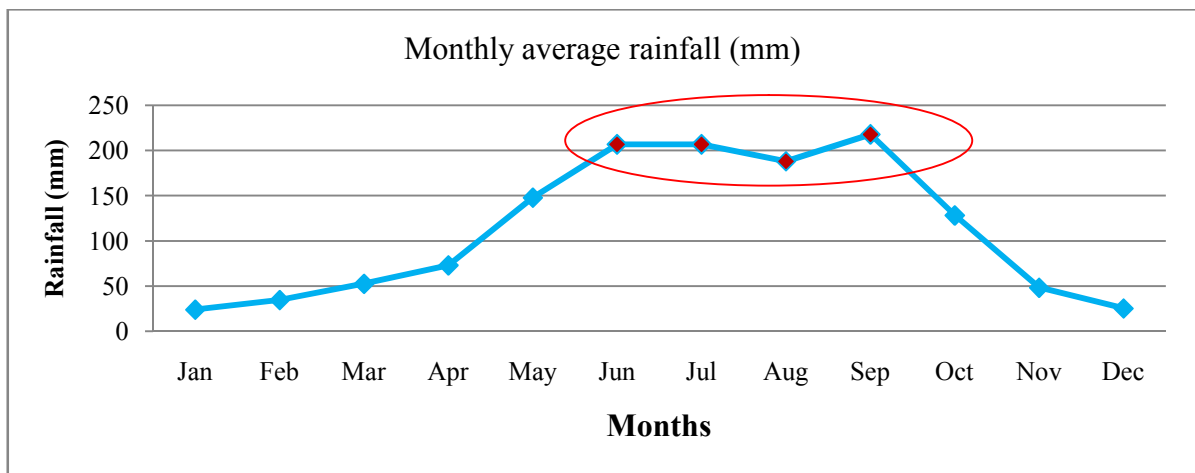


Figure35: Monthly average rainfall from 1980 to 2014 in the study area, Jessore.

But 20% fishers reported that rainfall pattern create breeding problem for local indigenous fish. Naturally fishes contained ripe eggs at the month March to mid-April and spawn immediately after rain started. But due to climate change rain pattern has changed and rain has come little late. So the native fish species could not breed properly and the amount of them has decreased. On the other hand, fishing technology improved day by day. For example introduction of current net and other small mesh size net has capacity to yield more fish. Fishers reported that small fish fry even fish eggs were yield by using hand net one kind of net contain small mesh size.

3.3.1.3 Temperature

Maximum respondent claimed that there has no effect of temperature on *baor* fish culture and management but agreed that temperature is increasing day by day. One fisherman who also worked as guard and was former authority of *baor* management claimed that increase of temperature increase the fry mortality after stoking in *baor*. All of the fishers agreed that every year a lot of fry has died after release in summer. They reported that fry died after rotten their gill and they also reported it to the fisheries officers but no result has come. From the analysis of temperature data of the study area it resulted that average maximum temperature has increased 0.5 to 0.6°C from 1980 to 2014. The average maximum temperature of 1980 to 1995 was 31.44°C where the average maximum temperature of 1995 to 2014 was 31.99°C. Among the data average maximum temperature was lowest in the year 1981 (30.61°C and highest in the year 2009 (32.92°C) (Figure 36).

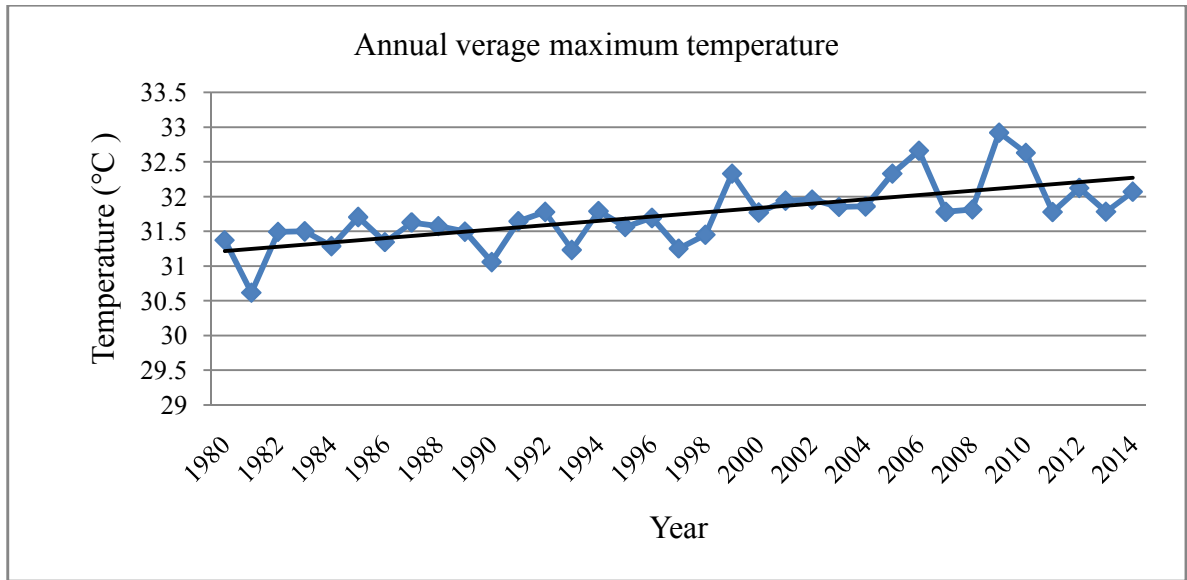


Figure 36: Annual average maximum temperature from 1980 to 2014 in the study area, Jessore

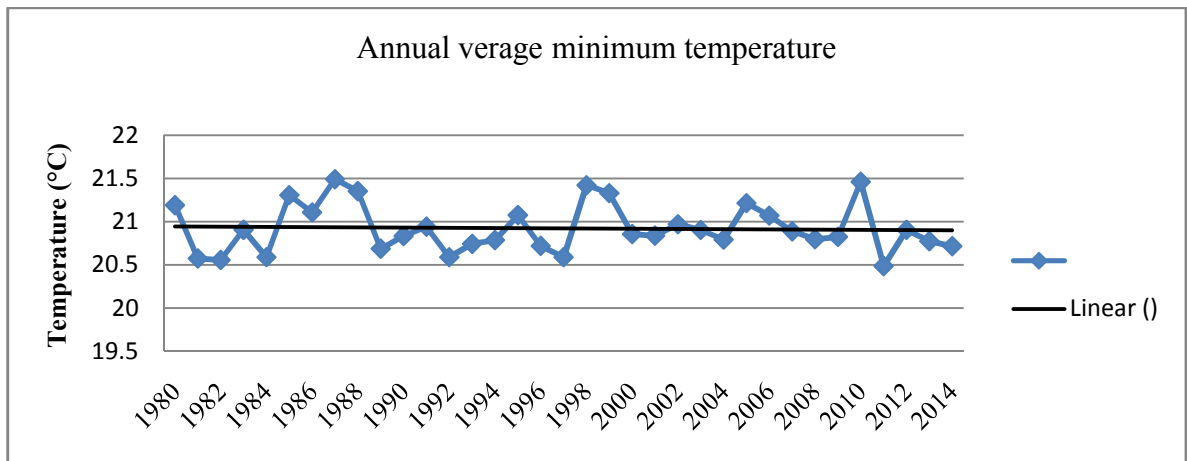


Figure 37: Annual minimum average temperature (Degree Celsius) of Jessore district (Source: Bangladesh Meteorological Department).

3.3.2 Institutional barriers

3.3.2.1 Leasing system

Leasing system of *baor* has been practiced since the period of landlord (1900-1950). That time the employer and relative of the landlord have got lease of the *baor*. It was the first leasing system and negotiation history of *baor fishers*'. They had eradicated the distressing and aquatic weeds and harvested fish from *baor*. Fish production of *baor* depended on nature. But after the period of British regime, the power of landlord has decreased and the local fishermen protested the landlords. After the extinction of *Jamidar* tradition and followed divided of India and Pakistan fishermen can harvest fish from *baor* freely. The Muslim came forward to take lease the *baor* in the middle of 1950 decades. Huge number of poor fishermen involved into fish harvest and fish marketing at that time (DFO, 2015).

In the Pakistani period 1960s fish culture in derelict pond and public freshwater started by developed fisheries act. There were some projects to develop *baor* fisheries resources (Government *Jalmahal* Management Policy 2009).

Expanded reclamation scheme (ERS) 1961-1967 was one of the early experimental schemes of *baor* fisheries development. Under this scheme some *baor* of Jessore district has maintained by the district and upazila fisheries officers. All the responsibilities such as fry stocking, fish guard and harvesting depended on the local fishermen but government provide them financial help. Fishermen have harvested the culture fish by their own net and boat and have got 25% of the harvested fish (DFO, 2015).

Development and management scheme (DMS) 1968-1978 has taken to develop *baor* fisheries resources in ten *baor* of south west region of Bangladesh. Under this scheme all the surrounded fishermen were categorized. Government provided money for fish stocking and fishermen could harvest by catch by paid BDT 10 firstly which increased in BDT 40.

Fishermen had chance to harvest cultured fish and had got 30% share firstly which increased 40%. Under this scheme fish production increased but fishermen didn't get proper benefit. *Results and discussion*

Ox-bow lake project-1 (OPL-1) 1979-1986 was another scheme to development of six *baors* fisheries resources by the help of the World Bank under Ministry of fisheries and livestock. The goal of that project was to develop socioeconomic status of the fishermen by development infrastructure of *baors* and applied scientific knowledge. Under this project *baors* were directly management by the Department of Fisheries via local fisheries office. Government established hatchery for fry production and also provided other technical help if necessary. District fisheries office also helped fishermen in formatting *baor* management committee. Management authority considered 5 times more production than the amount of fry they release. Only license holder fishermen could harvest fish from this *baor*. Fisheries office provided license surrounding fishermen by a small amount of fee. Fishermen had got 40% share of the harvested fish and other 60% has gone to the government. Among that 60% share department of fisheries has got 35% and Ministry of land has got 25% of the share. Local fishermen could harvest by catch freely without any share (DFO, 2015).

Ox-bow lake project-2 (OPL-2) has taken after OPL-1 in the year 1988 to 1997 within 22 *baors*. At first 30 *baors* were selected for OLP-2 but DoF could manage only 22 *baors* for this project. At first the study area *Jhapa baor* were selected for OLP-2. Relevant authority claimed that some local musclemen obstructed in that who finally took lease of the *baor* form Ministry of land (DFO, 2015).

Under this project government lease the *baor* to the local fisher's community. Leasing money has increased 10% every year. In this project management depended on fisher's community but government provided technical help. All the responsibilities and activities were depended on local fisher's community under OLP-2 (DFO, 2015).

Baor leasing system has a long and complex history in Bangladesh. It is predicted that from the beginning of formation of *baor* local fishermen has free access to fishing and no fish has cultured. During the period of British regime, the central British government provided the *baor* to the local landlord (*Jamidar*) to establish their regime. Most of the *baor* were covered

by distressing and aquatic weeds. In rainy season fish came from nearest river and canal sometime local landlord stocked some fish for recreation. Traditional Hindu fishermen could harvest fish where one fourth of the catch got the landlord (DFO, 2015).

Government jalmahal management policy 2009

Government of Bangladesh has redialed *Jalmahal* policy 2009 to create a favorable condition for the fishermen in public water body as well as development and protection of public water fisheries resources.

Real fishermen

According to the *Jalmahal* policy 2009 real fishermen refers the person who catches fish from natural sources and sale mainly for livelihood. This definition was supported in the study area. Beside them fishermen included lower caste Hindu *Rajbonsi*, *Malo*, *Halder* who are traditionally lived on fishing.

Fishermen community

According to the *Jalmahal* policy 2009 fishermen community refers a tidying accumulation of real fishermen which is registered by the local co-operative directorates. If any member of the fishermen community is not real fishermen that community will not consider as real fishermen community. Only the real fishermen community has the capability to take lease of *Jalmahal*. According to the *Jalmahal* policy 2009 any single person or unregistered organization can't take lease a *Jalmahal*.

Jalmahal

According to the *Jalmahal* policy 2009 *Jalmahal* refers these water bodies which contain water all year long or a certain tart of the year and these may open or close. Open *Jalmahal*

has certain boundary for example *Haor*, *Baor*, Pond etc. closed *Jalm* *Results and discussion*
such as river, sea etc.

According to the *Jalmahal* policy 2009 only the nearest fisher's community of a resource can get lease it by creating an association. No single person or unregistered association can take lease the resource. Only the real fishermen can get lease the resources but determine of real fishermen is difficult. The area of the *Jalmahal* more than 20 acre leased by the district *Jalmahal* committee on behalf of Ministry of land. In the study area both *baors* were more than 20 acres and district commissioner maintained the leasing system. But there were some leasing problem in *baors* which effect on livelihood of fishermen.

Leasing system is very important issue for livelihood of *baor*fishers' and *baor* management. Leasing system of *baor* of the study area was a big problem for management and fishers livelihood. There was various leasing system of this resource. According to the *Jalmahal* policy 2009 ministry of land gives lease this *baor* to the nearest fishermen community via district commissioner. There are two type of *baor* leasing management, where some *baor* were leased by Department of fisheries and other *baors* were leased by Ministry of land.

In *Jhapa baor*

In *Jhapa baor* practiced community based fisheries management (CBFM) for fish culture by a local fishermen association named "*Jhapa Matsajibi Somoboy Samiti Ltd*". There are 180 members of the association who were fully dependent on it. Some respondent reported this 180 member formatted only for show up to took lease. Actually only 10-15 stakeholders managed the *baor* other member of the committee were inactive. They didn't get any facility from the *baor* but they were owner officially. On the other hand in the study area a lot of fishers involved in *baor* fishing and they built more fisher's co-operative association. In *Jhapa baor* area there were about 8 fishers associations around the *baor* but only one got lease of the *baor*, other fishermen deprived from their right. Fishermen reported that that situation increased conflict among them. Fishermen also suggested that if the leasing authority monitored regularly at the site that problem may be solved.

There were many fishers community who have ability to get the *baor* lease but only one get lease. As the leasing money of the *baor* was very high so the poor fishermen involved rich local powerful people as stakeholder to get the lease of the *baor* easily. These rich non fishermen involved with *baor* fisheries management association and provided most of the leasing money. Then they were interfered all management policy in *baor* and real fishermen participation has declined.

In the study area 60% respondent reported that poor fishermen tried to involved local rich and powerful people as they had no money to take lease or fish culture. Although they conceded it was harmful for them, they did it to get lease of the *baor* and to avoid conflict with surrounding people. They also reported that after involving these rich people real fishermen has lost the power management discussion. Generally fishermen are considered as poor and frightened population of the society. They always try to involved local powerful people to avoid unnecessary conflict with part-time fishermen who were not involved with share and other management problem.

Some 20% fishermen reported that most of the time local powerful people have inspired poor fishermen to organize an association by which they could get lease the *baor*. Most of the financial help came from the powerful people, fishermen contribute very small amount of the leasing money. *Baor* management association contributed only the membership fee of the committee. Among the members who could contribute a significant amount of money for *baor* leasing, only they can involve in management committee rather than all member. So all the members officially involved in the *baor* but were not involved in management committee. In *Jhapa baor* total 180 members were involved in *baor* leasing association but only 10-15 involved in management committee other members deprived from it as they could not contribute any money during lease and they acted as normal part-time fishermen.

Relevant authority claimed that at first the study area *Jhapa baor* were selected for OLP-2 but some local musclemen obstructed in that who finally took lease of the *baor* from Ministry of land. District fisheries office also reported that if they were able to took the *baor* under this project then the leasing money were not too high and the real fishermen would

get more benefit from the *baor*. One staff of district office reported that it for their own benefit rather than the fishermen. *Results and discussion*

In *Perkhajura baor*

There were also some more problems in *Perkhajura baor* beside the previous mentioned problem in *Jhapa baor*. This *baor* area was 230 acre among this area 164.5 acre area was under private ownership and 65.5 acre was under fisheries community named “*Maswimnagor Matsajibi Somoboy Samiti Ltd*”. Private ownership has gone by taking lease from the former landlord of this region at 1950s. The duration of this lease is 61 years and it will be end at 2021. Fishermen community got 27% share of cultured fish. But these dual leasing processes of a *baor* create a critical management situation. Conflict between private owner and fishermen community was common phenomenon there reported by the fishermen. As most of the share of the *baor* was under private ownership so they took most of the management decisions. Fishermen reported that private owner was powerful and they obstructed fishing freely by catch. Fishermen also reported that powerful men sometime harvested fish by power. On the other hand private owner claimed that sometime fishermen used to Poaching culture fish. Poor fishermen in *Perkhajura baor* area wished to get lease full *baor* under fishers’ community after finished the private lease in the year 2021. Real fishers will get more benefit if the total *baor* goes under their control.

3.3.2.2 High leasing money

Leasing money has a great influence on *baor* fisheries management as well as livelihood of fishers. If the leasing money is very high then stakeholders adopt more restriction on fishing of part-time fishers. In the both *baor*s was managed by fisher’s community. *Jhapa baor* practiced community based fisheries management (CBFM) for fish culture by a local fishermen association named “*Jhapa Matsajibi Somoboy Samiti Ltd*”. Where *Perkhajura baor* practiced both privately and community based management. In the study area two *baor* leasing money has a massive variation.

The leasing money of *Jhapa baor* was very high, which was one of the major obstacles for *baor* management. Before the year 2006 *Jhapa baor* leasing money was tolerable. During the caretaker government of Bangladesh in 2006 district commissioner offered open tender for leasing the *baor*. This rule was the starting of suffering of the poor fishers. Where the leasing money of this *baor* before open tender was BDT 450,000 it increased in BDT 3,700,000 after open tender. Including the vat total amount of leasing money reached BDT 4,200,000. Poor fishers had not ability to provide this money to take lease. It was the chance for the rich, powerful people as well as the politician to take lease the *baor*. At first the wealthy musclemen offered high leasing money to get the *baor* as it was an open tender. Taking lease of the *baor* in high leasing money stakeholder restricted fishing to the local poor fishermen and excused financial loss due to high leasing money. Most of the fishermen have tolerated this deprived as most of the stakeholders were musclemen and politician.

According to the “Government Jalmahal management Policy 2009” ministry of land gives lease this *baor* to the nearest fishers’ community via district commissioner. Fishermen of the study area reported that this rule was effective but also have some problems. As the leasing money has increased fishers communities were not able to provide enough money. So they had to take help from the rich and then the management authority delivered to the rich powerful people.

Perkhajura baor was not under open tender so the leasing money was not so high. The leasing money of the *baor* was BDT 464862 which increased every year with a consistence rate. The leasing money of *Perkhajura baor* was not a big fact reported by the fishermen. The main problem of was to select *baor* management authority (Private and fishers community).

Fishermen also reported that biodiversity and natural balance of *baor* also hampered due to high leasing money. As leasing money was high stakeholder tried to culture fish in high density and fast growing fish which has negatively affected the indigenous fish species. This densely stocking of fast growing cultured fish competed with indigenous fish for shelter and food. They also harvested more indigenous fish for their profit. These conditions paved the

way to extinction of indigenous fish species. Beside this more restriction adopted due to high leasing money and leasing system.

Results and discussion

The *baors* leased from Ministry of land, the criteria to selected management authority were leasing money with local fishers' community. But the real fishers did not have enough money so they were only a catalyst to get the *baor* of the local powerful people. So local powerful men and politician who have enough money and power have got lease with the help of poor fishers. Management authority always tried to get maximum profit without any concerning about environment, biodiversity or poor fishermen. Some respondents reported that in this kind *baors* government or fisheries administration did not involve directly so the management authority has taken the chance to misuse of the resources. District fisheries officers reported that total production of the *baors* leasing from Ministry of land was higher than the *baors* under OLP but the fishers were more benefited from the *baors* under OPL.

3.3.3 Social barriers

Main social barriers of *baor* fisheries management were Poaching, restriction on fishing, conflict between fishermen and stakeholder, and illiteracy.

3.3.3.1 Poaching

Poaching of culture fish from the *baors* was big problem to *baor* fisheries management reported by entire stakeholders. Poor fishermen have the permission to harvest bycatch freely by some specific fishing gear such as set net, fishing trap and line. If any cultured fish has trapped in fishers gear they should release it. But management authority claimed that fishermen didn't release it rather they caught it secretly. Beside that some fishermen also caught culture fish by prohibited net. *Perkhajura baor* management authority also claimed that sometime local muscle man harvested culture fish by compelled. Sometime they hurt the guard and break down the guard's boat.

3.3.3.2 Restriction on fishing

There were some restriction on fishing from *baor* and that restriction came from *baor* management authority. *Baor* authority banned fishing 15days to 1 month during stock fry. The reported that if fishermen continue to harvested fishing there were a change to harvest stocked fry and increase fry mortality. *Baor* authority mainly banned net fishing during but there was no restriction on fishing by trap. Some fishermen reported that the banned period was longer than required. This long time fishing banned hamper the socioeconomic status for the fishermen. Fishermen reported that 1 week bandwas enough but *baor*authority banned 15 to 45 days.

3.3.3.3 Conflict

Conflict is a common characteristic between the fishermen and the *baor* management authority. *Baor* management authority claimed that some fishermen involved in fish poachingand continued fishing during banning period which caused decrease the cultured fish production. Beside the fishermen claimed that the banning period of fishing during stocking period was longer. Fishers reported 1 week that banning period during stoking fish was enough to survive fry but management authority boned 15 days to 1 month. This long banned period affected their livelihood. On the other hand fishermen also claimed that *baor* management authority only allowed set *net along* the bank of the *baor* for fishing which was sufficient only for rainy season. But in the winter season when the water level has gone down then setting *net along* the *baor* bank was not enough for get enough fish. Fishermen wanted to set *net along* the wide of the *baor* in the deep water. But *baor* authority prohibited that reported that setting net in deep water was harmful for culture fish. That situation increased the conflict between *baor* authority and the fishermen.

Fishermen reported that if government fixed the banning period then the situation can be improved. They also reported that if government should provide some financial help at the banning period toimprove the present situation.

3.3.3.4 Low education level

In the study area about 70% of fishermen education level was below primary (Figure 6). Among them about 35% fishermen were illiterate. Low literacy rate of *baor* management authority and fishermen also was responsible for poor *baor* management. High illiteracy rate was also responsible for the remote condition of the fishermen. People of the study area reported that fry mortality during stoking period in summer responsible for lack of proper knowledge of stakeholder. For lack of proper knowledge they did not know about stocking time, stocking strategy and fry handling strategy.

Most of the fishermen reported that they are deprived from the *baor* management authority for lake of education. Officially 179 people are member of *baor* management committee but more than 150 members ignorant about the management policy. Very few (about 10-15) members were involved in *baor* management. If other members intended to know the management policy they always deprived from the stakeholders. One fisher reported that “management authority get chance to deprive us because we are illiterate”.

Beside this here was no accountability and transparency between fishermen and stakeholder through monthly meeting. Fishers reported that when they wanted the account of the *baor* to the management authority they neglected them and showed financial loss due to flood or other causes. Poor fishermen who were member of the management committee reported that they didn't get any profit from the culture fish production. Some fishers reported that management authority gave them small amount of money (BDT 200-1000) in religious occasion such as Eid or Puja. They also said that management authority also helped them by money or fish if any family member of the fishers has died. But that support was not sufficient for them where they the *baor* took lease on behalf of the fishers. One agitated fisher reported that “If we were educated it was not possible to deprive us”.

3.3.4 Economical barriers

3.3.4.1 Low income

The main economical barrier was the low income of the *baor*fishers which led their bale livelihood condition. The study of socioeconomic status of fishers of the study area was poor, which was the major factor for deprived fishermen. Monthly average income of the fishers household in *Jhapa baor* area were BDT 8930 and in *Perkhajura baor* area were BDT 7880 (Table 3) which were lower than the national level. On the other hand the leasing money of *baor* was high fishers' communities were not able to provide enough money. So they had to take help from the rich and powerful people. Then the main management authority delivered to the rich powerful people. Thus the poor fishers were deprived from taking lease of the *baor* due to low income.

Most of the fishers lived hands to mouth and 60% of fishers household have no agricultural property (Table 4) who always suffered in depression for earning. Everyday fishermen had to fish or work in agriculture land to maintain their family. If they did not catch fish or had no work they had to borrow money from other or arrear to the shopkeeper. So the fishermen always tried to involve with job. The poor fishermen always suffer insecure if the stakeholders adopt more restriction on fishing. That was the cause fishers could counterblast against the stakeholder. Some fishermen claimed stakeholders adopt more restriction as they knew that fishermen can't protest them. Some fishermen reported that they tried to protest these malpractices but they could not do it for lack of manpower. They also reported that, although fishermen know they are deprived by stakeholder, they are apathetic to protest this condition for fear of their livelihood. Most of the fishermen thought that it is fruitless and time loss rather they did other job. One fisher said "I know that management authority has deprived me but I can't protest them in the fear of, if they adopt more restriction on fishing then what I can do? I can't do anything without fishing".

There were some other problems for low income of fishers in *baor* management. All of the committee members and some fishermen reported that the management authority had not

enough money to pay the leasing money. All of the respondents of the stake holders and some fishermen reported that management authority had gone a commitment with the hatchery owner to release fry at high price in *baor*. They also reported that a big portion of benefit has gone to the hatchery owner as the release fry in time without full payment. So at first management power has handed over for lack of leasing money then profit has gone due to lack of money to release fry in *baor*.

CHAPTER 4: CONCLUSIONS AND RECOMMENDATIONS

Bangladesh is an overpopulated country with limited resources. A considerable portion of population of South-Western Bangladesh depends on *baor* fisheries resources for their livelihoods. The natural resources of *Jhapa baor* and *Perkhajura baor* still offer a variety of economic opportunities for the people living around the *baor*. The aim of this study was to assess the current status of two ox-bow lake (*baor*) fisheries in Jessore and barriers to their management.

This study found that the socio-economic conditions of the *baor* fisheries dependent households were not good. Their incomes were less than the national average with single earning member household and dependency on micro-credit. The quality of their houses was not good and most did not have land except homestead. Although most of them had access to safe drinking water, few had access to quality health services and sanitary latrine. Their education levels were very low – 70% fishers had no or below primary level education. Although currently most of their children are school going (72% in *Jhapa* and 62% in *Perkhajura*) and their percentage is increasing gradually. This study also found that both aquaculture and capture fisheries are present in both *baors*. Only lease holders had access to culture fish harvesting while anyone was eligible to catch the capture fish as common property resources.

This study found four categories of barriers to *baor* fisheries management - climatic barriers, social barriers, institutional barrier and economical barriers. These are:

Climatic barriers: Flood, rainfall pattern, siltation

Social barriers: Poaching, restriction on fishing, conflict between fishers and stakeholder, illiteracy

Institutional barriers: *baor* leasing system, high leasing money, local fisheries officers neglect and

Economic barrier: low income.

Although fish production has increased in the study area fish fauna of the *baors* was being drastically reduced due to environmental and human intervention such as over fishing, flood, siltation, use of banned gear like very small mesh size fishing nets, indiscriminate use of gears and as a whole due to absence of proper management policy.

The present management system of both *baors* was influencing the socio-economic conditions of surrounding fishers household which were not satisfactory. The fishers were deprived of many amenities. The government should take initiative on proper licensing system for the genuine fishers, involvement of GO and NGOs for training them to improve their socioeconomic condition and incorporation of lion's share for the fishers in the management process. The findings of such a study could also contribute to an understanding of these issues in other *baors* of the Bangladesh with similar environmental, socio-economic and livelihood conditions.

Flood was the main climatic problem of baor fisheries so it needed to be solved for better livelihood of fishers. Daggaring of *baor* adjacent *Kapotakkho* River and embankment of *baor* can prevent flood.

Fishers' unfavorable leasing system and high leasing money were the main institutional barriers for baor management. High leasing money restricted the poor fishers from fishing and increase conflict between fishers and stakeholder. To solve these barriers it needs to ensure that real fishers get lease of the *baor* and *baor* leasing money should reduce to minimize restriction on fishing and conflict between fishers and stakeholder. Poor fishers will able to get their proper rights by increasing literacy rate and providing financial help to them. Local fisheries offices and NGO can play a major role to improve fisher's livelihood by providing technical and financial help to them.

Although the fish production of the *baor* increases but indigenous fish species has decreased. As indigenous fish has decreased due to improper culture management fish sanctuary should build up to ensure breeding ground of bycatch fish to protect them from

extinction. So the solution mention above should follow to solve the barriers and improve the management system and socioeconomic status of fishers.

Moreover considering the study it can also conclude that for the overall development of the socioeconomic and cultural development of the fisher's scientist, policy makers and relevant authority should be more focus on the backward and forward linkages development. A proper extension linkage mechanism should be developed between the extension personnel's of the State Fisheries department and the fishers for effective transfer of technologies and should ensure that a maximum number of fishers should participate while organizing any training facilities at the village level.

Scope and limitations

It also considered as the natural habitat and breeding ground of different indigenous fishes other than major carps (Abdullah-Bin-Farid *et al.*, 2013). Beside this some Indian major carps and Chinese carps have also cultured in baor. There was apprehension that proper management, such as introduction of large-scale stocking of carps in the oxbow lakes might have imbalanced the lake ecosystem and lake biodiversity leading to an adverse impact on non-stocked indigenous fish (Ali, 1997). During the study the study area was over flooded so measure of biodiversity was not possible. So the study of biodiversity of *baor* habitat is necessary to estimate the present status of indigenous fish species and find out the pathway to protect them.

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APPENDICES

Appendix 1: Fisher's Livelihoods

Age distribution

Age structure and gender distribution knowledge of fishers is important to estimating the potential productive human resources. 30 to 40 years is the dominated age group of fishers in Bangladesh which denote the human potentiality of this sector. Islam, *et al.*, (2013) reported that the mean age of the respondents was 35.22 ± 9.67 years at Monirampurupazilawhere 54.17% belonged to age group 31 to 40 years. It was found that 27% of fishers were 31-40 year age group, 15% were below 20 year, 20% were 20-30 year, 24% were 41-50 year, 11% were 51-60 and 3% above 60 year of age at *Basantapurbeel* (Alam, *et al.*, 2009). Sarkar *et al.*, (2008) conducted a survey at *Mokash beel* in *Kaliakoir* Upazila of *Gazipur* district and reported that most fishers were quite young. Bhaumik and Saha (1994) reported that age structure of fishers at the *Sundarban* was ranged from 20 to 70 years.

Occupational status

Labor employment in fisheries sector has been increasing approximately by 3.5% annually (Ahmed). In Bangladesh there were both full time (fishing > 6 months in a year) and part-time (Fishing < 6 months in a year) fishers. Fishing is the main occupation for the full time fishers. The study of *Basantapurbeel* has reveal that 48% of fishers were engaged in fishing as their main occupation, 24% is in agriculture, 15% in business, 5% in daily labour and 10% were engaged in other occupation (Alam *et al.*, 2009). All the respondents had more than two occupations founded by Islam *et al.*, (2013) while he studied with fishers at Monirampurupazila. Major primary occupation (in terms of income) was fishing and this was found for 90% respondents he also reported that majority respondents did not give up

the profession of their ancestors. Kostori (2012) mentioned that this tendency of involving into a different occupation is high during off-fishing season. Sarkar, *et al.*, (2008) conducted a survey at *Mokash beelin Kaliakoir Upazila of Gazipur* district and reported that professional (full time) fishers 50%, Seasonal professional fishers 40% and Subsistence fishers 10% on that area. This finding indicates that number of fishers increased due to poor economic condition, over growth of population, lack of employment opportunity, lack of awareness and poor education (Bhaumik and Pandit, 1999).

Religious status

In an area religion has great impact on the socio-cultural activities of residence. In Bangladesh the Muslim is the dominant religious group followed by the Hindu. However, it was a common trend in Bangladesh that almost all the by-born fishers or fishers' community were belonging to the Hindu (Islam *et al.*, 2013) mainly the cast included *Rajbonshi, Malo, Barman, Halder* etc. Alam, *et al.*, (2009) found that 93.33% of the fishers are Muslim and the remainder 6.66% are Hindu with no Buddhists and Christians at *Basantapurbeel*. Saha (2004) found in his pond survey in *Tangail* upazila, 86% pond farmers were Muslim and 14% were Hindu. Sarkar, *et al.*, (2008) conducted a survey at *Mokashbeelin Kaliakoir Upazila of Gazipur* district and reported that 66% of fishers were Muslims and the remainder 34% were Hindus with no Buddhists or Christians. On the other hand it was found that all of the fishers were belonging to the Hindu religion in the *BaluharBaor, Jhenaidah* (Abdullah-Bin-Farid *et al.*, 2013).

Family type and size

The family functions as a unit for income generation, consumption, reproduction and social interaction. There were variations in family type of fishers around Bangladesh. BBS 2011 reported that national mean family size was 4.4 members in Bangladesh specifically 4.2 members in Jessore district. Dutta (1893) found at *Rajshahi and Pabna* districts that most of the families of fishers are nuclear (51.11 %) followed by 33.33 % are joint and 15.53 %

extended family. Alam, *et al.*, 2009 found that 75% fishers had family size of 5-7 members, 15% had <5 and 10% had their family size of 8-10 members at *Basantapurbeel*. Saha (2004) found in his pond survey in *Tangail sadar* Upazilathat the average family size was 5.65. Where Islam *et al.*, (2013) reported that the mean family members were 3.60 ± 1.34 (2 to 8) in each household of fishers in Monirampurupazila. Almost similar results also reported by Halder *et al.*, (2011) and Kostori (2012) while working with fish traders and fishers of the *Chala beel* respectively.

On the other hand (Abdullah-Bin-Farid *et al.*, 2013) found that 58% fishers' families were joint family at *Baluhar baor* area. Ali *et al.*, (2009) in *Mymensingh* district found that 42.5% of the fish farmers lived in nuclear family and the rest (57.5%) in joint family. Das and Hossain (2004) and Hossain (2007) conducted a study in *Gazipur* and *Mymensingh* district, respectively and found joint families in maximum cases.

Daily income

Income is the most important factor for better understanding of the socio-economic conditions of fishers (Kostori 2012). BBS 2011 reported that people average monthly income of Bangladesh BDT 11480 where in urban area people monthly income BDT 16477 and in rural area people BDT 9648. The daily incomes of most of the fishers are range of BDT 100-150 per day at *Basantapur beel* (Alam *et al.*, 2009). He also said that the income of the fishers is little bit higher than the national average income of BDT, 22,500 (BBS, 2002).

(Abdullah-Bin-Farid *et al.*, 2013) found that annual income of the fishers varied from BDT 15,000 to BDT 60,000+ at *Baluhar baor* area at *Jhenaidah*. He selected fishers were grouped into four categories based on the level of annual income and found that majority (40%) had an annual income of BDT 46,000-60,000. Mean annual income was found BDT $43,800 \pm 15,018$. Flowra *et al.*, (2009) found that the income of a fisherman community of the *Dahia beel* under *Natore* district was BDT 51 to 75 daily (annually BDT 18,600 to 27,400). Islam *et al.*, (2013) reported that the mean monthly income of the household in Monirampurupazilawas BDT 9470 ± 4806.89 . Another study, Kostori (2012) stated that at the time of peak fishing, majority fishers (50%) earn BDT 200-250 per day at *Chalan beel*.

Low product price, lack of water in dry season and lack of marketing facilities are the dominant problems for fishers (Haider, 1995).

Educational status

Educational status is an important parameter to measure social status of a region or community. Educational status of fishers in Bangladesh status of is very poor. BBS 2001 showed that in national literacy rate of Bangladesh was 47.68% where in rural 44.70% and in 60.19%. Person who is able to write a simple letter is defined as literate. BBS 2001 reported that literacy rate of Monirampur upazila literacy rate was 50.76%. Overall education rate of fishers in Bangladesh lower than this rate. Zaman *et al.*, (2006) found 23.3 % illiterate among the fishers' of the *Mohanpur Upazila in Rajshahi* district. A study at *Baluhar baor* Abdullah-Bin-Farid *et al.*, (2013) found that fishers was can sign only (37%) followed by up to primary level (31%) and so on. Mahbubur., (2001) reported that 68% of hoar fishers were illiterate, 28% up to primary level and 4% had only secondary level education. Alam, *et al.*, (2009) found that are illiterate (44.44%), some of the fishers only can sign but illiterate (33.33%), 13.33% fishers education level was up to primary and 8.88% fishers were from secondary level and there was not a single fisherman from higher secondary or above in the *Basantipur beel* area. Another study at *Mokash beel* in *Kaliakoir Upazila of Gazipur* district by Sarkar *et al.*, (2008) reported that 52% of fishers were illiterate, 34% had primary level of education and only 14% S.S.C level of education. Shahjahan *et al.*, (2003) observed the educational level 66.33% of riverine fishers were illiterate, 31.67% were up to primary level and 5.00% only secondary level.

Housing condition

Household status refers the livelihood characteristic of people. The housing status of fishers was not satisfactory. Three types of houses of fishers were identified, i) earthen ii) Tin shade houses iii) Concrete in Bangladesh. Most of the fishers in Bangladesh lived in earthen house. About 82.22% of housing structures of fishers in *Basantipur beel* area were earthen while 11.11% were semi-Concrete and only 6.66% were Concrete (Alam, *et al.*, 2009). A study at *Baluhar baor* Abdullah-Bin-Farid *et al.*, (2013) found that Housing condition was

dominated by earthen(74%) in *Baluhar baor* area *Jhenaidah* district. Another study at *Mokash beel* in *Kaliakoir* Upazila of *Gazipur* district, 62% of housing structures were earthen while 34% were semi-Concrete and only 4% were Concrete reported by Sarkar *et al.*, (2008).

Health facilities

Health facilities are also an important parameter to measure the status of livelihood. Among other facilities health facilities status of fishers was worse in Bangladesh. Alam, *et al.*, (2009) reported that the fishers of the *Basantapur beel* were poor and health condition was not satisfactory and it was found that 75% of fishers households were depend on “village quack” that did not have any knowledge on medical science. Only 20% usually get health service from the Upazila Health Complex and 5% have medical services from MBBS doctors. The (Abdullah-Bin-Farid *et al.*, 2013) found that highest proportion (82%) of fishers depended upon village doctors at *Baluhar baor* area at *Jhenaidah*. Shahriar *et al.*, (2010) found in the *Morgangi Beel* area 64% of the fishers’s households were dependent on village doctors, 24% of the fishers got health service from upazila health complex and remaining 12% got health service from MBBS doctors. This difference could be due to low income the lack of knowledge of the fishers concerned and health facilities that were enjoyed by the fishers were not satisfactory at all (Abdullah-Bin-Farid *et al.*, 2013).

Drinking water and Sanitary facilities

Among other parameter of social status drinking water facilities status of fishers was better. Alam, *et al.*, (2009) reported that 48% fishers were found using only tube-well, 28% tube-well and well and 22% fishers use tube-well and pond water for their household purposes. (Abdullah-Bin-Farid *et al.*, 2013) found that showed that household (HH) of 100% fishers used tube-well water for drinking and among them, 96% HH used owned tube well, and remaining 4% used tube-wells belonging to others at *Baluhar baor* area at *Jhenaidah* .

It was observed that the fishers’ sanitary condition was very poor. About 55.55% fishers had earthen sanitary latrine, 26.66% semi-Concrete, 5.5% Concrete, and 6.66% close pit, 4.44% open pit latrine and 2.22% still used open field for his sanitation. The present study reveals

that the sanitary conditions of the *beel*fishers were not satisfactory than rice-fish farmers in *Mymensingh* district where Podder (2005) in her study found that 58% of the rice-fish farmers had semi-Concrete, 10% had earthen/open and 17% had Concrete sanitation facilities. Shahriar *et al.*, (2010) was found that 68% of toilets were earthen while 18% and 6% were semi-concrete and concrete and 8% of the fishers had no sanitary facilities in *Morgangi Beel* area. Ali *et al.*, (2009) found that 62.5% of the farmers had semi-Concrete, 25% had earthen and 12.5% Concrete sanitary systems *Mymensingh* district.

Credit access

Credit activities of fishers extremely related with the livelihood of fishers. A big portion of fishers related with credit organization for saving or taking loan. Islam *et al.*, (2013) reported that a vital portion of the fisher's community (46%) was involved in NGOs to take loan from these organizations and deposit their savings while he studied with fishers at Monirampur upazila. He also showed that the mean loan amount was BDT 9,856.52 ± 10,826.56 (BDT 1,000 to 55,000). Interest rate of NGO loan was reported too high by all the fishers. Alam *et al.*, (2009) reported that the national and local NGO like BRAC provide credit only to the organized poor members for purchase fishing gears and boats. After repayment only 52.63% became self-sufficient who do not need financial help but 7.89% borrow money from their neighbors, 15.78% from relatives, 18.42% from NGOs and 5.26% from co-operatives for their fishing business. In a study by Zaman *et al.*, (2006) it was revealed that poor fish farmers had no access to bank loan due to lack of mortgage assets.

Appendix 2: A semi-structured questionnaire for fishers' household interview

A semi-structured questionnaire for identifying the socio-economic status of fishers depended on Ox-bow Lake (*baor*)

Respondent ID:

Date:/...../.....

Name of the *Baor*:

Personal information

1. Name of the respondent:
2. Father's name:
3. Address: a. House: b. Village:
4. Phone no. (if any):
5. Age:
6. Gender: a. Male b. Female
7. Religion: a. Muslim b. Hindu c. Others
8. Number of household member(s):
9. Number of earning members in the household:
10. Educational qualification of the respondent:
 - a. Illiterate b. Primary
 - c. Secondary d. Higher secondary and above

Information on socio-economic status

11. Average monthly household income

Household member (s)	Source of income	Income (Taka/month)
	Fish from <i>baor</i>	
	Fish from other sources	
	Fish culture other than <i>baor</i>	
	Agriculture	
	Business	

	Service	
	Others	

12. Average monthly household expenditure:

Area of expenditure	Expenditure (Taka/month)
Food	
Health	
Accommodation	
Education	
Others	

13. land ownership status (in decimal)

- a. Agricultural
- b. Homestead
- c. Water body

14. Ownership status of the house:

- a. Owned b. Rented c. Free use

15. Type of house:

- a. Earthen b. Semi Concrete c. Concrete

16. Type of latrine in the house

- a. Sanitary b. Ring/slab c. Open latrine d. None

17. Source of drinking water

- a. Deep tube-well b. Shallow tube-well c. Well
- d. Surface water e. Rain water f. Tap water

18. Source of water for other household activities

- a. Deep tube-well b. Shallow tube-well c. Well
- d. Surface water e. Rain water f. Tap water

19. Do you have own tube well?

- a. Yes b. No

20. Source of light (main two sources)?

- a. Kerosene b. Electricity c. Bio-gas
- d. Candles e. Solar lamp f. Battery powered light
- f. Solar power h. Others.

21. Do the children of your household go to school?

- a. Yes b. No

If no, why?

22. Where do you go for health facilities?

- a. Local village doctor b. Upazilahealth complex c. Both d. Other (please specify).....

23. Do you have any savings? a. Yes b. No

24. Do you receive any credit?

a. Yes b. No

If yes,

Source	Purpose	Amount

25. Are you satisfied with the current credit support?

a. Yes b. No

Why/ why not?

26. Are you or your family member of any credit organization?

a. Yes b. No

If yes,

Name of the organization	Type
	GO
	NGO
	Both

27. Is anybody from your household member of any cooperative organization?

a. Yes b. No

If yes,

27.1 Name of the organization

27.2 Please mention the type of organization involved

Information on fishing

28 Why do you fish?

a. Household consumption b. Sale c. Both

29 What kind of fish do you catch?

a. Culture fish b. By catch (Bycatch fish) c. Both

30 Where are you sale the harvested fish?

a. Retail market b. *Aratdar* c. *Bapari* d. Others (Please specify)

31 Are you satisfied with the price you get?

a. Yes b. No

If no, why?

32 When do you catch fish?

Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	------	------	-----	-----	-----	-----	-----

33 Why do you catch in these months?

34 What do you do in the other months?

35 Do you have any licenses for fishing?

- a. Yes b. No

35.1 If yes, from where you get the licenses?

35.2 Type of licenses

36 What kind of fishing gears do you use?

- a. Net b. Traps c. Both

37 Do you have any boat?

- a. Yes b. No

37.1 Type of boat

- a. *Khosa nowka* b. *Dingi nowka*

37.2 If yes, ownership of the boat

- a. Personal b. Rented

37.3 In which purpose you use the boat?

- a. Fishing b. Transport c. Other

38 Is there any banning period of fishing in the *baor*?

- a. Yes b. No

39 What kind of ban is it (Please describe)?

40 Who declared the ban?

41 What do you do for your livelihood in the fish banning period?

Appendix 3: Common checklists for oral history interviews

Common checklists to identify *baor* management barriers

1. How environmental factors impact the *baor* management?

Environmental factors include:

- Flood
- Temperature
- Rainfall
- Siltation
- Others

What was the past climatic history in this locality?

How you response these?

2. How the social factors impact on *baor* management?

Social factors include:

- Lack of education
- Poaching
- Skilled workforce

How you tackle these, both in the short-term and in the longer-term?

3. How the institutional factors impact on *baor* management?

Institutional factors include:

- *Baor* leasing system
- *Baor* fisheries regulation
- Restriction too access to fishing
- Local fisheries officers negligence
- Others

How you response these?

4. How the economic factors on *baor* management?

Economic factors include:

- Income level
- Access to credit

How you response these?

5. Is there any technological problem to *baor* management?

How you tackle these, both in the short-term and in the longer-term?

Appendix 4: Common checklists for Focus Group Discussions (FGDs)

1. How environmental factors impact the *baor* management?
2. How the social factors impact on *baor* management?
3. How the institutional factors impact on *baor* management?
4. How the economic factors on *baor* management?
5. Was there any support from non-government sources?
6. Was there any support from government?
7. What is your future plan of overcome the obstacles?

8. What is your future plan to livelihood?

Appendix 5: Analysis of nominal data of two *baor*

Respondent distribution of *Jhapa baor* area according to village

Respondent village				
Village name	Frequency	Percent	Valid Percent	Cumulative Percent
<i>Hanuair</i>	2	3.3	3.3	3.3
<i>Jhapa</i>	12	20.0	20.0	23.3
<i>Komolpur</i>	13	21.7	21.7	45.0
<i>Mobarakpur</i>	9	15.0	15.0	60.0
<i>Rajbari</i>	18	30.0	30.0	90.0
<i>Rampur</i>	6	10.0	10.0	100.0
Total	60	100.0	100.0	

Respondent's distribution of *Jhapa baor* area according to age

Fishers age				
Fishers age (year)	Frequency	Percent	Valid Percent	Cumulative Percent
23	1	1.7	1.7	1.7
24	1	1.7	1.7	3.3
26	1	1.7	1.7	5.0
28	1	1.7	1.7	6.7
29	1	1.7	1.7	8.3
30	1	1.7	1.7	10.0
32	2	3.3	3.3	13.3
33	3	5.0	5.0	18.3
34	1	1.7	1.7	20.0

35	6	10.0	10.0	30.0
36	1	1.7	1.7	31.7
38	2	3.3	3.3	35.0
39	1	1.7	1.7	36.7
40	5	8.3	8.3	45.0
42	2	3.3	3.3	48.3
45	4	6.7	6.7	55.0
47	1	1.7	1.7	56.7
50	11	18.3	18.3	75.0
52	3	5.0	5.0	80.0
53	1	1.7	1.7	81.7
55	4	6.7	6.7	88.3
56	1	1.7	1.7	90.0
57	1	1.7	1.7	91.7
58	1	1.7	1.7	93.3
60	3	5.0	5.0	98.3
70	1	1.7	1.7	100.0
Total	60	100.0	100.0	

Fishers' household member distribution of the *Jhapa baorarea*

Fishers household member

Number of HH member	Frequency	Percent	Valid Percent	Cumulative Percent
2	2	3.3	3.3	3.3
3	13	21.7	21.7	25.0
4	15	25.0	25.0	50.0
5	15	25.0	25.0	75.0
6	9	15.0	15.0	90.0
7	4	6.7	6.7	96.7
8	1	1.7	1.7	98.3
12	1	1.7	1.7	100.0

Total	60	100.0	100.0
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Distribution of Number household earning member of Fishers at *Jhapa baorarea*

Number of earning member in Fishers' household

HH earning member	Frequency	Percent	Valid Percent	Cumulative Percent
1	36	60.0	60.0	60.0
2	16	26.7	26.7	86.7
3	5	8.3	8.3	95.0
4	1	1.7	1.7	96.7
5	2	3.3	3.3	100.0
Total	60	100.0	100.0	

Total household income of the respondents at *Jhapa baorarea*

Fishers household income

HH income (BDT)	Frequency	Percent	Valid Percent	Cumulative Percent
3500.00	1	1.7	1.7	1.7
4000.00	3	5.0	5.0	6.7
4500.00	3	5.0	5.0	11.7
5000.00	3	5.0	5.0	16.7
5200.00	1	1.7	1.7	18.3
6000.00	9	15.0	15.0	33.3
6500.00	3	5.0	5.0	38.3
6600.00	1	1.7	1.7	40.0
7000.00	7	11.7	11.7	51.7
7200.00	1	1.7	1.7	53.3
8000.00	3	5.0	5.0	58.3
9000.00	6	10.0	10.0	68.3

9500.00	1	1.7	1.7	70.0
10000.00	4	6.7	6.7	76.7
11000.00	2	3.3	3.3	80.0
12000.00	3	5.0	5.0	85.0
14000.00	1	1.7	1.7	86.7
15000.00	2	3.3	3.3	90.0
18000.00	1	1.7	1.7	91.7
18300.00	1	1.7	1.7	93.3
19800.00	1	1.7	1.7	95.0
20000.00	1	1.7	1.7	96.7
21000.00	1	1.7	1.7	98.3
23700.00	1	1.7	1.7	100.0
Total	60	100.0	100.0	

Respondents' household income came from *baor* at *Jhapa baorarea*

Fishers household income from *baor*

Household income from <i>baor</i> (BDT)	Frequency	Percent	Valid Percent	Cumulative Percent
500.00	3	5.0	5.0	5.0
1500.00	1	1.7	1.7	6.7
2000.00	1	1.7	1.7	8.3
2500.00	1	1.7	1.7	10.0
3000.00	1	1.7	1.7	11.7
3500.00	1	1.7	1.7	13.3
4000.00	8	13.3	13.3	26.7
5000.00	8	13.3	13.3	40.0
5450.00	1	1.7	1.7	41.7
5500.00	2	3.3	3.3	45.0
6000.00	13	21.7	21.7	66.7
6600.00	1	1.7	1.7	68.3
7000.00	4	6.7	6.7	75.0
8000.00	6	10.0	10.0	85.0

10000.00	2	3.3	3.3	88.3
11000.00	2	3.3	3.3	91.7
11500.00	1	1.7	1.7	93.3
12000.00	3	5.0	5.0	98.3
20000.00	1	1.7	1.7	100.0
Total	60	100.0	100.0	

Household expenditure of respondents at *Jhapa baorarea*

Fishers household expenditure

Household expenditure (BDT)	Frequency	Percent	Valid Percent	Cumulative Percent
3500.00	1	1.7	1.7	1.7
4000.00	5	8.3	8.3	10.0
4500.00	2	3.3	3.3	13.3
4800.00	1	1.7	1.7	15.0
5000.00	4	6.7	6.7	21.7
5400.00	1	1.7	1.7	23.3
5900.00	1	1.7	1.7	25.0
6000.00	13	21.7	21.7	46.7
7000.00	5	8.3	8.3	55.0
8000.00	7	11.7	11.7	66.7
9000.00	4	6.7	6.7	73.3
9500.00	1	1.7	1.7	75.0
10000.00	8	13.3	13.3	88.3
11000.00	1	1.7	1.7	90.0
11500.00	1	1.7	1.7	91.7
12000.00	2	3.3	3.3	95.0
13000.00	2	3.3	3.3	98.3
15000.00	1	1.7	1.7	100.0
Total	60	100.0	100.0	

Fishers' household agricultural land ownership status at *Jhapa baorarea*

Fishers household agricultural land ownership status

Land area	Frequency	Percent	Valid Percent	Cumulative Percent
.00	36	60.0	60.0	60.0
7.00	1	1.7	1.7	61.7
10.00	1	1.7	1.7	63.3
12.00	2	3.3	3.3	66.7
20.00	3	5.0	5.0	71.7
24.00	1	1.7	1.7	73.3
30.00	3	5.0	5.0	78.3
33.00	2	3.3	3.3	81.7
48.00	2	3.3	3.3	85.0
50.00	1	1.7	1.7	86.7
96.00	1	1.7	1.7	88.3
99.00	1	1.7	1.7	90.0
120.00	1	1.7	1.7	91.7
132.00	1	1.7	1.7	93.3
196.00	1	1.7	1.7	95.0
198.00	1	1.7	1.7	96.7
231.00	2	3.3	3.3	100.0
Total	60	100.0	100.0	

Fishers' household homestead land ownership status at *Jhapa baorarea*

Fishers homestead land ownership status

Land area	Frequency	Percent	Valid Percent	Cumulative Percent
2.00	2	3.3	3.3	3.3
3.00	4	6.7	6.7	10.0
4.00	2	3.3	3.3	13.3
4.50	1	1.7	1.7	15.0
5.00	8	13.3	13.3	28.3
6.00	3	5.0	5.0	33.3
7.00	1	1.7	1.7	35.0

7.50	1	1.7	1.7	36.7
8.00	11	18.3	18.3	55.0
9.00	2	3.3	3.3	58.3
10.00	7	11.7	11.7	70.0
11.00	1	1.7	1.7	71.7
12.00	3	5.0	5.0	76.7
13.00	1	1.7	1.7	78.3
14.00	1	1.7	1.7	80.0
15.00	3	5.0	5.0	85.0
18.00	1	1.7	1.7	86.7
20.00	1	1.7	1.7	88.3
33.00	2	3.3	3.3	91.7
48.00	1	1.7	1.7	93.3
50.00	3	5.0	5.0	98.3
60.00	1	1.7	1.7	100.0
Total	60	100.0	100.0	

Fishers' pond area ownership status at *Jhapa baorarea*

Fishers pond area status

Area	Frequency	Percent	Valid Percent	Cumulative Percent
.00	59	98.3	98.3	98.3
3.00	1	1.7	1.7	100.0
Total	60	100.0	100.0	

Fishers' household credit amount received status at *Jhapa baorarea*

Fishers household credit amount

Credit amount (BDT)	Frequency	Percent	Valid Percent	Cumulative Percent
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5000.00	1	1.7	2.8	2.8
10000.00	4	6.7	11.1	13.9
14000.00	1	1.7	2.8	16.7
15000.00	2	3.3	5.6	22.2
20000.00	8	13.3	22.2	44.4
25000.00	1	1.7	2.8	47.2
27000.00	2	3.3	5.6	52.8
30000.00	5	8.3	13.9	66.7
36000.00	1	1.7	2.8	69.4
40000.00	2	3.3	5.6	75.0
45000.00	2	3.3	5.6	80.6
50000.00	1	1.7	2.8	83.3
71000.00	1	1.7	2.8	86.1
75000.00	1	1.7	2.8	88.9
80000.00	1	1.7	2.8	91.7
85000.00	1	1.7	2.8	94.4
90000.00	1	1.7	2.8	97.2
100000.00	1	1.7	2.8	100.0
Total	36	60.0	100.0	
Missing System	24	40.0		
Total	60	100.0		

Status of fish harvested duration of fishers at *Jhapa baorarea*

Duration of fish catch of the fishers

Duration (Months)	Frequency	Percent	Valid Percent	Cumulative Percent
3	1	1.7	1.7	1.7
4	1	1.7	1.7	3.3
5	1	1.7	1.7	5.0
6	4	6.7	6.7	11.7
7	4	6.7	6.7	18.3
8	5	8.3	8.3	26.7

9	17	28.3	28.3	55.0
10	5	8.3	8.3	63.3
12	22	36.7	36.7	100.0
Total	60	100.0	100.0	

Boat ownership status of fisher's household at *Jhapa* baor area

Number of boat of the fishers

Number of boat	Frequency	Percent	Valid Percent	Cumulative Percent
1	41	68.3	97.6	97.6
2	1	1.7	2.4	100.0
Total	42	70.0	100.0	
Missing System	18	30.0		
Total	60	100.0		

Contribution of *baor* in fisher's household total income at *Jhapa baor* area

Baor contribution

<i>Baor</i> contribution in income (%)	Frequency	Percent	Valid Percent	Cumulative Percent
11.11	3	5.0	5.0	5.0
22.22	1	1.7	1.7	6.7
22.88	1	1.7	1.7	8.3
23.08	2	3.3	3.3	11.7
23.81	1	1.7	1.7	13.3
33.33	1	1.7	1.7	15.0
33.33	3	5.0	5.0	20.0
44.44	1	1.7	1.7	21.7
44.44	1	1.7	1.7	23.3

53.33	1	1.7	1.7	25.0
54.55	1	1.7	1.7	26.7
57.14	1	1.7	1.7	28.3
57.89	1	1.7	1.7	30.0
58.08	1	1.7	1.7	31.7
62.50	2	3.3	3.3	35.0
65.57	1	1.7	1.7	36.7
66.67	2	3.3	3.3	40.0
71.43	1	1.7	1.7	41.7
76.92	1	1.7	1.7	43.3
80.00	2	3.3	3.3	46.7
83.33	1	1.7	1.7	48.3
83.85	1	1.7	1.7	50.0
85.71	2	3.3	3.3	53.3
88.89	1	1.7	1.7	55.0
91.67	2	3.3	3.3	58.3
92.31	1	1.7	1.7	60.0
100.00	24	40.0	40.0	100.0
Total	60	100.0	100.0	

Respondent distribution of *Perkhajura baor* area according to village

Respondents village	Frequenc y	Percent	Valid Percent	Cumulative Percent
<i>Hakimpur</i>	14	28.0	28.0	28.0
<i>Maswimnagor</i>	12	24.0	24.0	52.0
<i>Perkhajura</i>	17	34.0	34.0	86.0
<i>Sahapur</i>	7	14.0	14.0	100.0
Total	50	100.0	100.0	

Respondent's distribution of *Perkhajura baor* according to age

Fishers age (Year)	Frequency of respondents	Percent	Valid Percent	Cumulative Percent
23	2	4.0	4.0	4.0
24	1	2.0	2.0	6.0
26	1	2.0	2.0	8.0
28	1	2.0	2.0	10.0
30	1	2.0	2.0	12.0
32	2	4.0	4.0	16.0
33	1	2.0	2.0	18.0
34	2	4.0	4.0	22.0
35	5	10.0	10.0	32.0
36	1	2.0	2.0	34.0
38	1	2.0	2.0	36.0
39	1	2.0	2.0	38.0
40	6	12.0	12.0	50.0
42	4	8.0	8.0	58.0
45	6	12.0	12.0	70.0
46	1	2.0	2.0	72.0
48	1	2.0	2.0	74.0
50	3	6.0	6.0	80.0
52	2	4.0	4.0	84.0
53	1	2.0	2.0	86.0
55	2	4.0	4.0	90.0

56	2	4.0	4.0	94.0
60	1	2.0	2.0	96.0
70	2	4.0	4.0	100.0
Total	50	100.0	100.0	

Fishers' household member distribution of the *Perkhajurabaor* area

Household member	Frequency of household	Percent	Valid Percent	Cumulative Percent
2	2	4.0	4.0	4.0
3	10	20.0	20.0	24.0
4	21	42.0	42.0	66.0
5	9	18.0	18.0	84.0
6	8	16.0	16.0	100.0
Total	50	100.0	100.0	

Distribution of Number household earning member of Fishersat *Perkhajurabaor* area

HH earning member	Frequency of household	Percent	Valid Percent	Cumulative Percent
1	38	76.0	76.0	76.0
2	10	20.0	20.0	96.0
3	1	2.0	2.0	98.0
5	1	2.0	2.0	100.0
Total	50	100.0	100.0	

Total household income of the respondents at *Perkhajurabaor* area

Household income (BDT)	Frequency of household	Percent	Valid Percent	Cumulative Percent
4000.00	2	4.0	4.0	4.0
4500.00	1	2.0	2.0	6.0
5000.00	6	12.0	12.0	18.0
5500.00	1	2.0	2.0	20.0
6000.00	9	18.0	18.0	38.0
7000.00	7	14.0	14.0	52.0
7500.00	2	4.0	4.0	56.0
8000.00	9	18.0	18.0	74.0
9000.00	2	4.0	4.0	78.0
9500.00	1	2.0	2.0	80.0
10000.00	1	2.0	2.0	82.0
10500.00	1	2.0	2.0	84.0
11000.00	1	2.0	2.0	86.0
11500.00	2	4.0	4.0	90.0
12000.00	3	6.0	6.0	96.0
13000.00	1	2.0	2.0	98.0
25000.00	1	2.0	2.0	100.0
Total	50	100.0	100.0	

Respondents' household income came from *baorat Perkhajura baor* area

Household income from <i>baor</i> (BDT)	Frequency of household	Percent	Valid Percent	Cumulative Percent
500.00	1	2.0	2.0	2.0
2500.00	1	2.0	2.0	4.0
3000.00	4	8.0	8.0	12.0
3500.00	1	2.0	2.0	14.0
4000.00	5	10.0	10.0	24.0
4500.00	2	4.0	4.0	28.0
5000.00	14	28.0	28.0	56.0
5500.00	1	2.0	2.0	58.0
6000.00	9	18.0	18.0	76.0

7000.00	3	6.0	6.0	82.0
8000.00	6	12.0	12.0	94.0
9000.00	1	2.0	2.0	96.0
10000.00	1	2.0	2.0	98.0
13000.00	1	2.0	2.0	100.0
Total	50	100.0	100.0	

Household expenditure of respondents at *Perkhajurabaor* area

Household expenditure (BDT)	Frequency of household	Percent	Valid Percent	Cumulative Percent
2500.00	1	2.0	2.0	2.0
3000.00	1	2.0	2.0	4.0
4000.00	3	6.0	6.0	10.0
4500.00	2	4.0	4.0	14.0
5000.00	4	8.0	8.0	22.0
5500.00	1	2.0	2.0	24.0
6000.00	14	28.0	28.0	52.0
6500.00	1	2.0	2.0	54.0
7000.00	8	16.0	16.0	70.0
8000.00	9	18.0	18.0	88.0
9000.00	4	8.0	8.0	96.0
10000.00	1	2.0	2.0	98.0
15000.00	1	2.0	2.0	100.0
Total	50	100.0	100.0	

Fishers' household agricultural land ownership status at *Perkhajurabaor* area

Land area	Frequency of household	Percent	Valid Percent	Cumulative Percent
.00	30	60.0	60.0	60.0
12.00	1	2.0	2.0	62.0

13.00	1	2.0	2.0	64.0
17.00	1	2.0	2.0	66.0
20.00	4	8.0	8.0	74.0
25.00	1	2.0	2.0	76.0
28.00	1	2.0	2.0	78.0
30.00	1	2.0	2.0	80.0
33.00	1	2.0	2.0	82.0
35.00	1	2.0	2.0	84.0
42.00	2	4.0	4.0	88.0
57.00	1	2.0	2.0	90.0
60.00	1	2.0	2.0	92.0
63.00	1	2.0	2.0	94.0
65.00	1	2.0	2.0	96.0
66.00	1	2.0	2.0	98.0
99.00	1	2.0	2.0	100.0
Total	50	100.0	100.0	

Fishers' household homestead land ownership status at *Perkhajurabaor* area

Land area	Frequency of household	Percent	Valid Percent	Cumulative Percent
2.00	3	6.0	6.0	6.0
3.00	6	12.0	12.0	18.0
3.50	2	4.0	4.0	22.0
4.00	6	12.0	12.0	34.0
5.00	5	10.0	10.0	44.0
6.00	6	12.0	12.0	56.0
7.00	1	2.0	2.0	58.0
8.00	5	10.0	10.0	68.0
9.00	1	2.0	2.0	70.0
10.00	2	4.0	4.0	74.0
12.00	2	4.0	4.0	78.0
14.00	3	6.0	6.0	84.0
15.00	1	2.0	2.0	86.0
18.00	3	6.0	6.0	92.0

20.00	2	4.0	4.0	96.0
23.50	1	2.0	2.0	98.0
25.00	1	2.0	2.0	100.0
Total	50	100.0	100.0	

Fishers' pond area ownership status at *Perkhajurabaor* area

Area (decimal)	Frequency of household	Percent	Valid Percent	Cumulative Percent
.00	47	94.0	94.0	94.0
1.00	1	2.0	2.0	96.0
15.00	1	2.0	2.0	98.0
25.00	1	2.0	2.0	100.0
Total	50	100.0	100.0	

Fishers' household credit amount received status at *Perkhajurabaor* area

Credit amount (BDT)	Frequency of household	Percent	Valid Percent	Cumulative Percent
3000.00	1	2.0	3.1	3.1
6000.00	1	2.0	3.1	6.3
10000.00	7	14.0	21.9	28.1
15000.00	7	14.0	21.9	50.0
16000.00	1	2.0	3.1	53.1
18000.00	1	2.0	3.1	56.3
20000.00	4	8.0	12.5	68.8
25000.00	3	6.0	9.4	78.1
30000.00	3	6.0	9.4	87.5
40000.00	1	2.0	3.1	90.6
50000.00	1	2.0	3.1	93.8

60000.00	1	2.0	3.1	96.9
94000.00	1	2.0	3.1	100.0
Total	32	64.0	100.0	
Missing System	18	36.0		
Total	50	100.0		

Status of fish harvested duration of fishers at *Perkhajurabaor* area

Duration (Months)	Frequency of respondent	Percent	Valid Percent	Cumulative Percent
4	1	2.0	2.0	2.0
5	1	2.0	2.0	4.0
6	4	8.0	8.0	12.0
7	3	6.0	6.0	18.0
8	4	8.0	8.0	26.0
9	6	12.0	12.0	38.0
10	2	4.0	4.0	42.0
12	29	58.0	58.0	100.0
Total	50	100.0	100.0	

Boat ownership status of fisher's household at *Jhapa* bapr area

Number of boat	Frequency of household	Percent	Valid Percent	Cumulative Percent
1	38	76.0	97.4	97.4
4	1	2.0	2.6	100.0
Total	39	78.0	100.0	
Missing System	11	22.0		
Total	50	100.0		

Contribution of *baor* in fisher's household total income at *Perkhajurabaor* area

<i>Baor</i> contribution in income %	Frequency of household	Percent	Valid Percent	Cumulative Percent
5.26	1	2.0	2.0	2.0
23.08	1	2.0	2.0	4.0
30.43	1	2.0	2.0	6.0
33.33	1	2.0	2.0	8.0
42.86	1	2.0	2.0	10.0
43.48	1	2.0	2.0	12.0
45.45	1	2.0	2.0	14.0
50.00	2	4.0	4.0	18.0
52.00	1	2.0	2.0	20.0
57.14	2	4.0	4.0	24.0
62.50	4	8.0	8.0	32.0
66.67	4	8.0	8.0	40.0
71.43	1	2.0	2.0	42.0
72.73	1	2.0	2.0	44.0
73.33	1	2.0	2.0	46.0
75.00	2	4.0	4.0	50.0
80.00	1	2.0	2.0	52.0
83.33	3	6.0	6.0	58.0
85.71	1	2.0	2.0	60.0
90.00	1	2.0	2.0	62.0
100.00	19	38.0	38.0	100.0
Total	50	100.0	100.0	

Appendix 6: Descriptive analysis of scale Data at study area

Descriptive Statistics of *Jhapa baor*

	N	Minimum	Maximum	Mean	Std. Deviation
Fishers age	60	23	70	43.82	10.452

Fishers household member	60	2	12	4.67	1.654
Number of earning member in Fishers household	60	1	5	1.62	.958
Fishers household income	60	3500.00	23700.00	8930.0000	4638.39174
Fishers household income from <i>baor</i>	60	500.00	20000.00	6209.1667	3286.56087
Fishers household expenditure	60	3500.00	15000.00	7510.0000	2652.96125
Fishers household agricultural land ownership status	60	.00	231.00	28.8333	58.14948
Fishers homestead land ownership status	60	2.00	60.00	12.6333	13.27572
Fishers pond area status	60	.00	3.00	.0500	.38730
Fishers household credit amount	36	5000.00	100000.00	34305.5556	25027.77822
Duration of fish catch of the fishers	60	3	12	9.52	2.332
Number of boat of the fishers	42	1	2	1.02	.154
% <i>baor</i> _contribution in income	60	11.11	100.00	73.1169	30.02164
Valid N (listwise)	25				

Descriptive Statistics of *Perkhajura baor*

	N	Minimum	Maximum	Sum	Mean	Std. Deviation
Fishers age	50	23	70	2108	42.16	10.710
Fishers household member	50	2	6	211	4.22	1.075
Number of earning member in Fishers household	50	1	5	66	1.32	.713
Fishers household income	50	4000.00	25000.00	394000.00	7880.0000	3372.39696

Fishers household income from <i>baor</i>	50	500.00	13000.00	278000.00	5560.0000	2093.81987
Fishers household expenditure	50	2500.00	15000.00	331500.00	6630.0000	2017.29765
Fishers household agricultural land ownership status	50	.00	99.00	767.00	15.3400	23.81357
Fishers homestead land ownership status	50	2.00	25.00	415.50	8.3100	6.01859
Fishers pond area status	50	.00	25.00	41.00	.8200	4.08427
Fishers household credit amount	32	3000.00	94000.00	707000.00	22093.7500	17952.19346
Duration of fish catch of the fishers	50	4	12	508	10.16	2.427
Number of boat of the fishers	39	1	4	42	1.08	.480
<i>Baor</i> _contribution	50	5.26	100.00	3780.05	75.6011	24.72354
Valid N (listwise)	28					