

Livelihood Strategies of People Surrounding the Sundarbans Mangrove Forest

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A thesis submitted for the degree of
Doctor of Philosophy

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July, 2014

Declaration of Originality

I declare that this work, now submitted as thesis for the degree of Doctor of Philosophy of the Charles Darwin University, is the result of my own investigations, and all references to ideas and work of other researchers have been specifically acknowledged. I certify that the work of embodied in this thesis has not been accepted in substances for any degree, and is not currently submitted in candidature for any other degree.

Abu Nasar Mohammad Abdullah

Signed: _____ On: ____/____/____

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Acknowledgement

During the development of my PhD studies at Charles Darwin University, several persons and institutions collaborated directly and indirectly with my research. Without their support it would be impossible for me to finish my work. It is my privilege to acknowledge their contribution.

First and foremost, I am grateful to the people in Mongla and Koyra Sub-districts, Bangladesh, for their friendship, hospitality and kindness towards me as a researcher. My special thanks go to the residents surrounding the Sundarbans mangrove forest who shared their valuable opinions, knowledge and experience with me, without which this study would not have been possible. They have made the Sundarbans another home for me.

This journey would have not been possible without the generous support of many individuals and institutions. Further appreciation and a deep sense of sincere gratitude go to the Ministry of Environment and Forest, Department of Fisheries and the Administration Offices of Mongla and Koyra Sub-District for granting me permission to carry out this research project. Government officers at the divisional, district and sub-district levels and local government representatives in the Union Councils provided vital support to enable me to carry out the field study. I am also grateful to the NGO personnel in Bagerhat District for helping me in the fieldwork.

An International Postgraduate Research Scholarship provided by the Australian Government and a University Postgraduate Research Scholarship provided by

Charles Darwin University enabled me to undertake my research. My main fieldwork was generously supported by a research grant provided by the Charles Darwin University Research Institute for Environment and Livelihoods (RIEL). I am immensely indebted to them for granting me financial support for this study.

My heartfelt thanks go to my primary supervisor, Dr. Natasha Stacey because she gave me the opportunity to research under her guidance and supervision. I received motivation, encouragement and support from her throughout my studies. Thanks to Natasha, I learned how to present qualitative data. My thanks are also due to her for valuable comments and suggestions on the various drafts of this dissertation. Natasha's quiet yet decisive style was the most effective way of pushing me to try even harder. I would also like to thank her for providing me with formal and informal support on occasions too numerous to mention; this support enabled me to complete a challenge I started with little understanding.

I am indebted to Professor Stephen Garnett who helped me in many ways, big and small. It is no exaggeration to say that there are many things one learns from observing Stephen and appreciating his generosity, affection and strength. Stephen's clarity in quantitative analysis helped me conceptualise this project. However, he was more than a mentor and a motivator. The ways in which he lifted me out of difficult situations without passing judgment, not to mention giving me the confidence that he was backing me in tough situations, will stay with me for life. Without his encouragement and support, throughout the ups and downs of this project, I would not have crossed the finish line.

I am also grateful to Dr. Bronwyn Myers who showed me the importance of finding a meeting point between the data and the analysis. Her quick and constructive criticisms and suggestions on drafts helped me to identify the problems at the early stages, and this assistance was crucial to the successful completion of the thesis. Bronwyn's critical comments and questions reminded me of the value of paying attention to the details while not losing sight of the overall structural integrity.

Dean of Postgraduate Research Study Dr. Jim Mitroy, RIEL Director Prof. Andrew Campbell, RIEL Business Manager Roanne Ramsey, RIEL Administrative Assistant Heather Robertson, Research Associate Michelle Franklin and Technical Manager of NT Fisheries Dr. Andria Handley all provided constant assistance in every aspect of my life, work and study in Darwin for which I am grateful. On a personal level, words alone cannot express the love and gratitude I feel for my friends and colleagues at RIEL who have cheered me on from near and far and who have shared invaluable advice and encouraged my work throughout this project. It is not possible to mention them all, but I would like them to know that my thoughts and gratitude are with them. This dissertation has also benefited from substantial assistance given generously by my friend Mr. Jahangir Alam who entered and cleaned up the SPSS data. Mrs Helen Whittle assisted me by proofreading the thesis.

I would like to express my deepest gratitude to my brothers, sisters and all well-wishers for their understanding, patience, inspirations, sacrifices, and blessings. In Mongla, I was fortunate enough to receive generous support from my cousin who works for the Mongla Port Authority. While I tried to spend as much time as possible

in the villages, my main home in Mongla was the “Cousin’s House”, where I could find the comfort, time and space to write up my field notes as each day closed.

Just for being there no matter what, I am enormously grateful to my wife Piashi and my daughter Tahnun whose love afforded me the freedom to pursue this dream through all the travails that this journey entailed. My daughter was both the motivation for me to embark on this journey and the reason for it to become a meaningful and enriching experience. Piashi and Tahnun’s presence made Darwin a second home for us, where we have met wonderful people and forged lasting friendships with so many people especially in the Bangladeshi community. At the same time that I grew intellectually in the pursuit of this degree, I also realised truly what family means. I want to express thanks to all Bangladeshi families for their good company here in Darwin, which I will never forget.

Finally, the completion of this doctorate thesis is dedicated to my parents. I believe it was their unstinting support, prayers and blessings that enabled me to persevere and complete this journey. Unfortunately I lost both of my parents on August 27 this year. They were always asking me to submit the thesis and return home to them. As I am submitting my thesis, my parents are no more with me. They were not wealthy, but they provided the best education for their children. They taught me the value of higher education. I hope I will be receiving their blessings from heaven.

Glossary

| | |
|----------------|--|
| Bagda | Black Tiger Shrimp, <i>Penaeus monodon</i> , a saline water shrimp species |
| Bawali | Wood cutter or golpata collector |
| Golda | Freshwater prawn <i>Macrobrachium rosenbergii</i> |
| Gewa | <i>Excoecaria agallocha</i> , used as low-value firewood and for other general purposes |
| Gher | A gher is a modified rice field with high, broad peripheral dikes used for shrimp farming |
| Golpata | Leaves of <i>Nypa fruticans</i> : common English name, Nipa palm. The leaves are used for roof thatching |
| Gon | Appropriate time when fish catch is plentiful, around new moon or deep moon |
| Goran | <i>Ceriops decandra</i> , mangrove species which grows as a small tree or shrub, highly valued for firewood |
| Hental | <i>Phoenix paludosa</i> , a slender, straight, small palm used for rafters, fences and house posts |
| Hilsa | <i>Hilsa ilisa</i> , this fish had high demand in the market |
| Homestead land | Land used for residential structures including courtyards and entrance & exit passages; the land adjacent to residences is used for temporary or perennial crops, ponds & tanks, and compact plantations |
| Impact Zone | The 17 sub-districts (upazilas) immediately adjacent and most dependent on the Sundarbans Reserved Forest |
| Khas | Land owned by the government, often leased out for fishery irrigation and other purposes |
| Mahajan | A powerful intermediary in the value chain, the traditional moneylender is the key person who invests money and organises the harvesting of resources of the forest; they also provide loans as part of interlocked credit-marketing transactions, whereby the borrower has to sell to/through the loan provider at a discounted price |
| Shrimp Fry | Post-larvae of shrimp and prawns |
| Sundari | <i>Heritiera fomes</i> , highly valued for fuelwood |
| Tk | Bangladesh currency; the conversion rate was US\$1 = Tk68.80 in 2009-2010, the years in which fieldwork was conducted |
| Union | The Union Council (Parishad) is the governing body at the union level (the lowest administrative unit of government) headed by an elected chairperson; one union is composed of 9 wards and each ward member is headed by one elected member |
| Upazila | Sub-district, the local government administrative unit; the local government institution in the sub-district is comprised of core officers of different ministries at the local level and a democratically elected union chairperson and vice chairperson |

Acronyms and Abbreviations

| | |
|-------|---|
| ADB | Asian Development Bank |
| BLC | Boat License Certificate |
| BBS | Bangladesh Bureau of Statistics |
| BWDB | Bangladesh Water Development Board |
| CEGIS | Center for Environmental, Geographic Information Services |
| CFW | Cash For Work |
| CPP | Cyclone Preparedness Programme |
| DOF | Department of Fisheries |
| DFO | Divisional Forest Officers |
| DFID | Department for International Development |
| DMB | Disaster Management Bureau |
| EJF | Environmental Justice Foundation |
| FAO | Food and Agriculture Organization |
| FD | Forest Department |
| FFW | Food For Work |
| FGD | Focus Group Discussion |
| GOB | Government of Bangladesh |
| HIES | Household Income Expenditure Survey |
| IMM | International Maritime Management |
| IPCC | The Intergovernmental Panel on Climate Change |
| IUCN | The World Conservation Union |
| KII | Key Informant Interview |
| MARC | Multidisciplinary Action Research Centre |
| MOEF | Ministry of Environment and Forest |
| MOFDM | Ministry of Food and Disaster Management |
| MOL | Ministry of Land |
| NGO | Non Government Organisation |
| PRA | Participatory Rural Appraisal |
| PEN | Poverty Environment Netwok |
| SLA | Sustainable Livelihoods Apparocahes |
| SLF | Sustainable Livelihoods Framework |
| SRF | Sundarbans Reserved Forest |
| SBCP | Sundarbans Bio-diversity Conservation Project |
| SIZ | Sundarbans Impact Zone |
| SOD | Standing Order On Disaster |
| UNDP | United Nations Development Programme |
| UNEP | United Nations Environmental Programme |
| UzDMC | Upazila Disaster Management Committee |
| UDMC | Union Disaster Management Committee |
| WB | World Bank |

Abstract

This thesis investigates the livelihoods of people living beside the vast Sundarbans mangrove forest in Bangladesh. The study examines how household assets, livelihood strategies and outcomes vary among households and the roles played in those livelihoods of the mangrove resources and shrimp farming. It also examines the vulnerabilities of these livelihoods, particularly to the cyclones that periodically affect the region. Policy responses addressing these issues are also evaluated. The research is informed by the sustainable livelihood framework and is based on household surveys, key informant interviews, focus group discussions and policy analysis. The research found that lower income households depend heavily on forest resources which help alleviate poverty and reduce income inequality. Constraints on access, resource variability and attacks by pirates and wildlife were the principal vulnerabilities of the mangrove dependent households. In contrast, commercial shrimp aquaculture had widened inequality. While shrimp aquaculture was important to higher income households, particularly land-owning households, it has led to loss of agriculture, livestock and access to land of lower income households. After a cyclone, however, higher income shrimp-farming households were more vulnerable than the poorer mangrove resource collectors. The cyclone destroyed assets, displaced people and prevented delivery of services. It was concluded that policies related to forest, shrimp aquaculture and disaster are inadequate, inconsistent and irrelevant and institutions charged with resource management performed poorly with respect to livelihoods and conservation of resources. The study recommends that policy approaches be adopted that ensure equitable growth by creating a balanced asset base within a livelihood framework with multiple interventions working simultaneously. This would facilitate favourable livelihood outcomes for the households surrounding the Sundarbans and would be valuable to the managers of coastal communities in relation to poverty alleviation and promotion of environmentally sustainable livelihoods, not only in Bangladesh but in other parts of the world.

Chapter 1: Introduction



Chapter 1: Introduction

1.1 Background

In the developing world, people's daily livelihoods are highly dependent on natural resources. Natural resource dependence also intensifies during times of natural disaster as people strive to maintain their livelihoods (McSweeney, 2005). The greater the linkage between human livelihoods and natural resources in both spatial and temporal terms, the greater incentive resource users and policy-makers are expected to have to maintain ecosystem integrity and productivity (Salafsky and Wollenberg, 2000). Livelihoods and the management of natural resources must be adaptable to ecological and social system fluctuations in order to be resilient and sustainable (Allison and Horemans, 2006; Chapin et al., 2010). The natural resources that communities depend upon, however, are coming under intense pressure (Barbier, 2005), largely as a result of population growth (Hecht et al., 2012), leading to their degradation and depletion (Guerin, 2007; Kesavan and Swaminathan, 2006; Midmore and Whittaker, 2000; Scherr, 2000), with significant impacts on the wellbeing of resource-dependent communities (Béné et al., 2000). Livelihoods based on natural resources are susceptible to risk and uncertainty in the form of natural and social trends and shocks, meaning that total reliance on these resources leaves many communities in a vulnerable state (Ferrol-Schulte et al., 2013).

More than 1.6 billion people worldwide depend, to varying degrees, on forests for their livelihoods. About 60 million indigenous people are almost entirely dependent on forests. Some 350 million people who live within or adjacent to dense forests depend on them to a high degree for subsistence and income (World Bank, 2004).

Despite the importance of forests for livelihoods, forests losses continue (Chomitz, 2007; FAO, 2012). The remaining forest cover in developing countries occurs in areas with high rates of human poverty, where many household livelihoods are dependent on extractive forest uses or wholesale conversion of forests to agriculture lands (Sunderlin et al., 2005; Sunderlin et al., 2008).

Mangroves are coastal forests generally found in tropical and subtropical regions, predominantly between 30° N and 30° S latitude (Giri et al., 2011). Being the source of a variety of renewable resources, mangroves play a significant role in local economies and livelihoods and in national economic development. Mangroves support a wide variety of ecosystem, economic and cultural services (Barbier et al., 2011; Ewel et al., 1998; Glaser et al., 2003, Millennium Ecosystem Assessment, 2005; Moberg and Rönnbäck, 2003; Rönnbäck et al., 2007; Warren-Rhodes et al. 2011). Overall mangroves are estimated to provide at least US \$1.6 billion in ecosystem services each year and yield about US\$200,000 to US\$900,000 per km² in economic output (Costanza et al., 1997; UNEP, 2006). Mangrove forests play a crucial role in provision of coastal livelihoods with a high proportion of global fish catches directly or indirectly dependent on mangroves (Polidoro et al., 2010). Mangroves habitats support the livelihoods and wellbeing of hundreds of millions of impoverished people around the globe (Mohammed, 2012) by providing food security and income for coastal populations from forest and fishery products (Hussain and Badola, 2010; Richman, 2002; Shervette et al., 2007; Walters et al., 2008).

Cultural services such as spiritual, recreational, and aesthetic provided by mangrove systems stem from dynamic and complex beliefs and values held by people (Walters et al., 2008). Mangrove ecosystems provide humans with many opportunities for aesthetic and recreational experiences, cultural and artistic inspiration, as well as spiritual and religious enrichment (Kaplowitz, 2001; Rist and Dahdouh-Guebas, 2006; Rönnbäck et al., 2007; Roy, 2007; Uddin et al., 2013).

Mangroves are also considered to be a natural barrier protecting the lives and property of coastal communities from storms and cyclones, flooding, and coastal soil erosion (Alongi, 2008; Badola and Hussain, 2005; Dahdouh- Guebas et al., 2005; Dahdouh-Guebas and Koedam, 2006; Das and Vincent, 2009; Hong, 2006; McIvor et al., 2013; Sathirathai and Barbier, 2001; Walters 2003; 2004). Mangroves forests are among the most carbon-rich biomes, containing an average of 937 t C per hectare (Alongi, 2012) and around the world sequester 25.5 million tonnes of carbon dioxide – the main cause of climate change – each year (Mithapala, 2008). They are becoming increasing important as ‘blue carbon’ habitats due to their ability to store and sequester of total organic carbon per year (Broadhead, 2011; Mcleod et al., 2011; Nellemann et al., 2009; Warren-Rhodes et al., 2011).

The global mangrove area is currently about 137,760 km² million hectares (Giri et al. 2011), a decrease of 35% worldwide in the last 20 years with current loss rates about 2.1% per year (Cornforth et al., 2013). Losses are occurring more rapidly in developing countries due to clearance for coastal shrimp aquaculture and logging for timber and fuel production (Duke et al., 2007). Sea level rise as a result of climate

change is also starting to affect mangroves, which may lead to a maximum global loss of 10-15% of mangrove forest (Alongi, 2008).

In this research, I confront questions concerning livelihoods in rural communities surrounding the Sundarbans mangrove forest of south-western Bangladesh. The study investigates the communities' assets, the shocks and stresses they face, their efforts in diversifying livelihood strategies, and the ways they handle livelihood vulnerabilities. Chambers and Conway (1992:7) defined a livelihood as comprising the capabilities, assets and activities required for a means of living. Adger (2000a: 739) defined vulnerability as "the presence or lack of capability to resist shocks and stresses to livelihood". Vulnerability variables such as loss or degradation of assets are inherently connected to people's livelihoods and to poverty (Alwang et al., 2001). In their research in rural Ghana, Dasgupta and Baschieri (2010) found that poverty alone was insufficient to identify those households most vulnerable to floods. In the sustainable livelihoods approach used by research and development agencies worldwide to investigate the links between local livelihoods and natural resources and which is applied in this study (see DFID 2000, Chambers and Conway 1992, Scoones 1998), it is held that assets dictate a household's ability to implement strategies to cope with shock events, such as flooding (Moser, 1998). Asset accumulation indicates a household's upward economic movement, and loss of assets in the process of making a living reflects a decline in livelihoods (IMM, 2001). Potential exit routes from rural poverty and vulnerability are to some extent revealed by the livelihood patterns of the better off (Ellis and Freeman, 2004). The goal of achieving a sustainable livelihood is one that will accommodate the basic needs of its

present inhabitants (DFID, 2000) while preserving the resources that will enable future generations to flourish.

In this introductory chapter, I provide a description of the context for this study and explore the key issues related to rural livelihoods and the status of mangrove forests in the Sundarbans, including livelihood dependency, shrimp aquaculture and natural disasters. Following this, I present the research aims, objectives and questions, justification and provide an overview of the thesis structure and contents.

1.2 Sundarbans Mangrove Forests and Livelihoods

The Sundarbans Delta stretches across coastal India and Bangladesh, over the northern part of the Bay of Bengal, covering an area of 10,000 km² of which about 62% of the Sundarbans forest is in Bangladesh and the rest is in India (Hussain and Acharya, 1994). The Sundarbans Reserved Forest (SRF) in Bangladesh (Figure 1.1) forms the single largest contiguous mangrove forest in the world and covers an area of about 6,017 km² representing 4.1% of the total landmass of the country (Siddiqi, 2001). The mangrove forest is the only natural habitat of the endangered Royal Bengal Tiger (*Panthera tigris*) and has high biodiversity, supporting around 330 species of plants, as many as 400 species of fish, about 40 species of shrimp and other crustaceans, 35 species of reptiles, over 270 species of birds and 42 species of mammals (Hussain and Acharya, 1994). The main mangrove species are *Heritiera fomes*, *Avicennia* spp., *Xylocarpus mekongensis*, *Xylocarpus granatum*, *Sonneratia apetala*, *Bruguiera gymnorhiza*, *Ceriops decandra*, *Phoenix paludosa*, *Rhizophora mucronata*, and *Nypa fruticans* (Gopal and Chauhan, 2006).

The Bangladesh Sundarbans was recognised as an internationally important Ramsar Wetland Site in May 1992. The Government of Bangladesh declared the three wildlife sanctuaries of the Sundarbans as World Heritage Sites (WHS) in December 1997 when the UNESCO world heritage committee inscribed the Sundarbans in the world heritage list for its outstanding natural value (Nuruzzaman et al., 1999). However, the area is vulnerable to rising sea levels. Pethick and Orford (2013) presented data from three tide gauges along the Passur Estuary which show rates of increase in Relative Mean Sea Level (RMSL) of 7.9 mm a^{-1} at the mouth of the estuary located in the Sundarbans area and 2.8 mm a^{-1} at 120 km inland near the Khulna city. In the Sundarbans Delta, accretion rate is decreasing and coastline is currently in a state of net erosion (Rahman et al., 2011b). Agrawala et al. (2003) estimated that a 45 cm sea level rise would inundate 75% of the Sundarbans, and a 67 cm sea level rise could inundate all of the system.

Apart from its ecological importance, the Sundarbans ecosystem provide direct or indirect employment to, at the last estimate, a population of about 3.5 million people living around the Sundarbans Impact Zone (SIZ) (sub-districts immediately adjacent and most dependent on the Sundarbans Reserved Forest (SRF), details in chapter 3) (ADB, 1998). This population is now probably much larger as, even ten years ago, another 100,000 new job seekers were moving to the Sundarbans each year in order to obtain a livelihood (IUCN, 2003). Along with subsistence and artisanal fishing, the SRF are also used as a source of timber, firewood, building materials and other foods by people living on its margins. In addition, large-scale export-oriented aquaculture industries have been developed in the coastal areas around the SRF using wild shrimp fry from mangroves as the basic productive unit. This industry has

provided both regional and national economic benefits for Bangladesh (Islam and Wahab, 2005).

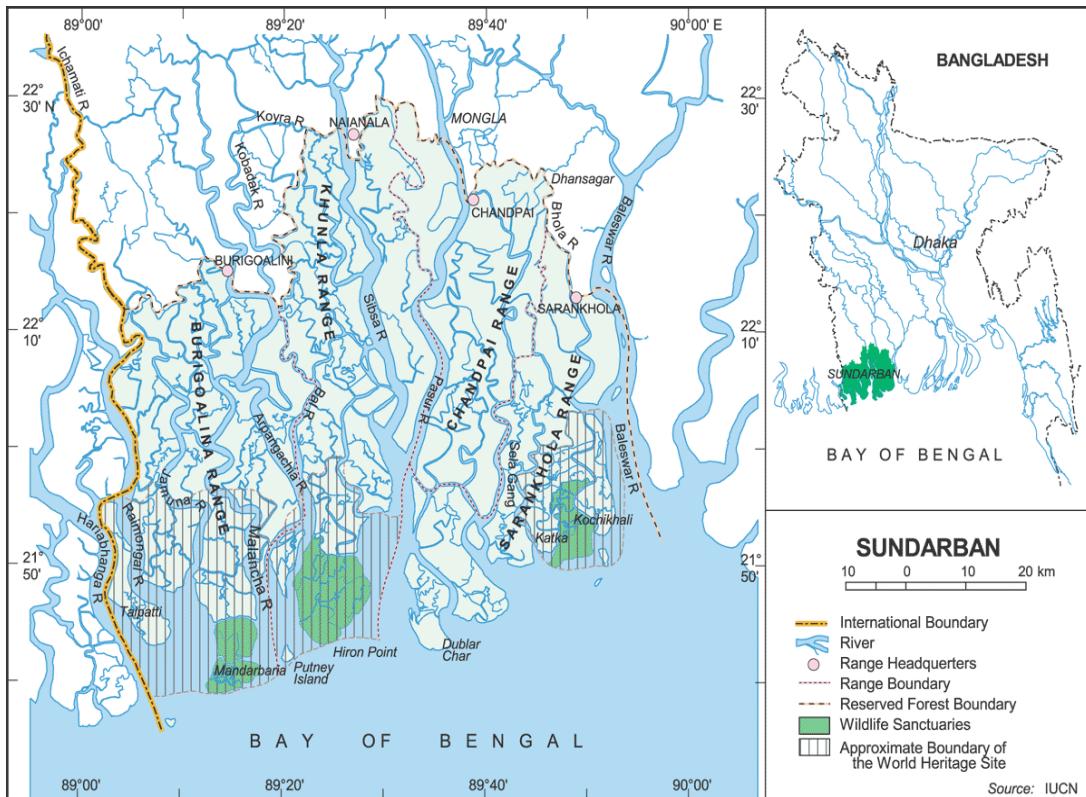


Figure 1.1: Map of the Sundarbans showing location in Bangladesh (Bangla Pedia, 2011)

The Sundarbans mangrove forest has been steadily degrading and biological resources have been rapidly depleted (Figure 1.2). Analysis of the inventories undertaken in 1959, 1983 and 1996 indicate that, on an overall basis for all mangrove species together, the growing stock declined by 51% between 1959 and 1996 (FAO, 2000; Iftekhar and Islam, 2004b) and the productivity of the mangrove system declined by 25% in the two decades leading up to 1985 (Millat-e-Mustafa, 2002). The forest is being depleted by the loss of growing stock (Iftekhar and Islam, 2004a) despite forest policies, laws and management plans that have been enacted to protect the forest (Roy et al., 2012). One of the reasons for the decline in major species of

mangroves (such as sundari *Heritiera fomes*) is their exploitation – both legal and illegal – for use in various livelihood functions such as fuelwood, charcoal and construction (IUCN, 2003). The rate of depletion of mangroves has been roughly calculated at 1% per year (Choudhury and Hossain, 2011). Despite a timber moratorium imposed by Ministry of Environment and Forest (MOEF), unofficial harvesting has caused significant deforestation in the Sundarbans (IRMP, 1998; Akhter, 2006).

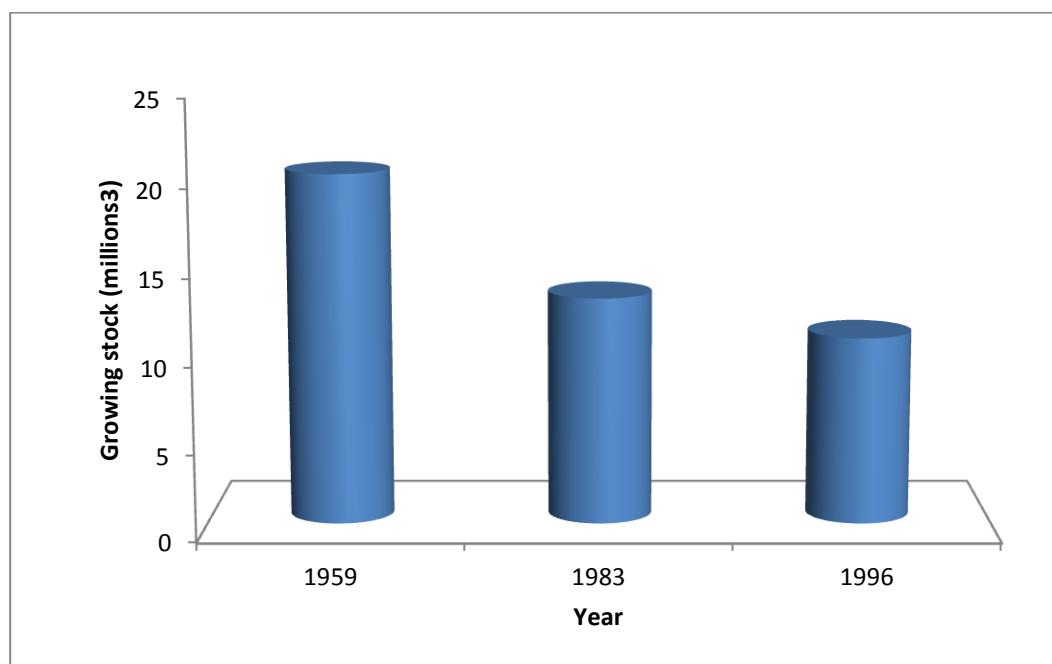


Figure 1.2: Growing stock of mangroves (million tonnes) in Sundarbans Reserved Forest (FAO, 2000)

The mangrove resources from the Sundarbans Reserved Forest (SRF) have been used for livelihoods by local communities located along its borders. Some researches have described some of the main livelihood activities conducted by communities who access the Sundarbans and also several of the constraints and opportunities. Islam and Chuenpagdee (2013) showed how fishers who operate in the mangrove areas of the Sundarbans coped with risk and shock, and identified the factors in their risk

negotiations and the implications of these factors for poverty alleviation. Islam (2010) studied the principal marketed value chains of products (aquatic resources, honey, nipa leaf, and mangrove timber) derived from the Sundarbans Reserved Forest. Sarker (2011) also described the livelihoods of fishers operating in the Sundarbans and identified several problems in fisher livelihoods such as health and sanitation, money lending and impacts of natural disasters. The research by Akon (2013) among fishers in two villages in the ecologically critical area (ECA) around the Sundarbans found that alternative income generating activities implemented there had a small but definite impact in reducing the fisher households' dependence on fishing and on local money-lenders. Zohora (2011) examined the harvest of non-timber forest product (NTFP) from Satkhira Range along the southwest border of the Sundarbans in the context of government regulations and found that restrictions on access to forest resources put harvesters in a vulnerable position and often drove them to break the rules in order to meet their livelihood needs. In a recent study, Getzner and Islam (2013) examined the income earned by four different mangrove resource-based occupation groups (fishers, crab, honey and nipa leaf collectors) in the Sundarbans and found that the major share of household cash income (90%) was directly related to the harvesting and use of Sundarbans resources.

While these studies have investigated some aspects of livelihoods of SRF resource users, they have not captured the livelihood strategies and level of dependence on mangrove and other sources across households in the different socio-economic groups residing in communities surrounding the Sundarbans. Therefore, research is necessary to document how households with different socio-economic backgrounds depend on mangrove resources, are able to organise themselves for survival, and how threats to their livelihoods can be overcome.

1.3 Shrimp Aquaculture, the Sundarbans and Livelihoods

Shrimp culture is confined to the southwestern part of Bangladesh surrounding the Sundarbans mangrove forest (Islam and Wahab, 2005). The area includes 80% of all shrimp farms in Bangladesh (Pokrant, 2006). The shrimp farms were established by converting rice land and using the shrimp fry gathered from the mangrove forests as the basic productive unit.

Shrimp aquaculture provides a livelihood for households, with USAID (2006) estimating that nearly 1.2 million people in Bagladesh were directly involved in shrimp production and an additional 4.8 million household members were supported by the industry.

In Bangladesh, a range of factors are responsible for the large-scale expansion of shrimp aquaculture. Structural adjustment policies were implemented in line with trade liberalisation and trade promotions were applied to stimulate exports, and these initiatives increased funds from international donors for shrimp farming in Bangladesh (Béné, 2005; Bhattacharya et al., 1999; Khatun, 2004; Paul and Vogl, 2011; Pokrant and Bhuiyan 2001; Pokrant and Reeves, 2001). Other factors such as a strong international market, high prices, cheap land and labour (Alauddin and Hamid, 1996; Fleming, 2004; Islam, 2009; Islam, 2008b; Islam et al., 2003), availability of shrimp fry (Islam et al., 2004; Islam and Wahab, 2005), ecological and climatic conditions of coastal areas (Chowdhury et al., 2011) and the investments made in upgrading production facilities and working conditions (Alam and Pokrant, 2009) also helped to expand shrimp farming areas.

In Bangladesh, while some people have greatly increased their income and well-being from shrimp farming (EJF, 2004; Manju 1996; Swapon and Gavin 2010), mangrove ecosystems and mangrove-based traditional livelihoods are increasingly under threat from shrimp culture (Gunawardena and Rowan, 2005; Primavera, 1997; Primavera, 2006). Shrimp farming has been major contributor to mangrove destruction with a corresponding loss of biological resources, particularly the destruction of by-catch involved with the collection of shrimp fry (Hoq et al., 2001; Islam et al., 2004; Shahid and Islam, 2003).

Ahmed et al. (2002) reviewed the literature on the shrimp industry in Bangladesh and identified that most of the research reported in the literature was primarily focused on the economic, environmental, social and management issues related to shrimp farming. Some studies have pointed to the environmental impact due to the unabated expansion of shrimp culture (Ali, 2006; Bala and Hossain, 2010; Chowdhury et al., 2011; Deb, 1998; Hoq, 2007; Hossain et al., 2013; Islam et al., 2003; Rahman et al., 2013a; Swapon and Gavin, 2010). Research on social issues has highlighted both the positive impacts of shrimp farming such as increased income and employment opportunities to farmers (Gammage et al., 2006; Hamid and Alauddin, 1998; Islam et al., 2003; Pokrant and Reeves, 2003; Sharmin and Ali, 2005; USAID, 2006), and the negative impacts including issues such as increased inequity (Ahmed, 1996; EJF, 2004; Halim, 2004; Ito, 2002; Manju, 1996; Samarakoon, 2004). It could be deduced from the literature that coastal aquaculture in Bangladesh has contributed significantly to rural employment and economic activity but this has been overshadowed by negative social, economic and environmental impacts (Azad et al.,

2009; Chowdhury et al., 2006; Halim, 2004; Swapan and Gavin, 2010; Wahab, 2003).

Even though shrimp cultivation has expanded in Bangladesh and around the Sundarbans region, there is a little information about its impacts on the households immediately surrounding the Sundarbans where the shrimp farming is most intense but where people also have access to forest resources. It is therefore important to identify the role that shrimp aquaculture has played in local household livelihoods and the extent to which shrimp farming has developed new livelihood strategies or vulnerabilities for the rural people.

1.4 Natural Hazards, the Sundarbans and Livelihoods

Bangladesh was recently ranked as the most climate vulnerable country in the world (Dasgupta et al., 2009; Harmeling, 2009). Floods, tropical cyclones and river erosion are the costliest natural catastrophes in Bangladesh and account for a significant proportion of damage, injury and loss of life and livelihoods (Parvin et al., 2008). Bangladesh currently has extreme vulnerability to cyclones, on account of its somewhat unique location and topography (Agrawala et al., 2003; Ali, 1996).

Climate change-related sea level rise and other hydro-meteorological effects could have a catastrophic impact on the Sundarbans mangrove ecosystems and surrounding human settlements (Cornforth et al., 2013). A high intensity event in 1986 devastated the Sundarbans and drowned thousands of its magnificent animals including the threatened species, the Royal Bengal Tiger (Agrawala et al., 2003). The Sundarbans was devastated by Super Cyclone Sidr which struck in November 2007 and Cyclone Aila which struck in May 2009; both of which entered Bangladesh from the

Sundarbans coast. The wind associated with the cyclones also devastated the vegetation of a large part of the forest. It was estimated that 45% (around 2500 sq km) of the total area of the Sundarbans was affected by Cyclone Sidr (Bhowmik and Cabral, 2013). Super Cyclone Sidr was one of the 10 fiercest cyclones to hit Bangladesh between 1876 and 2007 (Hossain et al., 2008); it damaged property worth Tk115.6 billion (US\$1.7 billion¹) which was equivalent to 2.8% of Bangladesh's GDP (GOB, 2008a). Despite protection from the Sundarbans, rural communities surrounding the forest were also affected by Cyclones Sidr and Aila. The estimated damage of assets by Aila was US\$270 million (CRED, 2011). The scale of the damage to households in affected areas caused by Aila was reported to be much higher than the damage caused by Cyclone Sidr (Kumar et al., 2010).

From the livelihood perspective, disasters play an important role in increasing vulnerability of rural communities (Khandlhele and May, 2006). Explicitly considering livelihoods within disaster plans, can assist when a threat manifests, helping to prevent a shock from becoming a disaster (Kelman and Mather, 2008).

There is little research documenting how livelihoods activities and strategies interplay with peoples' vulnerabilities and coping capacities in the face of natural hazards in the Sundarbans region. The research carried out in the present study will help understand how people surrounding the Sundarbans coped with the extreme natural events and shocks caused by Cyclone Aila in 2009, the losses incurred as a result of the cyclone and the different coping mechanisms adopted by affected people for survival.

¹ In this thesis a conversion rate of 68.8 Taka to the 1US dollar is adopted.

1.5 Research Objectives and Questions

The aim of this research was to study the livelihoods of people in Mongla and Koyra Sub-Districts on the edge of the Sundarbans. It considers how these livelihoods are influenced by mangroves, shrimp aquaculture and cyclones. The research centred on how to bridge the gap between human livelihoods, natural resource use and management and vulnerability in the Sundarbans region. It applied a sustainable livelihoods analysis (SLA) framework (see Chapter 2) to examine five objectives around assets, the shocks and stresses people face in their lives, their efforts in diversifying livelihood strategies, and the ways they handle livelihood vulnerabilities.

This study has five objectives:

1. To investigate the components of livelihoods assets and livelihood strategies and the outcomes of households in different income groups surrounding the Sundarbans mangrove forest.
2. To determine the level of dependence on forest resources across different income groups, the socio-economic factors that influence forest income dependency and the role of forest incomes in poverty alleviation and vulnerability associated with forest resource collection from a livelihoods perspective.
3. To understand the contribution of shrimp-based income within the overall household income portfolios among the different income groups and to identify the socio-economic factors necessary to engage in shrimp farming from the livelihood perspective, as well as the nature and extent of the vulnerabilities that have been created by this sector.

4. To analyse the impacts of the cyclone on households' assets and present a detailed assessment of the various factors that made households in the study area vulnerable to cyclone, and their coping strategies.
5. To examine the intentions and impacts of the policies and management actions relating to forest resources, the shrimp fishery and disaster management, which either promote or inhibit the livelihood activities of the people who depend on the resources in the Sundarbans study area.

This thesis addresses questions of livelihoods and natural resource use and management and vulnerability among rural communities in the surrounding regions of the Sundarbans and strives to address the following overarching questions and sub-questions:

Research Question 1

How are livelihoods structured, and what are the key factors underpinning them?

- What assets do households surrounding the forest have?
- What are the most important livelihood strategies and outcomes?

Research Question 2

How important are the mangrove resources in shaping the structure of livelihoods?

- To what extent do different income groups depend on mangrove forest income?
- What socio-economic characteristics of households determine this dependency?
- What is the potential effect of mangrove forest income for reducing income inequality and poverty?
- What are the vulnerabilities associated with mangrove resource collection?

Research Question 3

How important is shrimp aquaculture in governing the structure of livelihoods?

- To what extent do different income groups depend on shrimp?
- What socio-economic characteristics of households influence the shrimp income?
- Does shrimp income promote income inequality in the study area?
- What are the vulnerabilities associated with shrimp aquaculture?

Research Question 4

What are the impacts and responses to cyclones, a major natural hazard of the study area likely to increase in intensity with climate change?

- To what extent did Cyclone Aila impact on the livelihood assets?
- What are the coping strategies that people adopted to survive?

Research Question 5

How do policies relate to local livelihoods in the study area?

- What are the roles of the forest-related policies and institutions in improving the livelihoods of the forest resource users at the local level?
- To what extent do the existing policies and institutions of shrimp management promote or inhibit livelihoods in the study area?
- What are the roles of national and local government agencies and NGOs in disaster management and assisting local people to cope with the adverse outcomes of cyclones?
- What initiatives are likely to improve livelihoods, given the findings of this research?

The research examined the relationships between resource dependencies, changes in asset situation and the survival strategies among the households surrounding the Sundarbans where livelihoods are greatly influenced by mangrove resources, shrimp culture and natural disasters. The research will show the local situation in terms of available livelihood options is continuously changing, and this includes seasonal fluctuations and other recurring changes as well as sudden and unique changes. By applying the livelihoods approach, the study provides the opportunity for this SLA to put into practice. It is argued that livelihood systems in the area are complex, varied and dynamic, and that – for development to be sustainable – it needs to be informed by a thorough understanding of the many factors that shape the context in which livelihoods are generated.

1.6 Importance of the Study

Globally, the high dependence on forests for livelihoods occurs in areas of high forest cover and prevalence of poverty (Sunderlin et al., 2008). The geographical coverage of research on the economic importance of forest resources in general is limited to dry southern and eastern Africa (Rayamajhi et al., 2012). Studies on this topic have been carried out by Sjaastad et al. (2005) in Malawi, by Babulo et al. (2009) and Yemiru et al. (2010) in Northern Ethiopia, by Fisher (2004) in Southern Malawi, by Mamo et al. (2007) in Central Ethiopia, by Kamanga et al. (2009) in Chiradzulu District, Malawi, by Shackleton et al. (2007) and Ambrose-Oji (2003) in South Africa, by Heubach et al. (2011) in Benin, and by Tieguhong and Nkamgnia (2012) in Cameroon. Representing a smaller body of work, there has been some empirical research on the level of dependence across Asia and other areas such as work by Hogarth et al. (2013) in China, by McElwee (2008) in Vietnam, by

Illukpitiya and Yanagida (2008) in Sri Lanka, by Rayamajhi et al. (2012) in the central Himalayan forest of Nepal, and by Kar and Jacobson (2012) in highly degraded hill forest in Chittagong, Bangladesh.

The contribution of mangroves to the livelihoods of coastal communities globally is often overlooked with some exceptions such as the work by Hussain and Badola (2010) in India and Barbier (2007) in Thailand. Singh et al. (2010) studied the contribution of non-timber forest products in the livelihood of mangrove forest dwellers in the Indian part of the Sundarbans. In the Solomon Islands, Warren-Rhodes et al. (2011) found that the minimum annual subsistence value from mangrove was US\$345-1501 per household. Badola et al., (2012) suggested that increasing livelihood options might reduce local communities' dependence on mangrove forests in India.

The Sundarbans comprises a unique and diverse range of habitats and biodiversity. However, the Sundarbans is relatively poorly understood from a livelihoods perspective. In the Sundarbans, millions of rural people live in close proximity to forests, yet as noted earlier there has been little research published on their livelihoods (with the exception of some studies such as Islam and Chuenpagdee (2013), Getzner and Islam (2013) Sarker (2011) and Akon (2013) with some part livelihood components or aspects to their studies), such as their community assets, the socio-economic factors or how the community copes with vulnerabilities. The research that has been carried out in the region predominantly focused on ecology, hydrology and biodiversity (Biswas et al., 2007; Ellison et al., 2000; Harun-or-Rashid et al., 2009; Iftekhar and Islam, 2004a & 2004b; Iftekhar and Saenger, 2008;

Islam and Gnauck, 2011; Millat-e-Mustafa, 2002; Rahman et al., 2010; Wahid et al., 2007), wildlife (Barlow et al., 2008; Islam et al., 2007; Loucks et al., 2010) and fisheries (Chantarasri, 1994; Hoq, 2007; Hoq et al., 2006; Hoq et al., 2001; Islam, 2003; Islam and Haque, 2004; Islam and Wahab, 2005). Roy et al. (2013b) analysed the efficacy of the state property regime in managing the Sundarbans forest through a close examination of the relationship between property rights and mangrove conservation practices. Some studies have focused on mangrove resources degradation but little attention has been paid in those studies to households' responses to fluctuating resources and the extent of their resource dependency.

The research carried out to date in the Sundarbans has not captured the importance of the biophysical, social, cultural, economic, political and institutional factors that largely determine the livelihood options of different sections of people in the region. Therefore, there is an urgent need to carry out such investigations to examine how mangrove resource-dependent households develop survival strategies to cope with changes in assets and/or the degradation of resources.

The sustainable management of coastal forests is of crucial importance in the light of the problems affecting the mangrove resource and the livelihoods of coastal communities, as well as the needs of future generations. The results of this research will be valuable to the managers of other mangrove and coastal communities in relation to poverty alleviation and environmentally sustainable livelihoods, not only in Bangladesh but in other parts of the tropical world. The results may also help policy-makers and development agencies to determine the types of interventions that could be implemented in mangrove areas to support poverty reduction and to develop

policies for sustainable mangrove and shrimp resource management regimes. It will be particularly useful for those concerned with climate change and its impact on livelihoods, as this study examines how rural livelihoods are impacted by cyclones.

1.7 Thesis Outline

This thesis is structured in nine chapters. Chapter 2 presents an overview of the SLA framework, its origin and its different components. The strengths and gaps in the SLA framework are discussed and the application of this framework in my research is justified. The importance of the framework in relation to the research objectives is also discussed.

Chapter 3 presents the analytical and methodological framework adopted in this research. This chapter also describes the biophysical and socio-economic characteristics of the study area- two districts of Mongla and Koyra. The research methodology is then outlined, and the research approach, strategy and methods of data collection and analysis employed in the study are presented. The research design and field research procedures (protocol) are also discussed, including the sampling and triangulation strategies. The constraints encountered during fieldwork are also addressed.

Chapter 4 addresses objective one which aims to examine the components of livelihoods assets and livelihood strategies and the outcomes of households in different income groups surrounding the Sundarbans mangrove forest. The analysis investigated the nature and distribution of poverty and vulnerability.

Chapter 5 addresses objective two which aims to determine the level of dependence on forest resources across different income groups, the socio-economic factors that influence forest income dependency and the role of forest incomes in poverty alleviation and vulnerability associated with forest resource collection from a livelihoods perspective. The relationships between household assets and the resources people depend on for livelihoods are provided. The chapter reports vulnerability associated with forest resource collection and its influence on the wellbeing of forest-dependent households.

Chapter 6 addresses objective three which aims to understand the contribution of shrimp-based income within the overall household income portfolios among the different income groups and to identify the socio-economic factors necessary to engage in shrimp farming from the livelihood perspective, as well as the nature and extent of the vulnerabilities that have been created by this sector. The discussion in this chapter situates shrimp aquaculture resources within the broader household livelihood system. This understanding is in the context of the prevailing socio-economic environment including the extent of dependence among different income groups across the community.

Chapter 7 addresses objective four which aims to analyse the impacts of the cyclone on households' assets and present a detailed assessment of the various factors that made households in the study area vulnerable to cyclone, and their coping strategies. The losses incurred, vulnerability of livelihoods and different coping mechanisms adopted by people are discussed with reference to the example of Cyclone Aila which hit the Sundarbans coast on 25 May, 2009. The chapter presents data on various measures of the immediate effects of the cyclone on incomes and earnings,

looking in particular at the loss of assets. It also identifies household coping strategies and analyses the factors determining the choice of coping strategies. It examines the impact of major government and NGO interventions on household incomes and food consumption. Most importantly, an overall livelihood perspective is discussed to indicate the strengths and capacities of people living with disasters.

Chapter 8 addresses objective five which aims to examine the intentions and impacts of the policies and management actions relating to forest resources, the shrimp fishery and disaster management, which either promote or inhibit the livelihood activities of the people who depend on the resources in the Sundarbans study area. An assessment is made of the roles of national government, local government and NGOs in immediate responses to disaster in the context of providing support to the survivors, relief and rehabilitation operations to restore normal livelihoods. This chapter includes some recommendations that could assist resource managers to develop strategies to promote the sustainable livelihoods of the communities in the region.

Chapter 9 draws together the conclusions from the research findings and answers the research questions as presented in the first chapter. The lessons learned from the study, recommendations and policy implications of the research findings are presented, together with suggestions for further research.

Chapter 2: Conceptual Framework

Chapter 2: Conceptual Framework

2.1 Introduction

In Chapter 1, I introduced the sustainable livelihoods approach as the conceptual framework used to carry out this research. According to Allison and Horemans (2006:757), the sustainable livelihoods approach “combines a conceptual framework, with a set of operational principles to provide guidance on policy formulation and development practice”. This chapter presents a more detailed overview of the sustainable livelihoods approach, discusses the sustainable livelihoods frameworks (SLF) that have been derived from the SLA and gives a justification for applying the approach and framework to the research reported in this thesis. I first describe the development of the SLA, including how it has been operationalised through a range of SLF, and summarise both the strengths and potential shortcomings of both the SLA and associated frameworks. I then describe in detail the components of the SLF used in this research.

2.2. Sustainable Livelihoods Approaches

The term “sustainable livelihoods” was first used in the report of an advisory panel to the World Commission on Environment and Development (WCED) in 1987. It was used to focus on the redistribution and allocation of resources to the poor as key factors in the challenge to improving food security and reducing poverty (WCED, 1987) and described how people can create a living in ways that build on their assets and reduce their vulnerability to external perturbations (Scoones, 2009). The approach was seen as a bottom-up approach that recognised the strengths and assets

of the poor, rather than a top-down approach that emphasised deficiencies. The term “sustainable livelihoods” has since been used widely in the development literature although the meanings attributed to the term vary widely (Scoones and Wolmer, 2003:4). Initially, during the decade from 1987 to 1997, the SLA was developed and refined by Robert Chambers (in Cahn, 2006).

In 1997, the United Kingdom government white paper on International Development committed the Department for International Development (DFID) to supporting policies and actions that would use the SLA to ensure better education, health and opportunities for poor people and better management of the natural and physical environment. DFID then gradually expanded the SLA into country programming (Carney et al., 1999). In 1999, DFID established the Sustainable Livelihoods Support Office to co-ordinate learning and research issues and, in 2000, DFID commissioned the Livelihoods Connect website to promote information sharing and learning on the sustainable livelihoods approach (Solesbury, 2003). The SLA has since been adopted by many other international organisations, such as the Food and Agriculture Organisation (FAO), UNDP, Oxfam, CARE (Carney, 2002; Singh and Gilman, 1999; Hussein, 2002), International Institute for Environment and Development (IIED) (Schreckenberg et al., 2010) and the International Union for Conservation of Nature (IUCN) (IMM, 2008). These organisations have placed a different emphasis on different elements of the SLA depending on their mandates and scale of operation, even though all of them have used the SLA in rural communities to focus on poverty reduction.

2.2.1 Strengths of the Sustainable Livelihoods Approach

The SLA is people-centred and works at multiple levels, both at the level of poor people as individuals and groups, with the communities that surround them and with the various levels in the institutions and agencies with which they interact at the regional and national levels (Ashley and Carney, 1999). The approach is responsive to people's own interpretations of and priorities for their livelihoods (Carney, 1998). The approach is multi-dimensional in that it can focus on the relationships between levels of society and identify factors that may restrict the mobilisation and efficient use of assets (Cahn, 2006).

One of the strengths of the SLA is the way it progresses from holistic analysis to identifying a limited number of activities to make a practical difference to the wellbeing of poor people at the household level. It is used to analyse the daily lives of rural communities, particularly those of the poor, to understand the nature of their poverty and its links to different aspects of their livelihoods (Clark and Carney, 2008). The approach aims to focus development on poverty elimination by understanding people's strengths and vulnerabilities (Ashley and Carney, 1999; Farrington et al., 1999). The SLA also advocates the linking of poverty with the state of the natural environment on which so many poor communities rely (DFID, 2002a; Norton and Foster, 2001) in the process of reducing poverty and enhancing sustainable environmental management (Ellis, 2000a).

According to Allison and Horemans (2006:757), the SLA is “an approach to development policy and practice— not just a research or conceptual framework”. Allison and Horemans (2006) further pointed out that the SLA has been used in

contemporary development programs to design research into the role of small-scale fishing in rural livelihoods and to inform policy that aims to enhance the contribution of small-scale fisheries to poverty reduction and improve the livelihoods and food security of fisheries-dependent people. The SLA has been used widely to identify key constraints and opportunities for development interventions (Farrington et al., 1999; Shankland, 2000).

The SLA seeks to improve rural development policy and practice by recognising the seasonal and cyclical complexity of livelihood strategies, and by identifying ways of improving the capacity of livelihoods as a whole in order to cope with adverse trends and shocks (Allison and Ellis, 2001). It also embraces an approach to people's livelihoods that looks beyond only income-generating activities (Farrington et al., 1999; Shankland, 2000; Chambers and Conway, 1992).

Sustainability is central to people's achievement of secure livelihoods (DFID, 2000). Within the SLA, however, sustainability is not considered as a static and balanced state but as a state that is always changing and requiring constant adaptation. In this way, the SLA aims to expand livelihood opportunities, promote sound environmental management and reform policy measures (DFID, 2006a). Reducing vulnerability and increasing the sustainability of the livelihoods of the poor is seen as a priority (Carney et al., 1999). Livelihoods are also sustainable when they provide benefits without undermining the natural resource base on which they rely (DFID, 2006a,b).

2.2.2 Criticism of Sustainable Livelihoods Approach

One of the persistent failings of livelihoods approaches has been the failure to address wider, global processes and their impact on livelihood concerns at the local level (Scoones, 2009). Allison and Horemans (2006) stated that the SLA is “insufficient for analysing and addressing power and power relations” and argued that “with its focus on ‘households’ it does not explicitly consider intra-household differences in livelihood”. For example, the SLA is sometimes thought to be insufficiently explicit about poverty and power relations with respect to gender (Ashley and Carney, 1999). Given its holistic perspective, it is also difficult to know the limits of the temporal or spatial limits of the analysis (Kleih et al., 2003) with a suggestion that the SLA ignores long-term spatial dimensions. Thus, the construction of a livelihood is seen as an ongoing process in which the dynamic nature of the elements is captured repeatedly over time and space (Ellis, 2000a). Some scholars consider SLA thinking as too micro and too household-focused and believe that it fails to provide practical assistance on how to understand the core issues of the relations between local and supra-local institutions/policies and their links to policy (Clark and Carney, 2008).

There have also been concerns and issues raised during the implementation of the SLA. The SLA requires the long-term commitment and coordination of several institutions for its implementation as a means of reducing poverty (Clark and Carney, 2008). DFID has recognised a gap between the SLA and practical tools such as participatory rural appraisal (PRA). Toner (2003) recommends that, for the SLA to operate effectively, local people must be able to participate fully in analysing their assets and vulnerabilities and in developing strategies to escape from poverty.

2.3 Sustainable Livelihoods Frameworks

The sustainable livelihoods framework is the conceptual framework that enables the sustainable livelihoods approach to be applied. Scoones (1998) developed one of the earliest conceptual frameworks to guide research into sustainable livelihoods. A slightly modified version was put forward by Carney (1998) to guide development aid policy, while McDowell (2002) proposed an adapted version of the model for use in resettlement policy. Other frameworks include those developed by CARE (Carney et al., 1999:7), Oxfam (Carney et al., 1999:11) and Ellis (2000a:30).

The DFID sustainable livelihoods framework (2000) is the most widely used and conceptually sophisticated of all the livelihood models (Lautze and Raven-Roberts, 2006). The framework became widely used to investigate the underlying causes of poverty and vulnerability and to suggest strategies for poverty reduction by many major international research and applied development organisations such as the United Nations Development Program and the World Bank (Hussein, 2002).

The different versions of the SLF have a common origin and a common rationale in their overall aim of poverty reduction (Cahn, 2006). All the contemporary frameworks put significant emphasis on multiple capitals, human capabilities, multi-level links and flexibility in development actions (Deb, 2009). All the frameworks formulated to date examine the competition for and translation of limited assets into a workable livelihood strategy influenced by sets of external factors. The frameworks summarise the main livelihood components and outline the factors that influence livelihoods. SLF have been heralded as a holistic conceptual approach to

understanding community livelihoods with a particular capacity for addressing poverty alleviation through livelihood diversification (Campbell, 2008).

2.3.1 Criticisms of Sustainable Livelihoods Framework

The sustainable livelihoods framework was originally designed for use at the household level. It is now frequently used at the community level, which raises issues about how assets are defined at this level and how local-level processes are related to national policy (Clark and Carney, 2008). The “Policy, Institutions and Processes” element of the framework has been described as something of a black box due to the difficulties in matching theory with practice and it is difficult to use the SLF to determine how governments can configure policy in order to achieve good livelihood outcomes (Kanji et al., 2005). Rew and Rew (2003) suggested that, in eastern India, the SLF never really managed to accommodate the critical importance of social rank, caste and power relations to livelihoods. The framework furthermore does not put enough emphasis on local power relations, according to de Haan and Zoomers (2005) who asserted that “livelihood activities are not neutral, but engender processes of inclusion and exclusion”.

The SLF treats the market as part of the transforming structure and process (DFID, 2000). Allison and Horemans (2006) argued that the role of markets in livelihood development and poverty reduction is downplayed in the SLF. Clark and Carney (2008) highlighted the need to develop the market side of the SLF, particularly the links between markets and the poor.

There is also little consideration of physical or ecological risks in the SLF (Adger, 2006) and the importance of natural hazards that occur relatively infrequently tend to be downplayed in the analyses of vulnerability (Twigg, 2001). Murray (2002) pointed out that the “vulnerability context” in the SLF does not seem to allow for sufficient attention to critical situations such as conflict. The SLF also does not seem to provide a good analytical grip on the subjective dimension of wellbeing (Weeratunge et al., 2013).

Contemporary sustainable livelihoods frameworks tend to put equal emphasis on multiple assets, but this tends to overlook the importance of the cultural, political and institutional histories of communities and intra-household dynamics (Weeratunge et al., 2013). In the DFID framework (Farrington et al., 1999), culture is absorbed into other capitals but Cahn (2006) and Petheram and Campbell (2010) considered culture to be as important an asset as the five assets of the DFID framework, although closely linked with social and human assets (Cochrane, 2006). Daskon and Binns (2010) illustrated the important role of culture in influencing livelihood choices, asset ownerships, livelihood resilience and sustainability. Cattermoul et al. (2008) identified culture as helping to determine the assets to which a person has access, as well as defining how the broader society responds to their personal characteristics.

Baumann and Sinha (2001) considered the SLF to be too apolitical and suggested that political capital should be given equal status with other capital assets but Toner (2003) argued that a sound definition of social capital would necessarily include a consideration of power and political relationships.

Despite these criticisms, I argue in favour of using the SLF which is appropriate to address my research objectives. The inter-connection among different livelihoods components such as dependency on mangrove or shrimp aquaculture for livelihoods, the assets that determine those dependencies, vulnerabilities associated with those resources and policies governing resources will result in a holistic understanding of livelihoods when addressed by the SLF. Contemporary vulnerability frameworks such as Risk-Hazard Model or Pressure and Release Model do not put sufficient emphasis on natural resource dependence, and hence adopting such a framework for the analysis of the typical natural resource-dependent livelihoods of people becomes complicated. I apply a version of the SLF which does not represent cultural asset as a separate asset. I do not ignore cultural assets during discussion of social assets, vulnerabilities related to resource dependency and disasters but incorporate cultural aspects of the community in discussions related to other asset classes. Cultural aspects also influenced by macro or sectoral policies which can negatively impact micro-level livelihoods at community or individual levels which is also discussed during the analysis of policies and their role in livelihoods. Justification for the SLF approach for an analysis of livelihoods in the Sundarbans is discussed further in the next section.

2.4 Appropriateness to this Research

The SLA (Chambers and Conway, 1992; Carney, 1998; Scoones, 1998) and SLF (DFID, 2000) were considered for use as the conceptual method to examine the livelihood of households surrounding the Sundarbans mangrove forest because of the strong association between livelihoods and the natural environment within the study population. Carney (1998) showed that the SLA incorporated both natural resource-

based activities such as agriculture and the use of ‘wild’ natural resources into the analysis of livelihoods. It was also specifically designed for application to research problems in developing country contexts. The SLA was considered appropriate for the purpose of the present study as it provides a conceptual model for the integration of environmental issues into a holistic rural development framework (Carney, 1998) with poverty as a key driver of livelihood choices (DFID, 2002a; Norton and Foster, 2001).

In the research reported in the literature, the SLA has been utilised in different ways, according to the goal of the study or program. A growing body of research reports the use of a sustainable livelihoods framework to show the dependency of rural households on natural resource-based activities such as livestock husbandry, on environmental resources and on ‘wild’ forest resources (Cavendish, 2000; Shackleton and Shackleton, 2006). It has also been used in small-scale fisheries-based livelihoods and their management (Allison and Horemans, 2006; Ellis and Allison, 2004; Ferrol-Schulte et al., 2013). In the present research, the SLF was used to describe the assets and livelihood strategies of mangrove resource-dependent households surrounding the Sundarbans mangrove forest. This included understanding the role of shrimp aquaculture systems in livelihoods, as also done by Paul and Vogl (2013) for organic shrimp farming, by Ahmed et al. (2008a,b) for freshwater prawn farming and by Ahmed et al. (2010) for prawn post-larvae fishing in southwest Bangladesh. Gammage et al. (2006) also used a pro-poor livelihoods approach to explore how rents and returns in the shrimp sector can be better distributed across the value chain and Swapon and Gavin (2010) used an SLF to

describe the vulnerability context of shrimp farming in Koyra *Upazila* adjacent to the Sundarbans mangrove forest.

There is also a growing literature reporting the use of sustainable livelihoods frameworks to understand disasters as part of the wider vulnerability context within which livelihoods exist. The SLF tends to consider different forms of vulnerability that shape livelihoods (Twigg, 2001). The International Marine Management Limited (IMM, 2001) evolved a framework for cyclone analysis from SLF. An SLF has also been applied to understand the impacts of volcanic eruptions (Kelman and Mather, 2008) and post-disaster reconstruction (Cannon et al., 2003; Sanderson, 2000; Twigg, 2001, 2004; Wisner et al., 2004). The use of the SLA to analyse disasters highlights the linkages between the poor and the support agencies and policy framework in which they operate (IMM, 2001). Using the sustainable livelihoods approach, Gaillard et al. (2009) documented how livelihoods interplay with people's vulnerability and capacity in the face of natural hazards. I therefore selected the analytical framework of the SLA in order to find out how livelihoods were affected by a cyclone and the mechanisms used by households to cope after a cyclone.

2.5 Sustainable Livelihoods Framework and its Components

The central themes of this research, namely, the assets, vulnerabilities and livelihood strategies of households around the Sundarbans, are examined through the SLF developed by DFID (2000). Within the DFID SLF, the following definition of sustainable livelihoods by Chambers and Conway (1992:7) is used:

A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base.

A brief summary of the various components of the SLF is provided in Figure 2.1. The framework is based on the understanding that livelihoods result from the complex interaction of a dynamic set of factors that influence people's livelihood choices. Key elements of the model are: the vulnerability context, the stores of livelihood capital that are available to people (alternatively referred to as assets), the institutional processes and organisational structures that influence access to these resources, the livelihood strategies that people adopt, and the livelihood outcomes resulting from these strategies. The model also sets out the way in which changes in different assets are linked to each other. These elements are thought to be related in a variety of ways as indicated by the arrows in Figure 2.1. The SLF draws attention to core influences and processes, and emphasises the multiple interactions between the various factors that affect livelihoods. Based on the various interactions, the framework delineates a set of livelihood outcomes, which go well beyond income measures.

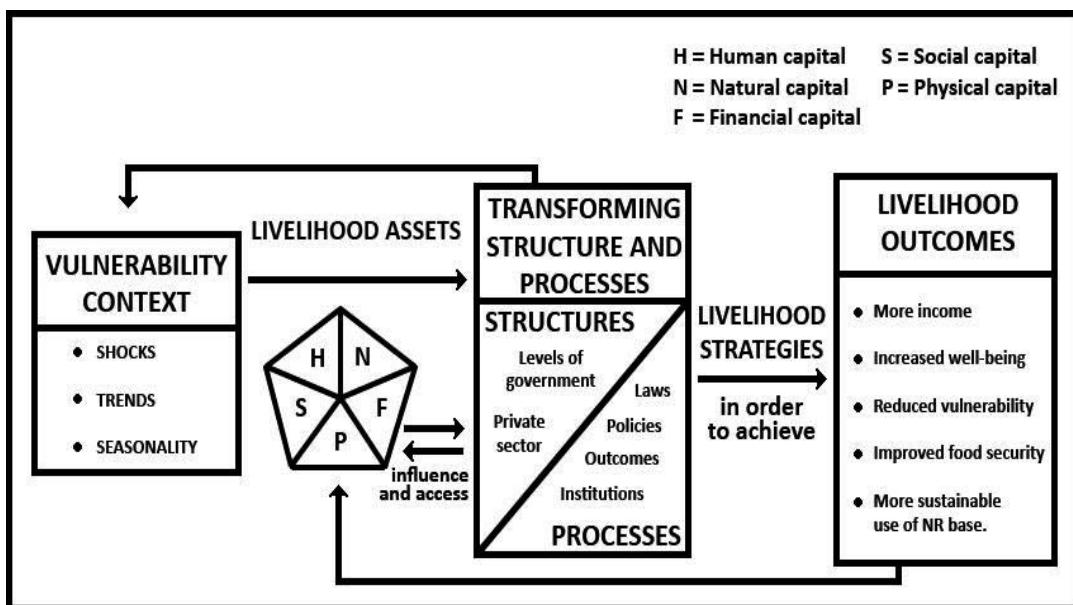


Figure 2.1: Sustainable livelihoods framework (DFID, 2000)

The framework as used in this thesis provides a way of organising livelihood analysis, either from the context of people's vulnerability or from the assets they have, which can be helpful in understanding how development constraints emerge at various levels (individual, household, or community) and why an individual chooses to adopt a particular livelihood strategy (DFID, 2000). The framework seeks to identify constraints and opportunities for the poor in their local environments, assess asset availability, and formulate opportunities in order to create an informed intervention.

2.5.1 Assets

The concept of assets was fundamental to this research. A livelihood strategy comprises “capabilities, assets and activities required for a means of living” (DFID, 2000). In this thesis, the term “assets” is used rather than “capital” for the sake of consistency. The pentagon in Figure 2.1 lists the five important assets or types of capital – a human, social, natural, physical and financial capital – that are the core of the livelihood framework. Capabilities are considered in relation to people’s freedom “to lead the kind of lives they value and have reason to value” (Sen, 1999:18). Assets refer to the basic material and social resources that people have in their possession (Scoones, 1998). Davies et al. (2008:57) explained that “different mixes of and degrees of substitution among the different types of capital assets provide inputs to people’s livelihood strategies, while these assets also represent the outcomes that characterize people’s lives”. A resilient livelihood requires flexibility and substitutability between assets so that adverse events can be withstood without compromising future survival (Ellis, 2000a).

Bauman (2002) stressed that the single most important factor in understanding livelihood strategies is to determine the ability of the poor to access assets. Assets, which are increasingly promoted to complement income-based measures of wealth in order to extend the understanding of the character of poverty and the complexity of processes underlying poverty reduction (Adato et al., 2006; Carter and May, 2001), are gradually scaled up quantitatively and qualitatively (Ellis and Mdoe, 2003). When the assets of a livelihood system are depleted and institutions are unable to adapt to change, available livelihood strategies become “brittle”, resulting in reduced resilience and increased vulnerability to disturbance (Glavovic et al., 2002). Vatsa (2004) suggested that assets are the key to reducing risk and vulnerability and that a sustainable strategy for disaster reduction must therefore focus on asset-building. Assets (that is, physical, financial, natural, social and human capital) are the function of the relevant enabling or hindering policies and the outcome of customary and formal institutions (Allison and Ellis, 2001; Ellis, 1998; Glavovic and Boonzaier, 2007).

Access to these capital or asset categories in the form of ownership or right of use is the main concern of the framework in efforts to support livelihoods and fight against poverty. For example, a study by Sen (2003) showed that the entry or exit from poverty depends on the initial asset position (for example, the amount of land owned) and that access to assets facilitated and encouraged the diversification of income-deriving activities. The household asset situation determines the ability of the members of the community to interact with policies, institutions and processes that shape the choice of livelihood strategies (Kleih et al., 2003; Larson et al., 2007). As Bebbinton (1999:2022) argued, assets “are not simply resources...they are also the basis of

agents power to act, and to reproduce challenges or change the rules that govern the control, use and transformation of resources". These, in turn, lead to livelihood outcomes. These outcomes feed back into the future asset base. The following section describes the attributes of each capital and how they relate to one another.

2.5.1.1 Human Assets

Understanding human capital in the SLA is extremely important in the assets pentagon as the SLA emphasises the collective capabilities of individuals in a community (DFID, 2000). Human capital includes knowledge, skills, labour ability, and good health that jointly enable a person to perform various livelihood strategies to achieve livelihood objectives (Scoones, 1998). Human capital is particularly important at a household level, which here includes the amount and quality of the available labour. Human capital at a household level varies based on household size and the leadership potential, skill level and health status of family members. Human capital can be considered a building block or means to achieve desired livelihood outcomes. In fact, when properly accumulated, it can be regarded as an end in itself. It encompasses not only the quantity of the physical ability embodied in human capital but also the quality of the human capital (such as skills and knowledge) that enables people to take advantage of economic opportunity (Rakodi, 1999). Human capital also refers to the knowledge and skills related to particular livelihoods that enable the community to take opportunities to engage in income-earning activity (Rakodi, 1999). Human capital also consists of knowledge of resources, traditional knowledge of resource use and the skills needed to make that knowledge operational and to collect resources (Allison and Ellis, 2001). Sen (1997) noted that the possession of human capital not only means that people produce more and more efficiently, it also gives them the capability to engage more fruitfully and

meaningfully with the world, and most importantly, the capability to change the world.

2.5.1.2 Natural Assets

Natural capital represents natural resource stocks that can be derived through resource flows and services that support livelihoods (Davies et al., 2008; Garnett et al., 2007; Scoones, 1998). There are various resources that make up natural capital, ranging from intangible public goods, like the atmosphere, to divisible assets used directly in production, like land and trees. Natural capital is the resource from which people derive all or part of their livelihoods. Natural capital includes land, forests, marine/wild resources, water and air (DFID, 2000). Salagrama (2006) identified three factors that affect the natural capital, namely, the status of the natural assets, habitat destruction, and the open access/common property of natural resources. Natural capital is clearly important to people who derive all or part of their livelihood from forest gathering, fishing, farming or mineral extraction.

2.5.1.3 Physical Assets

Physical capital is the basic infrastructure and goods (tools and equipment) needed to support livelihoods. Infrastructure comprises changes to the physical environment that help people to meet their basic needs and to be more productive (DFID, 2000).

Physical capital is the combination of producer goods and basic infrastructure that support livelihoods. Producer goods are the equipment and tools used by people in production; such goods constitute the physical infrastructure that enables people to become productive (Scoones, 1998). Examples of essential infrastructure include transport, shelter, water supply and sanitation, energy and information. Better

infrastructure drives down transaction costs and boosts investment in both the agricultural and non-agricultural sectors (Escobel, 2001). Improvements in physical assets and human assets have been identified as the two most important factors influencing the escape from poverty (Sen, 2003).

2.5.1.4 Financial Assets

Financial capital is comprised of cash, savings credit/debt and other economic assets (DFID, 2000). The increased cash earned can be put into savings or invested in physical assets, such as livestock, jewellery, tools or household furniture, some of which promote a regular inflow of money. Remittances are also a form of financial capital. Ellis (1998) found that members of a family who worked in urban areas or other places often maintained their strong relationships with family in rural areas through providing cash especially during emergencies. Livestock are also considered as a store of wealth and as a buffer against bad times. Another important factor in financial capital is the existence of financial institutions.

Gertler et al. (2009) found that the presence of financial institutions in rural areas in Indonesia helped the rural community to mobilise their financial resources in coping with vulnerability. In Bangladesh, micro-credit provided by financial institutions is widely available to poor people (Hashemi, 2006; Khandker, 2005) although the evidence for the effectiveness of micro-credit programs remains inconclusive (Rahman and Khan, 2012). According to the Grameen Bank (cited in Rahman and Khan, 2012), micro-credit is a special type of financial service for people who are underprivileged, unemployed and unable to provide the collateral necessary to access the traditional banking system. Financial capital can easily be converted into other

assets depending on the available transforming structures and processes. Financial capital can also be used directly to achieve livelihood outcomes, such as purchasing food to reduce food insecurity.

2.5.1.5 Social Assets

Putnam (1993) defined social capital as the features of social organisation such as networks, norms and social trust that facilitate coordination and cooperation for mutual benefit. Ballet et al. (2007) described the various social organisations making up a society, such as family, social networks and voluntary associations, as structural social capital. This group of assets has also been defined as a “resource of last resort” because it provides a buffer that helps the poor to cope with shocks (DFID, 2000; Farrington et al., 2002).

Woolcock (2001) defined social capital as a norm and network, while Ballet et al. (2007) included shared norms, values, attitudes and beliefs within cultural social capital. Putnam (1993, 2000) identified two forms of social capital: bonding and bridging. Bonding social capital is defined as the connections that bring a group together, whereas bridging social capital refers to the connections between organisations/groups. In addition to norms and networks, social capital also consists of rules, sanctions and levels of association (Pretty, 2003). Pretty and Smith (2004) pointed out that norms, rules and sanctions could also trap people within harmful social arrangements.

Social capital is an important factor in understanding the community’s livelihood because it helps understand the relationship between assets, institutions and

livelihoods (Bebbington, 1999). Bodin and Crona (2008) suggested that social capital provides a framework for understanding the structure of social networks, leadership and links to external agencies that enhance natural resource management at the community level. In the sustainable livelihoods framework, access to livelihood opportunities is governed by social relations, institutions and organisations (de Haan, and Zoomers, 2005). An assessment of a combination of social and cultural capital helps to understand the underlying power relationships that shape individuals livelihoods which determine people's ability to co-operate explicitly or implicitly in community-based natural resource management (Ballet et al., 2007).

2.5.2 Vulnerability

Vulnerability has emerged as a crucial concept in a variety of disciplines. In the SLF, people are viewed as operating in a context of vulnerability. The framework presents three different types of vulnerability, namely, trends, shocks and seasonality (DFID, 2000). In the DFID SLF, vulnerability is considered both a “context” (e.g., shocks, trends, seasonality) and a “livelihood outcome” (Alwang et al., 2001). Livelihood sustainability is affected by external factors, referred to as the vulnerability context, comprised of cycles (e.g., seasonality), trends and shocks that are beyond the household's control (Allison and Horemans, 2006). DFID (2000) further defined vulnerability as risk, uncertainty, lack of security, lack of assets and clarified that it consists of many factors, some of which relate to policies and institutions.

Livelihoods can be made more or less vulnerable by long-term trends, with not all trends being negative or causing increased vulnerability (DFID, 2000). According to DFID (2000), many economic trends – such as the long-term decline in the real prices of many tropical agricultural commodities – are relatively fixed and

predictable. Trends such as decreasing catch rates and increasing prices of fish, and the role of factors unrelated to fisheries that nevertheless impact on fishing households (such as the rising cost of food staples or medicines), make poor households in a fishing community more vulnerable (Allison and Horemans, 2006). Trends in environmental change and other social and demographic processes make individuals and social systems more vulnerable to surprises and more susceptible to unforeseen consequences of action (Cutter, 2003). In the context of the study area for the present research, the change from agriculture to shrimp aquaculture is a trend at the local level that can have positive or negative outcomes for local livelihoods. Negative outcomes caused by such trends are regarded as vulnerability (DFID, 2000). The positive outcomes and vulnerabilities caused by shrimp aquaculture in relation to the livelihoods investigated in the present study are discussed in Chapter 6. Similarly, trends in resource collection in the Sundarbans, such as dependency on moneylenders and illegal livelihood activities, are examined in Chapter 5.

Seasonality is expressed through seasonal shifts in prices, production, food availability, employment opportunities and health (DFID, 2000). Some aspects of household vulnerability vary with the seasons (Pomoroy et al., 2006). In the context of the study area, seasonality also had an impact on the availability and type of the resources from the Sundarbans (as discussed in Chapter 5).

Vulnerability begins with a notion of risk which is characterised by a known or unknown probability distribution of events where the events are themselves characterised by their magnitude (including size and spread), their frequency and duration, and their history (Alwang et al., 2001). In the DFID SLF, vulnerability is considered both a “context” (e.g., shocks, trends, seasonality) and a “livelihood

outcome”. The term “vulnerability” describes the risk-response interactions and the outcome (Carney et al., 1999). Therefore, the outcome of risk or risk-response interaction is the loss of livelihood and continued vulnerability to subsequent shocks. The risks and the associated outcomes for livelihoods in the Sundarbans are discussed in Chapter 5.

Shocks, on the other hand, are typically sudden, unpredictable, and traumatic (Chambers and Conway, 1992). Shocks include storm damage to shore facilities, toxic algal blooms, fuel-price hikes and sudden changes in currency value that affect the costs of fishing inputs and market prices for fishery products (Allison and Horemans, 2006). Natural hazards such as cyclones and floods are placed within the shock category of vulnerability. The definitions of vulnerability in the disaster and climate change-related literature tend to fall into two categories in which vulnerability is viewed: either (i) in terms of the amount of (potential) damage caused to a system by a particular climate-related event or hazard (Jones and Boer, 2003); or (ii) as a state that exists within a system before it encounters a hazard event (i.e., structural factors that make human societies and communities susceptible to damage from external hazards) (Allen, 2003). Levine et al. (2007) found that people are threatened by hazards because of their social, economic and environmental vulnerability. Vulnerability in a given social situation in combination with environmental forces produces a disaster (Oliver-Smith, 2005). Wisner et al. (2004:11) defined vulnerability as “the characteristics of a person, or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard”. Vulnerability is perceived as being connected to the human occupancy of a hazardous location and their risks of exposure to potentially

damaging but external trigger events (Borden et al. 2007; Cutter, 1996; Few, 2003; Twigg, 2001). Vulnerability as a function of the exposure (who or what is at risk) and the sensitivity of the system (the degree to which people and places can be harmed) is borne from inequalities which affect access to resources and information, the ability to absorb the impacts of hazards and disasters without government interventions, housing choice and location, and the political marginalisation of impoverished residents (Cutter et al., 2008). Vulnerability can also be seen as the inability of certain groups to cope with shocks and take advantage of profitable opportunities (Dercon, 2005). In the context of the study area in the present research, the vulnerabilities that arise as the result of cyclones are examined in Chapter 7.

According to Chambers (1989), vulnerability has two sides: an external side of risks, shocks and stress to which an individual is subjected; and an internal side which is defencelessness, meaning a lack of the means to cope without damage or loss. Ellis (1998) defined coping as the ability to maintain consumption in times of disaster, which may include drawing on savings, using food stocks, selling livestock, or receiving gifts from relatives and friends. The internal side of vulnerability is linked to net assets; as Moser (1998:3) noted, “the more assets people have, the less vulnerable they are, and the greater the erosion of people's assets, the greater their insecurity”. Fewer assets equate to greater vulnerability, and a low potential for substitution between assets and activities makes livelihoods more vulnerable, especially to shocks (Morris et al., 2001). Assets that can readily be liquidated and used to purchase more appropriate assets provide for livelihood flexibility (Ellis, 2000a). In Chapter 4, vulnerability is discussed in relation to the asset status of the investigated households.

Most research on vulnerability suggests that, while the concept is closely linked to poverty (Allison et al., 2009, 2011), vulnerability and poverty should be understood as two divergent phenomena. Poverty is usually a state of not having enough for a basic livelihood, while vulnerability forecasts the likelihood of suffering or falling into poverty traps in the future (Lok-Dessallien, 1998; Moser, 1998). The definition of poverty, or wellbeing, is commonly based on estimates of income or consumption expenditure (Khan, 2001; Headey and Wooden, 2004; Ravallion, 1996). The World Bank (2000) defined extreme poverty as living on less than US\$1/day, measured at purchasing power parity. Those analyses, however, do not acknowledge the multi-dimensional nature of poverty (Baulch, 1996; Bossert et al, 2009; Chambers, 1995; Kabeer, 1994).

While poverty is associated with a lack of income and productive assets (such as cultivable land), poverty is also associated with limited or no access to basic sanitation, minimal health services (Brocklesby and Hinshelwood, 2001), unhealthy and unhygienic living conditions, illiteracy and lack of formal education, lack of political power or exclusion, and overall marginalisation (Allison et al., 2005, 2011; Béné et al., 2006; DFID, 2002b; Narayan et al., 2000). United Nations (1995) defined absolute poverty as a condition characterised by severe deprivation of basic human needs, including food, safe drinking water, sanitation facilities, health, shelter, education and information. It depends not only on income but also on access to services.

These features of poverty make the poor vulnerable (Holland et al., 2000). Based on the views, experiences and aspirations of more than 60,000 poor women and men from 60 countries, Narayan et al. (2000) defined poverty as hunger, precariousness, lack of assets and a limited or lack of ability to access loans and capital. One way of viewing poverty is to see it as “deprivation” (Kabeer, 1994:137) or as an “end”. Another way of viewing poverty is to see it as a “means” whereby people do not have the capabilities, entitlements, resources or assets to acquire a decent livelihood (Kabeer, 1994:138). Vulnerability encompasses the lack of capability, which reproduces the multi-dimensional poverty conditions (Anwar, 2008). This vulnerability turns into poverty when the poor do not have access to resources (Sen, 1981). Using a new framework combining vulnerability and exclusion as the two central dimensions of poverty, Béné and Friend (2011) argued that the issue of poverty in fish-dependent communities cannot be reduced to a simple correlation between income poverty and fishery dependence; rather, poverty in fishing communities often relates to a wide range of socio-institutional factors other than income, including land ownership, debt, access to health, education and financial capital, and marginalisation from political decision-making. In Chapter 4, the poverty and vulnerability of the households investigated in the present research are discussed in relation to the income and asset status of the households.

2.5.3 Policies, institutions and processes

A key component in the sustainable livelihoods framework combines policies, institutions and processes because the three are closely inter-related contextual factors that have a great effect on all aspects of livelihoods (DFID, 2000). This component, referred to as “transforming structures and processes” in earlier versions

of the framework, are the institutions, organisations, policies and legislation that influence and are influenced by people's livelihood strategies or that shape livelihoods (DFID, 2000). Livelihood approaches explicitly consider the links between local issues, meso-level processes and wider concerns, including national policy and economic or social change (Allison and Horemans, 2006). Sustainable livelihoods analysis highlights the importance of macro-micro links, including how they affect people's lives in multiple ways, and the extent to which people themselves can influence these links (DFID, 2000). "Policy" is complex and dynamic, and the term embraces a range of different aspects (Pasteur, 2001a). Pasteur (2001a) stated that policy statements are what one might firstly think of as policy, but the processes by which policy is informed and formulated are also highly significant. The impact of policy on people and their livelihoods is mediated by organisations and institutions, such as markets, laws, the media, NGOs or bureaucracies (Pasteur, 2001a,b).

The term "institution" can itself be complex and difficult to define. Freeman et al. (2004:164) defined institutions as "customs, rules, regulations, laws, public agencies and the way these habitually, and from precedence go about doing what they do".

According to Allison and Horemans (2006:762) institutions mean:

...the way that organisations operate within the public and private sectors and the rules and norms governing peoples' interactions and activities. These may include systems of taxation, land tenure arrangements, social and professional organisations, the way markets function, traditional and religious authorities, kinship and ethnic networks and community-based organizations.

An analysis that includes policies, institutions and processes within a sustainable livelihoods framework places the focus firmly on the practice of institutions rather than the rhetoric (Cahn, 2006).

Assets and activities are highly influenced by the policy, institution and process (Allison and Horemans, 2006) that impact on the community, households and individuals (Scoones and Wolmer, 2003). Policies, institutions and processes can also influence the livelihood strategies that people choose and the way these strategies are “played out” (Scoones and Wolmer, 2003:4). In the last decade, there has been more emphasis on how the structures of institutions and organisations (government, private, market, or community) affect livelihoods as well as the processes such as laws, policies, societal norms and incentives (Carney, 2002; Helmore and Singh, 2001; Scoones and Wolmer, 2003).

These policies, institutions and processes exist at multiple levels: local, regional and national. Policies, institutions and processes, according to Baumann (2000), are also a political asset that links an individual or a group to power structures and policy outside the locality. The public and private sectors, civil society, and community institutions may all be relevant considerations, as are laws and culture. Macro-level policies, institutions and processes may influence decentralised decision-making that, in turn, may affect local livelihoods and therefore responses to local demands (Baumann, 2000).

2.5.4 Livelihood Strategies

In the SLF, “livelihood strategies” is an overarching term used to denote the range and combination of activities and choices that people make or undertake in order to achieve their livelihood goals including productive activities, investment strategies and reproductive choices (DFID, 2000). Livelihood strategies are composed of activities that provide the means of household survival or living (Ellis, 2000a). The diversification of livelihoods helps to reduce vulnerability in rural communities (Allison and Ellis, 2001). The kinds of strategies which may, or may not, be available to a household are thought to be mediated by the nature of its asset holdings in relation to broader political and economic contexts that influence livelihoods. These assets interact with policies, institutions and processes to shape the choice of livelihood strategies. In his formulation of an SLF, Scoones (1998) listed three broad clusters of livelihood strategies that cover a wide range of options available to poor people in rural areas: 1) agricultural intensification/extensification, 2) livelihood diversification, and 3) migration.

The concept of coping strategies also has connections to livelihood resilience; households with a higher level of livelihood resilience are expected to enjoy livelihood wellbeing and sustainability (Chambers and Conway, 1992). Livelihood strategies can be positive, helping households to become more resilient and less vulnerable, or negative when they result in a further erosion of the asset base (Chambers and Conway, 1992).

The degree of diversification depends on three factors, namely, resource availability, the level of risk associated with alternative options, and the potential benefit derived from the chosen livelihood options (Scoones, 1998). Allison and Ellis (2001)

promoted a livelihood approach to management that takes into account the diversity of livelihoods, not just in the community, but also in extended family structures.

Allison (2004) suggested diversification and risk-spreading behaviour as common features in livelihood strategies. Ellis (2000a) discussed the expectations of rural communities when diversifying their livelihoods, such as greater food security, reduced income failure and reduced intra-year variability due to the effects of seasonality or market fluctuations.

2.5.5 Livelihood Outcomes

Livelihood outcomes are defined as the achievement or outputs from livelihood strategies as livelihood strategies are intended to provide a range of outcomes that will improve wellbeing and reduce poverty in its broadest sense (DFID, 2000).

Livelihood outcomes include conventional indicators such as income, food security and the sustainable use of natural resources but can also include a strengthened asset base, reduced vulnerability and improvements in non-material aspects of wellbeing (DFID, 2000). The outcomes will be context-specific and will vary between individuals, households and communities. There will also be trade-offs between outcomes.

Based on the various interactions, the sustainable livelihoods framework delineates a set of livelihood outcomes by looking beyond income-generating activities (Chambers and Conway, 1992; Farrington et al., 1999; Shankland, 2000). In an analysis of outcomes and trade-offs, Scoones (1998) argued that sustainable livelihoods tend to create the following results: increased numbers of working days, reduced poverty, improved wellbeing, and enhanced human capabilities.

The sustainable livelihoods framework takes a positive stance on livelihood outcomes, with an emphasis on outcomes such as livelihood wellbeing, better ecosystem health, social equity and justice (DFID, 2000). It is argued that such a generalisation is difficult to make, and livelihood outcomes might not necessarily be positive, especially in the case of marginalised sections of a society (Deb, 2009). Under negative externalities, such as ecosystem health degradation, macro- and micro-economic instability, poor governance and antagonistic roles of the formal institutions, the livelihood outcomes of the poor would inevitably become brittle (Glavovic et al., 2002).

This chapter has reviewed the concept of sustainable livelihoods that was applied as the basis of this study. It then focused on the sustainable livelihoods framework, exploring the different components of the schematic diagram developed by DFID. The sustainable livelihoods framework requires a “hybrid” methodological approach (Scoones, 1998); accordingly, in the next chapter, I discuss the various methods that were applied to examine livelihood issues in the study area.

Chapter 3: Methodical Context and Study Approach



Chapter 3: Methodical Context and Study Approach

3.1 Introduction

This chapter discusses the methods that were applied to examine the different aspects of household livelihoods. First, this chapter describes the physical setting and the socio-economic and demographic environment of the study area. Then, it outlines the methodologies used in both the field work and analysis stages of this research. Both qualitative and quantitative research methods were used to collect the data, employing a variety of techniques such as household surveys, focus group discussions, key informant interviews and observations. The final section discusses the challenges and difficulties faced in conducting the research.

3.2 Study Region

3.2.1 Bangladesh Country Profile

Bangladesh is situated in the north eastern part of South Asia between latitudes the 20°34' and 26°38' North, and between the longitudes 88°01' and 92°41' East. Bangladesh is bordered in the west, north and east by a 2,400 km land frontier with India, in the south-east by a short land and water frontier (193 km) with Myanmar, while in the south there is an irregular deltaic coastline (700 km) on the Bay of Bengal (BBS, 2011b). The total area of Bangladesh is 147,570 km² which extends 820 kilometres north to south, and 600 kilometres east to west (BBS, 2011b; Figure 3.1).

Bangladesh is located on one of the world's largest river deltas, created by the Padma (as the Ganges is called Bangladesh), the Brahmaputra, the Meghna and the Karnaphuli Rivers and their tributaries. Three distinctive features characterise the topography of Bangladesh: a broad deltaic flood plain (80%), terrace areas (8%), and a small hilly region (12%). Except for the hilly regions in the north-east and south-east and some higher lands in the north, the country consists of a fertile plain a few metres above sea level across which flow 230 river tributaries with a total length of about 24,140 kilometres. The alluvial soil is thus continuously being enriched by heavy silts deposited by rivers during the rainy season (BBS, 2011b).

Bangladesh has a sub-tropical monsoon climate with three seasons: winter (November-February), summer (March-June), and the monsoon (July-October). The average annual rainfall varies from 1429 to 4338 millimetres (BBS, 2011b). Bangladesh is governed by a Parliamentary form of government. The President is the head of the state while the Prime Minister is the head of the government. The Prime Minister is selected by the President. The Prime Minister is assisted by a council of ministers in discharging his/her duties. For the convenience of administration, the country is divided into six administrative divisions, each placed under a Divisional Commissioner. Each division is further sub-divided into 64 districts. Each district is headed by a Deputy Commissioner who is assisted by other officials. Each district is further divided into a number of sub-districts (Upazila) headed by a democratically-elected Upazila Chairman.

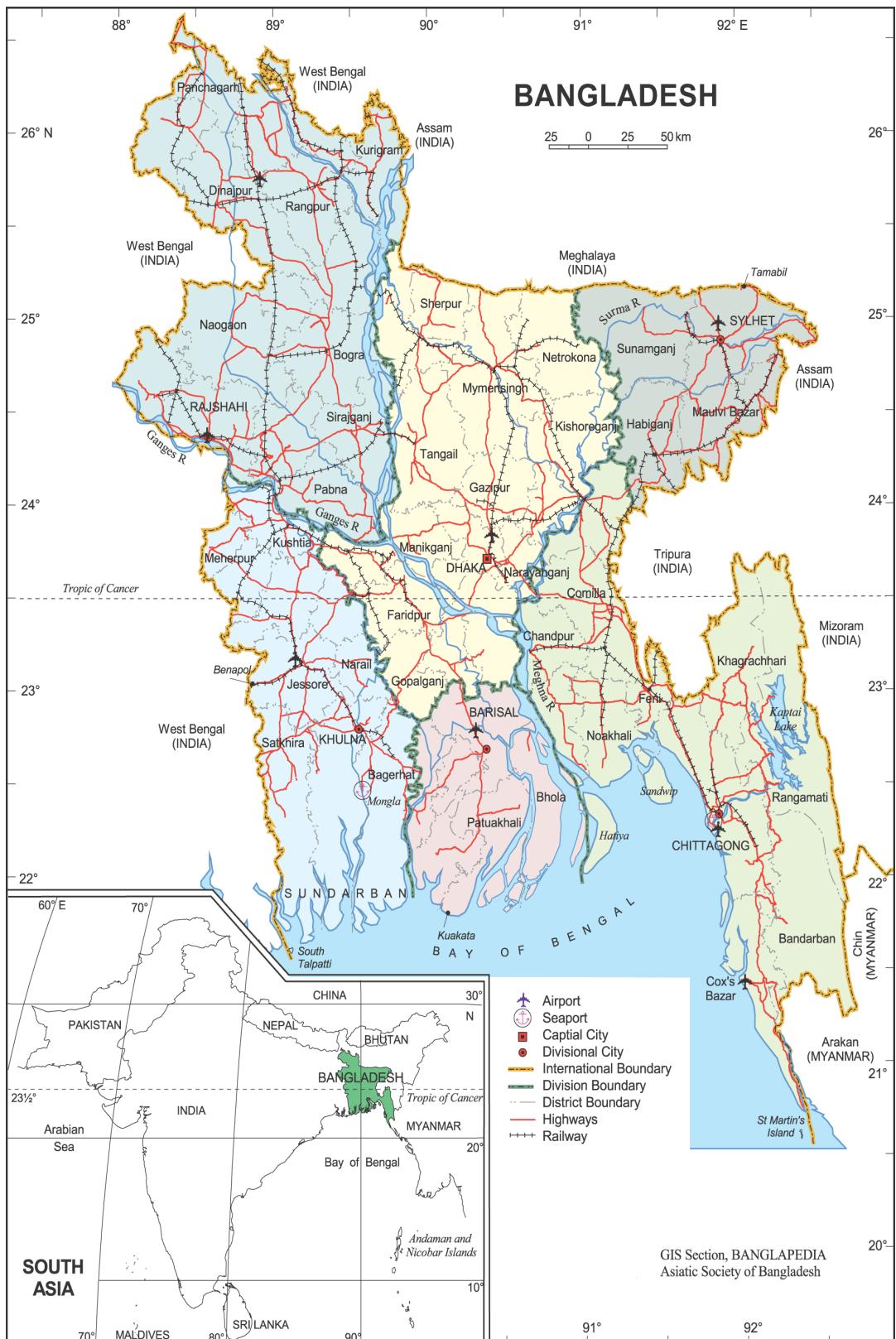


Figure 3.1: Political map of Bangladesh (Bangla Pedia, 2013)

The Bangladesh population was 150.6 million in 2011 (GOB, 2012) of which 76% was rural, with 103 males per 100 females. The density of population was approximately 964 per km² in 2011 with a population growth rate of 1.37% between 2001 and 2011 (GOB, 2012). The average household size declined from 6.1 in 1991 to 4.8 in 2001 and 4.4 in 2011 (BBS, 2012 a, 2012b) while life expectancy rose from 49.0 years in 1980 to 67.2 years in 2009 (GOB, 2012).

According to the UNDP (2013) Human Development Report rankings, Bangladesh ranked 146th out of 186 in 2012 with a multi-dimensional poverty index score of 0.292. The monthly household nominal income in 2010 was estimated at Tk11,480 (US\$167) nationally, averaging Tk9,648 (US\$140) in rural areas and Tk16,477 (US\$240) in urban areas (BBS, 2011a). GDP grew by 6.32% in 2011-12 (GOB, 2012). GDP per head was US\$755 when last recorded in 2000, and was highest around the capital, Dhaka, and lowest in Khulna Division where the Sundarbans is located (BBS, 2011b). Although the agricultural sector, including fisheries and forestry, employed about 25.2 million people in 2010 (BBS, 2011b), its share of GDP declined from 18.6% in 2001 to 15.8% in 2010 (BBS, 2011b).

3.2.2 The Sundarbans and its Impact Zone

The Sundarbans mangrove forests cover an area of about 10,000 km² of which about 62% is in Bangladesh and the remainder in India (Hussain and Acharya, 1994) (Chapter 1, Figure 1.1). The forests are bounded on the south by the Bay of Bengal, to the west they are contiguous with the Indian Sundarbans and on the east and north they are separated from cultivated land by a complex of small rivers and streams (IRMP, 1998; Siddiqi, 2001). Within Bangladesh, the forests are spread across 17

sub-districts within the five districts of Khulna, Satkhira, Bagerhat, Pirojpur and Borguna (Samarakoon, 2004; ADB, 1998; Islam, 2010). The forested area was set aside as a reserve in 1878; this status has been retained since independence, and the area was recognised as an internationally important Ramsar Wetland Site in May 1992 and as a World Heritage Site in 1997.

The Sundarbans Reserved Forest is divided into four zones: the marine zone, including the marine area of the extreme south of the forest; the protection zone, including three wildlife sanctuaries where all types of resource collection are illegal; the production zone, which is subject to sustainable harvest; and a buffer or impact zone, which is a belt approximately 20 km wide on the periphery of the reserved forest (Figure 3.2).

The research project was carried out in Mongla and Koyra Sub-Districts, both within the SIZ, in villages that are peripheral to the Sundarbans.

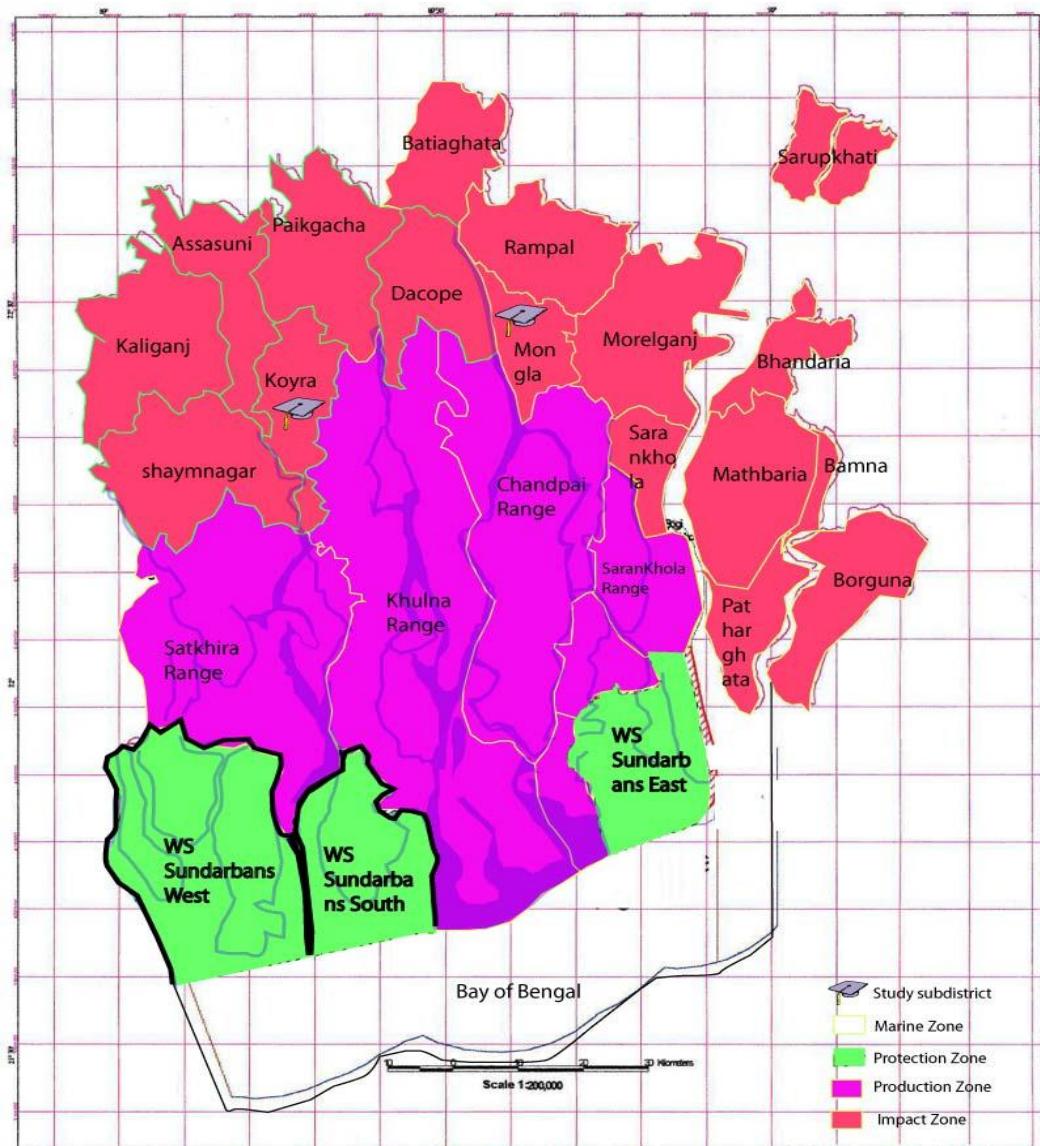


Figure 3.2: Map of the Sundarbans showing different zones and the study area (ADB, 1998)

3.2.3 Mongla Sub-District Profile

Mongla Sub-District is within Bagerhat District and bounded by the Sundarbans and the Bay of Bengal to the south. Mongla is the second largest sea port of the country, handling about 13% of total exports and 8% of imports (GOB, 2011) and is well-connected to the capital by road. Characteristics of the Mongla and Koyra Sub-Districts are described in Table 3.1.

Table 3.1: Characteristics of sub-districts in which study was undertaken (BBS 2004a,b; 2012a,b)

| Characteristic | Mongla | Koyra |
|-------------------------------------|-----------------------|-----------------------|
| Area | 1,461 km ² | 2,037 km ² |
| Within Sundarbans | 1,083 km ² | 1,774 km ² |
| Outside Sundarbans | 378 km ² | 263 km ² |
| Distance from district headquarters | 35 km | 110 km |
| Extent urbanised | 30% | 5% |
| Municipalities | 1 | 0 |
| Union Councils | 6 | 7 |
| Villages | 83 | 133 |
| Markets | 19 | 33 |
| Population in 2011 | 136,588 | 193,931 |
| Males | 71,494 | 95,393 |
| Females | 65,096 | 98,538 |
| Urban | 36,983 | 11,594 |
| Rural | 96,751 | 86,944 |
| Households (size) | 32,383 (4.02 people) | 45,750 (4.25 people) |
| Urban | 8,927 (3.97 people) | 2,687 (4.32 people) |
| Rural | 23,456 (4.16 people) | 43,063 (4.23 people) |
| Literacy | 57.2% | 50.4% |
| Males | 58.9% | 55.8% |
| Females | 55.3% | 45.2% |
| Occupations | | |
| Agriculture | 21.4% | 43.4% |
| Forestry | 0% | 3.2% |
| Fishing | 6.2% | 5.0% |
| Agricultural labourer | 12.4% | 20.4% |
| Non-agricultural labourer | 13.4% | 4.6% |
| Commerce | 15.1% | 9.5% |
| Transport and Service | 18.2% | 2.9% |
| Others | 13.3% | 11.1% |

The Mongla Sub-District is governed locally by a council comprising an elected Upazila Chairman and two vice-chairmen, *Upazila Nirbahi Officer* (UNO) - the Chief Executive Officer, a representative of the central government and 24 other officers belonging to respective ministries. The Mongla Port Authority, Mongla Custom Office, Chandpai Range Office of the Forest Department, Western Regional Office of the Bangladesh Coast Guard, Sector One Naval Base of the Bangladesh Navy and Sector One of the Bangladesh Border Guard are all located in Mongla. NGOs such as BRAC (formerly called the Bangladesh Rural Advancement Committee), Bridge, Caritas, World Vision, Prodipon, Heed Bangladesh, Community Development Centre (CODEC) and Rupantor are active in this sub-district. Most national banks have branches in Mongla. The Bangladesh National Tourism Authority has one motel in Mongla, which is full during winter. The sub-district has one health complex, six family planning centres, one hospital run by the Mongla Port Authority and one hospital run by Christian missionaries.

3.2.4 Study Villages in Mongla

Six villages were selected for sampling in the Mongla Sub-District. Three in Chila Union and three in Sundarban Union were selected on the basis of their proximity to the Sundarbans forest (Figure 3.3). The basic characteristics of the study villages are summarised in Table 3.2.

Table 3.2: Characteristics of the study villages in Mongla Sub-District

| Name of village | Total households | Total population | % males | Surveyed households | Distance from Sundarbans (m) |
|-------------------------|------------------|------------------|---------|---------------------|------------------------------|
| Union: Chila | | | | | |
| Joymony Ghol | 541 | 2,152 | 51.0 | 65 | 20-50 |
| Joymony Katakhali | 260 | 1,037 | 50.7 | 36 | 30-30 |
| Joymony Sankirchar | 380 | 1,548 | 50.7 | 29 | 30-50 |
| Union: Sundarban | | | | | |
| Baiddomari | 84 | 353 | 49.9 | 15 | 50-70 |
| Burburia | 492 | 1,809 | 53.8 | 50 | 150-200 |
| South Bashtola | 520 | 2354 | 49.3 | 69 | 100-150 |

Joymony Ghol, Joymony Katakhali and Joymony Sankirchar Villages are within the Chila Union. These three villages are located along the Passur River which enters the Bay of Bengal through the Sundarbans forest. The Sundarbans is within a 20 to 50 meter range on the east side of these three villages.. Community households are limited to the both sides of the 5 km paved (bitumen) road that is the principal connection with Mongla where a full range of services is available.

Joymony Ghol (commonly known as Joymony 7 as this village is the 7th administrative ward within Chila Union) is situated at the junction of the Shalla and Passur Rivers, about 20 km south of Mongla. A long and narrow village, it is made up of four different hamlets that are spread along both sides of the gravel road coming from Mongla. This village has a temporary landing site for the Hilsa fishery but most fish are landed at Mongla or are taken direct to Khulna. Joymony Katakhali (Joymony 8) is relatively rich in terms of infrastructure and access. The Chandpai Range Headquarters, one of the four forest ranger stations in the Sundarbans, and the Chandpai Forest Station Office are both in this village as well as a police camp to protect villagers from pirates. Joymony Sankirchar (Joymony 9) is nearly 1.5 km

long with little infrastructure and poor access. Most people in this village are poor and have migrated relatively recently from other places.

The villages of Baiddomari, South Bashtola and Burburia, in the Sundarban Union, have no direct connection to the river. The villages are located within 50-200 metres from the Sundarbans from which they are separated by the narrow Khorma canal excavated by the Forest Department to create a demarcation between the forest and the villages on its periphery. This canal has silted up and many poor families have settled on this land without permission from the authorities. Baiddomari is the smallest village with only 84 households and one grocery cum tea stall. It was created by landless families from surrounding villages in the silted-up Khorma canal. South Bashtola is a large village with many well-off households. Burburia is also large with more educational and religious institutions.

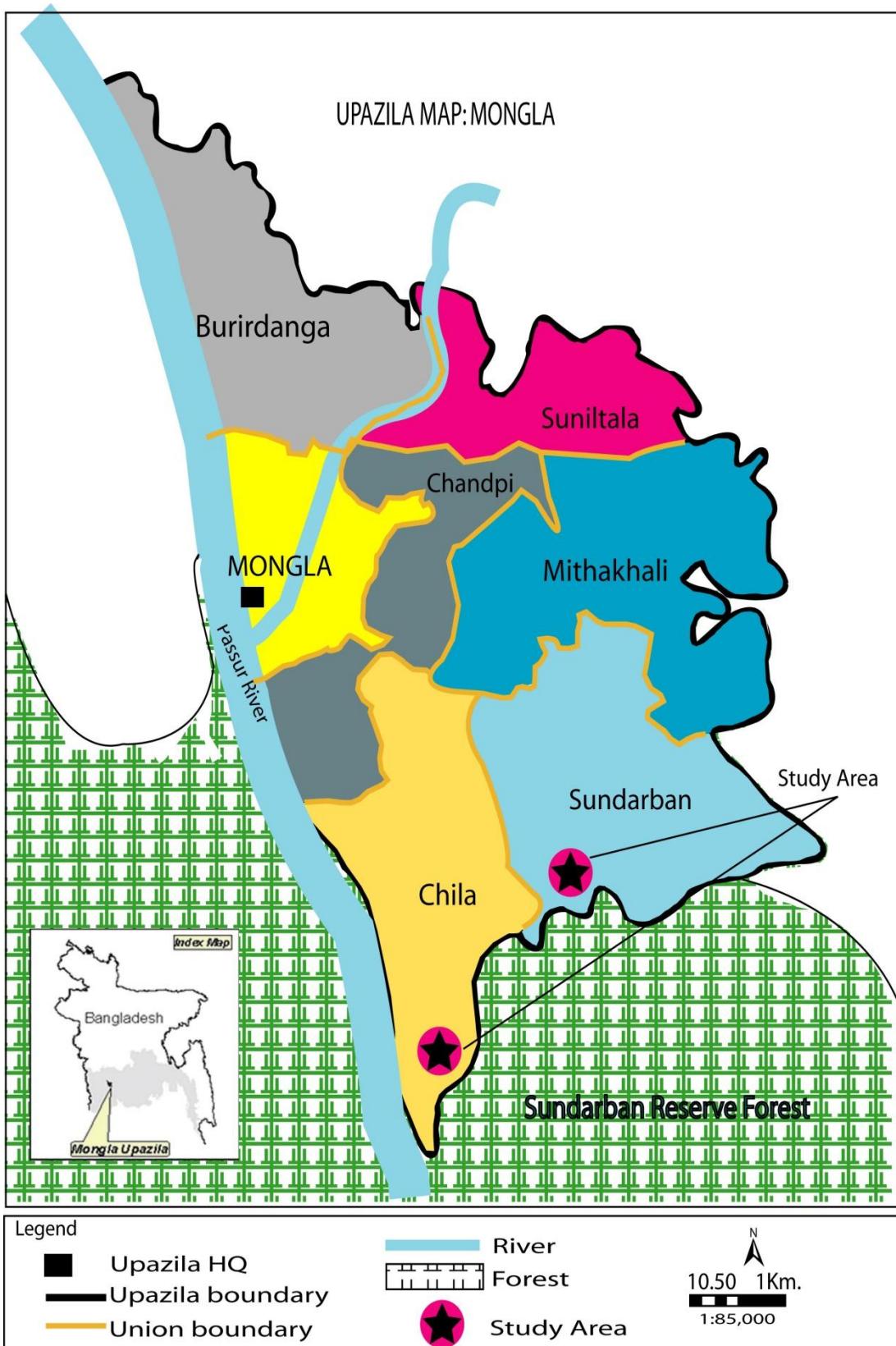


Figure 3.3: Map of Mongla Sub-District showing the study villages

3.2.5 Sub-District Profile: Koyra

Koyra Sub-District is situated nearly 110 km from the city of Khulna within Khulna District (Figure 3.4). The sub-district is connected with Khulna by passenger launch but there is no heavy or large industry. The council that is responsible for running the sub-district comprises a directly elected chairman, two elected vice-chairmen (one man, one woman), a CEO representing the central government, other officials representing different ministries and the chairmen of different unions within the sub-district. Three forest station offices and eight forest petrol offices are responsible for the Sundarbans forest in this sub-district. There is one health complex, one health sub-centre and six family planning centres. NGOs like BRAC, Proshika, Grammen Bank, Prodipon, Setu, Jagrata Juba Shangha (JSS) are active in this sub-district. The characteristics of Koyra Sub-District are summarised in Table 3.3.

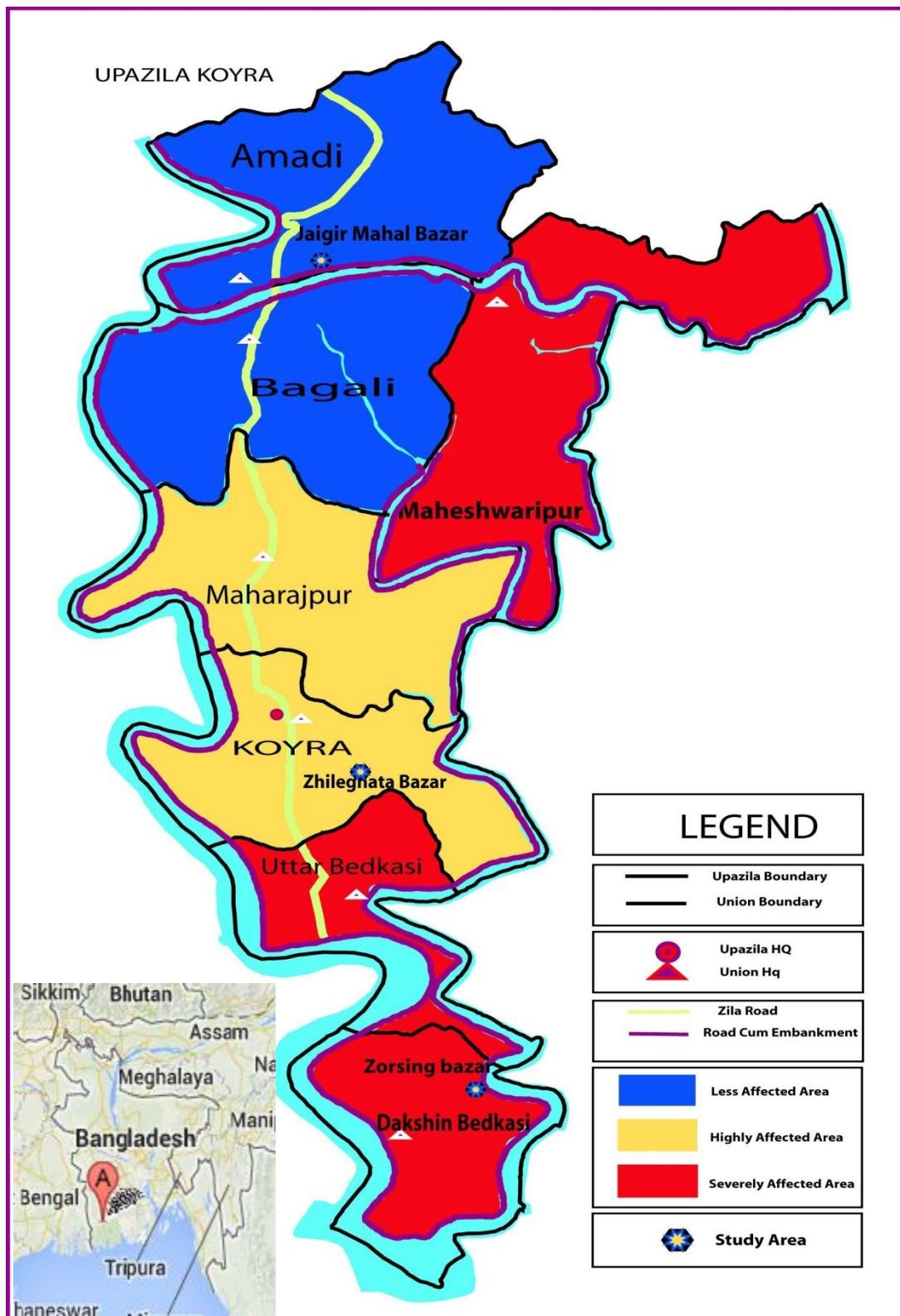


Figure 3.4: Map of the Koyra Sub-District study area

3.2.6 Study Villages in Koyra

Five villages in Koyra Sub-District were selected for the study on the basis of their proximity to the Sundarbans: Koyra No. 3 Village, part of Koyra No. 2 Village under the Koyra Union, Jorshing and Patakhali Villages under South Bedkashi Union, and Jaigirmahal Village under Amadi Union.

Table 3.3: Characteristics of the study villages in Koyra Sub-District

| Name of village | Union | Total households | Total population | % males | Surveyed households |
|-----------------------|----------------|------------------|------------------|---------|---------------------|
| Jorshing | South Bedkashi | 803 | 3345 | 49% | 75 |
| Patakhali | | 199 | 844 | 49% | 16 |
| Koyra No. 3 | Koyra | 525 | 1999 | 51% | 50 |
| Koyra No. 2 (part) | | 300 | 1293 | 48% | 24 |
| Jaigirmahal | Amadi | 838 | 3614 | 51% | 84 |

Most people in Jorshing and Patakhali villages, situated 15 km south from Koyra headquarters on the north bank of the Shakbaria River opposite the Sundarbans, were directly or indirectly dependent on forest resources (e.g., fish, timber, honey, wild shrimp fry and golpata). The principal crop is Bagda shrimp.

Koyra No. 2 Village and No. 3 Village were only 2 km away from the Koyra Sub-District headquarters and the Sundarbans. The principal crops in the union were rice and vegetable with a few people owning shrimp farms. Most of the villagers were farmers and some were mangrove resource collectors, wage labourers and service providers.

Jaigirmahal Village, on the bank of the Kabodak River and nearly 15 km north of Koyra headquarters and 8 km from the Sundarbans, contained the Koyra Sub-District health complex, three schools, a cyclone shelter, a branch of the Bangladesh Agriculture Bank and an office of the Bangladesh Water Development Board. Many

households owned agricultural land as well as having either a profession or a business. Many poor people, however, still depended on the Sundarbans to maintain their livelihoods. The main crops in the area were rice and vegetables, with some shrimp and fish farms.

In 2009, Koyra Sub-District was severely affected by Cyclone Aila (see Chapter 7). Of the five study villages, Jorshing and Patakhali were the worst affected, being severely inundated and losing most of the roads that once connected them to the outside world, leaving boats as the only means of transport. Koyra No. 2 and 3 Villages were the next worse affected and Jaigirmahal the least.

3.3 Research Process and Methods

This section describes the ethical considerations and field experience in collecting the data. An overview of the qualitative and quantitative methods used in the data collection is provided, including how the target groups were chosen, and how the data were analysed.

3.3.1 Field Research Process

3.3.1.1 Selection of the Study Villages

Before commencing the main period of fieldwork, introductory and ground proofing procedures were carried out. In September, I visited the study sub-districts and preliminarily selected study villages to gain an overview of the study areas. The initial plan was to carry out only one household survey among 320 households (160 from two villages in Koyra Sub-District and another 160 households from two villages in Mongla Sub-District). Unfortunately, when I visited Koyra Sub-District

for the preliminary survey in September, 2009, I found that 80% of the Koyra Sub-District area was still under water due to damage to the embankment caused by Cyclone Aila that had hit the area on May 25, 2009. It was not possible to study the livelihoods of the people influenced by mangroves and shrimp aquaculture in the initially selected villages in Koyra Sub-District. Thus, it was a good opportunity to study livelihoods impacted by the cyclone in the Koyra Sub-District. I discussed the situation in the study area with my supervisors and subsequently selected five villages in Koyra Sub-District in September by consulting local officials and considering the data on the extent of the damage collected by the Upazila Council and based on my direct observation of the study areas. Mongla Sub-District was not affected by Cyclone Aila, and I selected six study villages from two sites in this sub-district after visiting the villages and consulting with NGO workers, local government representatives and Forest Department officials.

3.3.1.2 Field Data Collection Process in Mongla Sub-District

The field process activity began with a two-day training session for four research assistants, of whom three were from Mongla Sub-District and one was not from the local area. The non-local research assistant had completed a Bachelor degree in Social Science and one local research assistant had completed a Bachelor of Political Science. The other two local research assistants had completed higher secondary education and had sufficient experience to be able to conduct household surveys. The local research assistants were known to the participants. The research assistants were very knowledgeable about and familiar with the specific local situation and circumstances, and well informed and trained regarding the main objectives of the surveys and the focus group discussions.

The field process activity in Mongla Sub-District began with resource mapping. The research team, accompanied by the local people, walked around the community and made detailed notes and maps regarding information such as the land features, cropping patterns, land cover with shrimp aquaculture, and Sundarbans forestry practices. These processes also served the purpose of making the acquaintance of the target villagers, and the gathered information was used as a guideline for the development of the survey and focus group discussion. The last stage of the field process activity in Mongla Sub-District included pre-testing of the questionnaire. In this process, the research assistants and I went through the questionnaire and discussed how to put the different questions, what to do when problems arose and so on. The questionnaire pre-testing resulted in revisions and the dropping of some questions that were not relevant to the local context and thus finalising the questionnaire for use in the survey. Due to the high levels of illiteracy and the participants' lack of familiarity with formal discussions, the questionnaire was not distributed to participants but filled out by a research assistant. Thus, the questionnaires were completed in a process whereby the research assistant read aloud and explained the questions in simple and clear terms to the respondents and filled in their answers for them.

3.3.1.3 Field Data Collection Process in Koyra Sub-District

In Koyra Sub-District, I started the data collection process with the non-local research assistant who had worked with me in Mongla Sub-District. However I was then introduced to a local insurance broker and sales representative from Koyra Sub-District who agreed to work as a research assistant and helped me to collect data in

the first and second household surveys. A village doctor from Koyra No. 3 Village worked as a research assistant during the second survey to collect data from all the study villages. They were both very knowledgeable, had previous experience of doing NGO-based survey work, were familiar with the specific local situation and circumstances, and were provided training on the main objectives of the interviews. In Koyra Sub-District, before starting the household surveys, pre-testing of the questionnaire was also done and very minor changes were made as I had prepared the questionnaire based on the experience I had gathered in Mongla Sub-District. In Koyra, particular care was again taken in the wording of the questions in consideration of the low education level of the respondents. The questionnaire was not distributed to the participants but filled out by a research assistant following the same process used in Mongla.

3.3.1.4 Ethical Considerations

The research received approval from the Charles Darwin University Human Ethics Committee (Reference No. H 09026) (21 August, 2009). Before commencing the data collection, permission to conduct the research was gained from the relevant authorities in fulfilment of the ethical considerations. Formal permissions for undertaking the research were sought from the Ministry of Environment and Forest and the Department of Fisheries located in Dhaka and an official letter of support was received in the Bengali language. Permission was also obtained from the CEO of Mongla and Koyra Sub-Districts to conduct the research at the selected study villages. An information sheet and consent form providing an outline of the aims and objectives of the project, a profile of the researcher, the duration and nature of the research and the role of participants were prepared.

At the village level, where the majority of the research participants were non-literate, such an approach was felt to be inappropriate. I personally felt uncomfortable asking people to sign or thumbprint a form that they could not read and which was meaningless to them. Prior to the household surveys, key informant interviews and focus group discussions, the research assistants and I sat down with the potential participants and explained the purpose of the research, the participants' rights, and how the data would be collected and processed. We then gained verbal consent. Participation in this study was completely voluntary and the confidentiality of the information received was assured. The participants understood that there were no consequences if they later chose not to attend or withdraw from the study, and that only pseudonyms would be used in this thesis. I gave the participants the relevant contact details of the university research institute and ethics office, to use in case they had any complaints.

3.3.1.5 Research Period

The research started in August 2009 when I applied for permission to carry out the research. Field research processes, such as preliminary visits to the study sites and the final selection of the study areas, were done in September 2009. For the livelihood study in Mongla Sub-District, the reference period covered one year from September 2009 to August 2010 in the Gregorian calendar. In Koyra Sub-District, the reference period was for ten months from June 2009 to March 2010. Table 3.4 presents a summary of the field data collection process carried out in this research.

Table 3.4: Field data collection process carried out in the research

| Date | Research process | Performed by |
|---------------------------|--|--|
| September 2009 | Visited study sub-district and study villages. Final selection of the study villages. | Principal investigator (PI) |
| 1-10 October 2009 | Selection and training of local research assistants in Mongla. Resource mapping and familiarisation with the community. Pre-testing the questionnaire. | Principal investigator, research assistant (RA) |
| 11-23 October 2009 | First household survey in Mongla Key informant interview Focus group discussions | PI, RA PI, RA PI, RA |
| 24-31 October 2009 | First household survey in Mongla | 3 RA |
| 24-31 October 2009 | First household survey in Koyra Key informant interview Focus group discussion | PI and 2 RA PI PI and 2RA |
| 15 February-20 March 2010 | Second HH survey in Mongla Key informant interview Focus group discussion Seasonal calendar | PI and 3 RA PI, RA PI and 3 RA PI and 3RA |
| 22 March-4 April 2010 | Second survey in Koyra Key informant interview Focus group discussion | PI and 3 RA PI PI and RA |
| 5 June-10 July 2010 | Third household survey in Mongla | PI and 3 RA |
| 16-19 August 2010 | Key informant interview in Mongla | PI |

3.3.2 Methods

The sustainable livelihoods framework requires a ‘hybrid’ methodological approach (Scoones, 1998; Mushongah and Scoones, 2012) and, therefore, this research incorporated a mix of household surveys, semi-structured key informant interviews, focus group discussions and a number of participatory rural appraisal tools. The different methods used to address each specific research question are summarised in Table 3.5. In the following section, I describe each method, how the methods were used in the data collection, how the target groups were chosen, and how the data were analysed.

Table 3.5: Methods used to address research questions

| Research Questions | Chapter, Study Area and Reference Period | Methods |
|---|--|---|
| What assets do the households surrounding the forest have? | Chapter 4 Six villages in Mongla Sub-District September 2009-August 2010 | HH survey, observation |
| What are the most important livelihood strategies and outcomes? | | |
| To what extent do different income groups depend on mangrove forest income? | Chapter 5 Six villages in Mongla Sub-District September 2009-August 2010 | HH survey |
| What socio-economic characteristics of the households determine this dependency? | | |
| What is the potential effect of mangrove forest income for reducing income inequality and poverty? | | |
| What are the vulnerabilities associated with mangrove resource collection? | | KII, FGD, seasonal calendar observation |
| To what extent do different income groups depend on shrimp? | Chapter 6 Six villages in Mongla Sub-District September 2009-August 2010 | HH survey |
| What socio-economic characteristics of households influence the shrimp income? | | HH survey |
| Does shrimp income promote income inequality in the study area? | | HH survey |
| What are the vulnerabilities associated with shrimp aquaculture? | | KII, FGD, observation |
| To what extent did Cyclone Aila impact on the livelihood assets? | Chapter 7 Five villages in Koyra Sub-District June 2009-March 2010 | HH survey, KII, FGD, observation |
| What are the coping strategies that people adopted to survive? | | HH survey, KII, FGD, observation |
| What are the roles of the forest-related policies and institutions in improving livelihoods of the forest resource users at the local level? | Chapter 8 Six villages in Mongla Sub-District September 2009-August 2010 | KII, FGD, policy analysis, observation |
| To what extent do the existing policies and institutions of shrimp management promote or inhibit livelihoods in the study area? | | KII, FGD, policy analysis, observation |
| What are the roles of national and local government and NGOs in disaster management and assisting local people to cope with adverse outcomes from cyclones? | Five villages in Koyra Sub-District June 2009-March 2010 | KII, FGD, policy analysis, observation |
| What initiatives are likely to improve livelihoods, given the findings of this research? | Mongla and Koyra Sub-Districts | KII, FGD, policy analysis |

3.3.2 Household Livelihood Surveys in Mongla Sub-District

Livelihood household surveys (Appendix A) were carried out in Mongla Sub-District to collect the field data related to mangroves, shrimp aquaculture, other income and the basic household assets of the households (Figure 3.5). This was a relatively large survey, taking nearly two hours to complete each interview. The analysis of the data gathered through this survey is presented in Chapters 4, 5 and 6.

3.3.2.1 Household as a Unit

According to Allison and Horemans (2006:758) the social and economic unit considered in the livelihoods framework is typically the household “conceived as the social group which resides in the same place, shares the same meals and makes joint or coordinated decisions over resource allocation and income pooling”. The smallest data unit in this research was a household (HH), in turn making the household the logical primary unit of measurement and analysis. For the purpose of this research, a household was defined as a unit whose members lived, cooked, and ate together. In the context of rural Bangladesh, the HH is considered as a composite social and economic unit consisting of one or more individuals who live together, and share both ‘the roof and the pot’; (i.e., dwelling place and food), income and labour in order to ensure that mutual sharing exists and continues. The HH is not static but extremely dynamic. Every HH serves the basic functions of consumption, biological reproduction, social networking and distribution across members as determined by sets of ideologies and values. To understand the basics of household economics, and explore reasons for diversification, a household survey is most useful (ODI, 2003; Bird, 2003) as the HH is the basic unit for production and reproduction (De

Sherbinin et al., 2008) in which every member shares their resources and dependencies (Ellis, 1998).

3.3.2.2 Survey and Questionnaire Design and Approach

Using a sustainable livelihood approach, a draft questionnaire was developed. Collection of the primary data to examine households' assets and income rested mainly on a detailed questionnaire (Appendix A: Livelihood Household Survey in Mongla). The Poverty Environment Network (PEN) (2008) quarterly household survey prototype questionnaire was modified for the local context in order to carry out this survey. Therefore, the collection of the primary data rested mainly on the detailed questionnaire (Appendix A) which was created following necessary modifications of the PEN household questionnaire. In its final form, the questionnaire included sections on basic household assets and household income and sections on agricultural production, livestock, forest resource extraction, shrimp aquaculture and non-farm activities with particular attention given to different forms of mangrove and shrimp aquaculture income accrued through both cash and consumption. Each of the sections covering income sources included detailed questions on the major categories of income and on sub-categories of income (e.g., the different forest sources, different crops and different animals).

It was anticipated that the data derived from the questionnaire would paint a picture of the livelihood situation prevailing in the villages surrounding the Sundarbans. The survey was purposively designed to capture the different categories of the households to analyse the broader livelihood situation which cannot be assessed by looking at homogenous households. Households were chosen using a random sampling

approach but attention was paid to take households from different socio-economic sections of the community. Originally it was planned to sample 160 households from two villages; this increased to 264 households from a total of 2277 households across six villages (see Table 3.2) in order to get a representative sample of significance (nearly 10% of the total households in the six villages).

Data were collected for the reference year of September 2009 to August 2010. Three household survey questionnaires (one every four months) were used to collect information about household incomes and engagement in different income-earning activities (Table 3.6). In the first survey, details on the household-level socio-economic characteristics such as household size, occupations, educational levels, land tenure and social network along with major household assets, were collected.



Figure 3.5: Conducting household surveys in villages on the edge of the Sundarbans (Mongla Sub-District)

Table 3.6: Household survey structure for livelihood study in Mongla Sub-District

| Survey segments and period | Month conducted | Peak Season/Months covered | Type of data collected |
|---|---------------------------|----------------------------|--|
| Survey Segment 1 September-December 2009 | October, 2009 | September 2009-August 2010 | Household demographic information and basic assets |
| | | August-October | Sundarbans fisheries income |
| | | September-December | Fuelwood data from the Sundarbans |
| | | September-December 2009 | Fisheries from homestead pond, agriculture, livestock, non-farm income, shrimp business/labour income. |
| | | September-October 2009 | Other fish products income of shrimp farm |
| | | October-December | Crab income from the Sundarbans |
| Survey Segment 2 January-April 2010 | February March 2010 | January-March 2012 | Nipa leaves from the Sundarbans |
| | | January-February 2010 | Rice income of agriculture |
| | | January-March, 2010 | Shrimp fry income (Bagda shrimp) from the Sundarbans |
| | | January-March | Fisheries from homestead pond, agriculture, livestock and non-farm income |
| | | January-April, 2010 | Fuelwood data from the Sundarbans |
| Survey Segment 3 May-August 2010 | June 2010 | April-June 2010 | Shrimp fry (Golda) from the Sundarbans |
| | | May-June 2010 | Wild shrimp (by-product) income from shrimp farms |
| | | May-June 2010 | Cultured shrimp income from shrimp farm |
| | | May-August 2010 | Fuelwood data from the Sundarbans |
| | | May-August 2010 | Fisheries from homestead pond, agriculture, livestock, non-farm income, shrimp business/labour income. |
| | July 2010 | July-August 2010 | Cultured shrimp income from shrimp farm |

3.3.2.3 Definitions of Different Types of Income

The definitions of forest, forest products and income used in this study followed the PEN (2007) definitions. Accordingly, household income was defined as the return to the labour and capital owned. Four types of forest income were distinguished: 1) income from self-employment in the harvesting of forest products that were used or sold in an unprocessed way; 2) income from self-employment of processed (value-added) forest products; 3) wage income from employment in forest-based activities; and 4) direct payment (transfers) to the household for forest-based environmental services. All the products obtained from the forest whose supply was not necessarily dependent on the existence of the forest (such as grazing and wild vegetables) were categorised as environmental products, of which none were found in the study area. Relative forest income (RFI) was calculated as the total forest income as a share of the total income from all sources (Vedeld et al., 2004).

The category of agriculture, livestock and homestead pond fisheries income was derived from the production or gathering of unprocessed crops, livestock or fish products only from homestead ponds or wage labour in these sectors.

Non-farm activities were defined as all activities outside the agriculture, forest and shrimp farming sector, regardless of the location or function. It referred to the income from self-owned businesses, remittances, receipts and rents, and non-farm wages including salaries and pensions for the reference period. According to Ellis (2000a), non-farm income includes income from non-agricultural sources such as non-farm employment, petty trade, transfers and remittances.

Shrimp farm income referred to all income from selling shrimps and other fish products, the processing or trading of unprocessed shrimps and other fish products that originated from the shrimp farms, and the wage labour or temporary employment in shrimp farms. Relative shrimp income was also calculated as the total shrimp income as a share of the total income from all sources.

Most of forest and shrimp based incomes were seasonal (Table 3.6). Seasonal incomes from all forest and shrimp products were added together to calculate the yearly (reference period September 2009 to August, 2010) income from forest and shrimp respectively.

3.3.2.4. Recall Period

Various recall periods have been used in similar livelihood and household questionnaires. The PEN Programme (PEN, 2007) used a recall period of one to three months for surveys on household income. Hogarth et al. (2013) used a recall period of one month for a survey on incomes from forest products. Lund et al. (2008) suggested that data collection instruments should use three month recall periods for high value major products and a one month recall period for minor, infrequently collected products. Rayamajhi et al. (2012) opined that a one year recall period can seriously underestimate the income based on forest products.

The income and activity reports for the mangroves and shrimp farming income were based on a recall period of 15 days as they depend on a lunar cycle which is locally known as *Gon*. *Gon* is the period of 3-5 days during the full and new moons when the spring tides affect the tidal heights. Inundation of the mangroves is more frequent and widespread during this period of the lunar cycle, which results in resource

collectors entering significantly deeper into the forest and an increase in the availability of fish, crabs and shrimp fry. It was observed that the shrimp farmers harvested shrimp from their farms once each *Gon* (once in 15 days), usually before the *Gon* started, releasing the shrimp fry during the peak time of the *Gon* when they recharged the saline water in the farms.

The income and activity reports for salary, wage labour, and non-farm business income, income from shrimp-based enterprise, crop income, livestock income and other transfer payments were based on a recall period of two months. In most cases, both husband (traditionally the household head) and wife were interviewed together in order to obtain the most comprehensive recall on answers.

3.3.3 Analysis of Household Livelihoods Survey Data

3.3.3.1 Calculation of Household Income

This research used the approach of Cavendish (2002) and Campbell and Luckert (2002) to measure the total net income (monetary or cash income and income in kind) as a broad measure of a household's economic status. Income was estimated from data on the economic activities conducted by the household, including both subsistence and cash. Total household income was the sum of cash income and subsistence income as well as -the value of products consumed directly by the household or given away to friends and relatives.

The income from production activities was estimated as the value of the main product and associated by-products minus the cost of production. For business enterprises and forest/ shrimp-processing activities, incomes were estimated as gross

returns minus business-related expenses, as recollected by the respondents. Salaries and wages were recorded as earnings per month, which were then multiplied by the number of months of employment in the occupation.

The basic equation for income was:

$$I = \sum_{i=1}^n p_i y_i - \sum_{j=1}^m q_j v_j$$

Income (I) was the gross value (price times quantities of all n products) minus the total costs (price times quantities) of all m purchased inputs (e.g., fertilisers, seeds, tools, hired labour). Income was calculated as the gross value minus the total costs of all purchased inputs. While the cost of hired labour was considered, family labour could not be calculated and was excluded in the cost calculation (Babulo et al., 2009; Mamo et al., 2007; Vedeld et al., 2004). Due to the lack of information, no allowance was made for the depreciation of fixed assets and owner-occupied housing that was sometimes used for business purposes. The total income of each household was computed by grossing all the available income sources. All the income values were converted to per capita income using the family size of the households (PEN, 2007).

All the price values were obtained from the respondents' own reports. A market survey was conducted in the main village, union and sub-district markets to assess the prices of goods throughout the year and check these against the prices reported by the respondents. Household consumption or accumulation, rather than the cash received for self-produced crops, livestock, forestry, homestead pond fishery and shrimp products, was converted into cash by multiplying by the prevailing market

price. In short, all products were valued according to the local market prices or the respondents' own reported values (Cavendish, 2002; Fisher, 2004).

3.3.3.2 Formation of Lower, Middle and Higher Income Groups based on Income

The theoretical relationship between assets and livelihoods has led to a growing number of studies that have explored differences in the livelihoods of different households groups based on income (Ellis, 2000a; Campbell et al., 2002; Cramb et al., 2004; Tesfaye et al., 2011). Several studies have followed the common practice of dividing the sample into several income groups based on the total annual income in order to determine the forest dependence of rural households (Nielsen et al., 2012; Hogart et al., 2013; Yemiru et al., 2010; Kar and Jacobson, 2012; Kamanga et al., 2009; Cavendish, 2000). The income group was thus used as the fundamental unit for data analysis in the context of the present study area in order to examine and compare the overall household livelihoods. The data were disaggregated to capture the potential differences between social groupings. This approach is promoted in sustainable livelihoods research, where communities are not assumed to be homogenous and where the researcher needs to display sensitivity to marginalised social groups (Ellis, 2000a). There being no natural breaks in the dataset that might allow the identification of income groups, the data were analysed on the basis of terciles using the total annual income data from all the villages combined. I decided not to try to remove the small number of high income households from the survey as this might have led to the loss of information on important aspects of the livelihood analysis.

The three groups, namely, “lower income” (US\$177-796), “middle income” (US\$805-1,506), and “higher income” (US\$1509-18,963), contained 88 households each. The mean total incomes between the groups were significantly different (US\$573, US\$1,114 and US\$4,606, respectively; ANOVA P<0.001). It was assumed that the households within the three income ranges thus delineated would adequately represent lower income, middle income, and higher income households. The terms “middle income” and “higher income” households are relative, as the average monthly income per household among the higher income households (Tk26,409 US\$384) – while high by national rural standards (Tk9,648; US\$140) in 2010 (BBS, 2011a) – was low compared to most OECD countries.

3.3.3.3 Measurement of Poverty

The money-metric measure of poverty used by Datt and Ravallion (1998) was used to calculate the amount of income required to purchase the basic minimum for survival. Most of the studies on poverty in Bangladesh have been based on data from the Household Income and Expenditure Surveys (HIES) conducted by the Bangladesh Bureau of Statistics (BBS, 2011a). From this data, the BBS calculated the cost of basic need (CBN) as a poverty threshold or national “poverty line” by compiling and pricing a basket of goods meant to reflect the basic human necessities, such as food, clothing and housing. The CBN defines the poverty line as the threshold level of income needed to satisfy basic minimum food and non-food requirements. The number of households (people) below that line as a percent of the total household (population) represents the head-count index (HCI). This measure is easily understood by the general public and hence is popular with policy-makers and development practitioners.

In the 2010 HIES for Khulna rural areas, the lower and upper poverty lines in Bangladesh were drawn at Tk1,192 and Tk1,435 per month per capita, using the CBN method to measure poverty (BBS, 2011a) (Appendix B). The lower poverty line (LPL) and upper poverty line (UPL) in the rural areas in the Khulna Division were used as a proxy to determine poverty in the present study as the study areas were situated in Khulna Division and regarded as rural areas. The next section describes the extent and pattern of poverty in the study area, using data on the per capita income per month to determine how the households compared with the lower and upper poverty lines.

3.3.3.4 Measurement of Income Inequality

The Gini coefficient was used to measure inequality. This composite indicator summarises the extent of concentration (inequality) of household income. The Gini coefficient can vary between ‘0’ and ‘1’, with ‘1’ being the most unequal state and the ‘0’ being the most equal state. I used the covariance formula to define the Gini coefficient of income inequality (Bellu and Liberati, 2006) (details are provided in Appendix B). To estimate the effect of income from different sources on income inequality, the Gini coefficient was first calculated for total income. Then, this Gini coefficient was recalculated by removing each income source and comparing it with the total income Gini coefficient, following the approach of Heubach et al. (2011).

3.3.3.5 Analysis of Livelihood Assets

The household survey was used to investigate the assets of households within and between the income groups in the study area. Information on different assets was

collected and grouped under the categories of natural, physical, human, social, and financial assets (Carney, 1998), with the terms “assets” and “capital” being used interchangeably. Cross-tabulation of the results was necessary for different types of households classified by land-holding and other wealth, since these were important influences on livelihood options and were potential escape routes from poverty (ODI, 2003).

For each household, data were collected on the household’s members, residence, gender, age groups, education, skills, personal information about the respondent and household head (e.g., age, gender), composition of the household, education and occupational status of the household members, number of welfare beneficiaries, and the main productive assets such as land and livestock. Among reproducible capital assets, the questionnaire included furniture, sewing machines, stoves, refrigerator-freezers, radios, radio-cassette players, CD/VCD, TVs, cameras, bicycles, motorcycles, cars, boats, nets and livestock. The value of each non-land-based asset was determined according to the present market value (PEN, 2007).

3.3.3.6 Analysis of Livelihood Strategies

Investigations of livelihood strategies tend to focus on income sources (DFID, 2000). The growing popularity of the sustainable livelihoods approach is leading to greater use of income data (Ellis, 2000a). Therefore, I focused predominantly on household income data in describing livelihood strategies. This is because, in the livelihoods approach, income is also used as a tangible livelihood outcome to establish the relative success (in terms of financial return) of various individual livelihood

activities. Income offers a measure of direct interest because of its clear interpretation as a welfare outcome (Barrett et al., 2001a).

DFID (2000) suggested that researchers divide sample households according to the dominant strategies the households pursue, and then cross-reference this to show whether there are significant differences between poor and better-off households. Households in the present study were classified into livelihood strategies on the basis of the net income (both cash and subsistence) that they derived from different resources, thus drawing conclusions regarding the relative importance of the strategies to the household survival (Iiyama et al., 2008).

In analysing livelihood strategies, income activities that contributed $\geq 10\%$ to the total net income for $\geq 10\%$ of the surveyed households were considered. Incomes from agriculture, livestock and homestead fisheries were not included as these contributed mainly to the subsistence of the households and contributed to the net income of only 1-4% of all households (Table 3.7). Households were classified into several livelihood strategies on the basis of their net income from mangrove forest, shrimp culture and non-farm income or the combination of one income with other income/s. While the range of income sub-categories recorded within these incomes could have allowed for a larger number of livelihood categories based on various combinations of income, this was avoided due to the problem of increasingly small sample sizes across the categories (Ellis, 2000a).

Table 3.7: Income distribution of households in the study area

| Source of income | Percentage of households | | | |
|--------------------------|--------------------------|-------------------------|-------------|--------------------------|
| | Net income | 10% of total net income | Cash income | 10% of total cash income |
| Forest | 77 | 75 | 77 | 75 |
| Shrimp | 66 | 57 | 66 | 56 |
| Non-farm | 74 | 47 | 55 | 46 |
| Agriculture | 85 | 2 | 26 | 1 |
| Homestead pond fisheries | 70 | 1 | 28 | 1 |
| Livestock | 68 | 4 | 33 | 4 |

3.3.4 Household Surveys in Cyclone-Affected Areas in Koyra Sub-District

The household surveys in Koyra Sub-District (Appendix C) consisted of questionnaires that focused on the impacts of Cyclone Aila and the coping strategies of the people in the area. This was a short survey, taking an average of 30 minutes to complete each interview. Household survey data collection was carried out twice: once at the end of the wet season in October 2009, and once at the end of the dry season in March 2010 (Figure 3.6). The analysis of the data is presented in Chapter 7.



Figure 3.6: Household surveys in cyclone-affected areas of Koyra Sub-District in the severely affected areas (A, B) and the least affected areas (C, D) in the wet (A, C) and dry (B, D) seasons

3.3.4.1 Survey Design

Since the purpose of the survey was to analyse the impact of Cyclone Aila and the households' resulting coping strategies, it was necessary to select households that would give a fair representation of the parts of Koyra Sub-District affected by the cyclone including areas that were little affected. Immediately after the cyclone, the sub-district administration assessed the damage due to Cyclone Aila in all the unions and categorised Maheswaripur, North Bedkashi and South Bedkashi as severely affected unions, Koyra Sadar and Maharajpur as highly affected unions and Bagali and Amadi as less affected unions (Figure 3.4). For the purposes of the present study, I selected households from the study villages (described in detail above) situated in the "low affected," "highly affected," and "severely affected" areas depending on the factors described in Table 3.8. Initially, 275 households were selected randomly in order to get a better representative sample but the sample decreased to 250

households as some households were away during the dry season when the second survey was carried out.

Table 3.8: Survey design for impact of cyclone on livelihood in Koyra Sub-District

| Affected areas | Union, villages and households | Reasons for consideration |
|-------------------------|---|--|
| Severely affected areas | Union: South Bedkashi Village: Jorshing and Patakhali Total Households: 1002 Sample Households: 91 | Closest to the coast and farthest from the sub-district headquarters Situated on the bank of Shakbaria River and protected by embankment which was breached due to tidal surge Each affected household received 20 kg of rice per month Remained isolated due to damage to embankment and roads connecting with sub-district headquarters |
| Highly affected areas | Union: Koyra Village: Koyra No. 3 Village and part of Koyra No. 2 Village Total households: 825 Sample households: 74 | Situated nearly 15 km away from the coast and closed to the sub-district headquarters Situated nearly 2 km inside from the river and people can travel to the sub-district headquarters with some difficulties during post-cyclone period Each affected household received 10 kg of rice per month |
| Low affected areas | Union: Amadi Village: Jaigirmahal Total households: 838 Sample households: 84 | Situated nearly 35 km away from the coast Situated on the bank of Kabodak River and protected by embankment which did not breach Affected households were not considered for any relief assistance by government and NGOs |

3.3.4.2 Survey Questionnaire

The questionnaire was structured in three sections. The first section focused on basic household information, the second section focused on the extent of the damage experienced during the cyclone, and the third section focused on the coping strategies adopted subsequent to the cyclone. The first section included general questions about the respondents' demographic and socio-economic characteristics such as age,

household income, occupation, level of education and yearly income before Cyclone Aila.

The second section specifically dealt with the impact of the cyclone, such as where people sheltered during and after the cyclone, whether they had to relocate their homestead due to the cyclone and the extent of the damage due to Cyclone Aila. This questionnaire aimed to identify the losses incurred during the cyclone and the impacts of the cyclone on life and livelihood, such as agriculture, livestock, housing damage, agriculture and fishery equipment, and other impacts including inundation, health-related impacts and damage costs (King, 2002; Morris et al., 2002; World Bank, 2010).

The third section highlighted the different coping strategies adopted by the households and the income gained from the primary and secondary occupations of the household members during the study period. Different coping mechanisms adopted by cyclone-affected people were identified from the questionnaire (Morris et al., 2002; Paul, 1998b; 2005). The coping-related questions were aimed at examining the sources of income and the amount of income from each particular coping source.

3.3.5 Analysis of cyclone affected household survey data

3.3.5.1 Analysis Based on Severity of Cyclone Impact

The severity of cyclone impact was the fundamental basis of unit for data analysis in the context of the cyclone-affected study area in order to examine and compare households in the differently affected areas as described above. I analysed the data on the basis of the severity of the impact of Cyclone Aila as measured by the affected

areas they represented (i.e., “low affected areas”, “high affected areas” and “severely affected areas”). This strategy helped collect information on household coping mechanisms, the extent of damage and the extent of recovery in the event of the crisis (Khandker, 2007). A similar approach was taken in some other studies analysing the impact of floods (del Ninno et al., 1998; 2003; Khandker, 2007) and cyclones (Alam, 2003) in Bangladesh.

3.3.5.2 Analysis Based on Income: Higher, Middle and Lower Income

Households

For identical analysis in line with the analysis described in the previous chapters, the households were also stratified in different income groups. The households were categorised as higher, middle and lower income, based on the household’s yearly income before the cyclone. Households were divided into three income terciles – “higher income” (US\$1,163-19,622, n=84), “middle income” (US\$610-1,090, n=62) and “lower income” (US\$218-581, n=103) – based on the total annual income before the cyclone in order to compare incomes before and after Cyclone Aila. The mean total incomes were significantly different among the three groups (US\$2818, US\$826 and US\$502, respectively; ANOVA P<0.001). Paul and Routray (2011; 2010) analysed households’ responses to cyclone and flood in Bangladesh based on income, assuming income to be a composite indicator that reflects assets, education and occupation and hence has an influence on an individual’s coping response.

3.3.5.3 Calculation of Total Loss of Damage due to the Cyclone

The amount of loss was only calculated based on the extent of damage data collected during the first survey at the end of the wet season (October, 2009). Using the

conceptual framework of the “damage, loss, need assessment” methodology (World Bank, 2010), the following cyclone effects were measured during the assessment:

1) Damage is the value of the physical, durable assets that may be destroyed due to the action of the natural hazard that caused the disaster, expressed in terms of the replacement value of the assets, assuming the same characteristics that they had prior to the disaster. In the present study, the household residents were asked to estimate the magnitude of the damage they suffered as a result of the cyclone in relation to their dwellings, nets and boats and other household assets.

2) Losses are changes in the normal flows of the economy that may arise in all sectors of economic activity due to the external shock brought about by an event such as a cyclone. Typical losses include the decline in output in productive sectors (agriculture, livestock, fisheries, industry and commerce) and the lower revenues and higher operational costs in the provision of services (education, health, water and sanitation, electricity, transport and communications). In the current study, it included the losses that occurred at the time of the cyclone and that may have continued until the first survey in October 2009, as expressed in current values.

The household residents were asked to estimate the magnitude of the loss (in cost and profit) they suffered as a result of the cyclone in the following sectors: agriculture (loss of stored crop, damage to crops and vegetables, death of trees in homestead gardens), shrimp farming (shrimp farmers' loss incurred as the shrimp floated away and structural damage to the farms; shrimp depot owners' loss due to the damage of shrimp and fish that could not be transported immediately after the cyclone), livestock (loss due to the death of livestock, and loss due to the forced sale of livestock after the cyclone), homestead pond fisheries (loss incurred as fish floated

away from ponds) and loss in trade and business (damage of stock and loss of income due to closure of businesses). Details of the questionnaire can be seen in Appendix C.

The amount of damage and loss were calculated separately for each household individually by adding up all damages and losses. I did not consider losses (such as cost of medicine, doctor fees, travel costs to hospital due to injury or disease caused by cyclone, cash and food support to relatives immediately after cyclone) incurred due to the unexpected expenditures necessary to meet humanitarian and medical needs during the post-disaster emergency phase. Validation of these losses were very difficult to achieve as household damage data collected by local government or NGOs did not cover those costs (see also Section 3.4 on Research Challenges).

3.3.5.4 Calculation of Household Income Before and After Cyclone

The households were asked simply to give their net monthly income in the questionnaire. Yearly income before Cyclone Aila was calculated by multiplying the monthly net income by 12. Incomes after Cyclone Aila were calculated by adding the income from different coping strategies, all external support and income from any primary or secondary occupations that household members continued after Cyclone Aila.

Income from different coping strategies consisted of income from selling assets and taking loans from relatives, moneylenders and NGOs. These were generally one-off income sources in either the wet or dry season.

Income from external support consisted of relief cash and in-kind materials provided by the government and NGOs, and cash donations from relatives due to the cyclone.

In terms of the monetary value, much of the relief consisted of food, clothing and household goods which were converted into income in this study by calculating the value of relief at the market price. The relevant officials of the government agencies and NGOs were consulted to obtain an estimate of the price of their relief packages.

An inventory of the aid provided by the government to the affected households in the months after the cyclone was also collected from the local government union council.

The income from the primary or secondary occupations of households in the low affected areas consisted of mangrove forest collection, trade and business, service, shrimp farming and agriculture. However, specific sources within each income source were not considered due to heavy destruction in severely and highly affected areas. A monthly recall period of one month was used to calculate this income.

The scope for shrimp farm and agriculture-based income was virtually nil in the severe and highly affected areas due to the saline and inundated land. Trade and business livelihood activities were restricted in the wet season due to the extensive damage of stock material, embankments and infrastructure. In the dry season, some households were receiving income as trade and business started to operate again but these were not fully underway in the high and severely affected areas. Households relying on income from resource collection in the Sundarbans forest did not seem to be affected by the cyclone in terms of productive earning in the affected areas. Some households in the high and severely affected areas that previously relied on selling labour also started to collect mangrove resources and sell labour in government

sponsored cash/food for work activities. In low affected areas, income from primary/secondary occupations was found to be normal except for some households that owned shrimp farms which were situated in high and severely affected areas.

3.3.6 Statistical Analysis of Quantitative Data

Descriptive statistics were usually expressed as percentages rounded to the nearest whole number. The Chi square test was used to test for differences in frequency data among sites and income groups (income groups in Mongla and affected areas in Koyra) using the Statistical Program for Social Sciences (SPSS version 18.0) software.

To compare continuous variables across single factors, the data were tested for normality and then a one-way ANOVA was used to determine whether differences existed among the means. If a significant difference was found at the 5% level, pairwise multiple comparison tests were conducted. Multiple comparison tests describe the confidence levels for an entire system of intervals, simultaneously, for a given variable (Campbell et al., 2002). I used ANOVA, an F ratio test (Analysis of Variance), to determine the significance of differences among the means and to compare the household characteristics and incomes of different sources among the three income groups and areas differently affected by the cyclone. ANOVA was used to determine whether the amount of loss due to flooding was significantly greater among households of farmers, fishermen or tradesmen (Brouwer et al., 2007).

Ordinary least squares (OLS) multiple regressions were used because the explanatory variables were continuous and this gives a more simple and precise estimation of the

statistics than many other methods (Shively and Luckert, 2011). I used the log-log forms of OLS whereby both the dependent and explanatory variables are converted into natural logarithms. OLS multiple regressions were used to build models of the household characteristics associated with relative forest or shrimp income. The multi-collinearity of the regressed variables was also checked to ensure that there was no perfect collinearity among the explanatory variables. I assumed that the samples represented the whole Sundarbans region following Kar and Jacobson (2012) who used linear regression to develop a forest income prediction model for the Chittagong Hill tract regions of Bangladesh. Several other studies have also used OLS regressions to build models of household characteristics associated with relative forest income (McElwee, 2008; Kamanga et al., 2009).

3.3.7 Interviews

Interviews enable a researcher to investigate complex behaviours and motivations and to gain insight into different opinions and experiences (Dunn, 2000). They can be used to seek out the opinions of marginalised groups whose voices are rarely heard (Townsend, 1995).

3.3.7.1 Semi-Structured Key Informant Interviews

On the interview continuum, semi-structured interviews are the middle ground between unstructured and structured interviews. Qualitative approaches, such as in-depth interviews are useful tools for understanding people's responses to, and the impact of, a disaster (Quarantelli, 1997) and assessing mangrove product and services at the local level (Kaplowitz, 2001). In the present study, the interviews were semi-structured so that the interviewees had a wide scope in answering

questions, thus allowing any topic of interest to be elaborated upon. The interview questions were, however, prepared in advance to serve as a guideline in covering the important topics. On average, each key informant interview lasted for one and a half hours. In exploring the livelihood vulnerability, the semi-structured interviews with key informants were the core source of information. To have an in-depth understanding of the micro-level livelihood dynamics, I sometimes approached the key informant interviews as an in-depth longitudinal examination of a single instance or event (a case) without following a rigid protocol of variables.

The local key informants consisted of persons who filled certain posts with sufficient knowledge who were in one way or another involved with the mangrove resources, shrimp culture or disaster management following Cyclone Aila. A profile of the key informant interviewees and a checklist of the interview questions are presented in Appendix D. This included interviews with range of people including marginalised groups such as members of local communities, fishers, farmers, government officials and NGO workers. These questions were intended to guide the interviews and enable the development of further areas of enquiry during the field research. The interviews were semi-structured and recorded manually. Many of these key informants were repeatedly consulted during the course of the research including after the formal data collection.

Key informant interviews were done to identify the internal weaknesses and external threats faced by Forest Department officials in managing the Sundarbans mangrove forest and the weaknesses in the policy and its implementation in relation to the livelihoods of forest-dependent people and biodiversity conservation. The interviews

also sought to find information about options for better management. In the case of shrimp aquaculture, the key informants were interviewed about the different vulnerabilities caused due to shrimp aquaculture, shrimp farming and trading, and present shrimp aquaculture management loopholes and alternatives for solutions. In the cyclone-affected areas of Koyra Sub-District, the interviews were adapted to the different professional backgrounds of the interviewees (Appendix D) in order to get specific information about government and NGO relief and rehabilitation programmes.

3.3.7.2 Focus Group Discussions

Focus group discussions take advantage of group dynamics and allow respondents to discuss an issue beyond the individual scope (Liamputtong, 2009). Ideally, focus groups are fairly homogeneous groups containing people with similar backgrounds, experience and values, and they contain five to seven participants. Participants can contribute and control the shared information as they can express their thoughts in a more relaxed manner when they see that others have a similar experience. One advantage of using focus group discussions is that this method helps to minimise the social and cultural divides between researchers and participants (Morgan, 2002).

Focus group discussions were conducted with the different mangrove resource collector groups such as *bawalis* (fuelwood and nipa leaf collectors), fishermen, shrimp fry collectors and crab collectors from the Sundarbans forest in order to explore how the resources were being collected, the season and process of resource collections, to identify the vulnerabilities and risks associated with resource extraction, major constraints or problems for their livelihoods, and to propose

realistic and sustainable solutions to overcome those constraints (Figure 3.7). I managed to carry out one focus group discussion with female resource collectors who were shrimp fry collectors who occasionally collected fuelwood from the forest. One focus group discussion was conducted with Forest Department field-level officials to get information about the structure of present forest management in terms of its strengths and weaknesses, the rules and regulations associated with management and their impact on livelihoods and options for best management.

Three other focus group discussions were conducted: two involved the joint participation of small and non-shrimp farmers, and one involved people with different occupations associated with shrimp aquaculture. The purpose of these discussions was to describe recent social, economic and environmental changes due to shrimp aquaculture and impacts on their livelihoods, the role of the Fisheries Department, and realistic solutions to overcome any constraints.



Figure 3.7: Focus group discussion with women resource collectors (A) and shrimp fry collectors (B) in Mongla Sub-District; with women cyclone victims (C) in high affected areas and cyclone victims in severely affected areas (D) in Koyra Sub-District at the end of the dry season

In Koyra Sub-District, the focus group discussions were carried out with cyclone victims (both male and female participants) at the end of the wet and dry seasons. Regarding the availability of post-disaster relief, I used the focus group discussions to assess the existence of social networks and institutional arrangements to support cyclone victims and to identify the roles of government, local government, NGOs and community groups in the relief and rehabilitations efforts after Cyclone Aila.

3.3.8 Policy Analysis

Analysis of policies is complicated by the need to know what is written in statute books, what the intended effects of the policies and associated laws are, and what happens in practice (DFID, 2000). Policy analysis for sustainable livelihoods can be investigated by an analysis of documents and key informant interviews to understand

what policies exist and the relationship between policy and the livelihoods of people (Pasteur, 2001a; Shankland, 2000).

In the present study, analysis of documents was done in order to understand the intents of the policies that influenced the promotion or prohibition of livelihoods. To find out about the existing policy, laws and documents, I collected government policy documents and ministerial orders, although finding such documents was difficult. The Ministry of Environment and Forest (MOEF) and the Ministry of Fisheries and Livestock (MOFL) were directly involved in the planning and policy formulation in the forestry and fisheries sector. Relevant policies, laws, circular, data were collected from these two organisations from their headquarters as well as from their divisional, district and sub-district level offices. I found some ministerial orders from secondary sources such as draft papers and project reports on Sundarbans management and shrimp aquaculture. Information from the key informant interviewees also pointed me towards some sources. However, an analysis of policy documents only helps in understanding policy content ‘on paper’ – it is not sufficient without an analysis of context, processes and impacts (Pasteur, 2001a).

Semi-structured interviews are effective for consulting and discussing with key informants – both those involved in making or influencing policy, as well as those impacted by policy (Pasteur, 2001a). Key informants can provide an assessment of the context, processes, measures and impacts to gain insights into the policies that influence livelihoods (DFID, 2000). Qualitative discussions with key informants from local communities, government agencies (including local government), NGOs and law enforcement agencies such as the Coast Guard and Police, were included for

the policy analysis in order to investigate the decision-making of local resource managers and to understand the institutional perspectives on the competing issues, key impacts of policies on livelihoods, and natural resource management perspectives targeting mangroves, shrimp culture and disaster issues. This investigation helped me to determine the type of interventions that would be most appropriate both for sustainable livelihoods and conservation and the levels of organisation for best management practices combining forest, shrimp and disaster at the local sub-district level.

3.3.9 Seasonal Calendar

For the seasonal calendar, a PRA was used to gain a baseline understanding of the availability of the resources from the Sundarbans mangrove forest. Seasonal calendars are a representation of activities in a community over a year (Kumar, 2002; Nguyen et al., 2006). People undertake very different activities as the seasons change. This can impact on supply and demand. The same changes can be observed in coastal mangrove environments, such as the fluctuation of key resources at different times of the year. Eight participants (two crab collectors, two fishermen, two shrimp fry collectors and two fuelwood collectors) who collected resources from the Sundarbans and who seemed to be very knowledgeable in the focus group discussions were selected to develop the calendar. The participants drew a table of rows and columns on a large piece of paper and wrote down the months (in Bengali) in the columns and the names of each important resource in the rows. The participants used red, green and blue colours for major extraction, minor extraction and occasional use of different resources and accordingly coloured the months against each resource. The calendar identified the critical times in the mangrove

resource collection cycle and provided information on the activities related to harvesting resources from forests such as the resource extraction period and the lean periods of job crises. Such calendars are used to indicate seasonal features and changes and are useful for allowing community members to plan in line with seasonal changes in climate.

3.3.10 Direct Observations

Observation is more than simply gathering information in the field and passively recording what people are doing and saying (McGoodwin, 2001). Direct observation involves the researcher visiting the case study sites to just observe (Kumar, 2002). Thus, it is an example of a less interactive method of data collection. In the present study, I attempted to observe the daily livelihood activities of the households and the community, including the environmental conditions while I was in the study villages. However, I did my write-ups of observations in private to minimise the risk that villagers would feel I was intruding into their lives. Direct observations were carried out to see shrimp fry catching and marketing activities (Figure 3.8), the shrimp farm preparation, shrimp caught from the farm, and shrimp trading in the shrimp depots. These observations also helped me to identify the assets required to involve, cost and profit from shrimp fry activities and the vulnerabilities faced by collectors. In Koyra Sub-District, direct observations helped me to understand how people survived after Cyclone Aila, the relief and rehabilitation activities carried out by the local government and NGOs, the embankment reconstruction works and associated problems, and the reactions of the people who survived the cyclone.



Figure 3.8: Direct observation of shrimp fry catching and sorting activities in Joymony Ghol Village along the Passur River

3.3.11 Qualitative Data Analysis

The qualitative data were analysed by sorting the data into themes and studying the interrelationships among the variables in order to build a logical chain of learning (Creswell and Miller, 2000). Vayda (2009) stated that a causal explanation enables researchers to respond to what affects the occurrence of particular events, the entities in the casual relationships and the nature of their relatedness. In qualitative data analysis, sufficient time must be taken to patiently organise unbiased information into different categories of knowledge. Categories are developed inductively from within the textual material by using terms or text passages that are formulated close to the textual content. Thereby, the data material is viewed line by line, and phrases, sentences or paragraphs are coded into corresponding categories. The qualitative findings from the focus group discussions and key informant interviews are discussed in Chapters 5, 6 and 7 as a conglomeration of secondary data, important quotes, community perceptions and my own impartial observations of facts and

findings wherever applicable as an independent observer in order to analyse the livelihood trends that were perceived in the study areas.

The qualitative data were analysed to find out the role of the policies and relevant institutions in forest, shrimp and disaster management to identify the best practice for managing these in terms of livelihoods and conservation. When the qualitative data gathered from the key informant interviews and focus group discussions are presented in this thesis, I use quotes to illustrate local perceptions; these quotes have been translated from the Bengali language to English with some adjustments made due to language and linguistic issues.

3.3.12 Secondary Data Collection

The first stage in this study involved a literature review of shrimp aquaculture, mangrove resource management and vulnerability to cyclones in Bangladesh in general, and in the Sundarbans regions in particular. Background information on the communities selected for the study and the sub-districts in which they are situated was collected from Mongla and Koyra Sub-District offices and local union council sources. Other data were obtained from the Bangladesh Bureau Statistics, the Ministry of Environment and Forest and the Ministry of Fisheries and Livestock. Statistics and copies of policies on trade related to shrimp aquaculture were obtained from agencies including the Bangladesh Bank and the Bangladesh Frozen Food Exporters Association. Relevant statistics were collected from these organisations to gain the background on export volumes, markets and significance to the national economy. The Sundarbans mangrove forest management data collected from the

Forest Department, Khulna Circle Office included information on revenue, human resources, administration, yearly income and expenditure (budget), and logistics.

Reports on the extent of damage caused by Cyclone Aila, as well as on government and NGO relief and rehabilitation efforts, were collected from the Koyra Sub-District office. Some data and relevant government rules and regulations relating to disaster management were also collected from the Comprehensive Disaster Management Programme office and the Ministry of Food and Disaster Management websites.

Many relevant project reports and documents prepared by government officials, the Bangladesh Frozen Foods Exporter Association, multilateral donor organisations like the World Bank, UNDP and FAO, local and international consultants, universities, research organisations, newspapers and NGOs were collected and reviewed from the internal libraries of these organisations and from open access Internet sources.

3.3.13 Triangulation

The research methods applied in this study were designed to evaluate the data through qualitative and quantitative methods according to the model of triangulation so that the results mutually supported each other and the intersecting individual findings represented the overall results. A research strategy integrating different methods is likely to produce results that are potentially more useful and relevant in terms of quality in contrast to research concepts following only one method (Mayring, 2001). The combination of qualitative and quantitative methods is an important and recognised technique that leads to an improved quality of information (Marshland et al., 2001).

The present research consisted of several components conducted in each of the study sites. The first component consisted of the administration of household surveys, the second component was made up of focus group discussions, and the final component involved key informant interviews. As additional triangulation, the relevant secondary data were collected and reviewed, and personal observations were made. The household surveys, focus group discussions and interviews complemented each other and verified the collected data. While walking through the area, the researcher made observations of the resources and of people's behaviours and activities, which also helped in the triangulation of the collected information and in the generation of new questions for the interviews or discussions.

Informal discussion was employed to check the data and no checklist was used as a basis for questions. Informal discussions were conducted at places where local people gathered spontaneously especially in open spaces in front of the mosque after prayer, local tea stalls and travelling together in boats or in country vans. During these informal discussions, I raised issues and checked the results of the focus group discussions and key informant interviews particularly in relation to the collection of illegal resources from the Sundarbans, misappropriation of relief distribution and the delayed response to the embankment reconstruction after Cyclone Aila.

3.4 Research Challenges

In Mongla, the greatest challenge in the research proceedings was to ensure participation of the local community as participants had to participate in three surveys in a year. As a government officer belonging to a civil service administration

office, I received very good support from the sub-district administration, Forest and Fisheries Departments and local government union council. I was introduced to the locally elected union council chairman and the NGO worker who worked with the forest-dependent community in the study areas by the Mongla Sub-District CEO. With the help of the relevant union council chairman and NGO worker, I made contact with local formal and informal leaders. With their help, I consulted with the community and explained my research objectives in community workshops in each village. The social network established through past experience while undertaking Masters research at Mongla helped me to penetrate easily into the community. Some of the potential participants also checked the purpose of the study with the local government representative and government officials at the sub-district level. I appointed two local informal leaders (one for each study site) who were popular in the study area to assist in the explanation of the research objectives and answer the various queries raised by the participants. Finally, I established strong ties in the community and it was difficult for me and the participants of the study to say goodbye as an amity had developed among us.

Another cultural and societal challenge was to carry out the research without having a female research assistant in the data collection process. The study areas in Mongla were situated nearly 20 km from the sub-district headquarters. I did not find any female NGO staff working there. In Koyra, the devastation of communication services by the cyclone put extra pressure on the facilities in the community especially as there was limited accommodation available and a lack of basic toilet and drinking water facilities. I and one research assistant had to travel 30 km from another sub-district by motorbike, rickshaw van and country boat. However, the lack

of a female research assistant did not undermine the quality of the data. In Mongla, the three local research assistants were from the study villages and their families were known to the women of the locality. Therefore, the women respondents did not feel uncomfortable during the household surveys and focus group discussions. One research assistant was able to organise focus group discussions with female mangrove resource collectors and shrimp fry catchers to identify problems very much related to women. Moreover, in cyclone-affected Koyra Sub-District, many women individually and also along with their husbands participated in the household survey (Figures 3.5, 3.6 and 3.7). I conducted one focus group discussion in Koyra with women with the help of a young woman who had just been admitted into a Bachelor of Political Science and was a daughter of a village physician. Her participation helped me to know about some problems particular to women after the cyclone, such as issues related to relief and rehabilitation activities and other issues. The aim of the research was not to study the livelihoods of households based on gender, although the gender perspective was highlighted during the data analysis such as the dependency of male and female household members on forest income, representation of males and females in different organisations and how women were vulnerable due to cyclone, shrimp aquaculture and tiger attack. In this way, the gender perspective was represented in this study and was not ignored.

In cyclone-affected Koyra Sub-District, data collection on extensive loss and damage was done during the first household survey at the end of the wet season in October, 2009 by me with help from one non-local and one local data collector. However, some participants especially from the low affected areas deliberately provided exaggerated data on the extent of the damage done by the cyclone, guessing it would

help them to get government relief. I did not use any help from NGO staff as NGOs were doing relief work in the study area and I wanted the participants to understand that the survey was purely for research purposes and therefore hoped that they would not exaggerate the extent of the damage they had experienced due to Cyclone Aila. I cross-checked the survey data for the low, high and severely affected areas with the household-level damage report prepared by the local union council under supervision of the union council and sub-district administration just after the cyclone. Some NGOs had prepared damage assessment reports which I compared with the research data collected through the household surveys. In some cases, I consulted with local elites especially in the low affected areas to get their views on the extent of damage. One local college teacher, a member of the local elite, in the low affected areas also helped me to check the data. Thus, the quality of the data was ensured in cyclone-affected Koyra Sub-District. The next chapter describes the livelihood assets of the households surrounding the Sundarbans mangrove forest.

Chapter 4: Livelihood Assets, Strategies and Outcomes



Chapter 4: Livelihood Assets, Strategies and Outcomes

4.1 Introduction

The ability of households to pursue livelihood strategies depends on their livelihood resources or assets (Cramb et al., 2004). As discussed in Chapter 2, assets are considered to play an important role in enabling a household to generate a means of survival (Ellis, 2000a). Assets reflect the capabilities of people and are shaped by social, economic and political forces (Sen, 1997, 2000). Assets, activities and incomes are thus complementary measures in the study of livelihoods, where income offers a measure of direct interest because of its clear interpretation as a welfare outcome (Barrett et al., 2001a).

Livelihood strategies refer to the range and combination of activities that people undertake in order to achieve their livelihood objectives. Strategies are thought to be influenced by people's vulnerability context, the extent of their livelihood assets and the nature of the transforming structures and processes (DFID, 2000). Livelihood outcomes are defined as the achievement or outputs from livelihood strategies as livelihood strategies are intended to provide a range of outcomes that will improve wellbeing and reduce poverty in its broadest sense (DFID, 2000). Livelihood strategies refer to the activities that generate the means of households' survival (Ellis, 2000a). Livelihood assets together with the external context result in different livelihood strategies and associated outcomes (Scoones, 1998). Access to assets in the form of ownership or the right of use can build positive livelihood outcomes.

The objective presented in this chapter investigates the components of livelihoods assets and livelihood strategies and the outcomes of households in different income

groups in six villages surrounding the Sundarbans in Mongla Sub-District (as explained in detail in Chapter 3). The focus of the main research question in this chapter is the identification of the key factors underpinning the livelihood structure in the study area (Chapter 1). This chapter covers the following research questions in order to address the main research question and fulfil the objective of the chapter:

- 1) What assets do the households surrounding the forest have?
- 2) What are the most important livelihood strategies and outcomes?

The first section identifies the asset holdings of the households and describes and organises assets into the categories of the natural, physical, financial, social and human assets of households in these communities. The second part examines the different kinds of livelihood strategies adopted by the households in the study area. Livelihood outcomes are discussed in relation to the households' livelihood strategies and asset situation in the discussion part of the chapter. The vulnerability context of the households is also discussed in relation to the overall asset and poverty condition of the households.

4.2 Methods

To investigate the livelihood assets, I collected information on household assets and incomes, both subsistence and cash, for the period of one year from September 2009 to August 2010 (as discussed in detail in Chapter 3). Households were ranked and divided into three income terciles based on total annual income, namely, “lower income” (US\$177-796), “middle income” (US\$805-1,506) and “higher income” (US\$1,509-18,963) of the same size (n=88 each). The mean total incomes among the

groups were significantly different (US\$573, US\$1,114 and US\$4,606, respectively; ANOVA P<0.001).

Household assets were grouped under the four categories of natural, physical, human, social and financial assets. In this chapter, only the income from natural assets is analysed in relation to its contribution to livelihood strategies. The major natural assets in the study area were the mangrove forest resources, which are examined in Chapter 4. Shrimps were also natural assets in the area but the shrimp farming was most heavily influenced by a combination of physical and financial assets. The shrimp farming is discussed in detail in Chapter 5. Information was collected by a questionnaire (see Appendix A) that included questions about land-based assets and non-land assets. The monetary value of each non-land asset was determined according to the present market value (as discussed in Chapter 3). Households were classified by livelihood strategies on the basis of the net income (both cash and subsistence) that they derived from different resources, thus drawing conclusions regarding the resources' relative importance to the household survival. Only the comparisons among the different income groups are presented here, using the means and totals of each group as convenient summary measures of the quantitative data. Some information, such as information about the physical community assets, was derived from personal observations.

4.3 Results

The results are presented in two sections. The first section presents the contribution of the non-natural asset types to household livelihoods in the study villages. The

livelihood strategies for households are then compared among the different income groups.

4.3.1 Human Assets

Human capital includes people's skill, knowledge, ability to labour and good health, which together enable them to develop strategies to improve their wellbeing (DFID, 2000). In the context of the study area, human assets included the household composition and size, the education status of household members and the occupation status of the household head, each of which are described below.

4.3.1.1 Household Composition

In the case study villages, my studies showed that the families were both nuclear and extended families. There were no official counts of the number of extended and nuclear families in the six case study villages. Average household size in the study area was 4.8 ± 1.54 , which was larger than the national rural household size of 4.5 as measured in rural areas of Bangladesh in 2010 (BBS, 2011a). Household size was smallest for the lowest income group (4.5 ± 1.45) and largest for the highest income group (5 ± 1.79).

In the sampled households, most households (94%) had a male head (Table 4.1). This was consistent with the fact that the society is patrilineal and patriarchal. Children inherited land and other property through the father's line. Almost all marriages were monogamous. Polygamous marriages were considered culturally inappropriate but some occurred in the study area. In cases where the husband died, the widow became the leader of the household. If the children were small when their

father died, the widow might return to her parents or remain with her deceased husband's family. The mother could choose to stay with her children. If the children were adults, the elder son usually took over as the head of the household from his deceased father.

Table 4.1: Number and percentage of households with a male or female household head in six villages on the edge of the Sundarbans, Mongla Sub-District (n and (%))

| | Income Tercile | | | |
|--------|----------------|---------|---------|----------|
| | Lower | Middle | Higher | Total |
| Female | 12 (14) | 3 (3) | 1 (1) | 16 (6) |
| Male | 76 (86) | 85 (97) | 87 (99) | 248 (94) |
| Total | 88 | 88 | 88 | 264 |

The organisation of labour within the household was determined by gender. The father usually made the decisions concerning the tasks to be done regarding the productive aspects of the household. Decisions related to reproduction and household chores (i.e., rearing children, cooking, washing clothes and plates, collecting drinking water) were usually made by the mother. The children were expected to follow the parents' decisions and instructions. Households commonly split when sons formed independent family units after the death of their father. Sons may separate from the family even when their parents are alive or economically active, starting their adult lives without land or only with homestead land (this is the land around a household residence used for crops, small plantations, ponds and tanks) and later inheriting land after the death of the father. Changes in land endowment were therefore most likely to be associated with the splitting of households into separate households.

4.3.1.2 Education

Initial endowments in human assets – as measured by the average years of schooling for the household head – were five times higher for the members of higher income households (average years of schooling = 6.4 years) (Table 4.2) compared with the lower income households (1.2 years) and many of them had at least one household member who had completed primary school. The average years of schooling for the household head was also moderate (3.6 years) among middle income households. School enrolment for primary school children was 80%, which was very close to the national figure of 84% calculated for the school enrolment rate of 6-10 year olds in rural areas in Bangladesh (BBS, 2011a), but secondary school participation was only 51% (Table 4.3). Most children enrolled in primary school but very few completed it. Few students were able to finish higher education beyond the secondary level.

Table 4.2: Educational status of the household head in six villages on the edge of the Sundarbans, Mongla Sub-District (n and (%))

| | Income Tercile | | | Total |
|--------------------|----------------|---------|---------|---------|
| | Lower | Middle | Higher | |
| Illiterate | 57 (65) | 23 (26) | 13 (15) | 93 (35) |
| Primary | 22 (25) | 41 (47) | 22 (25) | 85 (32) |
| Secondary | 7 (8) | 18 (21) | 28 (32) | 53 (20) |
| Higher secondary | 2 (2) | 5 (6) | 19 (22) | 26 (10) |
| Graduate and above | - | 1 (1) | 6 (7) | 7 (3) |
| Total | 88 | 88 | 88 | 264 |

Table 4.3: Educational status of children among households in six villages on the edge of the Sundarbans, Mongla Sub-District (frequency (%))

| Education level | Age class | |
|-----------------|-----------|---------|
| | 5-10 | 11-16 |
| No schooling | 31 (19) | 14 (10) |
| Primary | 131 (80) | 55 (38) |
| Lower secondary | 1 (1) | 74 (51) |
| Upper secondary | - | 2 (1) |
| Total | 163 | 145 |

4.3.1.3 Occupation

In the Sundarbans, most of the heads of lower income households were mangrove forest resource collectors working either as shrimp fry or fuelwood collectors or fishermen who engaged in other economic activities such as wage labour (Table 4.4). Most households combined multiple mangrove resource collection activities (57% and 26% for the lower and middle income households, respectively) in order to maintain livelihoods. The higher income households were mostly shrimp farmers (30%) or traders (32%).

Table 4.4: Primary occupation of household heads in six villages on the edge of the Sundarbans, Mongla Sub-District (n and (%))

| Occupation Category | Income Tercile | | | Total |
|---|-----------------------|---------------|---------------|--------------|
| | Lower | Middle | Higher | |
| Sundarbans fuelwood collection | 9 (10) | 4 (5) | - | 13 (5) |
| Sundarbans shrimp fry collection | 11 (13) | 3 (3) | 1 (1) | 15 (6) |
| Sundarbans fishermen | 2 (2) | 1 (1) | - | 3 (1) |
| Sundarbans multiple resource collection | 50 (57) | 23 (26) | 3 (3) | 76 (29) |
| Sundarbans resource trading | - | 3 (3) | - | 3 (1) |
| Shrimp fry trading | 1 (1) | 9 (10) | 15 (17) | 25 (10) |
| Petty trading/business | - | 2 (2) | 14 (18) | 16 (6) |
| Petty trading-grocery shop | 1 (1) | 9 (10) | 12 (14) | 22 (8) |
| Shrimp trading | - | 3 (3) | 7 (8) | 10 (4) |
| Shrimp farming | 1 | 18 (21) | 26 (30) | 45 (17) |
| Service | 1 (1) | 4 (4) | 7 (9) | 12 (5) |
| Wage Labourer | 3 (3) | - | - | 3 (1) |
| Housewife | 7 (8) | 3 (3) | 1(1) | 11 (4) |
| Auto-Rickshaw/Van Driver | - | 4 (5) | 1(1) | 5 (2) |
| Begging | 2 (2) | - | - | 2 (1) |
| Village Doctor | - | 1 (1) | - | 1 (0.4) |
| Others | 1 (1) | - | 1 (1) | 2 (1) |
| Total | 88 | 88 | 88 | 264 |

Human assets were described in relation to household composition, education status of the household members and occupation status of household heads. In the following section, I present an overview of the social assets of the households in the study area.

4.3.2 Social Assets

Ballet et al. (2007) defined social capital as structural social capital such as social organisations, family, social networks, voluntary associations and cultural social capital such as trust, reciprocity, norms and beliefs. To understand the dynamics of social capital in the context of rural Bangladesh, this study examined structural social

capital in relation to household memberships in the Union Council, various management committees of school, market and mosque groups, NGOs, government welfare recipient groups including Vulnerable Group Feeding (VGF), widow and old age pensions, professional associations, and household participation in community programs and events such as festivals, weddings and different ceremonies within the communities. Social capital (Table 4.5) includes the average number of members of organisations according to gender and income groups in the six villages.

Households in the lower income group had no representation in the local government union council and negligible representation in local educational, religious and market management committees (Table 4.5). Some male members belonging to higher income households were members of social and professional organisations situated in the sub-district headquarters not in the study area. Male members of higher income (46%) and middle income (43%) households had strong representation in the local political activities of the two major political parties of the country while members of the lower income group had below-average membership rates (16%). Both male and female members of the middle income households were better represented in development NGO membership than lower income households. Most of the NGOs provided micro-finance, yet the lower income households usually lacked the collateral necessary to qualify for credit. Female members belonging to the lower income households received different allowances provided by government safety net programs such as VGF, Food for Work (FFW) widow and old age pensions but so too did many women belonging to the middle and higher income households.

Table 4.5: Social capital presented as average number of members of organisations according to gender and income groups in six villages on the edge of the Sundarbans, Mongla Sub-District (n and (%))

| | Income Tercile | | | | | |
|--|----------------|---------|---------|---------|---------|----------|
| | Lower | | Middle | | Higher | |
| | Male | Female | Male | Female | Male | Female |
| Member of political party | 14 (16) | 3 (3) | 38 (43) | 2 (2) | 40 (46) | 4 (5) |
| Member of union council | - | - | 1 (1) | - | 6 (7) | - |
| Member of managing committee of educational institutions | 1 (1) | - | 3 (3) | - | 21 (24) | - |
| Member of religious institution | 1 (1) | - | 9 (10) | - | 20 (23) | - |
| Member of market committees | 1 (1) | - | 13 (15) | - | 45 (51) | - |
| Member of social organisation | - | - | 13 (15) | - | 26 (30) | - |
| Member of NGO | 12 (14) | 10 (11) | 23 (26) | 15 (17) | 8 (9) | 14 (16) |
| Participation in community program | 66 (75) | 87 (99) | 73 (83) | 86 (98) | 84 (96) | 88 (100) |
| Recipient of government allowances | 1 (1) | 16 (18) | 2 (2) | 8 (9) | 2 (2) | 3 (3) |
| Member of professional organisation | 3 (3) | - | 3(3) | - | 14 (16) | - |

I personally observed that political membership of the party of power was a key social asset enabling individuals to influence decision-makers or to manoeuvre in the local bureaucracy. Thus, lower income households, most of which had no social capital, had established patronage with local leaders belonging to higher income households in their struggle to receive government safety net supports for improving livelihoods.

Most household members participated in community events like marriage ceremonies, birth and death ceremonies and different festivals. The worshipping community shared the organisation of, and participation in, religious ceremonies including observance of several important Islamic holy days and rituals surrounding lifecycle rites of passage. On nearly all ritual occasions, food is shared, and these occasions are an important symbolic feature of community activities representing important aspects of social capital and social cohesion.

4.3.3 Financial Assets

Financial assets are the financial resources that enable people to access different livelihood strategies (DFID, 2000). I analysed three types of financial assets accessed and owned by the households in the study area, namely, livestock (poultry, goat and cattle), credit (in the form of amount, source and reasons for loans), and household cash income sources. Credit data were collected for a one year period from November 2008 to October 2009 while the income data presented here cover the period of September 2009 to August 2010. Poverty and income inequality data were also collected in the same timeframe as the income data.

4.3.3.1 *Livestock*

The various types of livestock owned by the households are shown in Table 4.6. Large livestocks (cows, buffalo) were a major store of wealth only for some higher income households in the study area. The difference in the number of cattle kept by the groups was the most striking. Households in the lower and middle income groups averaged 0.4 large livestock, whereas for the higher income group 1.4 large livestock were kept. The data also showed that the numbers of poultry, goats and large

livestock owned were highest among the higher income households. In the study area, animal husbandry was the least common agricultural activity and was often only carried out by some poor families for subsistence by keeping a few chickens.

Table 4.6: Livestock ownership among households in six villages on the edge of the Sundarbans, Mongla Sub-District

| | Income Tercile | | | |
|---------------------------------|----------------|---------|---------|----------|
| | Lower | Middle | Higher | Total |
| Poultry | | | | |
| Number of households | 37 (42) | 67 (76) | 68 (77) | 172 (65) |
| Mean within total households | 3.4 | 9.4 | 13.4 | 8.7 |
| Goats | | | | |
| Number of households | 14 (16) | 24 (27) | 26 (30) | 64 (24) |
| Mean within total households | 0.3 | 1.0 | 1.5 | 1.0 |
| Large livestock | | | | |
| Number of households | 2 (2) | 19 (22) | 28 (32) | 49 (19) |
| Mean within total households | 0.1 | 0.6 | 1.4 | 0.7 |
| Total value of livestock (US\$) | 32 | 210 | 562 | 268 |

4.3.3.2 Credit

The main source of cash credit for households came from moneylenders or national government or private financial institutions such as banks or NGOs. Only 31% of households in the three income groups had taken credit from November 2008 to October 2009 (Table 4.7). More middle and lower income households (33%) accessed credit than higher income households (27%), but higher income households received nearly 20 times more money.

Table 4.7: Households accessing credit (all sources) over 12 months in six villages on the edge of the Sundarbans, Mongla Sub-District (n and (%))

| Credit accessed | Income Tercile | | | Total |
|-----------------|----------------|---------|----------|----------|
| | Lower | Middle | Higher | |
| Yes | 29 (33) | 29 (33) | 24 (27) | 82 (31) |
| No | 59 (67) | 59 (67) | 64 (73) | 182 (69) |
| Amount (US\$) | 44-218 | 58-1817 | 102-7267 | 44-7267 |

The higher income households sourced loans mainly for shrimp farming and shrimp-related trading (58%) and other non-farm trade and business (26%) purposes (Table 4.8). Middle income households took credit for diversified purposes but largely related to shrimp farming, buying nets (17%) and buying solar panels (7%) for establishing small business. An NGO working in Bangladesh provided loans to install solar panels in the study area. Lower income households took out loans to buy nets for catching shrimp fry (62%) or building a boat (14%) as these were important physical assets for generating income for this group (Table 4.9). However, the amounts were small (between US\$55 and US\$73).

Table 4.8: Reasons for taking credit among households in six villages on the edge of the Sundarbans, Mongla Sub-District (n and (%))

| Loan Reason | Income Tercile | | | Total |
|---------------------|----------------|--------|---------|---------|
| | Lower | Middle | Higher | |
| Land purchase/rent | 1 (3) | 6(21) | 1 (4) | 8 (10) |
| Buying net | 18 (62) | 5 (17) | 2 (8) | 25 (31) |
| Boat buying/ making | 4 (14) | 2 (7) | | 6 (7) |
| Shrimp farming | | 6 (21) | 14 (58) | 20 (24) |
| Trade/Business | 3 (10) | 8 (26) | 6 (26) | 17 (20) |
| Buying solar panels | | 2 (7) | | 2 (2) |
| Others | 3 (10) | | 1 (4) | 3 (4) |
| Total | N= 29 | N= 29 | N= 24 | N=82 |

The lower income group obtained credit mainly from moneylenders (77%), followed by NGOs (23%). The evidence points to the importance of non-institutional sources of financial capital for the lower income groups. The higher income households had greater access to credit provided by private and government banks than the middle and lower income households (Table 4.9). The higher income households had loans from the government or the private banking sector on a long-term basis (5-15 years) with a low interest rate and land as collateral for shrimp farming and establishing

shrimp-related businesses such as permanent shrimp depots. The middle income group took loans from diversified sources such as NGOs (61%), government banks (16%) and moneylenders. The Bangladesh Rural Development Board (BRDB), a government funded co-operative organisation, also provided collateral-free low interest loans to establish non-farm trade or business enterprises in the study area but these were limited to middle and higher income households.

Table 4.9: Source of credit among credit-taking households in six villages on the edge of the Sundarbans, Mongla Sub-District (n and (%))

| Source | Income Tercile | | | Total |
|-----------------|----------------|---------|--------|---------|
| | Lower | Middle | Higher | |
| Moneylender | 23 (77) | 7 (24) | 2 (8) | 32 (39) |
| NGOs | 6 (23) | 15 (52) | 5 (21) | 26 (32) |
| Private Bank | - | 1 (3) | 6 (25) | 7 (9) |
| BRDB | - | 1 (3) | 2 (8) | 3 (4) |
| Government Bank | - | 5 (17) | 9 (38) | 14 (17) |
| Total | N=29 | N=29 | N=24 | N=82 |

Lower income households in the study area considered moneylenders to be more flexible with respect to negotiating the terms and conditions of loans, and they were considered to be more responsive to the needs of the people at more favourable terms and at the peak season of resource collections as well as flexible regarding repayments. I observed that the moneylending system was deeply rooted in the existing socio-cultural structure and that moneylenders provided some critical services to the borrowers. Micro-credit NGOs failed to provide credit as a tool for poverty alleviation and empowerment, particularly for lower income households who tended to lack collateral, and who also found it difficult to establish credentials with formal institutions. Some high profile NGOs were completely absent from the study area.

4.3.3.3 Income

Forest income was the most important income source among 97% of the lower income households while nearly 81% of middle income households and 53% of the higher income households derived a cash income from different mangrove forest resources (Table 4.10). In this regard, shrimp fry (post-larvae) was the most important cash income source for all income groups. Shrimp and associated businesses were common cash income sources among the higher income households. Only 7% of the lower income households had the opportunity to earn cash from shrimp farming sources, compared to 85% of the higher income households. Members of lower and middle income households provided labour in shrimp farms, with approximately 31% and 21% of lower and middle income households actively selling labour to obtain cash income compared with none in the higher income households.

Another strong impetus source for cash income came from the highly remunerative non-farm sectors especially from trade, service, and remittances from which, respectively, 35%, 18% and 16% of the higher income households had earned cash income. A total of 44% and 47% of the households in the lower and middle income groups had used non-farm sources for cash income compared with 75% in the higher income group. No households in the lower group had income from salary or business sources. Interestingly, higher income households had significantly higher levels of remittance sources than the other income groups. Regular service or savings were not significant sources of income among the income groups but the magnitude of income was greater for the higher income group. Government allowances were not a significant source of cash income for the lower income group as the middle and

higher income groups had similar access to government allowances provided through the social security safety net.

Table 4.10: Sources of cash income among the different income households in six villages on the edge of the Sundarbans, Mongla Sub-District (n and (%))

| Income Source | Income Tercile | | | χ^2 Value | P Value |
|-------------------------|-----------------------|---------------|---------------|----------------|---------|
| | Lower | Middle | Higher | | |
| Forest Income | 85 (97) | 71 (81) | 47 (53) | 47.2 | P<0.001 |
| Golpata | 3 (3) | 14 (16) | 14 (16) | 8.9 | P<0.05 |
| Fish | 50 (57) | 38 (43) | 22 (25) | 18.5 | P<0.001 |
| Shrimp fry ¹ | 63 (72) | 53 (60) | 35 (40) | 18.7 | P<0.001 |
| Wage labour | 45 (51) | 28 (32) | 2 (2) | 52.4 | P<0.001 |
| Crab | 37 (42) | 13 (15) | 8 (9) | 31.9 | P<0.001 |
| Fuelwood | 73 (83) | 34 (39) | 4 (5) | 111.6 | P<0.001 |
| Shrimp Income | 34 (39) | 64 (73) | 76 (86) | 47.3 | P<0.001 |
| Shrimp labour | 27 (31) | 18 (21) | - | 30.4 | P<0.001 |
| Shrimp business | 2 (2) | 10 (39) | 14 (16) | 9.6 | P<0.01 |
| Shrimp farming | 6 (7) | 56 (64) | 75 (85) | 115.7 | P<0.001 |
| Non-Farm Income | 39 (44) | 41 (47) | 66 (75) | 20.8 | P<0.001 |
| Trade/Business | 4 (5) | 15 (17) | 31 (35) | 27.3 | P<0.001 |
| Selling labour | 12 (14) | 7 (8) | 3 (3) | 6.1 | P<0.05 |
| Service | 8 (9) | 13 (15) | 16 (18) | 3.0 | NS |
| Remittance | 5 (6) | 3 (3) | 14 (16) | 10.2 | P<0.01 |
| Government allowance | 13 (15) | 9 (10) | 10 (10) | 1.17 | NS |
| Rent | 1 (1) | 4 (5) | 20 (23) | 27.7 | P<0.001 |
| Cash/savings | - | 2 (2) | 5 (6) | 5.6 | NS |
| Homestead Pond | | | | | |
| Fisheries | 26 (30) | 24 (27) | 24 (27) | 0.2 | NS |
| Livestock | 29 (33) | 33 (38) | 24 (27) | 2.1 | NS |
| Agriculture | 24 (27) | 21 (24) | 23 (26) | 0.3 | NS |

1. Shrimp fry consists of both Bagda fry (*Penaeus monodon*) and Golda fry (*Macrobrachium rosenbergii*).

Table 4.11 presents the mean cash income from different sources from September 2009 to August 2010 as the reference year. The average total annual cash income was estimated at US\$529 for the poor, whereas it was estimated at US\$1,016 for the middle income group and US\$4,349 for the higher income households (Table 4.11).

Higher income households had the highest share of cash income from shrimp farming (51%), followed by non-farm income (30%) and forest (17%) income. The lower income households depended more on forest (78%) and non-farm sources (11%) than on shrimp income (8%) for cash income. For the middle income group, forest income was also the most important source of income (contributing 49% to total household income), followed by shrimp aquaculture (25%) and non-farm income (22%). Significantly, non-farm income was the most important cash income source for all the income groups. I found a low contribution of income from agriculture, livestock and homestead fisheries over that period, as these incomes did not contribute significantly to household economies and failed to show significant patterns across the different income groups.

Table 4.11: Mean cash income from different sources for the households in six villages on the edge of the Sundarbans, Mongla Sub-District (US\$ and (% of total cash income))

| | Income Tercile | | | F-Value | P- Value |
|--------------------------|----------------|----------|-----------|---------|----------|
| | Lower | Middle | Higher | | |
| Mangrove forest | 414 (78) | 498 (49) | 753 (17) | 5.9 | <0.001 |
| Shrimp | 42 (8) | 255 (25) | 2234 (51) | 44.8 | <0.001 |
| Non-farm | 56 (11) | 222 (22) | 1283 (30) | 25.2 | <0.001 |
| Livestock | 6 (1) | 26 (3) | 43 (1) | 4.4 | <0.001 |
| Agriculture | 4 (1) | 6 (1) | 14 (0) | 6.6 | <0.001 |
| Homestead pond fisheries | 7 (1) | 8 (1) | 22 (1) | 9.9 | <0.001 |
| Total cash income | 529 | 1016 | 4349 | 92.5 | <0.001 |

4.3.3.4 Poverty and Inequality

A poverty line is defined as the minimum level of household income that can enable the purchase of a bundle of goods and services to satisfy the basic needs of the household (BBS, 2011a) (see the details in Appendix B and Chapter 3). The data, as presented in Table 4.12, showed that almost 43% and 55% of the Sundarbans

dwellers included in the survey appeared to live below the lower and upper poverty line, respectively which was very high in comparison to the national figures of 18% and 32% based on the 2010 HIES data (BBS, 2011a). Not only the lower income households but also the middle and higher income households in the study area fell into the category of absolute poverty. Based on 2005 and 2010 HIES data, the population below the poverty line at the national level reduced to 32% in 2010 from 40% in 2005 (BBS, 2011a). Yet, for the study area, poverty still remained high.

The study area is located within Khulna Division. When compared with the poverty data of the Khulna rural areas, the lower and upper poverty in the study area was 28% and 24% higher than that of the Khulna Division rural areas based on the HIES data calculated by the Bangladesh Bureau of Statistics (2011a). This study used September 2009 to October 2010 as the reference year while the BBS (2011a) also conducted HIES research in 2010.

The result of this study is also supported by other studies. In a study funded by the World Bank in 2010, the BBS found that around 48% of people in the sub-districts adjacent to the Sundarbans lived below the poverty line (The Financial Express, 2010). Based on 2005 HIES data, Islam (2010) found that the sub-districts situated in the impact zone of the Sundarbans had much higher extreme poverty rates (42%) compared to the sub-districts situated in the non-impact zone of the Sundarbans (26%).

Table 4.12: Proportion of villagers living below the lower and upper poverty line (head count ratio) in six villages on the edge of the Sundarbans, Mongla Sub-District

| Poverty Line | Study area | Khulna (rural) | Bangladesh (rural) | Bangladesh (national) |
|--------------------------|------------|----------------|--------------------|-----------------------|
| Below lower poverty line | 42.8 | 15.2 | 21.1 | 17.6 |
| Below upper poverty line | 54.9 | 31.0 | 35.2 | 31.5 |

Source: BBS (2011a) for data Khulna rural, Bangladesh (rural and national)

The level of income inequality as measured by the Gini coefficient in the study region (0.38) was less than the national average (0.43) (BBS, 2011a). The reasons for this might be the greater dependence on forest resources by every income class and the small number of non-farm business, services and remittance-earning opportunities.

4.3.4 Physical Capital

Physical capital is the infrastructure and tools/equipment used to support livelihoods such as land and non-land assets which are important means for accelerating growth in household incomes (DFID, 2000). The physical assets of the different income households in the study area, such as the housing materials, land ownership status by homestead land, total land and size of land and non-land asset ownership, were examined.

4.3.4.1 Housing Facilities

Housing facilities varied considerably from the higher income to the lower income households in the study area. Generally, the roofs of the majority of the houses were made of corrugated iron-tin, and the walls were made of tin or wood or a combination of tin and wood (Table 4.13). The housing sector also showed a great

deal of difference in the study area. Almost all the households reported having at least one house (main house). Higher income households had a separate kitchen and a separate guest house for visitors. Middle income households usually had a separate kitchen. However, lower income households did not have a separate kitchen and performed kitchen activities in open spaces. I observed that households that had received high income either from successful shrimp harvests, businesses or remittances from family members living abroad typically invested in new concrete housing structures with brick walls (Table 4.13).

Table 4.13: Wall and roof materials (%) among households in six villages on the edge of the Sundarbans, Mongla Sub-District

| Construction Materials | Income Tercile | | | Total |
|------------------------|----------------|--------|--------|-------|
| | Lower | Middle | Higher | |
| Wall | | | | |
| Brick | - | 1 | 21 | 7 |
| Tin | 8 | 16 | 9 | 11 |
| Wood | 33 | 28 | 46 | 36 |
| Tin + wood | 25 | 41 | 22 | 29 |
| Bera | 18 | 13 | 2 | 11 |
| Golpata | 16 | 1 | 1 | 6 |
| Roof | | | | |
| Concrete | - | - | 9 | 3 |
| Tin | 39 | 65 | 78 | 61 |
| Golpata | 61 | 35 | 13 | 36 |

Note: N=88 for each income group

The roofs of the houses were made of simple structures of concrete, leaves of nipa palm or metal sheet. Roofs made of leaves of an abundant local mangrove nipa palm species named golpata were more common in households with lower incomes, while tin roofs were more common on houses belonging to the higher income group (Table 4.13). Nearly 39% of the roofs of the lower income households were made of tin, and

65% and 78% of the roofs of the middle income and higher income households were made of tin. Only a few houses belonging to the higher income households were made of concrete. Most of the houses in the lower income groups were observed to be in poor condition with the ramshackle appearance of the homes becoming worse in the rainy season.

4.3.4.2 Land

The lower income households in the study area had 0.08 ha of land whereas the average land owned by the middle and higher income households was 0.74 and 4.8 ha (Table 4.14). Lower income households did not own any agricultural land. The higher and middle income households had established shrimp farms by either converting their own agricultural land, combining their own land with leased land, or leasing land.

Half of the lower income households owned only homestead land and the remaining households in the low income group were landless, did not own any homestead land and had dwellings either built on government-owned land (called “khas” land), leased land or land belonging to relatives (Table 4.15).

Table 4.14: Amount of land (ha) owned by type by households in six villages on the edge of the Sundarbans, Mongla Sub-District

| | Income Tercile | | | F-value | P-value |
|------------------------------------|-----------------------|---------------|---------------|----------------|----------------|
| | Lower | Middle | Higher | | |
| Amount of total land | 0.08 | 0.74 | 4.8 | 28 | P <0.001 |
| Total land including leased in/out | 0.12 | 1.00 | 5.8 | 44 | P <0.001 |
| Amount of homestead land | 0.06 | 0.14 | 0.4 | 67 | P <0.001 |
| Amount of shrimp land | 0.07 | 0.77 | 5.3 | 39 | P <0.001 |

Table 4.15: Ownership status of homestead land among households in six villages on the edge of the Sundarbans, Mongla Sub-District (n and (%))

| | Income Tercile | | |
|---|----------------|---------|----------|
| | Lower | Middle | Higher |
| Homestead land owned | 44 (50) | 84 (96) | 88 (100) |
| No homestead land owned | 44 (50) | 4 (4) | - |
| Landless-reside on Khas land | 28 (32) | 3 (3) | - |
| Landless-reside on relatives' land | 6 (7) | - | - |
| Landless-reside on others' land paying rent or not | 10 (11) | 1 (1) | - |

In Table 4.16, the households of the study area are classified based on the amount of land that they owned according to the definition used by the BBS (2010) in its agricultural census. Nearly 93% of the poor households possessed less than 0.2 ha of total land and were defined as functional landless. Nearly 40% of the middle income households also fell into the functional landless category. About 46% of the middle income households owned less than 1 ha of land and were included in the small land owner group compared with only 23% of the higher income households (Table 4.16). Only 5% of the middle income households had land of more than 7.5 acres in contrast to 46% of the higher income households and none in the lower income households.

Table 4.16: Classification of households based on land among households in six villages on the edge of the Sundarbans, Mongla Sub-District (n and (%))

| | Income Tercile | | | Total |
|------------------------------------|----------------|---------|---------|----------|
| | Lower | Middle | Higher | |
| Landless – land owner <0.2 ha land | 82 (93) | 35 (40) | 8 (9) | 125 (47) |
| Small land owner 0.21 - 1 ha land | 6 (7) | 40 (46) | 20 (23) | 66 (25) |
| Medium land owner 1.1 - 3 ha land | - | 9 (10) | 20 (23) | 29 (11) |
| Large land owner > 3 ha land | - | 4 (5) | 40 (46) | 44 (17) |

4.3.4.3 Non-Land Assets

Higher income households had the highest mean value of non-land assets, followed by the middle income and lower income households (Table 4.17). The average amount of non-land fixed assets held by the higher income households was about three times higher than that owned by the lower income households. Households in the lower, middle and higher income groups owned non-land assets with average values of US\$167, US\$697 and US\$1,701, respectively. While the ownership of bicycles and motorcycles increased with increasing income, boat ownership was most common in the lower income group. Ownership of electronic goods (mobile phones, TV, radio and DVD/cassette/CD players) was more common in the higher income groups (Table 4.17). The high ownership of boats and nets in the low income group reflects the importance of shrimp fry collection (see Table 4.11 above) to livelihoods within this group.

According to local perceptions, items that were symbols of modernity, such as sofas, dining tables, televisions, solar power, motorbikes and mobile phones, were indicators of wealth. Mobile phones were common possessions and a necessary investment for shrimp farmers whose farms were far away from market centres. Possessing a mobile phone is one thing, but the type of mobile phone one can afford is another. Motorbikes were among the most desirable item for rural households whose mobility had long been constrained by their remoteness, and a motorbike often acted as a symbol of status.

Table 4.17: Numbers (percentage) of households owning non-land assets in six villages on the edge of the Sundarbans, Mongla Sub-District

| | Income Tercile | | | Total |
|--|----------------|---------|----------|----------|
| | Lower | Middle | Higher | |
| Motorcycle | - | 2 (2) | 9 (10) | 11 (4) |
| Bicycle | 1 (1) | 12 (14) | 22 (25) | 35 (13) |
| Mobile phone | 22 (25) | 76 (86) | 88 (100) | 186 (71) |
| TV | 1 (1) | 27 (31) | 65 (74) | 93 (35) |
| Radio | 3 (3) | 11 (13) | 15 (17) | 29 (11) |
| DVD/Cassette/CD | 1 (1) | 11 (13) | 35 (40) | 47 (18) |
| Boat | 63 (72) | 47 (53) | 18 (21) | 128 (49) |
| Gun/rifle | - | - | 6 (7) | 6 (2) |
| Solar panel | 1 (1) | 33 (38) | 74 (84) | 108 (41) |
| Shrimp fry net | 65 (74) | 39 (44) | 10 (11) | 114 (43) |
| Water tank | - | 2 (2) | 14 (16) | 16 (6) |
| Average value of furniture (US\$) | 69 | 283 | 615 | 322 |
| Average value of household assets (US\$) | 167 | 697 | 1701 | 855 |

4.3.4.4 Access to Other Physical Assets

Table 4.18 presents the data on the physical assets that were owned by the community as a whole in the study villages. There were three government primary schools and three secondary schools in the study villages. Drinking water came from government-owned ponds but the supply was insufficient. There were no electricity or phone lines. There were no dedicated cyclone shelters but one of the secondary schools, which had two storeys, was designated as such.

There were two markets in the study area. Joymony Market was newer than Baiddomari Market which was a well-established permanent market having 70 shops

and a daily commodity market. People usually went to Baiddomari Market for shopping and to sell products as it was a large growth centre, trading place and established rural market. The Chila Union council office, the IPAC Mongla project office, the Union health and family planning centre and a few NGO offices were located near Baiddomari Market. The study villages were well connected to Baiddomari Market. The stock in the shops included a variety of shrimp products, groceries, household basic commodities, building materials, fuel and medicines. From these markets, people can easily go to Mongla due to the availability of cheap motorised rickshaw vans and motorcycles. It is only 14 km from Mongla Sub-District.

One paved road connected Mongla township and the study area, and provided access to the two major markets and other growth centres (such as the sub-district headquarters, educational institutions and health facilities). This paved road was constructed in 2007, allowing a direct connection between Mongla Sub-District headquarters and study area to be established. Before that, people relied on boat transport. Biomass fuel from the Sundarbans constituted the major source of energy for cooking and heating for both rural and urban dwellers.

Health facilities in the study area were few. There was no government community health centre in the six villages. Villagers had to go to the union health and family planning centre. Although a health and family planning centre was established within the union council building near Baiddomari Market, medicine, physicians and family planning workers were rarely available. People had to travel long distances to receive

medical treatment either from the government-owned sub-district health centre or a Christian missionary hospital situated in the sub-district headquarters.

Table 4.18: Physical assets shared by the community in the study villages on the edge of the Sundarbans, Mongla Sub-District

| Physical Asset | Exists in Community | Comments |
|--|--------------------------------|---|
| Secondary school | Yes | South Bashtola, Bururia and Joymony Katakhali |
| Primary school | Yes | South Bashtola, Bururia and Joymony Katakhali |
| Cyclone shelter | No | Secondary schools located at the villages used as cyclone shelter |
| Market | Yes | Baiddomari Market and Joymony Market |
| Piped /Tube-well water | No | Due to salinity caused by shrimp aquaculture |
| Government pond reserved for drink water | Yes | People used to travel 0.5-3 km to get this water |
| Electricity services | No | Generator services available only at Baiddomari and Joymony Markets |
| Telephone services | Yes | Good mobile network coverage |
| Main roads - paved | Yes | Joymony Villages and Baiddomari Market |
| Main roads - brick built | Yes | South Bashtola and Baiddomari |
| Village roads - mud built | Yes | Unusable during wet season |
| Community clinic | Yes | One only in Joymony Katakhali, but it had remained closed for nearly one decade; villagers had to visit union health centre for health care |
| Union health centre | Yes | Located near Baiddomari Market; medicines, physicians and family planning workers were rarely available |
| Chemist | Yes | Only in Baiddomari Market |
| Public transport | Yes | Auto-rickshaw van and motorcycle services to Mongla from Baiddomari and Joymony Markets |
| Post Office | Yes | Located at two markets |
| Banking services | No | |

There was no tap or tube-well water in the study area. People in the middle or lower income groups drank water rainwater during the wet season and water from government-owned ponds during the dry season. However, the actual supply was

insufficient to meet the demand. The water quality became degraded, discoloured and undrinkable during the prolonged dry season. During field data collections, I observed that people were collecting water from the river during the wet season for cooking and drinking purposes. Nearly 88% of the households used or had access to hygienic latrines, while 12% of the households belonging to the lower income group used non-hygienic latrines or open spaces for toilet purposes. The reasons for the high use of hygienic latrines were the increased awareness about sanitation and the supply of materials to build toilets by the government public health department and NGOs. In the next section, I consider how the main asset groups were used by the households of the different income groups to construct livelihood strategies.

4.3.5 Livelihood Strategies

Across the six study villages, four livelihood strategies were identified. These were mangrove forest, shrimp, non-farm and diversified strategies, that is, a combination of forest, shrimp and non-farm strategies (Table 4.19). Forest-based livelihood strategies were largely undertaken by lower income households (41%), whereas shrimp-based livelihoods were dominated by higher income households (14%). Only 7% depended solely on shrimp farming with most of these households in the higher income group, whilst solely non-farm-based livelihoods were rare (5%). In total, nearly 31% of the households depended on these three independent livelihood strategies. In contrast, a strategy based on a combination of livelihood activities was represented by 69% of the households in the study area.

Table 4.19: Livelihood strategies of households in six villages on the edge of the Sundarbans, Mongla Sub-District (n and (%))

| Livelihood Strategy | Income Tercile | | | Total |
|--------------------------------------|----------------|---------|---------|---------|
| | Lower | Middle | Higher | |
| Forest-based | 36 (41) | 12 (14) | 2 (2) | 50 (19) |
| Shrimp-based | - | 6 (7) | 12 (14) | 18 (7) |
| Non-farm-based | 2 (2) | 8 (9) | 4 (5) | 14 (5) |
| Diversified | | | | |
| Combined forest and shrimp | 17 (19) | 35 (40) | 20 (23) | 72 (27) |
| Combined forest and non-farm | 29 (33) | 10 (11) | 11 (13) | 50 (19) |
| Combined shrimp and non-farm | 1 (1) | 7 (8) | 27 (31) | 35 (13) |
| Combined forest, shrimp and non-farm | 3 (3) | 10 (11) | 12 (14) | 25 (10) |

Chi-square value: 111.2; Likelihood ratio = 119.4; df=12; P <0.001

Livelihood strategies based on a combination of sources were the most common (total of 69%; Table 4.19). A strategy based primarily on a combination of forest and shrimp farming was the most common overall (27% of households). Households in the lower income group had a strong forest component in their livelihood strategies (41% forest only, 33% forest and non-farm, 19% forest and shrimp; Table 4.19). A livelihood strategy based solely on mangrove forest was uncommon among the middle and higher income groups (12% and 2%, respectively; Table 4.19); however, livelihoods combining forests and shrimp were the most common for the middle income group (40%) and significant for the higher income group (23%). Shrimp farming was most common in households in the higher income group, with shrimp in combination with non-farm activities being the most common livelihood strategy of this group. A strategy based on a combination of forest and non-farm strategies was mostly prominent in lower income households, representing 33% of the households

in this group. The fact that lower income households had high dependence on mangrove resources as a source of livelihood suggests that access to natural assets was highly significant to their livelihoods (detailed further in Chapter 5 and Chapter 8). In the next section, I discuss the livelihoods strategies, vulnerability and poverty issues and livelihood outcomes of the three income groups.

4.4 Discussion

4.4.1 Livelihood Strategies

Four livelihood strategies were identified among the households surrounding the Sundarbans. These four strategies are broadly divided into two groups: strategies related to natural resources such as forest and shrimp; and strategies related to non-natural resources such as trade, business, service and remittance. This supports the analysis of livelihood strategies by Carney (1998) and Ellis (2000a). Carney (1998) listed the main categories of livelihood strategies as natural resource-based, non-natural resource-based, and migration, while Ellis (2000a) categorised livelihood strategies as natural resource-based activities and non-natural resource-based activities (including remittances and other transfers). However, it contradicts the identification by Scoones (1998) of agricultural intensification or extensification as one of the main livelihood strategies.

The present study found that the majority of the households in the study area combined several livelihood strategies in order to maintain livelihoods. This supports the results of other livelihood studies in Africa and Asia in which only a few rural households were found to rely on one source of strategies for livelihoods (Table 4.19). Jacobs and Makaudze (2012) in the West Coast District, South Africa, Babulo

et al. (2008) in Tigray, Northern Ethiopia, Cramb et al. (2004) in the central highlands of Vietnam, Tesfaye et al. (2011) in the bale highlands in Southern Ethiopia, Iiyama et al. (2008) in Kerio Valley in Kenya, Oumer and De Neergaard (2011) in central highlands of Ethiopia, Ellis et al. (2003) in Malawi, Ellis and Mdoe (2003) in Tanjania, Ellis and Bahiigwa (2003) in Uganda and Rahut and Scarfy (2012) in the Nepalese Himalayas also found that rural households relied on a mix of livelihood sources and found marked differences between households in relation to the livelihood strategies pursued.

4.4.1.2 Mangrove-Based Livelihoods

Mangrove forest-based livelihoods were the chief means of survival for large numbers of lower income households surrounding the Sundarbans. This strong dependence on forest resources was intractably associated with the lack of key assets especially land as these lower income households did not even have their own homestead land. The lower income households received credit facilities from traditional moneylenders to buy boats and nets and thus were able to collect mangrove forest resources (Tables 4.8 and 4.9). The lower income households engaged in mangrove-based activities; they usually had relatively low credit support from government and NGOs as the strict credit regimes were difficult to manoeuvre without any collateralisable assets especially land. Quisumbing and Baulch (2009) found that NGOs were biased against the landless in Bangladesh even though landlessness is one of criteria for receiving NGO micro-finance (Khandker, 2005). Middle income households were usually resource collectors and also diversified through trading mangrove resources (basically shrimp fry trading) on a commercial basis. They also invested cash to supply credit to the poor resource collectors during

the mangrove-based shrimp fry collection season and thus functioned as moneylenders or middlemen in the value chain. The higher income households considered mangrove resources to be of low importance for livelihoods as the investment in mangrove resource collection and trading provided low returns for them. However, dependence on mangrove forest resources can be vulnerable due to dependence on moneylenders or restrictions on resource collection or other reasons; thus, impacts on household livelihood security can be significant and lead to conflict over remaining resources and increased poverty (Chapters 5 and 8).

4.4.1.2 Shrimp-Based Livelihoods

In terms of livelihood activities, shrimp farming households focused on high capital return activities which corresponded to all shrimp-related activities like shrimp farming and supplying to the shrimp processing and related trade. Shrimp culture activities mainly occurred at the upper end of the productivity scale in which the higher income group had a clear edge over the rest. Shrimp farming households were significantly better endowed in terms of asset accumulation for all types of capital but especially land and credit. Many of the higher income households had expanded their shrimp-related business activities to add value or exploited primary shrimp production. For example, shrimp depots or shrimp supply to the processing factories had been initiated since shrimp aquaculture began. In addition, the political position and social network of the households of this group also helped them to get loans from the state and private banks to increase their shrimp farm by leasing land or establishing shrimp-based enterprises such as permanent shrimp depot or supplying shrimp to the processing factories (as discussed in more detail in Chapter 6). In

Western Kenya, Lay et al. (2008) found that high-return activities were indeed confined to richer households.

The lower income group faced limitations in exploring the potential of shrimp culture to enhance their livelihoods due to the lack of assets especially the land or linkages (social capital) required to make use of them and to compete in larger markets (as discussed in more detail in Chapter 5). Shrimp culture stimulated the benefits among the wealthier and the benefits failed to trickle down to the poorer sub-populations initially excluded from the lucrative shrimp sector. Nonetheless, for the rural poor, it appeared also to have led to increased socio-economic differentiation through increasing landlessness and land agglomeration and thus they had decreased income opportunities. These conflicting interests surrounding the shrimp aquaculture are discussed in Chapter 5.

4.4.1.3 Non-Farm Livelihoods

The rural non-farm sector had experienced a more rapid expansion of relatively medium/small-scale enterprises that created low to high earning self-employment activities primarily for the middle and higher income households. These activities required financial assets in which the higher and middle class groups had a clear advantage over the lower income households. The higher income households were all characterised by fairly stable non-farm income sources including salaried employment, business or remittance (Table 4.11). Relatively high paying and stable formal employment opportunities were limited to a few teaching or development agency positions which required higher access to human capital and were restricted to a few higher income households. The higher source of local or foreign remittances

received might reflect the existence of a wider social network for these households. In a case study in south-western Kenya, Freeman and Ellis (cited in Iiyama et al., 2008) found that poorer households were engaged in strategies with low return farm activities, while well-off households were diversified into high return activities such as salaried employment. Non-farm activity was positively correlated with income and wealth in rural Africa (Birch-Thomsen et al., 2001) and but the unskilled and uneducated poor in land and capital faced an uphill battle to overcome entry barriers and steep investment requirements to participate in non-farm activities (Barrett et al., 2001b).

Potential opportunities for improving livelihood security through the development of small enterprises were not well enabled by lower income households due to a lack of the skills, knowledge, attitudes, organisational ability, confidence, finances, or access rights necessary to be able to respond quickly or effectively enough to these opportunities. Stimuli to the non-farm sector benefit those already possessing the assets (namely, the financial savings, skills, education and social contacts) necessary to take advantage of emerging market opportunities rather than the poor (Barrett et al., 2001b). In the hilly areas of the Loess Plateau of China, Wang et al. (2010) found that the poor did not have enough capital to participate in non-farm activities as a certain amount of funds was necessary to establish a non-farm enterprise. Rahut and Scharf (2012) examined the livelihood diversification strategies of rural households in the Himalayas and found that the better-off diversified in high return non-farm activities.

Only 5% of the households in the study area exclusively depended on non-farm livelihood activities. The main reasons for this were the lack of human capital and physical capital such as roads and communication. There had been a progressive expansion of industrial activity in Mongla (as described in Chapter 3) but this did not increase employment opportunities for people in the study area due to low literacy rates and the lack of a communication network between the study area and Mongla Township. The people in the study area failed to grab the livelihood opportunities that were created in Mongla Township just only 20 km away although people migrating from other regions of the country have taken the opportunities associated with rapid industrialisation in Mongla. Another factor was the absence of any higher secondary college and graduate-level educational institutions in the study area. Many researchers have explained that the expansion of human capital significantly increases income from non-farm activities, and that households with high levels of education are more likely to participate in non-farm activities (Wang et al., 2010; Barrett et al., 2001b).

4.4.1.4 Diversified Livelihood Strategies

Diversification is defined as the process by which households construct increasingly diverse livelihood portfolios making use of increasingly diverse combinations of resources and assets (Niehof, 2004). Diversification explicitly draws attention to a variety of dissimilar income sources as its chief characteristic (Niehof, 2004). Diversification into several livelihood activities is viewed as a part of adaptive/survival strategies, and opens avenues for growth by providing extra income and resources (Ellis, 2000a) that would otherwise be unavailable to rural households

especially in vulnerable ecosystems with high agro-ecological risks (Assan and Kumar, 2009).

In the present study, some middle and higher income households had diversified livelihood strategies focused primarily on shrimp-related activities but then including a relatively diverse range of non-farm activities. High percentages of broad ranging non-farm enterprises operated by these households were also established after shrimp aquaculture. Ownership of land used as collateral facilitated the access to significant amounts of credit (Table 4.14). Higher and middle income households have accessed to shrimp aquaculture loans from government or private bank as they had more shrimp lands than lower income households (Table 4.8 and Table 4.9) This was because the average size of loans is much higher than the actual cost of shrimp farming (see Chapter 8, Section 8.4.2). Some parts of the credits were invested by the shrimp farming households to establish shrimp-related businesses (for details see chapter 6, section 6.3.4) or other rural and urban-based small-scale and medium-scale self-employment business activities not only in the locality but also in Mongla, or even the divisional city, Khulna. Lower income households only have accessed to the loan provided by the local money lenders or NGOs which was very small in amount (Table 4.8 and Table 4.9) and not enough to establish any shrimp or no-farm enterprises. Involvement in shrimp farm activities in Bangladesh had increased shrimp farmers' capacity to invest in other business activities (Islam et al., 2003 and Sharmin and Ali, 2005). A similar finding was observed by Owusu et al. (2011) who maintained that the development of non-farm activities actually complemented the effort to develop farm activities since investment in the former largely came from the latter in Northern Ghana. In Western Kenya, Lay et al. (2008) observed that

engagement in high return non-agricultural activities was significantly associated with increased agricultural productivity. Ellis and Freeman (2004) investigated rural livelihoods and poverty reduction strategies in four African countries and observed that the diversity of on-farm and non-farm income sources of better-off households originated primarily in diverse livestock ownership.

The receipt of remittance money and the availability of credit in the non-farm sector were the factors enabling diversification within shrimp and non-farm livelihood strategies. Another important feature of some higher income households was that their remittance incomes were from both local and foreign sources. Some middle income households even had income from local remittances sent by family members who worked in the capital city, Dhaka. Remittances were also important contributors to investment as remittances helped some families to set up small businesses or purchase or lease lands to establish shrimp farming or shrimp-based businesses. Remittance money also helped to purchase important assets such as a motorbike or auto-rickshaw van which also helped to diversify into non-farm activities such as shrimp fry transportation. Credit for solar panels to establish small-scale enterprises from NGOs also contributed to such diversification. Out-migration was found to influence rural households' livelihood capital in western China and Li et al. (2012) maintained that this had significant, strong and positive influences on financial, human, and social capital and negative influences on physical and natural capital. Dasgupta and Baschieri (2010) stated that households in rural Ghana who were receiving remittances were able to invest in other income activities and were less vulnerable.

The combination of mangrove forest resources and shrimp or non-farm activities for lower income households was based on selling human labour. The lower income households were engaged in the lower end of the productivity scale by either selling casual labour to shrimp farms or in non-farm sector activities, such as rickshaw pulling, and working as labourers in the government-sponsored “Food for Work” and “Cash for Work” activities in rural road maintenance programs which were more risky and less remunerative self-employment options for the poor. Little diversification outside mangrove resource collection with low-return selling human labour activities meant households were not investing in improving human capital. Societal protection, through government programs such as the provision of public works at critical times, creates employment opportunities in lean seasons and provides a buffer to hardships (Islam et al., 2011a). Rahut and Scharf (2012) examined the livelihood diversification strategies of rural households in the Himalayas and found that the poor were mainly agricultural labourers and worked in the low return non-farm sector. Oumer and de Neergaard (2011) investigated the links between livelihood strategy and poverty in the central highlands of Ethiopia and found that the households in the bottom income quartiles engaged in casual off-farm work along with their main cereal-dominated livelihood strategies.

4.4.2 Vulnerability and Poverty

Poverty and vulnerability have cross-scale, spatial and temporal dimensions, as discussed in detail in Chapter 2. Vulnerability is often viewed as simply identical to a decisive dimension or condition of poverty (Devereux, 2001) as people move in and out of poverty due to vulnerability (Glewwe and Hall, 1998; Moser, 1998). Vulnerability results in poverty when people do not have access to resources (Anwar,

2008; Sen, 1981). Poverty and vulnerability are closely linked and discussed in relation to the asset status of households. The skewed access to basic resources was an important determinant of vulnerability that plunged households and communities into poverty in South Africa (Khandhela and May, 2006). Ulrich et al. (2012) analysed livelihood assets and strategies in Laikipia County, Kenya, where smallholders were shown to easily slip back into poverty due to a striking persistence in low asset endowment.

Poverty is not purely a function of low income but has non-income dimensions. Reardon and Vosti (1995) referred to the lack of assets as both a cause and a consequence of poverty, as a poor asset base restricts livelihood strategies. Research findings in Uganda show that rural poverty is strongly associated with a lack of land, livestock and an inability to secure non-farm alternatives to diminishing farm opportunities (Ellis and Bahiigwa, 2003). The low ownership or control of productive assets is an important indicator of livelihood vulnerability as assets generate income. Another compelling reason is that the low level of assets itself reduces the marginal savings (investment). In the context of the study area, the vulnerable position of the lower income households was evident in respect of all asset categories, namely, the average years of schooling of household members, average land owned and operated, access to credit, and ownership of non-land fixed assets. These lower income groups possessed low-quality human assets (no formal education; most occupations are natural resource-based), few natural assets (no entry to tenancy market due to shrimp aquaculture, and risky access to mangrove forest resources) (as discussed in detail in Chapters 4 and 5), and few physical assets (poor tools or equipment for production or processing; lack of productive land), minimal

financial assets (e.g., lack of cash or savings; poor access to credit or insurance markets; little livestock) and limited social assets (in a patron-client relationship system). In the case of a natural disaster or the death or prolonged illness of the earning member, these households become more vulnerable as they had no option to generate cash by selling important basic household assets. However, households' ability to recover reasonably quickly by turning to their asset base after a natural disaster depends on many factors which are described in detail in Chapter 7.

The results from the analysis of poverty and vulnerability in the study area are consistent with the findings of other studies from Bangladesh. Poverty is not purely a function of low income but has non-income dimensions. According to Quisumbing and Baulch (2009), the persistence of large numbers of rural households with minimal asset holdings is consistent with the existence of an underclass of chronically poor households in Bangladesh. Sen (2003) identified having the possession of few agricultural and non-agricultural assets and illiteracy as the common causes of poverty in rural Bangladesh. The NGO BRAC (2001) viewed the “poorest of the poor” as those having characteristics such as possession of 0.1 acres of land, full dependence upon seasonal labour, recurring food insecurity, no or very low productive assets, very poor quality houses, dependence on a single-income earner (especially female-headed households), and having a disabled husband.

In Bangladesh, landless households are defined as those which own less than half an acre of land (BBS, 2010) and are nearly always poor (Kam et al., 2004). Landless households are eligible to receive benefits from government through social safety net programs (Hossain, 2007) or micro-finance from NGOs (Khandker, 2005). The

majority of the lower income households in the study area were landless. Land is still desired and contested particularly because its agricultural value has increased in recent times. Households who own higher amount of land also experience growth in non-land assets, possibly because of complementarities between land and other assets, and also because land can be used as collateral for loans (Quisumbing and Baulch, 2009). In rural areas, historically, the association of land inequality and poverty has been pervasive (Hossain, 2009). Quisumbing and Baulch (2009) analysed assets and poverty traps in Bangladesh and found that relatively land-poor respondents also had lower baseline asset values and remained in chronic poverty. Rahman and Manprasert (2006) researched landlessness and its impact on economic development in Bangladesh and found that landlessness often proved to be both the cause and the manifestation of poverty, insecurity, indebtedness and powerlessness among the majority of rural households. Hatlebakk (2010) found similar results in Mali. Ellis (2000a) observed that land ownership was the chief asset separating the rural better-off from the rural poor in rural Asia.

The lack of education facilities in the study area impacted on the population and made them increasingly vulnerable with little chance of getting better jobs. Taking a more encompassing human capability dimension, Bebbington (1999) explained that the individual's ability to read and write not only enhanced the likelihood to secure a better job but also enhanced their ability to engage in discussion and to add their voice to the debates about development and other issues. In the study area, the lower and middle income households were vulnerable as they did not get the opportunity to educate their children and thus failed to engage in more remunerative jobs and higher productivity labour. Poverty has been found to be closely associated with low levels

of education and skills in Bangladesh (Kam et al., 2004). In Bangladesh, poverty is most concentrated in households headed by people who do not have any formal education, and chronic poverty is totally absent among people who have tertiary education (Azam and Imai, 2009). For the lower income households in the present study, the opportunity costs for keeping children in school were high because children helped with the household work and other labour, especially the collection of shrimp fry. A lack of investment in human capital in the short-term limited the long-term income-earning opportunities of the lower and some middle income groups and thus prevented the improvement of the socio-economic status of these groups who then remained vulnerable.

In the rural areas of Bangladesh, having a thatched house (roof and walls made of straw/hay/bamboo) is a sign of poverty. Owners of a house made of brick and cement houses or having both an iron roof and brick walls are likely to be above the poverty line (Suliaman and Matin, 2008). An improved and increased productive asset turns out to be the most important indicator of improvement in rural society because such changes are visible to the community (Kam et al., 2004) and are often a status symbol in rural Bangladesh (Suliaman and Matin, 2008). The vulnerability of the built environment is also related to location and proximity to the source of a hazard or threat. Poorly constructed buildings and certain types of housing stock all enhance the vulnerability of the built environment in communities (Borden et al., 2007). The fragile condition of housing in the study area can significantly increase the level of vulnerability especially in the face of a natural disaster (Chapter 7).

The social positions of lower income households show their vulnerability. In the study area, social capital occupies a less prominent place in the portfolio of assets of the poor as they had very poor representations in the local political, institutional and social and religious organisations. Patronage through the local political party plays a role in determining the ability of lower income households to access non-farm external supports such as government allowances, services and benefits. Anwar (2008) found that local elites in Bangladesh controlled the rural political culture (such as the voting behaviour and rural power structure), the economic culture (such as the employment and income opportunities), and social capabilities in the context of access to resources. Lindberg (2012) examined the diversity and spatiality of rural livelihoods in southern Sri Lanka and identified social assets as most crucial for access to lucrative non-farm segments, since it also affected access to other assets. In Bangladesh, poverty is a part of the social relationship whereby the poor remain poor due to structural reasons and not being allowed to associate with the upper class in anyway (Titumir and Rahman, 2011). Investing in social capital was found to be a sensible strategy for poor households in Burkina Faso where membership in local associations contributed to higher household welfare levels (Grootaert et al., 2002).

The sharp decline of livestock possession was observed in the study area due to the loss of grazing fields and crop-based agriculture after the introduction of shrimp farming (discussed in detail in Chapter 6). Higher poultry, cows and buffalo ownership was concentrated among the higher income households. The lower income households had little livestock of their own and were vulnerable as they didn't have any options for selling livestock as a coping strategy after a natural disaster or during lean or crisis times. After a cyclone, for livestock-owning

households, livestock was an important source of income opportunity and a ready coping mechanism (Chapter 7). In Bangladesh, livestock provide a ready source of investment. Livestock ownership is often featured in reports of accumulation which describe the progression from shared ownership to full ownership, from poultry to goats to cattle, and in a few cases report respondents selling cattle and buying land (Kam et al., 2004; Sen, 2003). The accumulation of cattle is not just for productive purposes, but is also done for insurance purposes, to be sold in cases of harvest failure or calamity (Grotaert et al., 2002; Suliaman and Matin, 2008; Van den Berg, 2010).

In the study area, people were in a vulnerable condition as inequality was high although lower when compared to the national average for rural areas in Bangladesh (BBS, 2011a). Sen (2003) defined inequality as social poverty and opined that income inequality also plays a role in determining sources of collective vulnerability. The concept of poverty is also related to inequality as high inequality results in rising poverty, this is because, the higher the initial inequality, the lower the rate at which income poverty falls (Ravallion, 1997). Inequality and vulnerability linkages are associated with the relationships between inequality and the diversification of income sources. Poverty as inequality affects vulnerability directly through constraining the options of households and individuals when faced with external shock, and indirectly through its links to poverty and other factors (Adger, 1999). Higher levels of income equality tend to produce more cohesive communities that are able to collectively support each other during times of disaster (Brouwer et al., 2007).

In the study area, households in all three income categories remained vulnerable due to the lack of basic community assets such as drinking water, cyclone shelters and health facilities. Drinking water came from government-owned ponds but the supply was insufficient. People were more vulnerable to water-borne diseases due to the degraded quality of the water. Additional elements that further exacerbated the vulnerability of these communities to diseases included the overall lack of access to medication and health services. In these places, health treatment was expensive and time-consuming as residents had to reach the sub-district hospital. In addition, resource collection from the Sundarbans is a relatively intense physical activity. Often, resource collectors have to operate manual (non-mechanical) fishing gear and/or non-motorised boat for many hours, sometimes under rough weather conditions with the risk of being injured from wildlife attack. Sickness and/or the physical weakness associated with illness usually severely reduce the capacity of resource collectors to operate effectively, and can therefore have a significant impact on household economic security. Similar evidence of health as a key source of vulnerability was found in a study in the Mekong Basin among wetland fishing communities. The study revealed that ill-health and lack of access to health service delivery were the key factors in determining household vulnerability (Action Aid/Mekong Wetlands Biodiversity Programme, cited in Béné and Friend, 2011).

There were no cyclone shelters in the study area apart from the school. In case of a severe cyclonic storm and tidal surge it is very difficult to survive in such areas if there are no strongly built shelters since the people have no where to go. Most people would need to take shelter at the nearest school, which was likely to be inaccessible during such events due to the mud road. The lack of a proper transport infrastructure

is another important factor in people's vulnerability to cyclone disasters. Insufficient cyclone shelters in the most hazard-prone areas means that a decision to move to distant and hard-to-reach cyclone shelters becomes a matter of making one's livelihood vulnerable during the extended period of disruption (as discussed in detail in Chapter 7).

4.4.3 Livelihood Outcomes

Livelihood outcomes, as the achievement of outputs from livelihood strategies, include conventional indicators such as income, food security and the sustainable use of natural resources and non-conventional indicators such as a strengthened asset base, reduced vulnerability and improvements in other aspects of wellbeing (DFID, 2000). Sufficient agricultural and livestock production is integral to the food security of many at-risk communities (Beddington et al., 2012). In the study area, households did not necessarily regard food security as the most desirable outcome of their livelihood strategies as agriculture and livestock contributed only 1-4% of net income for less than 10% of the households. Men and women from landless and land-poor households had not only lost jobs in the agricultural sector but had also lost access to the commons crucial for subsistence due to shrimp aquaculture (discussed in more detail in Chapter 6). It is within the context of increasing risk and vulnerability that men and women failed to engage in the livestock activities that strengthened households' buffers during income shocks. The increased reliance on a cash economy to provide for basic food has meant that the poorest villagers would be exposed to food security if their income became uncertain and this would put stresses on livelihood. Lack of subsistence orientation activities among the households often

prompted them to take risks for cash income and, again, any substantial risk of loss would jeopardise their livelihood security due to the lack of subsistence products.

Wellbeing is one of the livelihood outcomes. Poverty is closely associated with wellbeing. Wellbeing is a fuzzy concept and defined in the various ways in the literature. Chambers (1997: 9) describes wellbeing as ‘the experience of good quality of life’. Weerantunge et al. (2013) emphasize the relevance of the three key components of wellbeing - material, relational and subjective dimensions, each of which is relevant to well-being at scales ranging from individual, household, and community level. Wellbeing includes social, mental, and spiritual aspects of the quality of life as well as physical aspects and income (Cahn, 2006). The poverty line sets a minimum standard specific to each society (Datt and Ravallion, 1998). Almost more than 50% of the households in the present study lived below the upper poverty line and would fail to purchase a bundle of goods and services to satisfy the basic needs of life as calculated by the traditional method of measuring poverty. Vulnerabilities associated with mangrove-based livelihood strategies such as illegal involvement in resource collection, dependence on money lenders, human-wildlife conflict (see chapter 5) and shrimp-based livelihood strategies that preclude agriculture and livestock activities, limit access to land and engender social conflict (in section 6.3.7, chapter 6) demonstrate the poor quality of life in the study areas. Therefore, these households were not achieving wellbeing as a livelihood outcome. Moreover, those households living above the upper poverty line were vulnerable and might fall into poverty due to the lack of assets as described above. Households with income levels above the poverty line can be vulnerable if they lack the assets base (and access to credit) to diversify their livelihoods or otherwise compensate for

income shocks (Nielsen et al., 2012; Vatsa and Krimgold, 2000). In the case of small-scale fishing communities, Béné (2009) showed that households can remain highly vulnerable to shocks and external changes even when their income was well above the average local income. Dasgupta and Baschieri (2010) found in rural Ghana that poverty alone was insufficient to identify those households which were vulnerable to climate change. Béné and Friend (2011) argued that the issue of poverty in fish-dependent communities cannot be reduced to a simple correlation of income poverty; rather, poverty in fishing communities was often related to a wide range of socio-institutional factors other than income, including landownership, debt, access to health, education and financial capital, and marginalisation from political decision-making.

The success of the higher income households in the study area lay in their pursuit of multiple strategies, demonstrating their ability to integrate multiple occupations and resulting in relatively higher income and asset accumulation. Higher levels of income and assets made them more diversified and less vulnerable as they were less reliant on one source of income and could spread risk among different income sources. The higher income households accumulated assets in the form of acquiring more agricultural land, higher education for children (especially boys) and building a strong brickhouse. These assets were regarded as the most valuable asset that parents can leave for their children and strengthened the traditional rural power base of these households. The ownership of good-quality brick housing is indicative of capital accumulation and an important indicator of improvement in a rural society because such changes are visible to the community as a whole (Kam et al., 2005). Many higher income households ostensibly engage in philanthropy, although their

donations to the local schools or religious institutions often gains them advantages arising from appointment to the management committees of the beneficiary institutions (personal observation).

Middle income households constantly seek opportunities to expand their assets while maintaining the household resource base. In the case of most middle income households in the study area, livelihood outcomes were improving. These households had managed to buy or lease land for shrimp farming or established temporary shrimp depots or small petty grocery shops either from the cash accumulated from mangrove resource collection or taking loans from different sources. Many households in this group had income from foreign and local remittances sent by family members which helped them to gain assets, making them more secure than lower income households and able to increase income through the diversification of shrimp and non-farm activities.

The lower income households in the study area faced two disadvantages: the inability to diversify income, and the inability to accumulate assets. Shifting to other occupations was extremely difficult for them within their existing asset base. The absence of enabling conditions such as institutional capacity, human resources, access to credit, together with social barriers such as social marginalisation and discrimination, left them with fewer opportunities to lift their socio-economic conditions, much less improve the quality of their lives. The lower income households who lived nearer to the forest seemed to have fewer opportunities to engage in multiple economic activities, which made them more vulnerable due to

dependency on forest resources. This was likely to continue under growing resource and economic pressures.

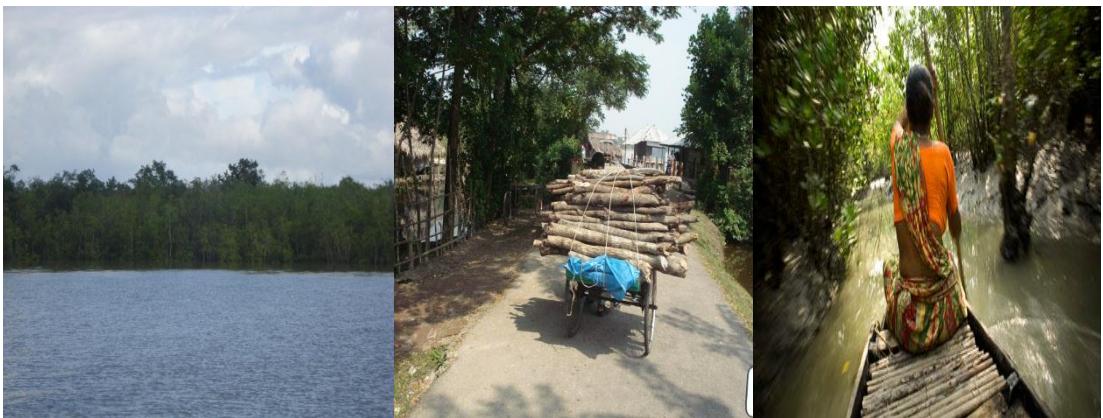
Many of their livelihood outcomes for the lower income households were worsening. On the whole, their jobs and social status were relatively low and the income that they received was inadequate to meet their basic needs at a subsistence level. For the lower income households, moving out of poverty was unthinkable, and maintaining the status quo was itself a daunting task as their immediate concern was to manage the next meal or immediate survival. The livelihoods for the lower income households were of much lower quality and of more limited potential compared with the changes observed for the middle income and higher income households.

4.5 Conclusion

This chapter examined the household assets, strategies and livelihood outcomes of the households of six villages in one district of the Sundarbans. The livelihood system was found to be complex and there were variations at the household level. Households employed their asset base to develop workable livelihood strategies. Differentiation was reflected in households' assets especially in physical and financial capital; this also led to differentiation in the ability of the household to develop livelihood strategies and sustain their livelihoods. The higher income households were in a position of advantage with respect to access and control of these assets. The inability to create a viable and sustainable asset base left the lower income households vulnerable and in poverty.

The higher income households participated in shrimp farming and non-farm activities that yielded higher income, while the lower income households participated in manual labour, were dependent on the mangrove forest, and laboured in casual non-farm work. Because of insufficient land and credit, the lower income households did not have the start-up capital to participate in self-employment, non-farm or shrimp farming activities. Strategies based on the combination of multiple sources, namely, diversified livelihood activities, were more important for the higher and middle income households than for the lower income households. The dependence on forest and shrimp and the multi-faceted risks associated with these resources among the income groups are further examined in Chapters 5 and 6.

Chapter 5: Mangrove Forest Resources and Their Role in Livelihoods



Chapter 5: Mangrove Forest Resources and Their Role in Livelihoods

5.1 Introduction

In Chapter 4, I discussed the finding that exploitation of mangrove forest resources is one of the dominant livelihood activities of the households surrounding the Sundarbans. It has been estimated that more than 1.6 billion people, mostly poor, depend on forests in varying ways for their livelihoods (World Bank, 2004; WRI, 2005). It also been established that income from forest resources can help alleviate poverty among rural households (Angelsen and Wunder, 2003; Cavendish, 2000; Fisher, 2004; Hogarth et al., 2013; Sunderlin et al., 2005; Sunderlin et al., 2008; Vedeld et al., 2007; Yemiru et al., 2010;) or can help to prevent further poverty as a safety net in times of income crisis (Fisher and Shively, 2005; Heubach et al., 201; Kamanga et al., 2009; McSweeney, 2005; Paumgarten, 2005). Published levels of dependence vary from 6% to 65% depending on the circumstances with a similar range of dependence recorded in many parts of the world. Table 5.1 presents a summary of selected studies on levels of dependence on forest environmental resources directly derived from fuelwood, non-timber forest and environmental products among poor rural communities around the world. However, none of the studies consider non-consumptive ecosystem services. All of these studies demonstrate the importance of natural environments for the livelihoods of people in their vicinity, although none consider dependence on mangrove forest resources in particular.

Table 5.1: Levels of dependence* on forest resources among poor rural communities at selected sites around the world

| Location | Percentage of income gained from local forest resources | Reference |
|--------------------------------|--|---------------------------------|
| Lobeke National Park, Cameroon | 44 | Tieghong and Nkamgnia (2012) |
| Ethiopia | 27-54 | Yemiru et al. (2010) |
| Central Ethiopia | 39 | Mamo et al. (2007) |
| Southern Malawi | 30 | Fisher (2004) |
| Chiradzulu District, Malawi | 15 | Kamanga et al. (2009) |
| South Africa | 17-25 | Shackleton et al. (2007) |
| South Africa | 6-15 | Ambrose-Oji (2003) |
| Northern Ethiopia | 12-24 | Babulo et al. (2009) |
| Benin | 39 | Heubach et al. 2011 |
| Central Himalayan forests | 22 | Rayamajhi (2012) |
| Sri Lanka | 9-19 | Illukpitiya and Yanagida (2008) |
| Northern Vietnam | 40-65 | Quang and Noriko (2008) |
| Ke Go Nature Reserve, Vietnam | 18 | McElwee (2008) |
| Yunan, China | 32 | Hogarth et al. (2013) |
| Eastern Honduras | 18 | McSweeney (2002) |

* Level of dependence measured absolute forest environmental income as a share of absolute income from all sources (Vedeld et al., 2004)

In the Sundarbans, millions of rural people live in close proximity to the mangrove forests, yet there has been little published research on forest dependency and livelihoods. The research has predominantly focused on ecology and biodiversity rather than on the people living there and their livelihoods (Chapter 1). The dependence on mangrove forest resources in comparison to other livelihood activities within the broader household livelihood system among households of different socio-economic backgrounds has not yet been examined.

Vulnerability has emerged as a critical concept, and several attempts have been made to define, measure, index and model it (Chapter 2). As discussed in Chapter 2, vulnerability from a livelihoods perspective encompasses trends, shocks and seasonality. Livelihoods can be made more or less vulnerable by long-term trends, with negative outcomes (DFID, 2000). Trends such as decreasing catch rates and increasing costs for catching fish make poor households in a fishing community more vulnerable (Allison and Horemans, 2006). Shock, on the other hand, is the “manifestation of risk” (Hoogeveen et al. cited in Islam and Chuenpagdee, 2013), and therefore the outcome of risk or risk-response interaction causes the loss of livelihoods (Alwang et al., 2001). In the Sundarbans, vulnerabilities associated with forest-based livelihood activities including risks and subsequent shocks are perceived to be ubiquitous not only in the livelihoods of the fishermen but also in the livelihoods of forest-dependent households. Therefore, the vulnerabilities associated with the collection of forest resources need to be identified.

The objectives of the discussion in this chapter are to determine the level of dependence on forest resources across different income groups, the socio-economic factors that influence forest income dependency, and the role of forest incomes in poverty alleviation and vulnerability associated with forest resource collection from a livelihoods perspective. The main research question addressed in this chapter is the importance of mangrove resources in the shaping of livelihood structures (Chapter 1).

This chapter covers the following research questions in order to address the main research question and fulfil the objective of the chapter:

- 1) To what extent do different income groups depend on mangrove forest income?
- 2) What socio-economic characteristics of households determine this dependency?
- 3) What is the potential effect of mangrove forest income on reducing income inequality and poverty?
- 4) What are the vulnerabilities associated with mangrove resource collection?

The first section presents the results relating to the socio-economic characteristics and the income groups, the income from different sources with particular emphasis on income from different mangrove resources, the determinants of household forest incomes which had an influence on forest dependency, and the role of forest income in reducing poverty and income inequality. The second section presents the results on the vulnerabilities related to the collection of mangrove resources in the Sundarbans. In the discussion, I focus on these topics and compare the results of the present study with the results found in other studies set in Bangladesh and around the world with an emphasis on livelihoods, poverty and vulnerabilities.

5.2 Methods

I examined the livelihood dependency of the Sundarbans villagers following the SLA approach (Chapter 2). The methods used to collect and analyse the data presented in this chapter are also discussed in Chapter 3. I ascertained the income derived directly from fish, shrimp fry, crab, fuelwood, nipa palm and other sources (honey, malia

grass and hental palm) with particular emphasis on forest-based daily wage and services. Income was derived from primary use of mangrove products as well as subsequent processing in the case of crab fattening and the distribution of shrimp fry to regions surrounding the Sundarbans. Data were collected for one year (in the reference period from September 2009 to August 2010), in six villages in Mongla Sub-District, Bagerhat District. Data were collected through household surveys with 264 households that were selected randomly from six villages. For each household, three household surveys were carried out at four-monthly intervals in order to determine the source of income for each household (discussed in more detail in Chapter 3 and Appendix A). I collected information on all types of household income, including both subsistence and cash. A monetary value was imputed to each type of good at average prices for the year of the survey. I examined all plant and animals products collected from the mangrove forest to establish their relative importance so that different sources of forest income could be clearly compared.

For the analysis, the 264 households were divided into three equal sized terciles ($n=88$ each) based on total annual income, namely, “lower income”, “middle income” and “higher income”. The mean total incomes between the groups were significantly different (US\$573, US\$1,114 and US\$4,606, respectively; ANOVA $P<0.001$). I used ANOVA with means to compare the household characteristics, income among the different income groups to examine significant differences in the variables, and OLS multiple regressions were used to build models of the household characteristics associated with forest income earnings using SPSS 18.0 software. Income inequality was measured using the Gini coefficient (Bellu and Liberati, 2006). I did not measure poverty directly but used the CBN method employed by the

BBS (2011a) in their 2010 HIES to estimate the number of households that were below the poverty line in the study area (details provided in Chapter 3).

In addition to the household survey, I also carried out focus group discussions with resource collectors, and key informant interviews with Forest Department officials, local government elected representatives, other government officials and NGO workers. In these focus group discussions and key informant interviews, I addressed and assessed the vulnerabilities associated with forest resource collection activities (Chapter 3). The focus group discussions were carried out with the different mangrove resource collector groups such as the Bawalis (fuelwood) and golpata (nipa leaves) collectors, fishermen, shrimp fry collectors and crab collectors in the study area in order to explore how the resources were being collected, the key trends in resource extraction, illegal resource collection, seasonality, the shocks and risks associated with resource extraction that create constraints or problems for their livelihoods and questions related to present forest management (Appendix D, Part A). I carried out one focus group discussion with female resource collectors who were shrimp fry collectors and occasionally collected fuelwood from the forest. One focus group discussion was conducted with Forest Department field-level officials working in the Sundarbans to get information on the structure of the present forest management in terms of its strengths and weaknesses, the rules and regulations associated with management and their impact on livelihoods, and to propose realistic and sustainable solutions to overcome those constraints. Moreover, in-depth key informant interviews on these issues were conducted with two former pirates (“dakats” in Bengali), a widow of a wildlife victim, moneylenders who financed resource extraction, higher ranking Forest Department officials, an officer in charge

of the local police station and the sub-district chief administrative officer. In addition to my personal observations of resource collection activities, secondary data were also collected from the media in relation to piracy in the Sundarbans.

5.3 Results

The results are presented in two sections. The first section presents the results on the socio-economic characteristics and income groups, the income from forest and other sources, the factors that influence forest-dependency and the role of forest income in poverty and inequality. The results on the livelihood vulnerabilities associated with mangrove forest resource collection are then identified in the second section.

5.3.1 Socio-Economic Characteristics and Income Groups

The results showing the average income of households are presented in Table 5.2. The households had an average of 4.8 members (SD1.6), which was slightly higher than the national average of 4.4 and the sub-district average of 4.02 (BBS, 2012b). Household heads had on average completed 3.7 years of schooling. The amount of land around a homestead was 0.2 ha and the average agriculture land holding per household was 1.9 ha, although this increased to 2.3 ha after including leased land.

Table 5.2: Socio-economic characteristics of households in six villages, Mongla Sub-District

| Socio-economic variables | Mean | SD | Minimum | Maximum |
|--|-------|-------|---------|---------|
| Family size | 4.8 | 1.6 | 2 | 11 |
| Age of the household head | 46.7 | 11.8 | 25 | 75 |
| Education (years of schooling) of household head | 3.7 | 4.5 | 0 | 16 |
| Land area (ha) | | | | |
| Homestead land | 0.19 | 0.2 | 0.01 | 1.6 |
| Area used for shrimp farming | 2.1 | 4.9 | 0 | 40.5 |
| Total land owned | 1.9 | 5.0 | 0.01 | 40.5 |
| Total including leased in/out | 2.3 | 5.0 | 0.01 | 40.5 |
| Household assets | | | | |
| Mobile phones | 1.2 | 1.1 | 0 | 5 |
| Boats | 0.6 | 0.7 | 0 | 7 |
| Nets | 0.5 | 0.7 | 0 | 3 |
| Total value (US\$) | 855 | 1,075 | 13 | 10,680 |
| Livestock (number) | | | | |
| Poultry | 8.7 | 10.3 | 0 | 70 |
| Goats | 1.0 | 2.1 | 0 | 15 |
| Large livestock | 0.7 | 1.7 | 0 | 12 |
| Total value (US\$) | 6.0 | 3.9 | 0.0 | 3,924 |
| Total income (US\$) | 2,098 | 2,743 | 177 | 18,963 |

Almost all of the agricultural land held by the households had been converted into shrimp farms with the average area of land used for shrimp farming being 2.1 ha.

Boats used for collecting mangrove resources and nets for catching shrimp fry were common important assets. The average number of poultry (8.7/household) was higher than the national average of 5.3, as was the average number of goats (0.9/household compared to 0.7/household nationally) but the average number of large livestock (0.7) was much lower than the national average (1.0) (BBS, 2011b).

The average number of mobile phones per household was 1.2.

There was substantial variation in household income and assets across the income groups (Table 5.3). Except for household size which was relatively even across the income groups, all the socio-economic variables were found to be significantly different among the groups. The heads of higher income households had significantly more schooling than those from lower income households. The lower income households, however, had more boats and shrimp fry nets than the middle or higher income households. The higher income households owned more land than the middle or lower income households, with many lower income households owning no homestead land and instead living in government “khas” land or renting land from others (Chapter 4). The higher income households also had more large livestock, poultry and mobile phones than the middle or lower income households. In the following section, I present the results on the income from forest and other sources among the households in the three income groups in the study area.

Table 5.3: Socio-economic characteristics of three income groups in six villages, Mongla Sub-District

| Characteristics | Income Tercile | | | F-value | P-value |
|--|-----------------------|---------------|---------------|----------------|----------------|
| | Lower | Middle | Higher | | |
| Family size | 4.5 | 4.9 | 5.0 | 2.77 | NS |
| Age of the household head | 41.6 | 46.9 | 52.1 | 19.80 | <0.001 |
| Education (years of schooling) of household head | 1.2 | 3.2 | 6.4 | 38.40 | <0.001 |
| Land area (ha) | | | | | |
| Homestead land | 0.1 | 0.1 | 0.4 | 66.60 | <0.001 |
| Area used for shrimp farming | 0.1 | 0.8 | 5.3 | 39.22 | <0.001 |
| Total area owned | 0.1 | 0.7 | 4.8 | 27.98 | <0.001 |
| Total including leased in/out | 0.1 | 1.0 | 5.8 | 43.64 | <0.001 |
| Household assets | | | | | |
| Mobile phones | 0.3 | 1.2 | 2.0 | 96.83 | <0.001 |
| Boats | 0.7 | 0.6 | 0.3 | 6.70 | <0.05 |
| Nets | 0.8 | 0.6 | 0.2 | 22.64 | <0.001 |
| Total value (US\$) | 167 | 697 | 1,701 | 70.60 | <0.001 |
| Livestock (number) | | | | | |
| Poultry | 3.35 | 9.36 | 13.40 | 24.93 | <0.001 |
| Goats | 0.33 | 0.99 | 1.52 | 7.34 | <0.05 |
| Large livestock | 0.06 | 0.64 | 1.38 | 14.54 | <0.001 |
| Total value (US\$) | 32 | 210 | 562 | 17.90 | <0.001 |

5.3.2 Income from Forest and Different Sources

The average total annual income was estimated at US\$573 for lower income households, US\$1,114 for the middle income group and US\$4,606 for the higher income households (Table 5.4). The income figures from all sources were significantly different among the groups. A variation in income from forest resources was obvious. On average, a major portion of the annual income for the lower income and middle income households (74% and 48%, respectively) came from forest resources. Forest resources were reported to contribute 23% of the annual income of the higher income households.

Table 5.4: Annual income sources and amounts for three income groups in six villages, Mongla Sub-District (US\$ and (% of total income))

| Sources of income | Income Tercile | | | F-value | P-value |
|------------------------------------|-------------------------|--------------------------|-------------------------|---------|---------|
| | Lower | Middle | Higher | | |
| Non-farm | 63 (12.7) ^a | 224 (18.7) ^a | 1,283 (25.7) | 25.05 | <0.001 |
| Livestock | 8 (1.3) ^a | 37 (3) ^{ab} | 65 (1.6) ^b | 8.74 | <0.001 |
| Cropping | 10 (1.9) | 27 (2.4) | 58 (1.6) | 46.1 | <0.001 |
| Homestead pond fisheries | 15 (2.7) | 30 (2.7) | 76 (2) | 53.7 | <0.001 |
| Shrimp farming | 44 (7.8) ^a | 283 (25.6) ^a | 2,367 (45.9) | 46.32 | <0.001 |
| Forest | | | | | |
| Fuelwood ⁶ | 96 (15.8) ^a | 68 (6.8) ^a | 21 (0.6) | 7.63 | <0.05 |
| Golpata ¹ | 5 (0.9) ^a | 38 (3.2) ^a | 143 (3.9) | 6.71 | <0.05 |
| Fish ² | 41 (6.9) ^a | 86 (7.6) ^{ab} | 199 (5.1) ^b | 3.55 | <0.05 |
| Shrimp fry ^{3,6} | 194 (33.8) ^a | 232 (21.6) ^{ab} | 334 (11.5) ^b | 4.91 | <0.01 |
| Crab | 48 (7.6) | 36 (3) | 40 (1.4) | 0.24 | NS |
| Other forest products ⁴ | 8 (1.3) ^a | 8 (0.8) ^a | - (-) | 13.67 | <0.001 |
| Forest services | - (-) | 14 (1.4a) | 18 (0.6) | 1.27 | NS |
| Forest wage labour ⁵ | 42 (7.3) ^a | 32 (3.2) ^a | 2.0 (0.1) | 19.27 | <0.001 |
| Total Forest | 434 (73.6) ^a | 514 (47.6) ^{ab} | 757 (23.2) ^b | 5.39 | <0.05 |
| Total Income | 573 ^a | 1114 (100) ^a | 4606(100) | 96.95 | <0.001 |

Bonferroni's test: means followed by a common superscripted letter implies the mean difference is not significant at the 5% level. NS= level of significance (5%).

1. Golpata (Bengali name) are the leaves of the nipa palm (*Nypa fruticans*).
2. Fish includes Hilsa, shrimp and other fish from the Sundarbans.
3. Shrimp fry consists of both bagda fry (*Penaeus monodon*) and golda fry (*Macrobrachium rosenbergii*).
4. Other forest products included income from Hental date palm (*Phoenix paludosa*) used as fence and house posts , Malia grass (*Cyperus javanicus*) used for bedding mats, and honey. Honey collection is not prominent in the Mongla part of the Sundarbans.
5. Forest wage labour means daily income from selling labour for forest resource collection, which was observed in the golpata collection activities.
6. Fuelwood and shrimp fry are legally prohibited for collection.

In the study area, 13% of the annual income for the lower income households was reported to come from non-farm sources. Apart from the forest, the poorest households depended mostly on non-farm sources for income. For the middle income households, shrimp income and non-farm income contributed 26% and 19% of total household income, respectively, and were regarded as the most important sources of income followed by the forest income. The income from the shrimp farming (46%) and non-farm activities (26%) was particularly important for the higher income households, followed by the income from non-farm activities and forest resources. The livestock, agriculture and fisheries from homestead ponds were not important for any income group (accounting for <3% of total income).

It is legal to harvest golpata (leaves of nipa palm), Malia grass, crabs and fish from the Sundarbans (Figure 5.1). On average, the legal collection of mangrove resources contributed 24% of the total income of lower income households; the contribution of this activity to incomes was 19% and 11% for the middle and higher income households, respectively. Other forest products such as Hental palm trees, Malia grass or honey contributed little to the total income. A few of the higher and middle income households received income from formal short-term employment in the forest services (e.g. working as a member of a tiger team or assisting office work on a casual basis during the resource collection season) in the study area, this represented only a few people.



Figure 5.1: Resources legally obtained from the Sundarbans mangrove forest - (A) Golpata leaves; (B) Malia grass (C) crabs; and (D) fish and shrimp

The extraction of golpata (leaves of nipa palm) was organised by a small number of high and middle income households who were capable of both investing money and managing every step from extraction to the marketing of the products. The actual harvesters of golpata were the members of lower income households who only worked as labourers and were paid on a daily basis. These resource extractions and the related marketing activities required financial capital, which created a barrier to entry for marginal or poor sections of the society. However, the harvesters received higher pay from selling their labour in golpata collection than any other income activities because the risks were higher and more physical fitness and prolonged stays in the forest were required while collecting these resources. Therefore, lower income households still earned a significant amount of income (8%) from forest wage labour, which mainly came from selling their labour for engaging in the collection of golpata.

High value fish including shrimp and Hilsa fish (*Hilsa ilisa*) were major harvestable resources from within and adjacent to the Sundarbans Reserved Forest. Only two higher income households were involved in commercial fishing activities which involved hiring people from Koyra Sub-District on seasonal contracts. This was very expensive fishing as it required a large investment to purchase different gill nets and engine boats and to pay 30-40% in advance salaries to the hired workers. Some higher and middle income households caught fish in the narrow canal in the forest by employing 1 or 2 people from lower income households as they had canal gill nets and boats but did not have enough financial capital for commercial fishing activities in the large river inside the forest. The middle income households earned the most from fishing (8%) in comparison to the other income groups, while lower income households received their highest income from crabs (8%) as crab collection required lower investment than fishing activities.

Much of the forest income was obtained from products which were illegal to harvest (Figure 5.2). On average, the illegal collection of mangrove resources contributed 50% of the total income of the lower income households; the illegal collection of mangrove resources contributed 29% and 12% for the middle and higher income households, respectively. Among the forest resources, both fry and fuelwood collection was legally prohibited, but contributed as much as 34% and 16% to the total income of the lower income households, respectively. Only the lower income households and some middle income households directly participated in shrimp fry collection activities. The survey revealed that 12% of the total income for the higher income households and 22% of the total income for the middle income households

were contributed by fry collection and related value chain activities. I observed that the higher income households gained income from shrimp fry by acting as moneylenders and transporting fry from the collection points to other places inside or outside of the Sundarbans impact zone. These activities provided more profit than by collecting shrimp fry themselves.



Figure 5.2: Resources collected illegally from the Sundarbans - A & B show wood cut illegally in the study area and transported to Mongla; C & D show the capture and sorting of shrimp fry

Annual income per capita was calculated as US\$139 for the lower income households, US\$242 for the middle income group and US\$1,089 for the higher income households (Table 5.5). The surveys revealed that forest products contributed approximately 48-74% of household per capita annual income and 50-76% per capita annual cash income for the middle and lower income households. On average, the lower income households depended on the forest resources three times as much as the higher income households and twice as much as the middle income households.

Among both the lower and middle income category households were several that obtained all of their families' annual cash income from the forest.

Table 5.5: Total forest income per capita for three income groups in six villages, Mongla Sub-District

| Incomes (US\$) | Income Tercile | | | F-value | P-value |
|-----------------------------|------------------------|------------------------|------------------|--------------|------------------|
| | Lower | Middle | Higher | | |
| Total cash income | 128 ^a | 221 ^a | 1030 | 55.65 | <0.001 |
| Total forest cash income | 99 ^a | 107 ^{ab} | 152 ^b | 3.91 | <0.05 |
| Relative forest income | 0.74 | 0.48 | 0.23 | 67.75 | <0.001 |
| Relative forest cash income | 0.76 | 0.50 | 0.24 | 64.82 | <0.001 |
| Total forest income | 104 | 111 | 153 | 3.36 | NS |
| Total income | 139^a | 242^a | 1089 | 57.87 | <0.001 |

Bonferroni's test: means followed by a common superscripted letter implies the mean difference is not significant at the 5% level. NS= level of significance (5%).

This concludes the presentation of the results on forest income. In the next section, I identify the factors that determined households' forest income and forest dependency.

5.3.3 Determinants of Household Forest Incomes and Forest Dependency

Table 5.6 shows the results of a multiple regression model of relative forest income against the socio-economic variables of all the households surveyed. The OLS model, which included 9 independent variables, explained 66% variance in forest income. It was observed that the number of boats, the number of shrimp fry nets and whether the household head was male had a significant positive influence on forest income. Ownership of a boat had the greatest positive impact as it was virtually impossible to enter the mangrove forest or collect forest resources without one.

Male-headed households had more forest income than female-headed households. The number of shrimp fry nets used to catch shrimp fry made the greatest positive contribution to income from forest products. The area of homestead and shrimp farm land, the total value of physical assets and the number of livestock were found to be negatively correlated with forest income. The distance travelled to collect drinking water from a government-owned pond and the value of livestock had no significant impact on forest income ($P>0.05$).

Table 5.6: Influence of socio-economic factors on forest income in six villages, Mongla Sub-District (OLS regression $F=55.41$, $P<0.001$, $R^2=0.66$, Adj $R^2=0.65$, $n=263$)

| | Unstandardised Coefficient | Std. Error | t | P |
|--------------------------------|-------------------------------|------------|-------|-------|
| Constant | 0.060 | 0.132 | 4.55 | 0.000 |
| Number of boats | 0.204 | 0.038 | 5.44 | 0.000 |
| Gender male | 0.102 | 0.041 | 2.48 | 0.014 |
| Number of shrimp fry net | 0.078 | 0.036 | 2.17 | 0.031 |
| Distance to drinking water | 0.011 | 0.008 | 1.37 | 0.173 |
| Value of livestock | -0.002 | 0.003 | -0.69 | 0.491 |
| Area homestead land | -0.031 | 0.013 | -2.37 | 0.019 |
| Area of shrimp farm land | -0.042 | 0.012 | -3.45 | 0.001 |
| Number of large livestock | -0.045 | 0.018 | -2.54 | 0.012 |
| Total value of physical assets | -0.046 | 0.012 | -3.90 | 0.000 |

Separate regression models to determine which socio-economic characteristics were important for the lower and middle income households were undertaken to explain dependencies on forest income (Tables 5.7 and 5.8). For the lower income households, a multiple regression model with all five predictors explained 41% of the variation in forest income ($F=11.23$, $P<0.001$). The number of boats and whether the household head was male had a positive influence on the forest income of lower income households (Table 5.7), while the area of homestead land and the total value

of physical assets were negatively correlated with forest income. The number of shrimp fry nets was not correlated with forest income for the poorest people.

Table 5.7: Influence of socio-economic factors on forest income among the poorest third of households in six villages, Mongla Sub-District (OLS regression F=11.23, P<0.001, R²=0.41, Adj R²=0.37, n=88)

| | Unstandardised Coefficient | Std. Error | t | P |
|--------------------------------|-------------------------------|------------|-------|-------|
| Constant | 0.915 | 0.210 | 4.36 | 0.000 |
| Number of boats | 0.286 | 0.070 | 4.07 | 0.000 |
| Male head of household | 0.165 | 0.042 | 3.90 | 0.000 |
| Number of shrimp fry nets | 0.060 | 0.066 | 0.91 | 0.365 |
| Area of homestead land | -0.035 | 0.016 | -2.19 | 0.031 |
| Total value of physical assets | -0.085 | 0.024 | -3.49 | 0.001 |

For the middle income households, five household characteristics accounted for 55% of the variability in relative forest income ($R^2=0.55$, adjusted $R^2=0.53$, F=20.34, P<0.001) (Table 5.8). The significant positive variables were again the number of shrimp fry nets (P<0.01) and the number of boats (P<0.01) when the five most important independent variables were entered into the regression equation. The area of shrimp land and the number of livestock were found to be the important independent variables negatively correlated with forest income. Therefore, people with more livestock and shrimp farms tended to gain less income from forest resources. The area of homestead land was not correlated with forest income, while the gender of the household head could not be included as a variable as there were too few middle income households headed by women.

Table 5.8: Influence of socio-economic factors on forest income among the middle third of households in six villages, Mongla Sub-District (OLS regression F=20.34, P<0.001, R²=0.55, Adj R²=0.53, n=88)

| | Unstandardised Coefficient | Std. Error | t | P |
|---------------------------|-------------------------------|------------|-------|-------|
| Constant | 0.294 | 0.058 | 5.07 | 0.000 |
| Number of shrimp fry nets | 0.159 | 0.056 | 2.82 | 0.006 |
| Number of boats | 0.183 | 0.061 | 3.02 | 0.003 |
| Area of shrimp farm | -0.084 | 0.029 | -2.94 | 0.004 |
| Area of homestead land | -0.021 | 0.032 | -0.65 | 0.519 |
| Number of large livestock | -0.056 | 0.033 | -1.68 | 0.098 |

By analysing the relationship between relative forest income and other income sources (Table 5.9), I found that an OLS model with all three predictors produced R²=0.46, F=73.61 and P<0.001. Households with less forest income engaged more in shrimp farm and non-farm income generation. As total income increased, there was a consistent decline in the variability of forest dependence, converging towards the lower ranges. In the following section, I present the results related to the role of forest income in poverty and income inequality in the study area.

Table 5.9: Influence of non-forest income sources on relative forest income among households in six villages, Mongla Sub-District (OLS regression F=73.61, P<0.001, R²=0.46, Adj R²=0.45, n=263)

| | Unstandardised Coefficient | Std. Error | t | P |
|----------------------------|-------------------------------|------------|-------|-------|
| Constant | 1.304 | 0.147 | 8.87 | 0.000 |
| Per capita shrimp income | -0.024 | 0.003 | -7.21 | 0.000 |
| Per capita non-farm income | -0.021 | 0.003 | -6.45 | 0.000 |
| Per capita total income | -0.069 | 0.017 | -4.17 | 0.000 |

5.3.4 Role of Forest Income in Poverty and Income Inequality

There was substantial income inequality among the households, with the Gini coefficient for the sample population estimated at 0.38 (Table 5.10). The calculation of the Gini coefficient for the total income and income excluding each income source individually indicated that the Gini coefficient was highest when forest income was excluded (0.52), showing that the addition of forest income to the household income reduced the measured income inequality by 27%.

Table 5.10: Levels of income inequality in six villages, Mongla Sub-District

| Income inequality | Gini coefficient |
|--|-------------------------|
| Total income | 0.38 |
| Without forest income | 0.52 |
| Without shrimp farm income | 0.28 |
| Without agriculture, livestock and homestead pond income | 0.39 |
| Without non-farm income | 0.37 |

The head count ratio (HCR) for the lower income households in the study area was estimated at 89% but this increased to 100% when calculated without forest income (Table 5.11). The HCR for middle income households was calculated at 38%, increasing to 78% without forest income, and nearly 16% of people belonging to the higher income households would fall into poverty if forest income was not considered. Without forest income, the proportion of people living below the lower poverty line increased from 43% to 65%. Thus, forest income was keeping 22% of the population or households in the communities surrounding the Sundarbans mangrove forest above the poverty line.

Table 5.11: Proportion of villagers living below the lower poverty line (HCR) in six villages, Mongla Sub-District

| Households | HCR based on total income including forest income | HCR based on total income excluding forest income |
|--------------------------|---|---|
| Lower Income Households | 89 | 100 |
| Middle Income Households | 38 | 78 |
| Higher Income Households | 1 | 17 |
| Total Households | 43 | 65 |

Lower poverty line = monthly per capita income Tk1192 (US\$17) (BBS, 2011a; Appendix B)

Head count ratio is simply the percentage of a population that exists, or lives, below the poverty line.

Given the large dependency of the surveyed households, particularly those in the lower income group, on mangrove forest resources, I investigated the vulnerabilities associated with forest resource dependence in the study area as discussed in the next section.

5.3.5 Vulnerability Associated with Forest Dependence Livelihood Strategies

In the context of the Sundarbans resource collections, a number of factors placed the households in a position of vulnerability. These factors included significant trends such as illegal resource collection and dependency on moneylenders for resource collection, shocks such as the death of family members from tiger or crocodile attack and the loss of assets due to pirate attacks, and seasonality in resource availability.

5.3.5.1. Dependence on Moneylenders for Resource Collections

Lower income households depended on moneylenders (mahajan) for credit, as discussed in Chapter 4. Lower income households that had relationships with traditional moneylenders were apparently better able to take credit to buy boats and

nets to collect mangrove resources as there were no other specific sources of capital or loans available for forest-dependent groups to buy boats and nets (as discussed in detail in Chapter 4). During the focus group discussions, most resource collectors revealed that they took money in advance to cover family expenses against probable earnings or took loans in lean periods from a moneylender for the purpose of consumption or any kind of expenditure especially medical costs. This often forced poor harvesters into informal credit schemes and/or into dependency relationships with the moneylenders to whom they intended to sell their products. Shrimp fry collectors during focus group discussions (FGD#SSFC) revealed that this interlocked selling reduced their profit. They further elaborated that the moneylenders advanced money on the condition that the collectors would sell the harvested resources to them at a price set by the moneylenders which was 15-20% below the market price (FGD#SSFC). All the resource collectors revealed that the moneylenders had only one thing in their mind, which was to extract the maximum resources and profit. This was demonstrated when the moneylenders pressured them to collect resources during harsh weather such as during a cyclone (FGD#SSFC, SFiC, SCC, SFWC). The female shrimp fry collectors complained that moneylenders compelled them to stay the whole night on the river to catch shrimp fry against their will, even during periods of illness in the peak season (FGD#SFRC). Thus, the resource collectors did gain a livelihood but most of the profit went to the moneylenders. In the focus group discussions, the resource collectors also expressed their gratitude to the moneylenders as they could not manage without the moneylenders' help. To the resource collectors, the moneylenders were the first and last resort for urgently needed money; the moneylenders were perceived to protect their livelihoods.

Another factor that forced resource collectors to depend on moneylenders was the control of the boat loading certificates (BLC), which were the main legal instruments necessary to collect resources from the Sundarbans. The focus group discussions with the legal resource collection group (FGD#SFIC, SCC) revealed that the moneylenders were the owners of the most certificates because they owned the boats. The Sundarbans Biodiversity Conservation Project (SBCP) collected data on the certificates that had been issued until 2000 and analysed the ownership of the certificates among the moneylenders and self-employed resource collectors (Table 5.12). Out of a total of 22,500 certificates, 18,750 belonged to moneylenders and the remainder were owned by self-employed resource collectors. The collection of any legally permissible forest produce from the Sundarbans had to be authorised by a boat owner using boats through the BLC system. The certificates were issued and renewed for each boat, with annual renewal fees paid by the owner of the certificate to the Forest Department. Officially, no new certificates were to be given unless permission was provided from the Chief Conservator of Forest based in Dhaka. Existing certificates had to be renewed each year by application to the Sundarbans Forest Division East or West Headquarters based in Bagerhat and Khulna Towns. The resource collectors reported (FGD#SCC, SiFC) that it usually required expense and time to travel from their remote villages to the divisional forest offices, often several times to renew the certificate each year.

**Table 5.12: Number of boat loading certificates issued in the Sundarbans
(Source: Sundarbans Bio-Diversity Conservation Project Database, SBCP
Project Office in Khulna, collected November 2006)**

| Product | Boat Loading Certificates | | |
|---|----------------------------------|----------------------|---------------------|
| | Total | Self-employed | Moneylenders |
| Fish | 21,000 | 5,000 | 16,000 |
| Honey | 500 | 50 | 450 |
| Goran ¹ and Golpata ² | 2,000 | 0 | 2,000 |

- 1. Goran (*Ceriops decandra*): Fuelwood from goran is legally permissible, usually found in the Koyra part but not found in the Mongla part of the Sundarbans
- 2. Golpata – the leaves of nipa palm (*Nypa fruticans*)

The focus group discussion with Forest Department officials (FGD#CSFO) at Chandpai Forest Station revealed that after the annual renewal of the boat loading certificate by the Divisional Forest Officer, the certificate owners had to bring their boat to measure the carrying capacity of the boat and re-register it at a defined forest station. The forest station would issue a permit for resource extraction and the resource collectors had to pay a fee for each resource depending on the amount of resource they would be collecting. After obtaining the permit, the station officer would identify the part of the forest from where resource collectors could collect the resources, and the resource collectors had to report to the nearest patrol office which would supervise their resource collection. In the key informant interviews, one golpata trader who acted as a moneylender in Joymony Ghol Village stated that he paid an unofficial levy of Tk. 21,000 (US\$305) to different Forest Department offices (divisional forest office, station office, and patrol post) for golpata extraction in order to complete the procedures from renewing the boat loading certificate and obtaining permission to extracting the best quality golpata from a convenient part of the forest (KII#GTCU). Resource collectors (FGD#SCC, SFiC) reported that the legal procedures were often highly complex and very costly. They had no money and

no boat; therefore, they were not able to collect resources themselves and were thus dependent on the moneylenders for resource collection.

In relation to illegal resource extractions such as shrimp fry and fuelwood from sundari trees (*Heritiera fomes*), the moneylenders managed everything from extraction activities to marketing the products. The moneylenders dominated the supply chain of these products as they had access to capital, transport and markets. They managed the Forest Department officials and the police and provided bribe money in each step of the process from extraction to marketing. In the case of fuelwood, the moneylenders managed the boats and dealt with the Forest Department officials, with the actual harvesters of the resources receiving a portion of the profit. In the case of shrimp fry, the collectors took loans from the moneylenders to buy nets and boats and were paid 10-15% below the market price. Resource collectors further stated that, in relation to the illegal resource collections, the resource collectors not only received money or working capital from the moneylenders but also received protection from harassment from the Forest Department, CoastGuard, police and even from pirates. The resource collectors were happy to accept the protective role of the moneylenders. Thus, the major part of the resource extraction was organised by the moneylenders, who were the patrons of the extraction system and gained most of the profit. I observed that many of the moneylenders were politically and socially powerful due to close links with the local forest administration and ruling party machineries and were capable of taking risks that would protect their exclusive profits. I found that the actual resource collectors in the Sundarbans did not have a local level association that could represent their common interests to the Forest Department (Chapter 4) or other government agencies. Their weakness in social and

financial capital meant that the resource collectors had very little bargaining power and were not able to negotiate with the Forest Department officials; rather, they depended on the moneylenders for their livelihoods.

5.3.5.2. Illegal Forest Collection Activities and Criminal Cases

Regulations created under the Forest Act of 1927 prohibited the fuelwood and shrimp fry collection upon which the households depended. However, as demonstrated above, most households in Mongla Sub-District depended on or participated in shrimp fry and fuelwood collection in the SFR areas. Forest fuelwood products were being harvested and sold at any time of the year for cash, largely to compensate for an inadequate electric power supply in the sub-district. Fuelwood collectors (FGD#SFWC) acknowledged that illegal wood collection was a major reason for a reduction in the abundance of plant resources, with local mangrove systems near these six villages in Mongla continually threatened with further depletion. In the focus group discussion, the shrimp fry collectors from the Sundarbans (FGD#SSFC) stated that during the shrimp fry collection they wasted the fry from other fish and crab. They further revealed that they discarded any non-shrimp fry caught in their nets and thus were destroying other fish resources in the Sundarbans.

Fishing was a legal activity in the study area but illegal fishing also occurred. In the focus group discussions (FGD#CSFO), Forest Department officials described how poor fishermen from the villages surrounding the forest who didn't have any nets would fish in the narrow canals of the Sundarbans using poisonous chemicals banned under 1985 regulations for the protection and conservation of fish. As the poison

spread during the high tide, the shrimp, fish and crabs came to the shore in an attempt to escape. The fishermen collected their catch and disappeared into the locality. In the focus group discussion with the Sundarbans fish and crab collectors (FGD#SCC, SFiC), they admitted that, due to the indiscriminate use of poison and destruction of fish and crab fry during the collection of shrimp fry, aquatic resources such as fish, shrimp and crab had become more scarce in the Sundarbans than previously.

The focus group discussion with crab collectors (FGD#SCC) revealed that another illegal resource collection activity was the harvesting of crabs during the crab breeding season (from December to February) when the market price was high due to higher demand in the international market.

Nevertheless, the resource collectors who were interviewed in this study considered that their illegal resource collection activities were justified (FGD#SFWC, SSFC, SCC, SFiC, SFRC). The resource collectors revealed that they were living in poverty with no money, no land and no jobs. They faced difficulty to survive and maintain livelihoods. They stated that they needed to collect resources by any means in order to sell the products and get cash to feed their parents and children. The resource collectors stated that they did not steal logs or use poison for fishing but they did not have any work other than going into the forest to collect resources to get their food. For them, going into the forest was the last option for them as they were not offered any other kinds of jobs. They considered the mangrove forest to be their “money tree”; it preserved their lives in their villages and was their only source of survival.

From the focus group discussions with resource collectors (FGD#SFWC, SSFC, SCC, SFiC, SFRC) and personal observations for over one year, I found that the resource collectors were not afraid of violating legal and management regulations related to resource collection even though the penalties for infractions were high (discussed in more detail in Chapter 8). Shrimp fry and fuelwood resource extractions were carried out illegally but operated at such a level that the cost-benefit ratio remained positive because illegal resource collection opportunities were well paid in comparison to conventional opportunities. However, Forest Department officials did sometimes initiate legal proceedings against resource collectors engaged in illegal activity (FGD#CSFO; KII#ACFCR), as did the police, Coast Guards and Fishery Department officials.

One key informant interview involved a fuelwood trader (KII#FWT) from South Bashtola Village whose income from September 2009 to August 2010 was calculated as \$877, within which nearly \$426 was forest income. This fuelwood trader described the implications of legal charges for his livelihood:

I was raised in a very poor family...from my boyhood...I was very experienced in the forest life, cutting trees, serving my parents after getting the money. I had elder brothers but they were married so they had their own family, and left the parents to me alone. I had 18 forest criminal cases filed against me for the last 15 years. Even sometimes I came to know about the cases after I got summons issued by the magistrate court. Most of the charges against me were false. In the court, forest officials failed to prove any of this against me. I had never been found guilty of any of the charges against me. But I had to spend a lot of money to get rid of these cases. ((KII, FWT, 27/02/2010; Baiddomari Market)

The focus group discussions with resource collectors (FGD#SFWC, SSFC, SCC, SFiC, SFRC) revealed that the most common reason for the filing of forest criminal cases was the failure of the moneylenders who financed and managed the resource extractions to provide a bribe to the Forest Department officials or police. However, the resource collectors reported that the Forest Department or police officers rarely caught any moneylenders as they were not directly participating in the resource collection activities. In these situations, the Forest Department or police officers arrested the resource collectors and took legal action against them. It was also stated by a moneylender (KII#GTCU) that if the Forest Department officials did not receive a bribe, they raided the forest to arrest resource collectors and seized their boats, nets and other equipment.

The resource collectors stated that, in most cases, the harvesters who were charged were not the real culprits; they worked for their employers, namely, the middlemen or traders. Nevertheless, the local forest officials admitted that it was much easier to enforce the law against the resource collectors than against those who were wealthier, were more powerful, and had connections with local politicians or Forest Department officials. One local NGO worker (KII#NGOM) who had been working with the Sundarbans communities for several years commented that the cases filed by the Forest Department officials were intended to earn rent money and real cases of illegal activity were few in comparison to the total number of cases. A criminal case filed under the Forest Act or Wildlife Preservation Act usually took seven to ten years on average to complete from the date of filing to the date of judgement (Abdullah, 2007). In summary, the resource collectors were vulnerable to the rent-

seeking behaviour of the Forest Department and other officials regardless of whether they were taking resources illegally.

5.3.5.3. Seasonality

Seasonality also had an impact on the availability and type of the resource collections in the Sundarbans and the work available in the surrounding villages (FGD#SFWC, SSFC, SCC, SFiC). Mangrove forest resource collection closely followed the seasons, although some activities occurred in the forest at most times of year (Table 5.13). The season for fish, including shrimp and Hilsa fish, started in July and continued until October (FGD#SFIC). In every month of the peak season, there was a period (Gon) of good catch followed by a lean period of catch. However, the fishermen, crab and shrimp fry collectors explained that the catch varies from day to day within the Gon period – on one day there might be a bumper catch, but on subsequent days there might be a poor or even no catch. The peak fishing season in the Bay of Bengal adjacent to the Sundarbans forest fell between December and March, however this season was insignificant in the case of the study villages as the fisheries resource collectors rarely went into the Bay of Bengal for fishing (FGD#SFIC). The extraction of honey began in March and continued until May, and the collection of golpata started in December and was finished by March (FGD#SFWC).

The focus group discussion with fuelwood collectors (FGD#SFWC) revealed that illegal extractions of fuelwood had been carried out, reaching a peak during the wet season when illegal loggers are able to reach deep into the forest because water levels are higher and senior officials from the Forest Department are absent because of rough weather. However, while low pressure systems, including occasional

cyclones, in the Bay of Bengal impeded resource collection from the Sundarbans between May and October, this was the time when the fishermen caught most fish (FGD#SFIC).

Table 5.13: Seasonal calendar of resource extraction from the Sundarbans in Mongla Sub-District (major extraction: red; minor extraction: green; occasional use: blue)

| Product | J | F | M | A | M | J | J | A | S | O | N | D |
|------------------|-------|-------|-------|-------|------|-----|-------|-----|-------|-------|-------|------|
| Golpata | Red | Red | Red | | | | | | | | | |
| Fish | | | | | | | | Red | Red | Green | | |
| Bagda shrimp fry | Green | Green | Green | Red | | | | | | | | Red |
| Golda shrimp fry | | White | Green | Red | Red | Red | Green | | | | | |
| Wood | Green | Green | Green | Green | Red | Red | Red | Red | Red | Red | Green | |
| Honey | | | White | Blue | Blue | | | | | | | |
| Crab | Green | | | | | | | | Red | Red | Red | Red |
| Malia grass | | | | | | | | | Green | Green | Green | |
| Dry fish | Blue | Blue | Blue | | | | | | | | | Blue |

The focus group discussions with resource collectors also indicated that the major resource extraction of products from Sundarbans usually occurred over a 2-6 month period, limiting cash income to a relatively short period per year and imposing a strain on household income and cash flow during the lean season (FGD#SFWC, SSFC, SCC, SFIC). Periods of high income were sometimes extended (e.g., harvesting of prawn post-larvae or long fishing seasons due to a prolonged monsoon) and sometimes they were restricted (short monsoons or poor fishing due to rough weather). Because of uncertainty, the resource collectors violated laws or took more risks with their lives by collecting resources after a cyclone warning or in rough weather without any viable protection. The poorest resource harvesters depended on the moneylenders for alternative employment opportunities or loans during the lean

periods (FGD#SFWC, SSFC, SCC, SFiC). In some months, the resource collectors had no income at all.

5.3.5.4. Attacks by Pirates

In the focus group discussions, the resource harvesters reported that piracy within the Sundarbans had increased in recent years. The resource harvesters also alleged that, despite law enforcement activities, pirates were continuing to murder, extort, rob and kidnap for ransom in the forest and adjoining the Bay of Bengal waters especially in the Hilsa and shrimp fry catching season. The resource collectors further maintained (FGD#SFWC, SSFC, SCC, SFiC) that law enforcers failed to bring the piracy under control in the Sundarbans and it had spread. According to the resource collectors, the pirates were very well organised and armed with deadly weapons. They believed that the one police camp in the area was insufficient to protect them from the pirates. They reported that the pirates came from the villages surrounding the forest, and were being supported and sheltered by local political and business interests groups. The resource collectors further opined that these hardcore criminals were undaunted in their repeated committal of crimes because a strong network of corruption, underworld activities and vested mafia interests were active behind them.

I interviewed two ex-pirates (KII#Ex-pirates 1 and 2) who took advantage of a period of clemency declared from the government in 1997 and returned to their normal life along with some of their associates, laying down arms and ammunition. They informed me in the interviews that the pirates maintained connections with different political leaders and supported these political leaders in factional disputes and village power struggles. The ex-pirates accused some large shrimp farm owners of using the

pirates to grab others' land or to evict poor people from government-owned land. According to them, the different pirate groups were also involved in the illegal arms trade and supplied arms during factional conflicts to earn more cash income.

According to these ex-pirates (KII#Ex-pirates 1 and 2), some pirates were involved with poaching tigers and smuggling tiger skins out of the forest through their contacts in the network. In the face of increased political rivalry, the political leaders surrounding the remote locations of the Sundarbans had begun relying more on the pirates. Law enforcement agencies, especially police, could not take action against the pirates due to political interference even though they had enough information about the pirates to convict them. Only when there was a change in the political party in power, could police take action against those pirates closest to the previous political regime. These informants also complained that some dishonest forest officers and members of different law enforcement agencies were assisting the criminals in the forest for their personal gain. They claimed, for example, that pirates frequently used the Forest Department offices as places for mediating ransom.

In the focus group discussions with field-level Forest Department officials of Chandpai Forest Station office (FGD#CSFO), one Forest Department official, who had been serving in the Sundarbans for a long time, stated that piracy had its roots in movements in support of communism and socialism during the 1980s with many pirates driven by ideological motives, believing their piracy contributed to some form of class struggle. These pirates used to take shelter for a few months to avoid arrest by law enforcement agencies and survived by taking rent from Forest Department officials and loggers as, during that time, systemic commercial logging was the only permitted activity in the Sundarbans. Since then, piracy had evolved to more

conventional banditry for personal gain. During the focus group discussion, the Forest Department officials further explained that piracy in the Sundarbans had increased remarkably after the introduction of shrimp aquaculture in the areas surrounding the forest as the shrimp aquaculture created a market for mangrove-based shrimp post-larvae which created a huge cash flow among the collectors, middlemen and traders. The Forest Department officials further elaborated that increasing competition for high cash value resources created a fertile ground for pirates to earn easy money.

From the key informant interviews with the Mongla Sub-District police chief (KII#OCM) and focus group discussion at Chandpai Forest Station Office with Forest Department officials working in the Sundarbans (FGD#CSFO), I learned that there were 20 to 30 ‘gangs’ of pirates existing in the Sundarbans forest with each group comprised of 30 to 40 pirates. The informants further reported that new gangs frequently emerged in this mangrove forest due to factional conflict over profit-sharing among members. They reported a recent incident in which a pirate leader and his second-in-command were killed in different gunfights, after which the vacuum was filled by the third or fourth row leaders of the gang. The criminals were in possession of modern foreign-made arms, plenty of ammunition and high speed boats (KII#OCM).

The resource collectors reportedly paid money to the pirates for safe passage and resource extraction. In the focus group discussions (FGD#SFWC, SSFC, SCC, SFiC), it was revealed that the resource collectors provided between Tk2000 (US\$29) to Tk20,000 (US\$291) per season per resource depending on the type of resource and its market value. In return, the pirates provided a token for ‘safe movement’ in the Sundarbans. Resource collectors who entered deep into the forest

and travelled long distances usually had to pay money to more than one gang of pirates. One golpata resource trader from Joymony Ghol Village (KII#GTCU) stated that he had to pay Tk14,000 (US\$203) each to two gangs of pirates in the last golpata collection season for two collection trips. Research by the Multi-disciplinary Action Research Centre (MARC) (1997) found that pirates received Tk0.7 million (US\$10,174) in a single year from the Sundarbans.

From the focus group discussions with the resource collectors, I learned that the woodcutters, shrimp fry collectors and fishermen frequently came under attack from pirates resulting in the loss of gear and any fish they had caught, which had a huge impact on their livelihoods (FGD#SFWC, SSFC, SCC, SFiC).

The focus group data further revealed that resource collectors had to sell their valuable assets or take loans from moneylenders to set family members free from captivity by pirates, causing further vulnerability to their livelihoods (FGD#SFWC, SSFC, SCC, SFiC). In addition, they described being tortured and harassed physically and mentally by the pirates. Sometimes, even the moneylenders needed to pay ransom money to release their kin (KII#GTCU), to the extent that many mangrove resource entrepreneurs had left the business. Ultimately, both collectors and moneylenders tried to minimise their losses by exploiting more forest resources illegally, which resulted in more destruction of forest resources and degraded the quality of the forest.

The focus group discussions with resource collectors (FGD#SFWC, SSFC, SCC, SFiC) provided information about the abductions by pirates, the ransoms demanded by the pirates and the impacts on livelihoods. According to the resource collectors, the pirates were the worst threat as they would just take what resource collectors had

on their boat and on some occasions they held resource collectors hostage and asked for ransom money. The resource collectors further claimed that, in the days following an abduction, the pirates waited for the ransom and did not torture the abducted people. The pirates usually passed a message to the resource collector's family or the moneylender for whom the resource collector worked, demanding they pay the required money through one of the pirate's agents. The pirates threatened to kill the abducted people if the families or moneylenders informed the police or the Coast Guard, and thus realised Tk5,000 (US\$73) to Tk25,000 (US\$363) and even Tk100,000 (US\$1,453) from each abduction as ransom depending on the economic status of the resource collectors. The resource collectors further stated that in cases where the ransom money was not paid, the pirates tortured, beat severely or even killed the abducted collectors.

The extent of piracy in the Sundarbans region was also revealed from secondary sources (newspaper articles). In September 2011, pirates in the Sundarbans were reported to have attacked at least 50 trawlers, looted fish and fishing nets worth about Tk5 million (US\$72,674) and also kidnapped around 100 fishermen demanding ransom (The Daily Star, 2011a). Das (2011) reported that around 1,000 fishing boats had been robbed by pirates in the Bay of Bengal and in the Sundarbans since June to October 2011; more than 325 fishermen had been abducted, with their families paying Tk100,000 (US\$1,453) as ransom to get each person released.

The key informant interview with the officer-in-charge of Mongla police station (KII#OCM) and personal communications with the head of the Western Zone Coast Guard indicated that the officials did not believe that traditional law enforcement

operations could work in the Sundarbans as the robbers and pirates mixed with the fishermen to evade arrest when anti-piracy drives were launched. Thus, law enforcement operations failed to uproot the pirates. The sub-district police chief (KII#OCM) described this problem as follows:

The law enforcers had no small vessels which were needed to raid inside the deep areas of the Sundarbans to arrest the pirates. Moreover, during the lowest tide it is impossible to enter deep into the forest through small canals and creeks. The local people's hostility to the FD [Forest Department] officials allows pirates to operate with ease. Pirates had many spies in the locality who inform them immediately after seeing the movement of Coast Guards and police. Development of infrastructure and communications is inevitable for protecting the forest and quick movement of law enforcers to contain crimes in the Sundarbans. Number of police camp should be increased along the Sundarbans forest to protect villagers from increasing number of pirates. (KII, OCM, 18/08/2010; Sub-District Police Station, Mongla)

Secondary data were reviewed to supplement the information provided by the key informants and participants of the focus group discussions. The data revealed that at least 25 pirates had been killed in gunfights in 2010 and 2011; of these 13 died in conflicts with law enforcers in the Sundarbans and the rest were killed in clashes between rival gangs (The Daily Star, 2011b) (Figure 5.3). A national daily newspaper reported that 34 forest robbers were killed in 24 armed encounters and that large stashes of firearms and ammunition used by the robbers were confiscated over the same period (The Independent, 2011b). However, the informants in the present study held the view that the efforts of law enforcement agencies in the Sundarbans had not been successful because the gang leaders on the mainland who controlled the robberies in the forest remained untouched (KII#Ex-pirates 1 and 2).



Figure 5.3: The bodies of two alleged pirates, killed in a gunfight with law protection forces at Vedkhali canal in the Sundarbans and arms and ammunition seized from the gang (Source: The Daily Star 2011b, date: 14 November, 2011)

5.3.5.5. Human-Wildlife Conflict

In the Sundarbans, tigers and crocodiles often attacked people inside the forest. Tigers also often moved out of their natural habitat to the villages adjoining the Sundarbans, killing people and cattle. The tigers were often scared away with drums, crackers and blank shots, but many were killed by villagers with sticks or axes at great risk to their own lives. Secondary data collected from the Conservator of Forest Office in Khulna revealed that 70 people were killed and 14 were injured from 2006 to 2010 in the Sundarbans. Reza et al. (2004) reported that a total of 401 people were killed by tigers between 1984 and 2000, an average human casualty rate of about 24 people per year. Similarly, Rahman et al. (2004) estimated that nearly 340 people were killed, 900 were injured and more than 1,500 cows and goats were killed by tigers in 10 years in the Sundarbans. The victims were mostly men aged from 26-35, followed by men aged from 36-45 (Reza et al., 2004).

Most of these men would have been married and with children. Following their deaths, their families often fell into miserable hardship as the loss of the principal bread-winner caused a sharp increase in poverty. The emotional trauma for the tiger victims' families was often higher because in most cases the body of the victim could not be recovered. Older widows without adult sons were considered the most vulnerable to extreme economic hardship due to the death of their husbands. One widow aged 27 from Joymony Katakhali Village (KII#WWV) shared her experience of survival after the death of her husband:

Married at age 13, now I have three young boys. My husband died from crocodile attacks while he was catching fish in this river. After his death, I was forced out from my husband homestead with children by my husband families. They blamed me as a cursed woman and accused me of bringing bad luck to the family. I lived with my parents for couple of months. Due to local government interventions, I could get back in my husband homestead. However, we fall into severe misery as we have no incomes. I could not able to take on the roles traditionally taken by the men like wood cutting or shrimp fry catching. I am selling cloths. Member (from local government) provided me widow allowance. I used to get some donation from my wealthy relatives. I am being pressured to marry again and abandoned my children in the orphanage from my surroundings to survive which I declined. Before he died, things were nice. Sometimes there aren't enough to eat for a single time in a day. My children gave up studies and no more attending the school. I become absolutely helpless and usually mistreated after the death of my husband. (KII, WWV, 10/03/2010, Joymony Katakhali)

In the focus group discussion (FGD#CSFO), the Chandpai Forest Station officials stated that two private insurance companies had introduced a life insurance scheme for the forest resource collectors with the payment of Tk100 (US\$1.50) in premiums for one year. This insurance scheme was managed by field officials of the Forest Department based at the station office. However, the resource collectors in the focus group discussions (FGD#SFWC, SSFC, SCC, SFiC) said that they were not

interested in taking out an insurance policy as the Forest Department officials processed and maintained records on behalf of the insurance company, receiving the compensation money from the insurance company and taking a high commission for the paperwork associated with the insurance claims. Therefore, they doubted they would get much, if any, of the insurance money. This was made more difficult because the victim's family had to travel to the divisional headquarters in Khulna nearly 80 km from their village, costing extra money if they were to claim the insurance.

Having presented the results, the discussion in the next section focuses on households' dependence on forest income, the socio-economic factors affecting forest income, the role of forest income in eradicating poverty, and the vulnerabilities associated with mangrove resource collection.

5.4 Discussion

5.4.1 Dependence on Forest Income

The dependence of people on the Sundarbans mangrove ecosystem for maintaining their livelihoods is well known and, as noted (in Table 5.1 above), resembles the dependence found elsewhere in the world wherever poor people live in proximity to forests. My study also confirms that mangrove proximity is little different to forest proximity, as has also been found by others. The lower income households surrounding the Sundarbans viewed the mangrove ecosystem as their principal source of cash income. The findings of the present study support the finding by Getzner and Islam (2013) as they examined the income earned by four different mangrove resource-based occupation groups in the Sundarbans and found that the

major share of household cash income (90%) was directly related to the harvesting Sundarbans resources. In Thailand, Barbier (2007) found that the economic livelihoods of the surveyed households were profoundly affected by the nearby mangrove forest where mangrove-based income accounted on average for 83% of all household income. In the Mahakam Delta, East Kalimantan, Indonesia, Bosma et al. (2012) found that about 40% of the households' income resources were related to the mangrove forest which included catching crabs, collecting shrimp and crab seed for pond farming, fisheries, collecting firewood and the trapping of crabs and fish. Hussain and Badola (2010) identified the contribution of mangrove forests to local livelihoods in the Bhitarkanika Conservation Area, on the east coast of India and found that mangrove resources contributed to around 30% for the households residing in the immediate vicinity of the forests. Vedeld et al. (2007) conducted a meta-review of 51 case studies of forest resource collection and revealed that forest income represented on average 22% of the total income, particularly for families near the survival line.

I found that dependence on mangroves was not uniform among the households in the study area. Absolute income from forests and the share of total income from forests (i.e., the relative forest income) were both very high in the study area. Overall, the lower income households had the highest relative forest income, but the higher income households had a higher absolute income derived from forest resources. Several empirical studies of the economic importance of forests to rural households have also shown that poor households are relatively more dependent on forest resources than better-off households which tend to have a higher total forest income

(Babulo et al., 2009; Cavendish, 2000; Fisher, 2004; Kamanga et al., 2009; Mamo et al., 2007; Narain et al., 2008; Vedeld et al., 2007; Yemiru et. al., 2010).

However, there is some variation. In a recent study, the “chronic poor” were found to be the most reliant on forest income in the Democratic Republic of Congo, while the “transient rich” had a higher absolute forest income (Nielsen et al., 2012). In India, Narain (2008) found that the poorest and richest households depended more on resources than households with intermediate incomes. In Vietnam, the middle class households were found to derive the most forest income in both absolute and relative terms (McElwee, 2008). However, in another study in Vietnam, Hue (2006) found that the average rich household earned 14 times more than the average poor household from mangroves and mangrove-related resources. In Uganda, Jagger (2008) found that relatively wealthy rural households living adjacent to a central forest reserve had the largest share of income from the forests. The causes of this variation are likely to be a function of local governance regimes and the patron-client relationships between different income classes; the carrying out of a meta-analysis is warranted to understand the variability.

5.4.2 Socio-Economic Factors Influencing Forest Income

This research has highlighted the key socio-economic characteristics of the forest-dependent households in the study area that explained the reasons for forest dependency. First, land was scarce and lower income households were landless. Second, few poor people kept livestock with most large livestock being kept by higher income households. This meant that the landless lower income households with no large livestock had to depend more on the mangrove resources than the

higher income households. For the most part, the only assets held by mangrove resource collectors were boats and nets. Globally, there is a common pattern whereby poorer households are relatively more dependent on non-timber forest products in order to fulfil basic needs (Heubach et al., 2011) or in times of shock or crisis (McSweeney, 2004; 2005) due to an absence of capital resources (Assan and Kumar, 2009). In China, Hogarth et al. (2013) found that lower income households were more dependent on forest-related income than wealthier households due to a lack of other resources. Similarly Yemiru et al. (2010) in Ethiopia and Illukpitiya and Yanagida (2008) in Sri Lanka both found, as I did, that the forest-dependent households had less wealth. Babulo et al. (2009) and Fu et al. (2009) found that female-headed households were more forest-dependent. In the study area in the present study, however, all the poorest households had a heavy reliance on the forest regardless of the gender of the head of household. Not surprisingly, forest-dependence was negatively related to the area of cropland or land (Yemiru et al., 2010; Mamo et al., 2007). Households with less land are often more dependent on forest product collection than the land-rich (Babulo et al., 2008; Fisher, 2004; Fu et al., 2009; McElwee, 2008; Vedeld et al., 2007). Forest income is often also negatively correlated with the ownership of large livestock (Yemiru et al., 2010) and goats owned (Fisher, 2004) or livestock income (McElwee, 2008). In north-eastern Honduras, it was found that household attributes, such as the area of land owned, strongly conditioned how and when forest resources acted as safety nets for the rural poor (McSweeney, 2005).

Involvement in non-agricultural and non-forestry activities showed the expected negative relationship to forest dependency. Thus, households with a higher portion of

their income from shrimp farming and other non-farm activities depended less on mangrove resources. Shrimp farming and associated business activities increased productivity and a higher income also diverted people from forest collection activities. It can be concluded that the households in the study area that were unable to access shrimp farming or non-farm employment relied to a greater extent on mangrove forest income. Heubach et al. (2011) also observed that the lower the total household income, the higher the share of forest product income. Gunatilake et al. (1993) found very similar results in Sri Lanka where forest income declined as incomes rose. Vedeld et al. (2007) undertook a meta-analysis of 51 different studies and found that absolute forest income increased as total household income increased, but forest income as a share of total income decreased. Forest dependence has been found to be negatively related to wage and self-employment (Mamo et al., 2007; McElwee, 2008) and involvement in non-agricultural or off-farm activities (Gunatilake, 1998; Illukpitiya and Yanagida, 2008), which supports my findings. Per capita income, however, has been found to be both negatively (Gunatilake, 1998; Mamo et al., 2007) and positively (Yemiru et al., 2010) correlated with forest income. Overall, the results of the present study indicated that the poorest sectors of the population in the regions surrounding the Sundarbans relied the most heavily on forest resources, even if more income was made in absolute terms by the richer portion of the population.

5.4.3 Forest Income to Eradicate Poverty and Inequality

The areas surrounding the Sundarbans have particularly high levels of poverty. I found that 42.4% households lived below the lower poverty line in the study area, which varied a little from the estimate of the Bangladesh Bureau of Statistics that

around 48% people in the sub-districts adjacent to the Sundarbans lived below the poverty line (The Financial Express, 2010). This meant that, in order to survive, they were required to exploit the Sundarbans forest resources, for the most part unsustainably. The rate of poverty was very high in comparison to only 21.1% in the rural areas of Bangladesh according to the 2010 HIES survey (BBS, 2011a).

Others have had similar results. Based on the CBN method, Islam (2010) calculated poverty using the 2005 HIES survey data and found that the sub-districts surrounding the Sundarbans impact zone had much higher extreme poverty rates (0.42) compared to other sub-districts in Bangladesh. Part of the reason for this poverty is that people surrounding the forest have limited access to non-forest forms of income. Globally, high levels of poverty and a high dependence on forests for livelihoods in areas of high forest cover are closely associated (Sunderlin et al., 2008).

The Gini coefficient for per capita total income was 0.38, which was similar to the upper level calculated for coastal parts of the Sundarbans impact zone by Islam (2010) who derived estimates of 0.19 to 0.36. This was lower than the national figure for rural areas in 2010 (0.43) (BBS, 2011a) and lower than the figure calculated by Islam (2010) for the Sundarbans area as a whole (0.42). So, while the Sundarbans area overall was characterised by severe inequality in income, the communities on the edge of the Sundarbans had a more equitable distribution of income. However, given it was the poorest who gathered forest products, restricting people's access to those resources would have substantial effects on livelihood security and would increase income inequality.

The finding that a reliance on forest income was associated with greater income equality is consistent with other studies. Forest income was found to reduce inequality (Gini coefficient) by 15.5% in Ethiopia (Yemiru et al., 2010) and Cavendish (2000) reported a 30% reduction in income inequality due to the inclusion of forest resources in household surveys in Zimbabwe. Das (2010) found that forest income after joint forest management reduced measured inequality by 12% in the involved households in India. In a World Bank meta-study (Vedeld et al., 2004), the average increase in the Gini coefficient when forest income was excluded was 0.13 (from 0.36 to 0.49). The inclusion of forest product income in total household income considerably reduced inequality between households from 0.61 to 0.23 (Anderson et al., 2006). However, while in the Sundarbans, and possibly elsewhere, the inclusion of forest products in total income might lead to lower Gini coefficient estimates, the greater levels of poverty in forest-dependent communities suggests that the Gini coefficient may also be low because a greater proportion of the population are very poor and even the wealthier members of the community are not exceptionally rich.

5.4.4 Vulnerabilities Associated with Resource Collections

The main vulnerabilities identified include dependency on moneylenders for livelihood activities regarding the collection of a variety of mangrove products, illegal activity, bribery and criminal cases associated with resource collections. The impact of seasonality, namely, the seasonal fluctuation of resources, and the risks and shocks associated with attacks from pirates and wildlife during mangrove resource collection activities led to negative outcomes for mangrove-based livelihoods.

I found that dependence on moneylenders for mangrove resource collections led to both positive and negative outcomes. Due to issues relating to procedural complexities, the money required to complete the permit process and the need for financial support to buy boats and nets, the role of the moneylenders facilitated resource collection for lower income households. Lending patterns in the interlocking transactions between the resource harvesters and moneylenders played a big part in limiting the profits for the actual harvesters and forcing them to collect resources under the control of the moneylenders. Therefore, the relationship between the moneylenders and resource collectors might be considered as part of the complicated survival processes, and this relationship would be very difficult to change.

This is consistent with Islam (2010) who found that the economy in the Sundarbans was based on informal credit arrangements between resource collectors and moneylenders where more than 95 percent of the working capital of Sundarbans resource collectors was derived from moneylenders and only 4 percent was derived from NGOs. Poor households throughout Bangladesh resorted to moneylenders for funds due to the unavailability of seasonal working capital from microfinance institutions and tight repayment schedules, which in turn increased the demand for moneylenders (Mallick, 2009). In Vietnam, Ruddle (2011) demonstrated that moneylenders were generous with their clients and the stereotypical negative image of the informal credit role played by moneylenders was not always justified. Gehlich-Shillabeer (2008) reported that nearly 60 percent of the respondents interviewed in her study in Bangladesh relied on one or more moneylender for emergency purposes throughout the year. According to Davis (2006), the extortionist interest rates

charged by traditional informal credit sources can be seen in most moneylender practices which they justify as a necessary precaution to mediate their risk. These traditional lending facilities in rural areas place individuals and families in a subordinate social relationship with the moneylender (Ellis, 2000a).

The trade-off between survival, conservation and sustainable management, and between the local communities and forest officials, forced many poor people in the study area to violate laws and thus criminalised their livelihoods. The victims of forest criminal cases incurred a huge financial burden relative to their income due to the money spent on lawyers, Forest Department officials and for other administrative and travel purposes. Resource collectors were sometimes arrested, or their nets and boats confiscated in case of shrimp fry collections, leading to the loss of assets following which they fall into further poverty and making them even more dependent on forest resources. With no other options available, the resource collectors who had been penalised under the law were forced to take out loans from the moneylenders so they could return to their livelihoods. The financial liability caused by forest criminal charges had a negative impact on livelihoods and made them more dependent on moneylenders. In that situation, they not only had to gather enough resources for themselves but also enough to pay the moneylenders. It created a vicious cycle.

Shocks including being attacked or paying ransoms to pirates increased the vulnerability context of the study area. Shocks due to pirates were recurrent and continued for longer periods in the Sundarbans. Shock is the outcome of risk or risk-response interaction causing the loss of livelihoods (Alwang et al., 2001), the loss of household income, a reduction in consumption and/or the loss of productive assets

(Dercon et al., 2005). The payment of rent to pirates also significantly increased the cost of resource collection operations. Paying ransom money or coping with the theft or destruction of key productive assets compelled families to sell key household assets or borrow from moneylenders. In the case of paying ransoms to pirates, their family members were freed but the family was in debt for the rest of their lives. According to Mendoza (2009), recurrent and longer-lasting shocks provide little prospect for the household to rebuild its assets.

Shocks including being attacked or killed by a tiger or crocodile had significant impacts on livelihoods and wellbeing in the study area. Human-wildlife conflict could ruin a household's future should the household head be injured or killed. More than 1,000 women were reported to have lost their husbands in tiger attacks in the Sundarbans (Kazim, 2011). Like Chowdhury et al. (2008) in India, I found that widows in the Sundarbans were among the most disadvantaged members of the community. Commonly referred to as "tiger widows", these women were symbols of misfortune in their villages and in their in-laws' homes (Islam and Chuenpagdee, 2013) (Figure 5.4). Associated vulnerabilities such as the cessation of the education of the wildlife victim's children further marginalised the families, who inevitably turned to the forests and faced again the vulnerabilities associated with livelihoods dependent on forest resource collection.



Figure 5.4: A) Bengal Tiger; B) House of a tiger widow; C) Entering deep into the forest to collect resources; D) Tiger widows in the Indian part of the Sundarbans (Sources: Photo A from NGO Prodipon Bangladesh; Photos B and C from <http://abcnews.go.com/blogs/headlines/2012/02/tiger-widows-life-in-the-sundarbans/> accessed 12 January, 2013; Photo D from <http://www.tigerwidows.org/> accessed 12 January, 2013)

Seasonality in resource availability can situate the households in the vulnerability context. In addition, natural fluctuations in catch such as unexpectedly poor catches or harvest failure in a single peak resource collection period were a serious blow to the income of the fishing households. The shock was severe when poor harvests were recurrent for more than one peak period and the resource collectors were forced to discontinue due to bad weather or tidal surges in the monsoon season. Islam (2010) found that on average there were usually five peak months when all Sundarbans forest products were collected together and shortages of resources lasted on average for 3.7 months. These attributes of seasonality led to a lack of income during lean periods and compelled the resource collectors to take loans from the moneylenders despite the lending being exploitative in nature.

While the harvesting of Sundarbans forest resources was relatively high among the lower income households, they failed to accumulate savings from the higher forest cash income. This was likely to be because so much of their income was spent offsetting the vulnerabilities they faced during resource collection. All these vulnerabilities in the resource extraction process contributed to self-reported causes of declining household livelihood security. This meant resource collection was a poverty trap for many lower income households, leading to a state of perpetual debt to moneylenders among the resource collectors due to a reasonably large number of vulnerabilities. Carter and Barrett (cited in Carter et al., 2007:837) defined a poverty trap as:

... a critical minimum asset threshold, below which families are unable to successfully educate their children, build up their productive assets, and move ahead economically over time. Below the threshold lie those who are ruined, who can do no better than hang on and who are offered no viable prospects for economic advance over time.

A high dependence on mangrove forest resources was indicative of the vulnerability of these households due to their low resilience to even the smallest shock. Therefore, understanding and addressing these vulnerabilities are very useful considerations for poverty reduction efforts in the Sundarbans regions. Further restrictions on access to the Sundarbans forest resources are likely to have the greatest effect on the poorest members of the communities living nearby.

5.5 Conclusion

On the basis of the evidence presented in this chapter, I conclude that, from a livelihoods perspective, the role of natural capital in the study area was highly important. All the surveyed households showed a significant dependence on

mangrove resources from the Sundarbans, with lower and middle income households being particularly dependent. The lowest income households had neither land nor livestock for generating income, making them highly dependent on the forest resources for survival. This also meant that the failure to include forest resources in poverty surveys will exaggerate income inequalities and poverty.

This dependency had become a motive for illegal activities and over-exploitation of the Sundarbans forest resources often resulting in the criminalisation of livelihoods. This study found that mangrove dependent communities were vulnerable due to the seasonality of access to resources, the unpredictable catch, the dependency on moneylenders for financial support and access to the resources due to the complex regulatory system, the risky resource collection operations as a result of piracy, rents sought by government officials, and the possibility of arrest and attacks by wildlife. The ability of the lower income households who depended more on forest resources to deal with these risks was limited. In the next chapter, I examine the livelihood options, opportunities and vulnerabilities associated with shrimp farming in the Sundarbans.

Chapter 6: Shrimp Aquaculture – The Challenge for Sustainable Livelihoods



Chapter 6: Shrimp Aquaculture – The Challenge for Sustainable Livelihoods

6.1 Introduction

Worldwide, more than 500 million people depend, directly or indirectly, on fisheries and aquaculture for their livelihoods (Vadacchino et al., 2011). In Bangladesh, fisheries were found to contribute 3% to GDP, 6% to export earnings and 63% of animal protein intake, and brackish water aquaculture contributed about 39% of total fish production (Murshed-E-Jahan and Pemsl, 2011). In the research presented in Chapter 4, I found that livelihood strategies in the Sundarbans eco-region were driven by shrimp aquaculture and forest resource collections. Moreover, I observed that shrimp aquaculture was a potentially important livelihood strategy compared to other livelihood activities of communities in the Mongla District surrounding the Sundarbans Reserved Forest.

Shrimp cultivation has expanded throughout the coastal belt of Bangladesh. The term “blue revolution” was used by Deb (1998) to refer to the rapid expansion of shrimp culture activities in coastal areas. This has mainly consisted of shrimp two species: *Penaeus monodon* (black tiger shrimp; local name, Bagda) and *Macrobrachium rosenbergii* (freshwater prawn; local name, Golda).

Commercial shrimp in Bangladesh is locally known as “white gold” (in Bengali, “*sada sorno*”) because of its high transnational value (Islam, 2009). The area under shrimp aquaculture comprised 20,000 ha in 1980, growing rapidly to approximately

217,877 ha in 2007/08 (DOF, 2009). In the past decade, the exports of shrimp, counting both species, rose to 51,599 tonnes in 2009-10 from 28,514 tonnes in 1999-2000 (Parvez, 2011a). The sector fetched \$625 million in exports in 2010-11 (Parvez, 2011b) and became the second largest foreign exchange earner after readymade garments. USAID (2006) estimated that nearly 1.2 million people were directly involved in shrimp production; with an additional 4.8 million household members supported by the industry, of whom more than ninety percent were fry collectors and shrimp farm workers. The rest were involved in processing industries and shrimp hatcheries (Pokrant and Reeves, 2003). The adoption of shrimp farming has also led to the establishment of other industries which are related to the shrimp such as pharmaceuticals, hatcheries, processing plants, feed sellers and ice factories.

In Bangladesh, the majority of the shrimp farming takes place in Khulna, Satkhira and Bagerhat Districts surrounding the Sundarbans mangrove forest. According to statistics collected from the Divisional Fishery Office in Khulna, the area of shrimp farms in these three districts was about 180,000 ha in 2010. Of this total area, the brackish water aquaculture of *P. monodon* took place on 142,461 hectares of land and the aquaculture of *M. rosenbergii* took place on 37,351 hectares of land. The expansion had been dramatic, and since 1990 shrimp cultivation had taken more than 77 percent of the region's agricultural land in these three districts surrounding the Sundarbans (Hossain, 2011). In the study sub-district, Mongla, *Penaeus monodon* took place on 10860 hectares of land and *M. rosenbergii* on 278 hectares of land (Mongla Sub-District Fishery Office, 2010). However, in the six study villages in Mongla Sub-District there was no *M. rosenbergii* cultivation due to the high salinity of the water.

Most of the literature related to shrimp aquaculture in Bangladesh highlights the policy, legal and institutional issues along with the social and environmental impacts. Some research has pointed to the environmental impacts such as the loss of mangrove areas and biodiversity due to the unabated expansion of shrimp culture (Hoq et al., 2001; Hoq, 2007; Hossain et al., 2013; Shahid and Islam, 2003), loss of agro-biodiversity and soil fertility due to increasing salinity (Ali, 2006; Chowdhury et al., 2011; Rahman et al., 2011a; Rahman et al., 2013a; Wahab, 2003), loss of livestock (EJF, 2004; Karim, 2006), changes in land use pattern (Ali, 2006; Azad et al., 2009), and deficit ecological footprint and reduced bio-capacity (Bala and Hossain, 2010). The research on the social and economic impacts of shrimp aquaculture has highlighted the increased employment opportunities and number of earners in households (Pokrant and Reeves, 2003), loss of land security (Hossain et al., 2013), greater earning opportunities for women (Islam 2008a; USAID, 2006; Gammage et al., 2006), violence against women and the landless (Halim, 2004), decline in access to sharecropping opportunities (Ito, 2002; Samarakoon, 2004), and exacerbation of existing unequal gender and class relations (Ahmed, 1996; Datta, 2001; Halim, 2001). However, there is a dearth of information on the contribution of shrimp farming in comparison to other economic activities and the outcomes of shrimp farming in overall livelihoods among households of different socio-economic backgrounds situated at the periphery of the Sundarbans.

In Chapter 2, I discussed that according to the DFID sustainable livelihoods framework, vulnerability is considered both a “context” (e.g., shocks, trends, seasonality) and a “livelihood outcome” (Alwang et al., 2001). Livelihoods can be made more or less vulnerable by long-term trends with not all trends being negative

or causing increased vulnerability (DFID, 2000). Trends such as decreasing catch rates, increasing prices for fish, and factors unrelated to fisheries that nevertheless impact on fishing households, such as rising costs of food staples or medicines, make poor households in a fishing community more vulnerable (Allison and Horemans, 2006). In line with this discussion, the long-term trends caused by shrimp aquaculture need to be identified in order to examine their positive and negative outcomes on livelihoods. From this perspective, the socio-economic impacts caused by shrimp farming over the last two decade in the study area were defined as causes of vulnerability.

The objective was to understand the contribution of shrimp-based income within the overall household income portfolios among different income groups and to identify the socio-economic factors necessary to engage in shrimp farming from the livelihood perspective, as well as the nature and extent of the vulnerabilities that have been created by this sector in the six villages on the periphery of the Sundarbans in Mongla Sub-District (details provided in Chapter 2). The main research question addressed in this chapter is the importance of shrimp aquaculture in shaping livelihood structure (Chapter 1). This chapter covers the following research questions in order to address the main research question and fulfil the objective of the chapter:

- 1) To what extent do different income groups depend on shrimp?
- 2) What socio-economic characteristics of households influence the shrimp income?
- 3) Does shrimp income promote income inequality in the study area?
- 4) What are the vulnerabilities associated with shrimp aquaculture?

In presenting the examination of these issues, this chapter first describes the shrimp culture practices in the study area, shrimp ownership status among households, production costs, yield and profit from shrimp farming, income comparisons between shrimp and other sources among households of different income groups, the socio-economic factors of households such as the amount of land and number of livestock that influence shrimp income, and consideration of income equality caused by shrimp aquaculture. Vulnerabilities defined as the negative outcomes of long-term trends caused by shrimp farming on local livelihoods are described in the second part of the chapter. In the subsequent discussion, I compare the results with other studies in Bangladesh and other settings, emphasising the positive and negative outcomes of shrimp aquaculture for livelihoods.

6.2 Methods

This study was based on income estimated from a survey on economic activities (see Chapter 3 for a detailed discussion of the methods). Data were collected through household surveys between September 2009 and August 2010 on all types of household income, both subsistence and in cash (Chapter 3). Household consumptions of self-produced crops, livestock, forestry, homestead pond fishery and shrimp products were included as part of income. The income from production activities was described in detail in Chapter 2. Households were divided into three income terciles based on their total annual income in order to compare incomes from shrimp and other sources; the three categories were “lower income”, “middle income” and “higher income” of the same size (N=88 each). The mean total incomes between groups were found to be significantly different (US\$573, US\$1,114 and

US\$4,606, respectively; ANOVA P<0.001). I used ANOVA to compare incomes among the different income groups and examine significant differences in the variables, while OLS multiple regressions were used to build models of the household characteristics associated with shrimp income earnings using SPSS 18.0 software. Income inequality was measured using the Gini coefficient (Bellu and Liberati, 2006).

In addition to the questionnaire household survey, focus group discussions and key informant interviews were carried out, with a particular emphasis on any vulnerabilities that had been created due to shrimp farming activities (Chapter 3). I carried out two focus group discussions with shrimp and non-shrimp farmers, one focus group discussion with participants comprised of shrimp farm labourers, caretakers and a temporary depot owner. The focus group discussions explored the long-term impacts of shrimp aquaculture on agriculture, sharecropping, livestock, employment opportunities, changes in land use patterns, access to land, access to other environmental resources that created constraints or problems for livelihoods, and highlighted issues related to shrimp farming, shrimp aquaculture-related business, market supply chains and questions related to present shrimp management in addressing these impacts with options for better management. The key informant semi-structured interviews were held with Fisheries Department officials, local government elected representatives, other government officials, an NGO worker and the owner of a large shrimp farm on the same issues (details are provided in Appendix D, Part B on the questions, dates and places of focus group discussion, interviews, and other information about the participants). In addition to my personal observations of the shrimp aquaculture activities, secondary data were also collected

in relation to information such as the area under shrimp aquaculture from the Mongla Sub-District and Khulna Divisional Office of the Fisheries Department.

6.3 Results

6.3.1 Shrimp Culture Practices in the Study Area

At the time of this study, the amount of agricultural land in Mongla Sub-District was 13,020 hectares. Of this land, 10,860 hectares had been converted into 3896 saline water shrimp farms according to the statistics of Mongla Sub-District Fisheries Office.

Shrimp farms (“gher”) are constructed in modified rice fields with high, broad peripheral dike systems (see Figure 6.1). The majority of shrimp farms in the study area were small-scale enterprises; much of the development had been unplanned and unregulated, carried out by the farmers themselves with limited knowledge and resources. Farmers in the study area practised shrimp aquaculture from February/March to September. Increased water salinity created good conditions for shrimp cultivation. Usually the shrimp farms were connected to estuaries and canals through channels and sluice gates enabling the farmers to manage the flow of saline water during the highest tide in the full moon or new moon. However, this level of salinity was not suitable for plants including paddy or vegetables.



Figure 6.1: Rice land converted into shrimp farms and rice cultivation in the elevated land in Bururia Village in Mongla Sub-District

The shrimp farms varied in size, from a few acres to over 30 acres and were normally fed by the tide, but the smaller farms with higher elevation were sometimes pump fed. The farmers followed an extensive system in which between 1,000 and 1,200 post larvae per acre stocked depending on the size of the farm and the availability of saline water. Despite the high stocking rate, higher mortality occurred, leading to significantly lower shrimp production (Alam et al., 2007; Islam et al., 2005).

The shrimp fry either from wild sources or hatcheries are released into the farms at high tide and trapped inside the farms by bamboo barriers placed at points where the water enters and exits. Partial harvesting of marketable shrimp commences three months following the initial stocking with post-larvae, which was followed by cycles of partial stocking and harvesting during the remaining culture period.

During the inletting of saline water into the shrimp farms, heterogeneous natural fry from wild shrimp and other fin fish were deliberately allowed to enter with the tidal water. These species are naturally grown and are the by-products of the farmed shrimp, and are also in heavy demand in the market (Figure 6.2). With the help of a Fisheries Extension Officer, after the heavy rainfall in the wet season (July/August), the shrimp farmers released the fin fish of freshwater carp, mainly Tilapia, in their farms as the salinity level was reduced at that time. According to the Senior Sub-District Fisheries Officer (KII#SFOM), this strategy had been generally adopted by the shrimp farmers as a way of coping against the loss of shrimp income due to disease and adverse weather.

The farmed shrimp were harvested along with naturally grown wild shrimp in the middle of September. Before completing the harvesting period, left-over naturally grown and cultured fin fish were usually harvested in late October/early November. After the shrimp farming season, most of the shrimp farms remained vacant, naturally drying out till the next season and were not used for rice cultivation. However, a few farmers cultivated transplanted “aman” (wet season rice)_paddy in the elevated parts of the shrimp farms during the October-January period (see Figure 6.1 above).



Figure 6.2: (A) Farmed shrimp and (B) fin fish caught from the shrimp farm; (C) Shrimp being processed in the depot in order to supply to shrimp processing factories (October, 2009)

The farmers preferred to sell high value farmed shrimp to the local shrimp depot where the price depended on the size of the shrimp commonly known as grade for export. The depot owners processed the farmed shrimp and sent it to processing factories for export. Wild shrimp, fin fish and carp fish were also sold to local depots while keeping some for subsistence use of households which contributed to family nutrition. The local depot owners also bought and processed wild shrimp, fin fish and carp fish and sent those to Dhaka and Khulna City for local consumption.

6.3.2 Shrimp Farm Ownership Status among Households

The results from the household survey, as shown in Table 6.1, demonstrated that 81 lower income households (92% of all the households in that category) did not own any shrimp farms, and 30 middle income households and 9 higher income households also did not own any shrimp farms. Among the different income households, only 7 lower income households (8% of all the households in that category) owned shrimp farms in comparison to 56 (65%) and 77 (88%) of middle

and higher income households. Households described as having “no possession” had lost ownership of their shrimp farms either permanently or temporarily due to land-related conflicts (described in detail in Section 6.3.7.3). Four households (2 each in the middle and higher income household categories) had lost possession of shrimp farms.

Table 6.1: Shrimp farm ownership status of households (N) in six villages in Mongla Sub-District

| Ownership | Income Tercile | | |
|--------------------|-----------------------|---------------|---------------|
| | Lower | Middle | Higher |
| No shrimp farm | 81 | 30 | 9 |
| No possession | - | 2 | 2 |
| Owned shrimp farms | 7 | 56 | 77 |

Among the types of ownership and operation of the shrimp farms, single ownership was observed to be the most common in the study area (Table 6.2). Among the higher and middle income households, 59 and 48 households, respectively, owned and managed their farms by themselves. Joint ownership was a system of multiple ownership in which the owners usually provided land or capital, and the farms were managed by an owner or by a caretaker/manager on behalf of the owner. This form of ownership was found to be higher in higher income households (9 HH) than in middle income households (7 HH) and lower income households (1 HH). Single with joint ownership was the third category of ownership, whereby households owned at least two farms; one was owned and managed by themselves and another one was managed with multiple owners. Nine higher income households had their own farms and, in addition, they had established joint ownership with other farmers in order to maximise earning opportunities.

Table 6.2: Category of ownership (N) among shrimp farming households in six villages in Mongla Sub-District

| Category of Ownership | Income Tercile | | |
|------------------------------|-----------------------|---------------|---------------|
| | Lower | Middle | Higher |
| Single | 6 | 48 | 59 |
| Joint | 1 | 7 | 9 |
| Single + Joint | - | 1 | 9 |

In regard to the land used for shrimp farms, out of 77 higher income households who had shrimp farms, 36 households had converted their own land into shrimp farms, while 32 households used leased land with owned land to establish their shrimp farms (Table 6.3). The establishment of shrimp farms on partly-owned and partly-leased land was found to be highest in higher income households (32 HH) followed by middle income households (24 HH). Landless households would have the opportunity to establish farms by leasing land. This study found that 12 middle and 9 higher income households had established shrimp farms by leasing land from other households with the payment of annual rental fees.

Table 6.3: Land used by shrimp farm-owning households (N) in six villages in Mongla Sub-District

| Land Used | Income Tercile | | |
|---------------------|-----------------------|---------------|---------------|
| | Lower | Middle | Higher |
| Owned land | 1 | 20 | 36 |
| Owned & leased land | 5 | 24 | 32 |
| Only leased land | 1 | 12 | 9 |

6.3.3 Production Cost, Yield and Net Return from Shrimp Farming

The survey results, as presented in Table 6.4, showed that the estimated cost of production of shrimp and associated fish by-products in the study area was US\$313 (Tk21,563) per hectare per season (with the average duration of shrimp farming being around eight (8) months per season). A large portion of cost was related to buying shrimp fry (either from a hatchery or collected wild from the Sundarbans waters), and paying the salaries of guards or caretakers/managers. The job of the guard was to protect the shrimp from being stolen by others during the night, whereas the caretaker/manager managed the overall operations of the shrimp farm. Other costs involved were dike maintenance and farm preparation before starting the shrimp cultivation. Shrimp farmers used an extensive system whereby usually no extra food or nourishment was provided to the fry, although some large owners provided artificial feed for the shrimp. The one-off farm reconstruction costs which were incurred at the time of converting the agricultural land to the shrimp farms were not included in these estimations of the cost. Traditional shrimp farming methods have been found in other studies to incur estimated costs of almost Tk30,000-Tk60,500 per hectare per year (USAID, 2006; Gammage et al., 2006), and Islam et al. (2005) calculated an average cost of Tk32,600 per hectare per year; these figures are very similar to the results of this study and thus support my findings.

In the study area, the mean yield of farmed shrimp (*Penaeus monodon*) was found to be 98 kg/ha per season (an average of eight months in each season) which accounted for 45% (98 kg/ha) of the total yield of 216 kg/ha. Wild shrimp and fin fish accounted for 17% (36 kg/ha) and 38% (82 kg/ ha) of the total yield, respectively (Table 6.4). Compared to other studies, the farmed shrimp in the study area showed

low productivity. Alam et al. (2007) reported that the shrimp farmers in their study achieved a variable yield ranging from 7.48 kg/ha to 455.03 kg/ha, with a mean yield of 146.39 kg/ha, through multi-stock and multi-harvest methods where 44% of the yield came from farmed shrimp (*Penaeus monodon*) while the rest (23% and 33%) came from wild shrimp and fin fish, respectively, in a year-round shrimp farm. In the extensive-traditional method, the yield of farmed shrimp can be as low as 150-250 kg/ha (Islam et al., 2005). Nuruzzaman et al. (2001) reported yields of shrimp from 189 kg/ha per year to 122 kg/ha per year in Khulna District, and between 221 kg/ha per year to 74 kg/ha per year in Bagerhat District, which were quite similar to the results presented herein.

Table 6.4: Per hectare production, cost and net profit from shrimp farming in Mongla Sub-District (Mean±SD)

| | Production (Kg) | Cost (US\$) | Net Profit (US\$) |
|----------------------------|------------------------|--------------------|--------------------------|
| Farmed shrimp ¹ | 98±13.8 | 295±53 | 203±75 |
| Fin ² fish | 82±18 | 18±11 | 102±21 |
| Wild shrimp ³ | 36±13 | - | 63±22 |
| Total | 216±29 | 313±54 | 367±84 |

1: Farmed shrimp means shrimp cultured in shrimp farms; local name Bagda (*Penaeus monodon*)

2: Fin fish grew naturally in the shrimp farm as by-products. Common fin fish species were Vetki (*Lates calcarifer*); Parsa (*Mugil parsia*); Guilla/nuna tengra (*Mystus gulio*); Carp fin fish tilapia (*Oreochromis nilotica*)

3. Wild shrimp grew naturally in the shrimp farms as by-products. The common species were Horina (*Metapenaeus monocero*); Hanny (*Metapenaeus lysianassa*); Chaga chingri (*Penaeus Indicus*); Chamma Chingri (*Metapenaeus brevicornis*)

In the study area, the mean net profit from shrimp farming was found to be US\$367 (Tk25,279) per hectare. The results showed that farmed shrimp contributed more than 55% of the total profit from shrimp farming per hectare. Fin and carp fish were found to be responsible for nearly 28% of the net profit, while wild shrimp contributed 17% of the net profit. Islam et al. (2005) found that net returns were between Tk25,000–37,000 per hectare in small and medium sized (1-10 ha) shrimp

farms in the Khulna region. Rahman et al. (2002) recorded an annual income from shrimp farming of Tk40,200 per hectare which was higher than the present findings. In other studies, average returns were found to range from Tk5,000 and Tk57,500 (USAID, 2006) and from Tk14,500 to 44,500 per hectare per year (Gammage et al. 2006).

6.3.4 Income from Shrimp Sources in Comparison to Other Income Sources

Drawing on the results presented in Chapter 6, the income across different sources was compared with the shrimp income. The average total annual income (reference period September 2009 to August 2010) was estimated at US\$573 for the lower income households in the study area, US\$1,114 for the middle income group and US\$4,606 for the higher income households. All sources of income showed significant differences among the groups (Table 6.5). The lower income households depended most on the forest (74%) and non-farm sources (13%). For the middle income group, the forest income was also the most important source of income, contributing 48% to the total household income followed by shrimp aquaculture (26%) and non-farm income (19%). Of particular importance for the higher income households was the income from the forest (23%) as well as non-farm income (26%), with the highest portion of income from shrimp farming (46%). Other livestock, agriculture and homestead pond fisheries were not important activities for livelihoods as they accounted on average only 1-3% of the total income for all three income groups. In the case of lower income households, shrimp farming accounted for only 8% of income, most of which was largely contributed by the selling of labour (4%) to the shrimp farms.

Table 6. 5: Annual net income sources and amounts for three income groups in six villages on the edge of the Sundarbans, Mongla Sub-District

| Source | Income Tercile | | | | | | F-value | P-value | | |
|---------------------------------------|------------------|------------------|--------------------|------|------------------|------|---------|---------|--|--|
| | Lower | | Middle | | Higher | | | | | |
| | Mean | % | Mean | % | Mean | % | | | | |
| Income (US\$) | | | | | | | | | | |
| Non-farm | 63 ^a | 12.7 | 224 ^a | 18.7 | 1283 | 25.7 | 25.05 | <0.001 | | |
| Livestock | 8 ^a | 1.3 | 37 ^{ab} | 3.0 | 65 ^b | 1.6 | 8.74 | <0.001 | | |
| Crop agriculture | 10 | 1.9 | 27 | 2.4 | 58 | 1.6 | 46.10 | <0.001 | | |
| Homestead pond fisheries ¹ | 15 | 2.7 | 30 | 2.7 | 76 | 2.0 | 53.70 | <0.001 | | |
| Forest | 434 ^a | 73.6 | 514 ^{ab} | 47.6 | 757 ^b | 23.2 | 5.39 | <0.05 | | |
| Shrimp fry ² | 194 ^a | 33.8 | 232 ^{ab} | 21.6 | 334 ^b | 11.5 | 4.91 | <0.01 | | |
| Other forest products | 240 | 39.8 | 282 | 26 | 423 | 11.7 | 3.03 | NS | | |
| Shrimp | 44 ^a | 7.8 | 283 ^a | 25.6 | 2367 | 45.9 | 46.32 | <0.001 | | |
| Farmed shrimp | 9.6 ^a | 1.6 ¹ | 124.8 ^a | 11.4 | 1191 | 22.3 | 38.62 | <0.001 | | |
| Fin fish | 5.7 ^a | 0.9 ¹ | 74.5 ^a | 6.7 | 557 | 10.8 | 36.60 | <0.001 | | |
| Wild shrimp | 3 ^a | 0.5 ¹ | 40.7 ^a | 3.7 | 403 | 7.9 | 41.80 | <0.001 | | |
| Labour | 24 | 4.4 | 9.5 ^a | 0.9 | 0 ^a | 0 | 8.38 | <0.001 | | |
| Business | 2 ^a | 0.4 | 33 ^a | 2.9 | 216 | 4.9 | 4.93 | <0.01 | | |
| Total | 573 ^a | 100 | 1114 ^a | 100 | 4606 | 100 | 96.95 | <0.001 | | |

Bonferroni's test: means followed by a common superscripted letter implies the mean difference is not significant at 5% level. NS= level of significance is 5%;

1. Homestead pond fisheries are usually fisheries traditionally done in the pond of the homestead. Generally, the homestead pond is used for household and domestic purposes and carp fish are also cultured in this pond. The income from homestead pond fisheries was calculated separately in order to get a clear picture of the contribution of shrimp income to the household livelihoods.

2. Shrimp fry consists of both bagda fry (*Penaeus monodon*) and golda fry (*Macrobrachium rosenbergii*).

The results reported above in Table 6.5 also showed the income gained by the households by trading shrimp. The higher income households earned nearly 5% of their total income from shrimp-related businesses, followed by middle income households (3% of total income). This supported the observation that higher and middle income households were increasingly engaging in shrimp trading through permanent and temporary depots along with their primary shrimp farming activities (Figure 6.3).



Figure 6.3: Permanent and temporary shrimp depots in the study area

Of the different products from the mangrove forest, shrimp fry contributed as much as 34%, 22% and 12% to the total income of the lower, middle and higher income households. However, if income from shrimp fry was considered within shrimp income, then shrimp income contributed 42% of the total income for the lower income households compared to 47% and 51% of the total income of the middle and higher income households. My personal observation was that lower income households and some middle income households actively collected shrimp fry.

However, the middle and higher households operated as primary and secondary traders who distributed shrimp fry from the primary collection points to the shrimp farms situated inside or outside the impact zone of the Sundarbans in one, two or three stages. The cost and benefit analysis by Thomas et al. (2001) showed that shrimp production, together with shrimp fry collection and fry and shrimp businesses, contributed 60% of the total household incomes in the shrimp producing areas in Bangladesh.

Shrimp is an important source of cash income among the households in the study. Per capita income and per capita cash income from shrimp were nearly the same (Table 6.6) Households pursuing higher return shrimp sector activities earned more than 3 (middle income households) to 6 (higher income households) times the relative shrimp income (RSI) and relative cash shrimp income (RSCI) compared to the lower income households. I found that the shrimp-based activities were the most important sources of income contributing to 26% and 46% of household per capita income and per capita cash income for the middle and higher income households, respectively. Only 8% of the per capita income and per capita cash income of the lower income households was derived from the shrimp sector, which was a very low proportion in comparison to that of the higher income households.

Table 6.6: Total income and shrimp income per capita for three income groups in six villages on the edge of the Sundarbans, Mongla Sub-District

| Income (US\$) | Income Tercile | | | F-value | P-value |
|-----------------------------|------------------------|------------------------|---------------|----------------|------------------|
| | Lower | Middle | Higher | | |
| Total cash income | 128 ^a | 221 ^a | 1030 | 55.65 | <0.001 |
| Total shrimp cash income | 10 ^a | 56 ^a | 540 | 33.00 | <0.001 |
| Relative shrimp income | 0.078 | 0.256 | 0.456 | 51.21 | <0.001 |
| Relative shrimp cash income | 0.085 | 0.263 | 0.463 | 45.26 | <0.001 |
| Total shrimp income | 11 ^a | 62 ^a | 571 | 34.01 | <0.001 |
| Total income | 139^a | 242^a | 1089 | 57.87 | <0.001 |

Bonferroni's test: means followed by a common superscripted letter imply the mean difference is not significant at the 5% level; NS=level of significance is 5%.

6.3.5 Socio-Economic Factors Influencing Shrimp Income

I created a multiple regression model of relative shrimp income against the socio-economic variables of the households in order to find out the important household factors or variables that determined shrimp farming income (Table 6.7). In combination, nine socio-economic variables accounted for a significant 71% of the relative shrimp income, $R^2=0.71$, adjusted $R^2=.70$, $F=69.72$, $P<0.001$. The OLS model showed that shrimp land owned by the households was the single largest factor determining the income from this sector (unstandardised coefficient=0.152, $t=16.27$, $P<0.001$). Therefore, landholding had a large positive impact on a household's income opportunities from shrimp sector activities. The age and education status of the household head, amount of homestead land, number of livestock and value of mobile phone were not found to play any role at this stage of the analysis as these had non-significant relationships with shrimp income. The value of boats had a significant negative relationship, whereas the value of nets and livestock had a positive relationship with shrimp income.

Table 6.7: Influence of socio-economic factors on shrimp income in six villages on the edge of the Sundarbans, Mongla Sub-District (OLS regression, F=69.72, P<0.001, R²=0.71; Adj R²=0.70, N=264)

| | Coefficient | Std. Error | t | P |
|------------------------|-------------|------------|--------|-------|
| Constant | 0.068 | 0.127 | 0.535 | 0.593 |
| Age of HH | -0.006 | 0.032 | -0.192 | 0.848 |
| Education of HH (yrs) | -0.005 | 0.010 | -0.480 | 0.631 |
| Homestead land | 0.002 | 0.010 | 0.201 | 0.841 |
| Shrimp farm land | 0.152 | 0.009 | 16.274 | 0.000 |
| Value of boat | -0.008 | 0.002 | -3.747 | 0.000 |
| No. of large livestock | -0.023 | 0.016 | -1.477 | 0.141 |
| Value of mobile phone | -0.001 | 0.003 | -0.268 | 0.789 |
| Value of net | 0.007 | 0.003 | 2.448 | 0.015 |
| Value of livestock | 0.005 | 0.002 | 2.136 | 0.034 |

I tested the differences in the relative shrimp income and households' total income through an OLS model (Table 6.7). By analysing the relationship between relative forest income and other income sources (Table 6.8), I found that the OLS model with all four predictors produced R²=0.53, adjusted R²=0.52, F=74, P<0.001. I found a positive co-relationship between total income and relative shrimp income. As total income increased, there was a consistent increase in the variability of shrimp income dependence. I observed that the relative shrimp income had a significantly strong negative relationship (P<0.001) with non-farm income and forest income, but a significant positive relationship with livestock income. Therefore, the findings suggested that higher shrimp income reduced the need for forest income.

Table 6.8: Influence of non-forest income sources on relative shrimp income among households in six villages on the edge of the Sundarbans, Mongla Sub-District (OLS regression F=74, P<0.001, R²=0.53, Adj R²=0.52, N=264)

| | Coefficient | Std. Error | t | P |
|-----------------------------|--------------------|-------------------|----------|----------|
| Constant | -0.582 | 0.118 | -4.936 | 0.000 |
| Per capita total income | 0.107 | 0.012 | 9.285 | 0.000 |
| Per capita non-farm income | -0.026 | 0.003 | -9.808 | 0.000 |
| Per capita forest income | -0.022 | 0.003 | -7.895 | 0.000 |
| Per capita livestock income | 0.007 | 0.004 | 2.029 | 0.043 |

6.3.6 Shrimp and Income Inequality

The Gini coefficient per capita income was estimated to be 0.38. The Gini coefficients for the total income and income excluding every single income source indicated that the coefficient increased when forest income was excluded (0.52), whereas the lowest coefficient was calculated when shrimp farm income was excluded (0.28) (Table 6.9). The calculations showed that the addition of forest income to household income reduced the measured income inequality (from 0.52 to 0.38) by 27%. I found that the inclusion of shrimp income in the household income increased the measured income inequality (0.28 to 0.38) by 36% percent. These results suggested that shrimp culture greatly affected the lower income households by increasing income inequality in the study area.

Table 6.9: Levels of income inequality in six villages on the edge of the Sundarbans, Mongla Sub-District

| Income Inequality | Gini Coefficient |
|--|-------------------------|
| Total income | 0.38 |
| Without forest income | 0.52 |
| Without shrimp farm income | 0.28 |
| Without agriculture, livestock and homestead pond income | 0.39 |
| Without non-farm income | 0.37 |

In summary, shrimp income had positive impacts on the middle and higher income households who were involved in shrimp farming. The inequality result supported the conclusion that shrimp income was correlated with higher levels of inequality in the study area. As described in Chapter 4, inequality causes vulnerability. In the following section, I discuss the vulnerabilities caused by shrimp farming in the study area.

6.3.7 Livelihood Vulnerabilities Caused by Shrimp Aquaculture

The results indicated that the expansion of shrimp aquaculture was related to vulnerabilities in the study area. The identified vulnerabilities included the reduced number of livestock and livestock income, reduced crop-based income and sharecropping, reduced access to land and other environmental resources; each of which is discussed in the following sub-sections.

6.3.7.1 Reduced Number of Livestock and Livestock Income

The expansion of the shrimp sector had contributed to the loss of livestock and access to animal protein in the study area. This study found that the average number of cattle, buffalo, goat and poultry had sharply declined from 1975, before the period

of shrimp cultivation, to 2009 (Table 6.10). The average of 0.3 cattle per household in 2009 had decreased significantly compared with the average of 7.8 cattle per household in 1975. The surveyed households had the lowest number of livestock and poultry in 2009 compared to the numbers of livestock and poultry in 1975, 1985 and 1999.

Table 6.10: Effect of shrimp aquaculture on livestock in Mongla Sub-District

| | 1975^a | 1985^a | 1999^a | 2009^b |
|--|-------------------------|-------------------------|-------------------------|-------------------------|
| Average number of cattle | 7.76 | 4.32 | 1.43 | 0.31 |
| Average number of buffalo | 1.03 | 0.81 | 0.41 | 0.38 |
| Average number of goat | 2.44 | 1.71 | 0.55 | 0.95 |
| Average number of poultry | 38.86 | 26.20 | 14.16 | 8.70 |
| Gross income ^c livestock (Tk) | 3890 | 2325 | 1794 | 2513 |

a. Shah and Karim (2001)

b. This thesis

c. Income is absolute and does not consider inflation over the period.

The participants of focus group discussions who were a combination of small shrimp farmers and landless non-shrimp farmers from Burburia and South Bashtola Villages (FGD#SNSFSU) and Joymony Ghol and Joymony Katakhali Villages (FGD#SNSFCU) identified that reduced sources of fodder and increased mortality rates of poultry were experienced due to the increase in shrimp farming. The paddy straw and the grass of the paddy fields were the main feed for cows, goats and buffaloes. Before shrimp farming, most of the agricultural land used to grow only one crop a year and remained vacant and used as common grazing lands for livestock for the rest of the year. The construction of ponds and dikes for shrimp farming had thus destroyed agricultural lands. In addition, shrimp farming had been illegally established on state-owned land and bank areas of the canals in the study villages where people had grazed their cattle. In a key informant interview, the Sub-District

Livestock Officer also stated that the livestock population had decreased due to decreasing grazing lands that had been converted into shrimp farms (KII#ULOM). The officer further stated that households were discouraged by neighbouring shrimp farm owners from keeping patio ducks since the ducks ate the shrimp larvae and feed. Therefore, the number of livestock had decreased in recent years and, as a result, the household income from livestock had declined (Table 6.10 above).

6.3.7.2 Reduced Crop-Based Agriculture, Sharecropping and Labour Contracts

In the past, like all other rural areas of Bangladesh, agriculture underpinned the economy and retained a central role in the livelihood systems in the study area. In Mongla Sub-District, shrimp cultivation had changed the land use pattern for crop-based agriculture. Out of a total of 13,020 hectares of cultivable agriculture land, nearly 11,138 hectares of land that had previously been used for crop-based agriculture purposes in the study area had been converted into shrimp farming (Mongla Sub-District Fisheries Report, 2010; Figure 6.4). This finding is consistent with results in the literature. Ali (2006) calculated that 79% of prime quality rice fields in two villages in Khulna District had been converted into shrimp farms during the period from 1985 to 2003.



Figure 6.4: Agricultural fields turned into shrimp farms in Burburia Village, pictured in the dry season (November 2009) and wet season (July 2010)

Local non-shrimp and small shrimp farmers in the focus group discussions (FGD#SNSFSU/CU) also revealed that rice production in the study area had fallen from 35-40 mounds (1 mound is equal to 37.34 kg) per acre to 5-7 mounds per acre following the expansion of shrimp aquaculture due to increasing soil and water salinity. They further stated that in the initial years of shrimp farming during the mid-1980s to early 1990s, farmers used to cultivate paddy in the same land immediately after the shrimp season ended but they gradually stopped this practice when the rice yield fell rapidly due to increasing salinity as the lands remained under saline water for nearly eight months of the year for shrimp farming. Participants of the focus group discussions also stated that paddy cultivation was now restricted to higher elevated land which was never used for shrimp farming and about 10-12 varieties of paddy (including Balam and Kartikshail) had already disappeared in the study area. Rahman et al. (2011a) found that, from 1975 to 2006, the number of indigenous rice varieties declined from seventeen to zero due to shrimp farming in coastal areas in Bangladesh. The land once produced surplus rice, vegetables and other crops. Vegetables and fruit trees had also significantly reduced in the area.

The results, as presented in Table 6.11, showed there had been a steady and sustained decrease in the income from rice and vegetables in Mongla Sub-District from 1975 to 2009. From 1985 to 2009, the rate of decline of agricultural income was faster than before. This study found that the gross absolute income from rice was Tk383 (US\$6), which had dropped nearly 3 times within the period from 1999 to 2009.

Table 6.11: Effects of shrimp culture on household agriculture income (Tk) in Mongla Sub-District

| | 1975^a | 1985^a | 1999^a | 2009^b |
|---|-------------------------|-------------------------|-------------------------|-------------------------|
| Gross income from rice | 21355 | 15234 | 1333 | 383 |
| Gross income ^c from vegetables | 1139 | 498 | 93 | 401 |

a. Shah and Karim (2001)

b. This thesis

c. Income is absolute and does not consider inflation over the period.

According to the focus group discussions with participants of Bururia and South Bashtola Villages (FGD#SNSFSU) and Joymony Ghol and Joymony Katakhali Villages (FGD#SNSFCU), sharecropping was one of the most pervasive forms of land tenure arrangement until shrimp farming was widely adopted in the early 1990s. Sharecropping had provided landless and marginal farmers with opportunities to participate in agricultural production before the shrimp culture began in the study area (FGD#SNSFSU/CU). Landless farmers could afford to access land through sharecropping and thus were able to engage in subsistence farming to ensure food security. The arrangements were such that generally a landowner and a sharecropping tenant each would receive one-third of the harvest, and the remaining one-third would be taken by the party that supplied the production inputs. Sharecropping became unattractive when the land lost fertility; repetitive shrimp farming in the last two decades had increased soil salinity and decreased productivity of the yield of rice, so that it was insufficient to meet the basic costs. The focus group participants further added that the mortgaging of land, another form of land tenure, though not common

in the study area had also existed in the past. In that arrangement, land was mortgaged for a certain period of normally 1-3 years. By the end of the period, the mortgagee had to repay the full amount of money borrowed in order to gain ownership of the land.

The practice of land leasing completely replaced sharecropping and the land mortgage system and became the most profitable, as the leasing arrangements usually covered a period of three to five years, with the leasing fee being paid annually (FGD#SNSFSU/CU). According to the participants in the focus group discussions, before the shrimp aquaculture came into this area, landless households could manoeuvre on lands belonging to others through sharecropping. This sharecropping helped them to achieve food security as the households could get plenty of rice to ensure survival for a period of one to two years. This was crucial for mitigating the inequality in the distribution of lands between the different heirs and co-villagers. They further added that rice farming was no longer the mainstay of the local economy and sharecropping opportunities no longer existed in the study area. In the past, people from other districts would come to assist them during the rice harvest. There was now a reverse flow of labourers seeking work outside the area. Many landless agricultural wage labourers who had been affected by shrimp farm development had moved into mangrove resource extraction activities. They caught shrimp fry to supply to the farms or went to the forest to collect other resources (FGD#SNSFSU/CU).

A focus group discussion with casual labourers and shrimp farm caretakers (FGD#CHCT) identified that the employment opportunities for lower income

landless households had generally decreased as the members of those households did not have any opportunities to work as wage labourers in the agricultural economy. The main agricultural labour market that operated in all areas in Bangladesh was centred on the wet season rice and dry season rice cultivation periods. As agriculture was replaced by shrimp aquaculture in the study area, this labour market centring on rice cultivation had ceased operating in the study area, causing surplus unemployed labour (KII#UAOM; CSU). Paddy fields require around 8-10 people throughout the year, whereas a large shrimp pond can be run by 1-2 staff (Swapan and Gavin, 2010). The Environmental Justice Foundation (EJF) (2004) estimated that employment from shrimp aquaculture for locals stood at just 40 workdays/ha/year in contrast to the labour demands for transplanting wet season rice which typically required 137 workdays/ha/year. In India, rice cultivation on 40 ha of land was found to require 50 labourers, but shrimp farming in the same area needed only five workers (Shiva, 1995). Based on these figures, the labour requirement of shrimp farming is around one-quarter of the labour required for traditional agricultural activities, meaning that about three-quarters of the agro-based labour force have been squeezed out of the market (Deb, 1998).

As revealed by the participants in the focus group discussions (FGD#CHCT), some jobs or new labour opportunities for the landless poor had been created by the shrimp sector in the study area; however, their opportunities were few in number and were largely informal (part-time, temporary or casual) and were offered without employment contracts. Such roles included casual labourers or part-time and temporary guards or caretakers at the shrimp farms. The wages for working as casual labour in the shrimp farms was very low, usually Tk70-90 (US\$1-1.30) for a half-

day's work, in comparison to other labour-based activities (KII#SFOM; FGD#CHCT). Guards or caretakers were employed by wealthy shrimp farmers in the study area for fixed terms with fixed salaries of Tk3,000-4,000 (US\$44-58) per month for periods of three to six months (FGD#CHCT). Swapan and Gavin (2010) found that the wage rate in shrimp farms was Tk50 (US\$0.72) for a half-day's work. Manju (1996) reported that the number of unemployed workers was high compared to the number of jobs in shrimp farming areas, and this had the effect of keeping the wage rate low.

The small shrimp farmers who participated in the focus group discussions (FGD#SNSFSU/CU) expressed their interest in going back into agriculture. They identified uncertainty in shrimp production (due to disease, salinity fluctuation and tidal surges created by cyclone) as the main reason for wanting to switch back to agriculture. They found shrimp to be a very sensitive crop as water temperature and salinity were important factors in the shrimp growth. They stated that heavy rainfall or continuous dry periods caused variations in the salinity level and induced the outbreak of disease, which ultimately limited the production of the shrimp.

In contrast, the owners of large shrimp farms stated that they did not want to go back into agriculture. In a key informant interview (KII#LSF), one large shrimp farmer from South Bashtola Village who was also a key leader of the Sub-District Shrimp Farmer Group claimed that agriculture would not be sustainable and profitable due to the salinity levels. He stated that increased salinity had destroyed soil fertility. He described the anti-saline water movement as a conspiracy by some local and

international NGOs to destroy the shrimp industry of the country even though it earns huge foreign exchange income through exports. He further maintained that:

The economy of the study area is dominated by the shrimp culture and associated business. People are better off now than before and can earn more income. People are getting more jobs due to shrimp farming. Otherwise they would destroy the forest [Sundarbans]. (KII, LSF, 11/06/2010, South Bashtola)

However in another key informant interview, one government officer (KII#UAOM) stated that returning to previous levels of crop production could be feasible and economically profitable if farmers grew saline-tolerant and high-yielding varieties of rice. However, resistance from the large shrimp owners who had the support of officials in the Fisheries Department was the main barrier to return to crop-based agriculture. He expressed this view in the interview as follows:

It is beyond doubt that nothing but shrimp culture is the main cause behind the increasing salinity and damaging the agriculture. Local farmers engaged in shrimp cultivation over the years are now losing interest in the business after having experienced huge loss due to viral infections of the fish. They want to go back to the agriculture. However the large land owners actually putting the barrier for agriculture. I even cannot raise the issue of declining agriculture for discussion in Upazila [Sub-District] Development Committee meeting as it is been dominated by the politically powerful representative of the local government who owned large shrimp farms or shrimp depot. Those who have challenged the local shrimp culture have usually ended up with more trouble and therefore keeping their mouth shut. (KII, UAOM, 18/08/2010; Sub-District Office Complex, Mongla)

Due to the expansion of shrimp aquaculture, the agricultural activities that had underpinned the local economy and played a central role in livelihood systems had been lost in the study area (Table 6.11; KII #UAOM; FGD#SNSFSU/CU);. Sharecropping, one of the most pervasive forms of land tenure, had also been lost (FGD#SNSFSU/CU). Lastly, the development of shrimp aquaculture had reduced the number of labour opportunities in the study area (KII#UAOM; CSU; FGD#CHCT).

6.3.7.3 Reduced Access to Land

Based on the focus group discussions, one case study and key informant interviews in Mongla Sub-District, I identified four main reasons for the occurrence of land conflicts related to shrimp farming in the study area. These conflicts had reduced many households' access to land, especially households in the lower income category. The reasons for the land conflicts were: 1) reduced access to government-owned land, 2) conflict relating to land leasing practices, 3) conflict between shrimp farmers over access to saline water, and 4) the impacts on land sale and leasing prices resulting from the expansion of shrimp farming. These land conflicts caused significant levels of social tension in the study area, and are discussed in detail in this section.

In Bangladesh, the lands of rivers and canals, the lands adjoining these wetlands and any land that is not owned by any person are recognised as “khas” land and are government-owned (KII#UNOM). These lands exist in government records but government authorities traditionally have not controlled these lands but rather allowed them to be utilised by the poorer section of the rural society for fishing purposes during the wet season and for grazing livestock and cultivating crops during the winter seasons as common access resources (KII#UNOM; CSU; CCU). In addition, government-owned lands except that of the rivers and canals were meant to be given over to the landless according to the Land Reforms Law of 1989 (KII #UNOM).

In the study area, government-owned lands except rivers and canals and their bank areas were leased to the shrimp farmers (KII#SFOM; UNOM). Local politically

powerful shrimp farmers used this advantage and occupied the river bank and canal areas adjoining their lands and converted that extra land into shrimp farms. In the study villages, the focus group participants (FGD#SNSFSU/CU) identified the canals and associated lands that were being opportunistically occupied by the powerful and large shrimp farmers. In Joymony Katakhali Village, two government canals amounting to 6 acres (2.4 ha) of land had been converted into shrimp farms by one large shrimp farmer (FGD#SNSFCU). In Burburia Village, 3 acres (1.2 ha) of narrow canal lands were occupied by shrimp farmers. In South Bashtola, another study village, 5 acres (2 ha) of land of two canals had been turned into shrimp farms by a large shrimp farm owner (FGD#SNSFSU). Turning these common access canals into the private property of large shrimp farmers had the effect of displacing poor fishermen from traditional subsistence-based fishing and caused livelihood insecurity (KII#CSU; FGD#SNSFSU/CU). Thus, land-poor people who had used government-owned land for their livelihoods for a long time had lost access to the land. The focus group participants alleged that government officials from the land administration or police did not take any action against the large shrimp farmers who occupied the government-owned land close to their shrimp enclosure; they speculated that this might be related to the bribe-seeking attitude of the government officials (FGD#SNSFSU/CU).

The second reason for the land conflicts arose from the land leasing activities. In the study area (as portrayed in the results presented above in Table 6.3), some shrimp farm owners leased land to expand their shrimp farming and used extra collateral assets to get a bank loan. A couple of years after getting a lease, some large shrimp farmers in the study villages had stopped paying lease money to the owner but

declined to return the leased land and forced the original land-owner land to sell the land at a very low price or forcibly occupied the land without paying any money. In the focus group discussions, local small shrimp and non-shrimp farmers (FGD#SNSFSU) stated that about 15 people had been forced to lease their land to one large shrimp farmer in Burburia Village and at least five people had been forced to lease land to local large shrimp farmers in South Bashtola Village. In both cases, the small farmers owned 1-3 acres (0.4-1.2 ha) of land adjoining existing shrimp farms and were forced to lease their lands. These small land-owners received Tk1000-1500 per acre based on production, much less than the market value for leases which was Tk4000-5000 per acre per year. If there was a bad yield, the lease provider did not get any rent money. The marginal or small farmers thus lost control of their leased-out land and were compelled to sell it at reduced prices to the wealthy shrimp farm owners, making them landless (FGD#SNSFSU/CU). In one focus group discussion, (FGD#SNSFCU) the participants reported that one large shrimp farmer forcefully occupied the lands of some minority people belonging to the lower caste Hindu religion and they had not been paid any lease money or any sort of compensation and the shrimp farm owner gradually grabbed the lands.

A third factor of concern in the focus group discussions with the small shrimp farmers (FGD#SNSFSU/CU) was the large shrimp farmers' control of water from the canal. They reported that conflicts had arisen between the small and large shrimp farmers in the study villages where the large shrimp farmers had exerted this control. The large shrimp farm owners built temporary embankments/dykes within the canal that brought saline water from the river in order to ensure the steady flow of saline water to their shrimp enclosures. This reduced the flow of water to other farms and

also disrupted the navigation of the canal. This problem was caused by the unplanned, random construction of shrimp farms without proper peripheral drainage and without open interconnecting canals around the farms and the resultant lack of water passing in the canals between the farms. As a result, the small shrimp farms situated in a pocket or behind a large shrimp farm did not have direct access to the canals. They lost access to the tidal saline water and thus failed to properly farm their land, causing financial loss.

A fourth factor of concern and a reason for land conflicts in the study area was the impact of shrimp farming expansion on the land sale and leasing prices in the study area. According to the small shrimp farmers and non-shrimp farmers during the focus group discussions (FGD#SNSFSU/CU), the lower income households or landless households had lost access to land due to increasing land prices influenced by the rapid expansion of shrimp farming. The development of shrimp aquaculture had inflated the land market, causing an increase in the land value. During the focus group discussions in October, 2009, I was told that land that would have sold for Tk99,000 per hectare four years ago was now worth Tk300,000 per hectare – a threefold increase. During the same period, the land leasing fee also increased by 3 times to Tk10,000-12,000 per hectare per year. In a key informant interview, one large shrimp farmer from South Bashtola Village said that he began shrimp farming with 1 hectare of land in the early 1990s and now he had nearly 40 hectares of land which he had purchased as well as under lease from other farmers (KII#LSF). Increasing land value and leasing fees acted as a key barrier for lower and middle income households to access land and therefore participate in shrimp farming (FGD#SNSFSU/CU). My personal observation was that due to the impact of this

situation, it was no longer possible for lower income landless households to lease land, as increasing land values due to the profitability of shrimp farming had put rental prices out of their reach and thus transferred the effective control of the land to large shrimp farmers with the political connections and financial resources necessary to farm shrimp.

The outcomes of the land conflicts in the study area included forcible occupation and counter-occupation of land and shrimp farms, which further generated more social conflict according to the key informant interviews (KII#CCU; CSU; NGOM). However, these conflicts were related to the political affiliations of the households. My personal observation was that within these conflicts, parties with strong connections to the ruling political party kept control and were able to carry out shrimp farming. During the household survey, I found four cases in Burburia Village where shrimp farmers had been evicted from their farms and forcibly taken over by other shrimp farmers. The heads of these four households held political affiliations in opposition to the affiliations of those responsible for the evictions from their shrimp farms. I was informed that the other shrimp farmers and the local leaders of the party in power had used their political influence following the change of government in 2009. The rich farmers belonged to the new party in power and grabbed control of lands that were already in dispute and were occupied by farmers affiliated with the previous government. With the change of political regime, the group of shrimp farmers who were using the government-owned land and forcibly taken leased lands were replaced by a new group of shrimp farmers, causing substantial social conflicts. This phenomenon would be expected to continue with future changes of government.

These issues had resulted in some conflict among the shrimp farmers in the study villages. In a key informant interview, a government officer (KII#SFOM) acknowledged that friction between small (<2 ha) farm owners and large (>5 ha) farm owners over the use of saline water from the canals was common. He mentioned that, on average, his office received 20 complaints per year related to the management of saline water in shrimp aquaculture. He stated that disputes were resolved by “shalish”, the local informal conflict management system and were usually mediated by local government representatives, local political leaders and members of the elite. Some land-owners went to court to resolve conflicts related to leases. If not resolved, land-related conflicts created more social conflicts in the study area. As reported in the key informant interviews, these conflicts included armed assault, poisoning of shrimp farms and in extreme cases murder and severe injuries (KII#SFOM; OCM; CCU; CSU; NGOM).

6.3.7.4 Access to Other Environmental Resources

During the discussions and interviews, the participants reported a range of concerns regarding the availability of environmental services, such as fresh water and biodiversity and habitat status, as a result of shrimp farming in the area.

Due to the levels of salinity in the fresh water, the people in the study area depended mainly on rain water for drinking. There were a few government ponds in the study villages which preserved rain water for use during the dry season. Households that experienced drinking water shortages needed to travel long distances to collect drinking water. During the field observations, I noted some people even drinking saline water from the river. This problem disproportionately affected women and

children, as described by women forest resource collectors (FGD#SFRC) who stated that they were not interested in shrimp cultivation any longer. They said that, before shrimp culture began in the study area, they could get drinking water from tube wells but now saline water came through the wells and made the water undrinkable. It took them three to four hours to bring drinking water from the nearby government pond, travelling up to 3-4 km to collect drinking water (Figure 6.5).

The focus group participants who were small shrimp farmers or landless non-shrimp farmers in Burburia, South Bashtola, Joymony Ghol and Joymony Katakhali Villages (FGD#SNSFSU/CU) and key informants (KII#UAOM; ULOM; CSU) reported a large reduction in agro-biodiversity and the destruction of fruit-bearing trees, homestead vegetable and agricultural crops and livestock production in the study area. They believed that increased salinity due to shrimp farming was responsible for the loss of wild vegetation that grew naturally in the water and land, the loss of indigenous rice varieties, and the decline of vegetable and fruit species. According to them, all the popular fruit trees and vines such as jackfruit, mango, guava, watermelon and palm had been significantly reduced in the study area.



Figure 6.5: (A) Child carrying water from government pond, (B) Shrimp net in the Passur River, (C) Shrimp fry being sorted out by a fry catcher in Joymony Ghol Village (March, 2010)

Sundarbans fishermen (FGD#SFIC) in the focus group discussion also blamed shrimp aquaculture as a destructive contributor to the Sundarbans fisheries sector because it constrained the availability of fisheries resources in the Sundarbans. Shrimp farming was dependent on the supply of raw materials, namely, shrimp fry from the Sundarbans and its surrounding water bodies. During the sorting of the shrimp fry, the collectors kept the shrimp fry and destroyed the fry of different fish species (Figure 6.5 above). The indiscriminant fishing of wild shrimp fry, combined with the destruction of the by-catch fry from other species, thus pushed the mangrove ecosystem and its related fisheries resources to the brink of collapse, as revealed by the participants of the focus group discussions.

Similar results were demonstrated by Hoq et al. (2001) who found that the abundance of *P. monodon* post-larvae was significantly reduced in 1999 ($P<0.05$) compared to the levels found in studies carried out 1992 and 1995 in the rivers surrounding the Sundarbans. They found that this reduction was due to the huge demand of the shrimp farms for natural wild shrimp fry. They further maintained that

about 12-551 post-larvae of other shrimp, 5-152 fin fish post-larvae and 26-1636 other macro-zooplankters were destroyed during the collection of a single *P. Monodon* post-larvae.

The transformation from agriculture-based activities to export-based shrimp aquaculture activities in the study area had created changes with long-term impacts on the livestock holdings, agriculture and sharecropping practices, access to land and environmental resources. These changes had negative outcomes for households' livelihoods in the areas surrounding the Sundarbans. In the following section, I discuss both the positive and negative outcomes of shrimp aquaculture for the livelihoods of the households surrounding the Sundarbans mangrove forest.

6.4 Discussion

6.4.1 Contribution of Shrimp Income to Livelihoods

Shrimp income formed an integral part of the higher income and some middle income households' income generation activities. The increased demand for shrimp exports led to a reorganisation of shrimp procurement and trade networks, which led the higher and middle income households to establish shrimp depots and shrimp-related businesses in order to earn more income from shrimp activities. In addition, shrimp farming helped some higher and middle income households to establish non-farm businesses or trading enterprises (as discussed in Chapter 4). Therefore, economic growth due to shrimp farming had a positive outcome for households with shrimp farms as shrimp farming increased their income earning opportunities. In Bangladesh, income from shrimp farming but not the shrimp sector as a whole was highly skewed in favour of the relatively rich; 84% of the very poor derived no

income at all from shrimp aquaculture, whereas the very rich earned 58% of the total income from shrimp farming, and the very poor earned only 8% (Quddus et al., 2001). Hue and Scott (2008) in Vietnam and Bosma et al. (2012) in Indonesia also made similar observations of the poor without any shrimp ponds being dependent mostly on mangrove resources and the rich households being the only group that earned income from trading shrimp. Shrimp farming was more profitable for households with a higher investment capacity than for poorer households in Mekong Delta (Jojre and Schmitt, 2010).

Land is identified as the single driver for earning from the shrimp aquaculture. The ability to profit from the shrimp industry thus seems intimately connected with the ability to own, lease or otherwise control land. In the study area, land was the fundamental physical asset required for shrimp farming, and land was used as collateral to get loans from banks or other credit- providing organisations (Chapter 4). The high and middle income households who owned land were utilising government support and market services for diversification through the development of shrimp aquaculture and related businesses that provided higher income. Shrimp sector stimuli benefited the higher or middle income households as they already possessed the lands and the extra support helped them to increase their land holdings through leases. The higher and middle income households were able to increase their amount of land, which was a very important physical asset for the household, and an indicator of positive outcomes for those shrimp farming households.

Landlessness is synonymous with poverty and vulnerability (Chapter 4). The lower income households in the study area were increasingly marginalised due to the lack

of available land and credit, which are significant risks inherent to shrimp aquaculture. Thus, landless lower income households were unable to engage in this costly business other than selling their labour. The average landholding of the lower income group had worsened after the introduction and expansion of shrimp aquaculture and it had become increasingly difficult for them to own further land due to the increasing land prices and competition associated with the increased demand of land for shrimp culture. Large shrimp farmers had turned government-owned canals into shrimp ponds, and these canals had earlier been used by the lower income households for their livelihoods. These results are supported by another study carried out on shrimp farming in the Khulna region which found that rich households controlled about 15 times more land than the poor (Quddus et al., 2001) and the 4% of the households with over 3 hectares of land derived the majority of direct benefits from shrimp cultivation, while the 41% of landless households derived just 2% (BCAS, 2001). The impact of this contrast has been reported by several other studies set in shrimp farming regions in Bangladesh where the reduced access to the land has been found to narrow the livelihood opportunities of the rural poor, widen the gap between rich and poor and diminish social cohesion in these areas (EJF, 2004; Deb, 1998; Swapan and Gavin, 2010).

Shrimp cultivation is no doubt economically beneficial for higher income households but it had negatively affected the livelihoods of landless and marginal farmers, creating difficulties for them in surviving in the area. These difficulties are discussed in the next section.

6.4.2 Vulnerabilities Related to Shrimp Farming

Shrimp income is a factor causing income inequality in the study area because the economic benefits of shrimp farming have not been shared fairly, and the economic activities related to shrimp farming have further widened the gap between the higher and lower income households. Shrimp farming had greatly increased income differentiation among the rural households in the study area. In particular, the increasingly disproportionate distribution of income from shrimp farming and shrimp-based enterprises was a worrying development from the point of view of promoting egalitarian growth in the rural area, which had “lost” much of its capacity to generate equitable income flows. Due to the income inequality, a growing income gap between higher and lower income households was augmenting the threat of poverty in the study area surrounding the Sundarbans mangrove forest. Inequality and vulnerability linkages are associated with relationships between inequality, diversification of income sources and poverty: inequality affects vulnerability directly through constraining the options of households and individuals when faced with external shocks, and indirectly through its links to poverty and other factors (Adger, 1999). The direct links between inequality and vulnerability relate to the concentration of resources in fewer hands (Adger, 1999) which in the case of shrimp farming in the study area was greatly evidenced as the higher income households controlled shrimp farming and associated businesses.

Rather than offering a universal panacea to assist rural development, the onset of shrimp aquaculture appears to have led to greater income disparities between rich and poor (EJF, 2004; Ito, 2002). Ahmed et al. (2002) maintained that the groups benefitting the most may include: outside shrimp farmers, large rural landowners,

absentee landlords, urban entrepreneurs, a few government officials and political elites. The distribution of benefits from shrimp across different social categories is unjust and unequal (Datta, 2001). As a result, the income opportunities for the poor reduce while these opportunities increase for rich and medium scale farmers.

The loss of agriculture due to shrimp farming in the study area was one of the major causes of vulnerability for the lower income households who no longer had access to any land for agriculture. Shrimp aquaculture expansion had shrunk the available agricultural land on which the landless people used to depend for food all year around. The reliance on the market for rice – the staple food – and other products had created a feeling of dependence and insecurity. The shift of livelihood activities from crop-based agriculture to commercial shrimp aquaculture by the higher and middle income households in the study area had made redundant the sharecropping system by which lower income landless households had previously gained access to land and thus ensured their food security. Income from agriculture had become so low that households no longer considered agriculture as a livelihood strategy in the study area. From the livelihood perspective, this reduction of agriculture-based income sources and associated food insecurity made poor people more dependent on forest resources to earn cash and forced them to act illegally (see Chapter 5, Section 5.3.5.2), ultimately making them more vulnerable to risk. My findings are supported by the work of Sen (2003) who showed that increased rice production benefited land-poor, labour-selling households in Bangladesh. The loss of sharecropping opportunities affected the landless and marginal farmers disproportionately (BCAS, 2001; Samarakoon, 2004).

Despite its high profit for higher income households, shrimp aquaculture in the study area was a critical livelihood constraint as it decreased the impetus for agriculture-based labour activities. Shrimp farming itself is less labour-intensive than rice cultivation, especially when extensive methods of shrimp culture are practised. Lower income households in the study area had lost the opportunity to earn income through selling their labour for rice cultivation. Women had lost their traditional roles during the harvests. Local populations who previously worked as labourers were shifting to market-oriented shrimp fry collection in order to supply the aquaculture ponds. While shrimp fry fisheries had provided a source of income for a large number of the poor, it should be recognised that many of these people became fry collectors because they were deprived of an alternative following the onset of shrimp farming in their locality. The numbers employed in fry fisheries did not necessarily represent a net gain in employment. To this end, the shrimp aquaculture failed to play any significant role in absorbing the surplus rural labour force from the rice-based activities. Ito (2002) observed that shrimp-related jobs for women were highly intensive, potentially hazardous and poorly paid.

The main alternative source of income for lower income households was fry collection which meant that households resorted to a “no-choice situation” as the opportunities for productive engagement in agriculture and others were scarce. Multidisciplinary Action Research Centre (1997) found that 14% of the people living within 10 kilometres of the Sundarbans participated in *P. monodon* fry collection. Frankenberger (2002) estimated that nearly 16,900 fry collectors caught around 39.2 million shrimp fry in the Passur River each year. A study of coastal livelihoods along the lower Passur River indicated that, on average, 40% of total annual incomes came

from post-larvae fishing (Ahmed et al., 2010). Azad et al. (2007) reported that 26-30% of the total household incomes came from the fry collection occupation in the coastal areas of Bangladesh. However, reliance on this one source of income was highly precarious for the lower income households in the study area as the government banned fry collection from 2000. This imposed stress on their livelihoods as they still depended on the illegal resources to maintain their livelihoods (Chapter 5). Resource dependency is an element of individual vulnerability and is constituted by reliance on a narrow range of resources, leading to social and economic stress within livelihood systems (Adger, 1999). This stress is manifest in instability, increased variance in income and the risk of the failure of particular sources (Adger, 1999).

Vulnerabilities in livelihoods in the study area had increased due to significant declines in livestock number and income. The recurrent shrimp farming had constrained livestock rearing, causing a vulnerable situation for lower income households for whom livestock had always acted as a buffer during a crisis (Chapter 4). While benefitting higher income households through more income, commercial shrimp farming had undermined the resource base for subsistence among agricultural and livestock producers. Livestock and trees are important assets which enable a household to overcome vulnerabilities during crises or shocks (Karim, 2006). Shah and Karim (2001) found that the production of cows, buffalos and poultry had declined sharply in the nine sub-districts of south-western Bangladesh surrounding the Sundarbans mangrove forest due to shrimp farming.

Land was found to be an important asset for participation in shrimp farming and a source of contention among shrimp farming households in the study area. The

expansion of shrimp aquaculture had led to social conflicts over land tenure, leasing land arrangements and user rights such as between rice and shrimp farmers, between small and large shrimp farm owners and between lessor and lessee households. These land-related conflicts tended to involve the higher or middle income households rather than the landless lower income households in the study area. Some households had lost their control or ownership rights to their lands due to such conflicts, become landless and immediately fallen into a vulnerable situation as they had lost important assets and the associated income sources. Legal challenges to settle issues related to land conflict could take five to ten years in court to resolve, which placed a serious burden on those households' financial resources. Social conflicts such as armed assault, poisoning of shrimp, and other criminal acts put serious pressure on the financial capital of the affected households and made them more vulnerable. Swapan and Gavin (2010) reported the occurrence of 150 incidents in shrimp-related land conflicts among households in Koyra Sub-District situated on the periphery of the Sundarbans which caused substantial social conflicts among the involved parties. It was also reported that many shrimp farm owners had, over the years, gradually and illegally acquired leased-out land in the shrimp farming areas in Khulna and thus the original land-owners had become landless (Begum and Alam, 2000; Khatun, 2009). Growing pressure on land in developing countries is another constraint that usually affects fisher communities and increases their vulnerabilities especially in Asia where the population is usually remarkably high (Béné and Friend, 2011). Datta (2001) found that non-land owners who ran shrimp farms through leasing arrangements pursued anti-social activities to keep their control. Over 150 people had reportedly been killed since 1980 in clashes related to shrimp farming (EJF, 2004).

The shrimp aquaculture generated significant changes in the environmental landscapes which posed a challenge to the livelihoods in the study area. The negative environmental effects of shrimp aquaculture in the context of the study area included: the reduction of aquatic resources in the mangrove forest due to by-catch destruction during the collection of wild seed and broodstock; and soil salinisation. Lack of fresh water in the study villages forced people to travel long distances to collect drinking water of degraded quality from government-owned ponds. This made all the households vulnerable to disease and more sensitive to infection. As lower income households lacked money for health treatments, their capacity to cope with, and recover from, infection would have a greater impact on their health and future income. Shrimp aquaculture is widely considered to be one of the most environmentally destructive forms of agro-biodiversity (Rahman et al, 2011a) and public health (Rahman et al., 2013a) in coastal Bangladesh. Salinity, caused by growing shrimp cultivation and other reasons over the last three and a half decades in Bangladesh, has damaged the soil fertility of more than one million hectares of coastal arable land that could have yielded 2.5 million tonnes of rice, enough to meet the country's annual food deficit (Hossain, 2011). It was undeniable that no other income source in the study area could compete with shrimp aquaculture in terms of profit volume. Vulnerability among the farming households in the area was rooted in a “crisis in the commons” as a result of changes in resource use and management especially since the shrimp boom. These changes included a reduction in affordable local food, common resources and livelihood options, and increases in financial outlays in order to purchase food.

An examination of the long-term impacts caused by shrimp aquaculture demonstrated negative outcomes for livelihoods especially for the lower income households in the study area. This result is supported by other studies. The change from agriculture to aquaculture dependence in Northern Vietnam, for example, was found to have imposed stress and had complex effects on the levels of vulnerability in local livelihood systems (Adger et al cited in Adger, 2000b). It has been shown that the promotion of export-oriented production can have detrimental consequences for the livelihoods of local populations and the environment (Rivera-Ferre, 2009; Veuthey and Gerber, 2012).

6.5 Conclusion

The chapter examined the changes in the livelihoods structure and wellbeing of rural households following the introduction of shrimp aquaculture. Higher income households often had more income from shrimp farming and related income opportunities than the lower and middle income households. Commercial shrimp aquaculture had clearly contributed to a widening gap among the households. The results of this study showed that rapid changes in local land-use systems, ownership, and management practices of shrimp farms in response to shrimp aquaculture had weakened the income-earning opportunities of the lower income households and it appeared also to have led to increased socio-economic differentiation through increasing landlessness and thus increased income inequality and vulnerability. The results presented in this chapter showed that shrimp aquaculture appeared to have been an important livelihood improvement for higher income households, particularly for the land-owning households. The distribution of the income it generated was biased in favour of the groups who controlled the land and the

resources necessary to participate in the activity. There were limited options for lower income households to participate and benefit due to their limited land ownership.

The large reduction of agricultural lands induced by unplanned shrimp farming had caused the destruction of trees and plantations, and reduced agricultural crops and livestock production in the study area. The results showed that the changes in land use, loss of mangrove resources, decreasing number of livestock and depletion of crop-based agriculture and labour opportunities were applying great pressure on local livelihoods and the sustainability of the Sundarbans region as a whole.

Local manifestations of vulnerability were linked to factors including: land tenure patterns that limited access to land; lack of livelihood opportunities for earning an income in the area due to the loss of agriculture and livestock and processes of environmental degradation (raising salinity, infertility); and rising prices of basic commodities (as basic staples such as rice and vegetables were being imported). Traditional food safety nets had broken down, leaving these communities dependent on buying rice imported from other parts of Bangladesh, imperilling food security, and undermining nutrition. The environmental risks associated with economic development following shrimp aquaculture therefore had deepened social inequalities. In the next chapter, I discuss this study's investigation of the coping ability of shrimp farming households in the face of a climate change-induced natural hazard – the cyclone.

Chapter 7: Natural Hazards and Their Impact on Livelihoods in the Sundarbans



Chapter 7: Natural Hazards and Their Impact on Livelihoods in the Sundarbans

7.1 Introduction

In the discussion about the results presented in Chapter 4, I concluded that the livelihoods of the households surrounding the Sundarbans mangrove forest were based on mangrove forest resource and shrimp farming. In Chapters 5 and 6, I examined in detail the extent of dependence on forest resources and shrimp farming, respectively, and the vulnerabilities associated with this dependence. However, any analysis of livelihoods also needs to consider the vulnerability context caused by natural hazards within which the livelihoods are conducted and the strategies used to cope with their consequences. The sustainable livelihoods framework characterises vulnerability as trends, shocks and seasonal events (DFID, 2000). Shocks are typically impacts that are sudden, unpredictable and traumatic (Chambers and Conway, 1992). When extreme shocks such as cyclones, floods, droughts, volcanic eruptions, landslides or earthquakes strike an exposed and vulnerable population that is insufficiently prepared and unable to cope with the adverse consequences, a shock becomes a disaster (Oliver-Smith, 2005). Ellis (1998) defined coping as the ability to maintain consumption in times of disaster, which may include drawing on savings, using food stocks, sales of livestock, or access to gifts from relatives and friends. Coping is the manner in which people act within the limits of existing resources and the range of expectations to achieve various ends (Alam and Collins, 2010). In general, this involves no more than “managing resources”, but usually it means how it is done in unusual, abnormal and adverse situations (Wisner et al., 2004:113). The

capacity to cope is increasingly seen as a key component of a household's or community's level of vulnerability (Few, 2003).

The definitions of vulnerability in the disaster and climate change-related literature tend to fall into two categories in which vulnerability is viewed: either (i) in terms of the amount of (potential) damage caused to a system by a particular climate-related event or hazard (Jones and Boer, 2003); or (ii) as a state that exists within a system before it encounters a hazard event (Allen, 2003). Vulnerability is also defined as the relative ability of an individual, household or community to respond appropriately to a shock or disaster (Levine et al., 2007). As discussed in Chapter 2, vulnerability explains the reasons for why the poor, especially in developing countries, are the most at risk of natural hazards (Haque, 1997; Hewitt, 1997). Therefore, the factors that force communities into a state of vulnerability due to natural hazards need to be identified.

The natural disasters most likely to affect livelihoods in Bangladesh and particularly in the Sundarbans are tropical cyclones. Bangladesh is located in a high risk cyclone prone area (Dasgupta et al., 2010). About 53% of all human deaths from tropical cyclones occur in Bangladesh (Ali, 2003). On average, a severe cyclone strikes Bangladesh every three years, a frequency that was thought to be increasing even a decade ago (Karmakar, 2003). In the region, since 2007, Cyclone Sidr hit Bangladesh on 15 November 2007, Cyclone Nargis hit nearby Myanmar on 2 May 2008, Cyclone Rashmi occurred in the region on 27 October 2008, and Cyclone Aila hit Bangladesh on 26 May 2009.

The societal exposure to such risks is exacerbated by the very high population and population density, very low levels of development and high levels of poverty in Bangladesh (Agrawala et al., 2003). In Cyclone Sidr, greater success in tracking cyclones and disseminating warnings significantly reduced the number of lives lost (Paul, 2009; Paul and Dutt, 2010); however, the potential for economic and infrastructural damage remains very significant (GOB, 2008a). There were about 3,500 casualties from Sidr, which was far lower than occurred after cyclones in 1970 and 1991; however, the economic loss of around \$1.6 billion (GOB, 2008a) was much greater in relative terms. The casualty rate from Cyclone Alia was around 190, which was very low in comparison to that of Sidr (DMB, 2009b). The economic loss, measured at around \$270 million (CRED, 2011), was also lower.

This chapter describes the impact of Cyclone Aila that crossed the West Bengal-Khulna coast on 25 May 2009 (DMB, 2009a). Classified as a cyclonic storm by the Bangladesh Meteorological Department (BMD), the maximum sustained wind speed within 54 km of the storm's centre (North Bay of Bengal, 285 km south-southwest of Mongla Port, Lat. 20.0° N and Long. 88.6° E) was about 70 KPH with gusts to 90 KPH (DMB, 2009a). It crossed the coast at high tide on a full moon and the accompanying storm surge reached at least 4 metres (Mehrunnessa et al., 2010) breaking embankments in many places and flooding large areas that could not then drain naturally.

The objectives of this chapter are to analyse the impacts of the cyclone on households' assets and present a detailed assessment of the various factors that made households in the study area vulnerable to cyclone, and their coping strategies. Five

villages in Koyra Sub-District were chosen because Koyra Sub-District was one of the areas surrounding the Sundarbans which was the most impacted by Cyclone Aila and was particularly dependent on forest and shrimp farming resources (as described in detail in Chapter 3). The main research question for this chapter deals with the impacts and responses to cyclones, a major natural hazard of the study area which likely to increase in intensity with climate change (Chapter 1). This chapter covers the following research questions in order to address the main research question and fulfil the objectives of the chapter:

- 1) To what extent did Cyclone Aila impact on the livelihood assets?
- 2) What are the coping strategies that people adopted to survive?

To examine these issues, the chapter first presents the results on the basic household characteristics and primary occupation of the household head, followed by the results relating to the impacts on different household assets, such as displacement, shrimp aquaculture, housing, the factors that caused vulnerability to cyclone, the different coping strategies adopted by households, and a comparative analysis of the amount of the income before and after Cyclone Aila among the households based on the severity of cyclone and the incomes and primary occupations of the households. The negative impacts of the cyclone on livelihoods are discussed, including the coping strategies adopted by households and the use of mangrove-based income as part of the coping strategies. Finally, comments are made about the future vulnerability of the community in the context of climate change.

7.2 Methods

As discussed in Chapter 3, household surveys were carried out in Koyra Sub-District at two times: 1) at the end of the wet season in October 2009, and 2) at the end of the dry season in March 2010. These surveys were carried out in order to assess the damage and loss of assets including changes in income before and after the cyclone and the coping mechanisms adopted. The surveys were conducted five and ten months after the cyclone hit. A total of 249 households were surveyed by using structured questionnaires in the villages (Table 7.1) and respondents were interviewed face-to face. By a random selection, 91, 74 and 84 households from the severely affected areas, highly affected areas and least affected areas were surveyed (see map in Chapter 3, Figure 3.4). Cyclone-affected exposure was determined by factors such as the distance from the coast, extent of damage and access to government relief support after the cyclone (as described in detail in Chapter 3, Section 3.3.4.1).

Table 7.1: Study villages in Koyra Sub-District

| Village name | Total households | Households surveyed | Level of impact |
|--------------|------------------|---------------------|-----------------|
| Jorshing | 803 | 75 | Severe |
| Patakhali | 199 | 16 | Severe |
| Koyra No. 3 | 525 | 50 | High |
| Koyra No. 2 | 300 | 24 | High |
| Jaigirmahal | 838 | 84 | Low |

The questionnaire is provided as Appendix C. The questionnaire contained three sections. The general introductory section included questions about the respondents' demographic and socio-economic characteristics such as their age, education,

household members' primary occupation, amount of land and yearly income before Cyclone Aila (see Appendix C). These data were only collected during the first survey at the end of wet season (October 2009). The second section of the survey dealt specifically with the cyclone and the extent and nature of the impacts of the cyclone on the respondents' lives and livelihoods. This included whether people had relocated (i.e., displaced), place of relocation, where people took shelter during cyclone and the distance of the place of shelter from their home, the loss of different types of assets and the cost of the damage. The amount of loss was only calculated based on the extent of damage data collected during first survey at the end of the wet season (Chapter 3, Section 3.3.5.3). The third section of the survey explained households' sources of coping and incomes from the primary and secondary occupations of household members after the cyclone struck in October 2009 and in March 2010 ten months later. The data were analysed according to the cyclone-affected exposure (severe, high and low) which was determined by certain factors (see details in Chapter 3, Section 3.3.4.1). For further analysis of the data, households were divided into three income terciles ("higher income", "middle income" and "lower income") based on total annual income before the cyclone in order to compare the amounts of loss due to Cyclone Aila, and the incomes before and after the cyclone. The mean total incomes were significantly different among the three groups (US\$2,818, US\$826 and US\$502, respectively; ANOVA P<0.001). Households were asked to provide their net monthly income before the cyclone and the monthly income was then converted into the yearly income. Incomes after the cyclone were calculated from by combining income from external support provided by government and NGOs, income gained from coping strategies such as loans taken from moneylenders, the sale of assets, and income from the primary or secondary

occupation of the household members such as mangrove resource collection, service and others (see details in Chapter 3, Section 3.3.5.4). Moreover, an analysis was done for the different groups based on the primary occupation of the household head in order to compare the amount of loss due to the cyclone, and the income before and after the cyclone. Information on the primary occupation of the household head was collected during the questionnaire household survey (Appendix C).

In addition, I carried out 10 semi-structured interviews with key informants and five focus group discussions (one solely with women) at the community level in Koyra Sub-District (see Appendix D, Part C for the questions, dates and places of interviews and other information about the participants). The focus group discussions explored: the impacts of the cyclone on the common assets of the community such as education, health, sanitation; the coping strategies adopted at the community level; questions related to the role of community members, NGOs and government agencies in the cyclone preparedness and relief and rehabilitation after the cyclone; and the factors that caused vulnerability to cyclones (details in Appendix D). The key informant semi-structured interviews with government officials, local government elected representatives, an NGO worker and a primary school teacher also covered these issues. In addition, in order to assess the impact of the cyclone on livelihoods, I used the personal observations that I gathered throughout the field data collection period.

7.3 Results

7.3.1 Socio-Economic Characteristics of the Respondent Group

The average age of the respondents was around 43 years (Table 7.2). Most of the respondents were born and raised in the region. The respondents had spent an average of 4.39 years at school. About 41% of the respondents did not have the opportunity to go to school and nearly 23% had completed primary level but were unable to enter the secondary level. Only 30% of the respondents had schooling up to secondary and higher secondary levels and very few respondents had completed tertiary education (6.4%). The average household size (5.4) in the study area was higher than that of the average of Bangladesh rural areas (4.46) and of Koyra Sub-District (4.24) (BBS, 2012a). Almost all the households owned the house they lived in, and 60% owned the land on which they grew their crops.

Many households were involved in the collection of resources from the Sundarbans forest to support their livelihoods (Table 7.3). Approximately 17% of the household heads consisted of day labourers. Nearly 30% of the household heads were involved in shrimp farming, agriculture or both. Shrimp farming dominated the severely affected areas, and agriculture dominated the highly affected areas and less affected areas, although most household heads had also invested in shrimp farming. About 10% and 8% of the household heads were involved primarily in trade/business and service industries, respectively.

**Table 7.2: Basic household characteristics of the 5 villages, Koyra Sub-District
Cyclone Effect**

| Characteristics | Severe | High | Low | Total |
|--|--------|-------|-------|-------|
| Household size | 5.7 | 5.3 | 5.2 | 5.4 |
| Qualification of the respondent | 4.3 | 4.6 | 4.3 | 4.4 |
| Age of the respondent | 43.0 | 43.1 | 42.9 | 43.0 |
| Amount of agricultural land (ha) | 4.8 | 6.8 | 10.5 | 7.3 |
| Amount of homestead land (ha) | 0.8 | 1.3 | 1.2 | 1.1 |
| Household yearly income before Cyclone Aila (US\$) | 1,448 | 1,425 | 1,219 | 1,364 |

Table 7.3: Primary occupation of household heads before cyclone in 5 villages, Koyra Sub-District, Bangladesh (N and %))

| Primary Occupation | Cyclone-Affected Exposure | | | |
|---|---------------------------|---------|---------|---------|
| | Severe | High | Low | Total |
| Shrimp farming | 27 (30) | - | - | 27 (11) |
| Daily labourers | 59 (6) | 22 (30) | 15 (18) | 42 (17) |
| Trade/business ¹ | 9 (10) | 4 (5) | 11(13) | 24 (10) |
| Sundarbans resource collection ² | 33 (36) | 15 (20) | 17 (20) | 65 (26) |
| Agriculture farming | - | 20 (27) | 11 (13) | 31 (12) |
| Agriculture and shrimp farming | - | 1 (1) | 17 (20) | 18 (7) |
| Service ³ | 4 (4) | 6 (8) | 9 (11) | 19 (8) |
| Sundarbans resource trading ⁴ | 11 (12) | 1 (1) | 1 (1) | 13 (5) |
| Other ⁵ | 2 (2) | 5 (7) | 3 (4) | 10 (4) |
| Total | 91 | 74 | 84 | 249 |

1. Trade and business means non-farm trade and business (“non-farm” was defined in Chapter 3)

2. Household head collected either single or multiple resources from the Sundarbans

3. Service means teaching, village physicians, working in government and NGOs

4. Sundarbans resource traders are the moneylenders working as intermediaries along the value chain

5. “Other” means housewife, boatman, begging

7.3.2 Impact of Cyclone Aila on Key Livelihood Assets

There was a wide diversity of assets lost within the communities affected by the cyclone (Table 7.4). Average cyclone damage costs were estimated by each household at almost US\$2,950, US\$2,018 and US\$454 per household in the severely, highly and less affected areas, respectively, which amounted to approximately 200%, 142% and 37% of the average annual household income in the areas. Most of the cyclone damage in the severely affected areas was caused to shrimp aquaculture (41%), houses (24%) and to agriculture (14%). Other damage categories included damage to homestead pond fisheries (4%), loss of poultry and livestock (4%), and income lost from trade and business (7%).

Table 7. 4: Extent of damage due to Cyclone Aila among households (in US\$ and % within total loss) in 5 villages in Koyra Sub-District

| Damage Type | Cyclone-Affected Exposure | | | F-value | P-value |
|------------------------------------|---------------------------|------------|-----------|---------|---------|
| | Severe | High | Low | | |
| Agriculture ¹ | 414 (14) | 778 (39) | 68 (15) | 18.44 | <0.001 |
| Dwelling | 704 (24) | 438 (22) | 43 (10) | 56.66 | <0.001 |
| Shrimp farming ¹ | 1197 (41) | 316 (16) | 232 (51) | 15.38 | <0.001 |
| Homestead fish pond ¹ | 120 (4) | 178 (9) | 20 (4) | 15.27 | <0.001 |
| Net and boat | 73 (3) | 10 (1) | 12 (3) | 29.80 | <0.001 |
| Trade and business ² | 193 (7) | 121 (6) | 7 (2) | 5.66 | <0.01 |
| Poultry and livestock | 103 (4) | 92 (5) | 24 (5) | 10.79 | <0.001 |
| Other household asset ³ | 146 (5) | 85 (4) | 47 (10) | 6.61 | <0.01 |
| Total loss | 2950 (100) | 2018 (100) | 454 (100) | 25.74 | <0.001 |

1. Definition given in Chapter 3

2. Trade and business refer to non-farm trade and business

3. Other households' assets means furniture, cooking utensils and clothes

In the highly affected areas, the most serious losses were to agriculture with average losses equal to US\$778, or 39% of the total loss value. Other household losses were concentrated mainly in housing (dwelling) (22%), shrimp farming (16%), homestead pond fisheries (9%), business (6%) and poultry and livestock (5%). In less affected

areas, most of the loss was to shrimp farming (51%). Although this area was less affected, the households had incurred losses as they had shrimp farms or had invested money in shrimp farms that were situated in severely affected parts of the sub-district.

Average damage costs in absolute terms were significantly higher for higher income households (Table 7.5). The average costs of damage caused by the cyclone were almost US\$4,007, \$961 and \$579 per household in the higher income, middle income and lower income households, respectively, which amounted to approximately 142%, 116% and 115% of the average annual household income for the respective income groups before the cyclone.

Table 7.5: Impact of Cyclone Aila on income groups in 5 villages in Koyra Sub-District

| | Income Group | | | F-value | P-value |
|----------------------------------|--------------|--------|-------|---------|---------|
| | Higher | Middle | Lower | | |
| Yearly income before Aila (US\$) | 2818 | 826 | 502 | 46.05 | <0.001 |
| Total loss of assets (US\$) | 4007 | 961 | 579 | 75.49 | <0.001 |
| Number of households | 84 | 62 | 103 | | |

7.3.2.1 Displacement

Cyclone Aila resulted in the significant displacement of people in the study area. Most people affected by the cyclone in the study areas were forced to relocate their houses and went to live in another location (Table 7.6). Almost 74% and 60% of the households in the severely affected and highly affected areas, respectively, were forced to relocate their households compared to none in the least affected area. Kumar et al. (2010) found that 95% of the Aila-affected families were forced to relocate their households in South Bedkashi Union. This is consistent with the

finding in this study that 74% of the households in the severely affected villages situated in the same union had relocated their houses.

Table 7.6: Number (percentage) of households in 5 villages in Koyra Sub-District that had to be relocated following Cyclone Aila

| | Cyclone Exposure | | |
|--------------------------|------------------|---------|----------|
| | Severe | High | Low |
| Relocated households | 67 (74) | 44 (60) | - |
| Non-relocated households | 24 (26) | 30 (41) | 84 (100) |
| Total | 91 | 74 | 84 |

The data from the household surveys revealed that the people who lost everything and had to relocate, left their homesteads and took shelter in makeshift houses on roads, damaged embankments, shops in markets, public buildings such as schools or community clinics, or took shelter in cyclone shelters or in the house of a relative due to the destruction of their houses by the tidal surge and subsequent water logging (Figure 7.1). Some relocated to relatives' dwellings and to next of kin in the same area, while others moved to join relatives in other areas. The research revealed that 55%, 13% and 12% of the households in the severely affected area relocated their families to embankments, roads, and cyclone shelters, respectively, with equivalent figures in the highly affected area being 7%, 77% and 2% (Figure 7.1).

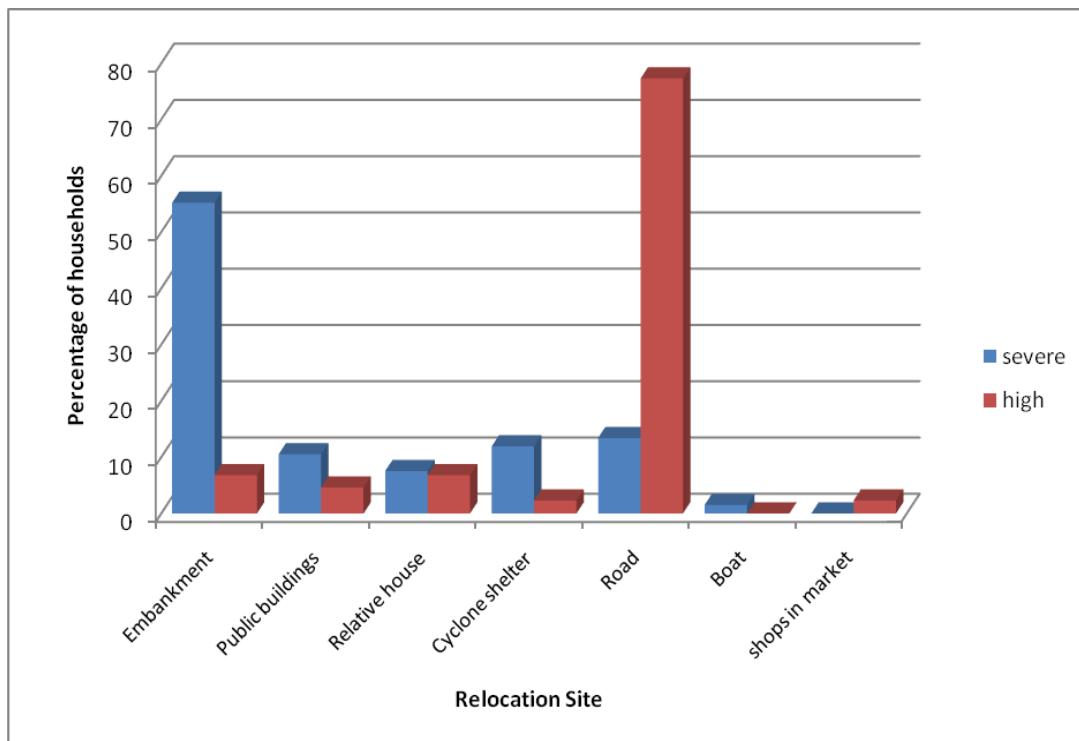


Figure 7.1: Place of shelter among households in severely and highly affected parts of Koyra Sub-District following Cyclone Aila in May 2009

Relocation to makeshift houses, mostly temporary and made of plastic sheets and bamboo, was common in the severely and highly affected areas where many houses had been completely ruined (Figure 7.2). This was particularly uncomfortable for women who stayed inside for long periods. A group of women in the focus group discussion in Koyra No. 3 Village (FGD#FCVK) described that getting into such a house was very difficult for them as the heights were very low. The female participants also complained that they needed to bend a lot and move carefully inside the house because they might hit the ceilings if they were not extra careful. Too much bending and falling caused bodily strains for them as it was very difficult to work in such a low structure. They revealed that they were also vulnerable as rain damaged these fragile shelters and they had no option but to sleep there. The female informants reported that carrying on regular activities, such as cooking, eating, cleaning and even sleeping, became more difficult. The amount of time and energy

devoted to caring for young children and protecting household possessions was greatly increased. Ten months after Cyclone Aila, in March 2010, 30% of the displaced households in the severely affected areas and 16% in the highly affected areas were still unable to return to their original homestead (Figure 7.3).



Figure 7.2: Many households displaced by Cyclone Aila built makeshift homes beside the main roads in Koyra Sub-District, and some households took shelter on remaining portions of the embankment (October 2009)

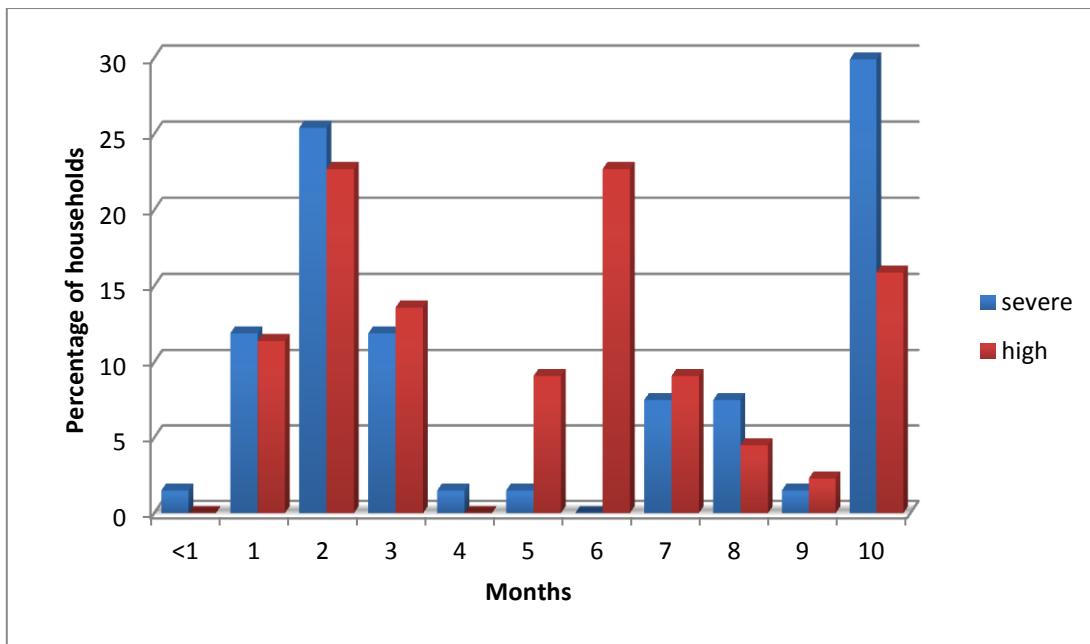


Figure 7.3: Duration of displacement among households in severely and highly affected parts of villages in Koyra Sub-District following Cyclone Aila in May 2009 and up to 10 months after

7.3.2.2 Impact on Shrimp Aquaculture

Loss of shrimp farms was the single biggest impact of the cyclone. According to the data provided by the Sub-District Fisheries Office, nearly 1026 fish ponds and 8,000 hectares of shrimp farm were completely destroyed in Koyra Sub-District. The cyclone hit as the sector was preparing to harvest the season's first output, meaning that all 'ready to export' grade shrimp was washed away. Most of the shrimp farms and ponds that were damaged by Cyclone Aila were still inundated 10 months later due to the broken embankments (Figure 7.4), resulting in major income losses and capital-intensive costs in restarting production. One respondent in the severely affected area of Jorshing Village for whom shrimp farming was the primary occupation described his economic conditions after Aila as follows (FGD#CVB):

I had 12-13 *bighas* [1.6-1.8 ha] of fertile land on which I grew shrimp. Their income was supplemented through shrimp trading. I had a comfortable existence. I had never seen a flood like it. I don't know what I will do next time. I used to survive on my shrimp farming and I can't afford to restart shrimp farming. Almost 10 months passed after Cyclone Aila, saline water intrusion could not be stopped as the wrecked embankments were not reconstructed yet. I have continued to receive 20kg of rice each month from the government, but with no income I and my family are now trapped and reliant on this to feed us. We barely managed to stay alive. It was indescribable.



Figure 7.4: (A) Shrimp farming areas in Koyra Sub-District remain under water 5 months (October 2009) and (B) 10 months (March 2010) after Cyclone Aila

7.3.2.3 Impact on Physical Assets

The housing sector also experienced a great deal of damage during the cyclone (Figure 7.5). Almost all households reported having had at least one house (main house) before the cyclone. Most of the houses were made of simple materials such as wood or mud with either a thatched palm or metal sheet roof (Table 7.7).

Table 7.7: Wall and roof materials of houses before Cyclone Aila in 5 villages in Koyra Sub-District (N houses (%))

| Construction Material | Cyclone Exposure | | | Total |
|-----------------------|------------------|---------|---------|----------|
| | Severe | High | Low | |
| Wall | | | | |
| Brick | 9 (10) | 10 (14) | 18 (21) | 37 (15) |
| Mud | 35 (39) | 49 (66) | 49 (58) | 133 (53) |
| Tin | 2 (2) | 1 (1) | - | 3 (1) |
| Wood | 5 (6) | 8 (11) | 7 (8) | 20 (8) |
| Goran | 33 (36) | 2 (3) | - | 35 (14) |
| Bera | 7 (8) | 4 (5) | 10 (12) | 21 (8) |
| Roof | | | | |
| Concrete | 1 (1) | 4 (5) | 7 (8) | 12 (5) |
| Straw | 1 (1) | 7 (10) | 10 (12) | 18 (7) |
| Golpata | 39 (43) | 34 (46) | 31(37) | 104 (42) |
| Tin | 36 (40) | 23 (31) | 30 (36) | 89 (36) |
| Asbestos | 14 (15) | 6 (8) | 6 (7) | 26 (10) |

Before Cyclone Aila, 15% of the houses were built from brick, 53% had walls made of mud and 14% had walls made from a mix of mud and goran (*Ceriops decandra* – a dominant plant species in the Koyra part of the Sundarbans), 8% had walls made of wood and 8% had walls made of bera, a product made from bamboo. About 90% of the houses in the severely affected areas were made of these more fragile materials but less than 80% in the less affected areas were made of these materials. Nearly 42% of the houses had roofs made from golpata, the leaves of the nipa palm, the dominant species in the Sundarbans, with other roofs made of paddy straw (7%), corrugated tin (36%), or asbestos (10%). Just 5% had concrete roofs with only 12 houses in the study villages having a concrete roof.



Figure 7.5: Most houses built with mud walls collapsed because of flooding following Cyclone Aila in Koyra Sub-District (September 2009)

In a key informant interview, the Sub-District CEO (KII#UNOK) stated that 140 km of roads and 125 km of embankment in Koyra Sub-District were fully destroyed by Cyclone Aila, and a further 90 km of roads and 61 km of embankment were damaged. The sub-district council was primarily involved in distributing relief goods to the affected areas but often did not have the transport capability to deliver them to their intended beneficiaries in remote and inaccessible areas (KII#UNOK). NGOs also faced difficulties in relief distribution as the roads went under water and there was a lack of transportation, as revealed by one NGO official working in Koyra Sub-District (KII#NGOK). I observed that there was virtually no direct communication to the highly affected areas during the wet season and not at all in the severely affected areas ten months after the cyclone. In these areas, boats were the only vehicle for the transportation of food items with only a few small and medium size mechanised boats being available. Even access to medical facilities for the people in the high and

severely affected areas was very limited due to the destruction of the roads and lack of transport as revealed by the focus group participants in Koyra No. 3 and Jorshing Villages (FGD#CVB; CVK).

Affected people did not get relief materials in time as a disrupted communication system resulted in irregular supply. Most households living in the severely affected remote areas received food aid late as poor communications and the collapse of the embankments slowed down the delivery of aid to those villages, as revealed by the chairman and member of the South Bedkashi Union Council (KII#CBU; M5BU; M6BU). All the local markets were severely damaged and communities faced difficulties in buying food. Physical access to markets was disrupted in some of the severely affected areas due to breaches of roads and embankments. Many boats were also damaged (Table 7.4 above), causing further disruption to transportation, and subsequently transportation costs rose, resulting in price increases for essential food and non-food items.

Difficulties in obtaining drinking water were one of the most critical concerns in the high and severely affected areas. Even before Cyclone Aila, less than 60% of all households in study areas had an adequate water supply and sanitation but afterwards the number of households in the high and severely affected areas suffering from drinking water shortage and the destruction of sanitation facilities increased greatly, as revealed by the focus group participants in Jorshing Village and Koyra No. 3 Village (FGD#CVB; CVK; FCVK). They further stated that during the wet season following the cyclone they did manage to use rainfall as a useable source of drinking. According to the focus group participants (FGD#CVB; CVK; FCVK), women and

young children had to spend a long time each day travelling long distances, sometimes through polluted salt water, to collect drinking water. Even ten months after the cyclone, at the time of the first survey, I observed that people were still living in unhealthy and unhygienic conditions without adequate supplies of pure drinking water and proper sanitary facilities. At that time, the wet season was ending and access to water was regarded as the most pressing need.

By October 2009, some basic slab latrines had been built by several NGOs (Figure 7.6) and hanging latrines were widely used by households who had taken shelter on the embankment. This was of particular concern among the focus group participants who stated that women and children were at higher risk of contracting skin-borne diseases and other health diseases due to the unavailability of potable water to support ablution, bathing and cleaning (FGD#FCVK). Women from Koyra No. 3 Village complained that hygiene promotion efforts by the government and NGOs were inadequate, inconsistent and irregular (FGD#FCVK). After Cyclone Aila, no specific toilet arrangements were made for women who had to go to the riverside or use the temporary hanging latrines provided by relief organisations for ablutions; these facilities were grossly inadequate for them. Female participants in the focus group discussion at Koyra No. 3 Village also reported that they needed to travel a long distance to avail toilet facilities and to collect water for drinking as they had no permanent sanitation and drinking water facilities since Cyclone Aila struck (FGD#FCVK).



Figure 7.6: Temporary toilet built by an NGO in Koyra No. 3 Village and hanging latrine in Jorshing Village in the cyclone-affected areas of Koyra Sub-District (October 2009)

7.3.2.4: Impact on Human Assets

The cyclone caused a major deterioration in the quality of the households' health environments in the high and severely affected areas by reducing their access to safe water, and destroying or damaging their toilet facilities, as revealed by the focus group participants in Koyra No. 3 Village and Jorshing Village (FGD#CVB; CVK; FCVK). They further reported that they were more vulnerable to vector-borne and water-borne diseases along with suffering from shortages of water and poor sanitation. Diarrhoea was reported by the participants to be the most widespread illness affecting people immediately after the cyclone, followed by influenza, malaria and skin disease. Some were affected by respiratory illnesses, fevers, nausea and dizziness. Individuals in all age groups, especially children, experienced deterioration in health at this time. Participants in the focus group discussions described the symptoms of diseases and health problems, which were related to physiological, respiratory, chronic and acute conditions (FGD#CVB; CVK; FCVK). The skin diseases that the participants referred to, and which I observed, included a range of dermatological conditions, backaches and lower body aches. Body sores

were said to emanate from mosquito and tick bites. The participants in the focus group discussions linked the increase in skin diseases to the effects of walking in contaminated saline flood waters. Another health-related problem was malnutrition, since people who had been affected by the flood lacked sufficient food to sustain them in good health (FGD#CVB; CVK; FCVK). However, there was not a widespread outbreak of water-borne diseases such as diarrhoea in the study area at the time of the study despite the scarcity of medical facilities according to the participants of the focus group in Koyra and Jorshing Villages.

During the key informant interviews, three elected member of the South Bedkashi local government (KII#CBU; M5BU; M6BU) stated that limited services were offered to the affected areas and described the visits by medical health officials to most of the affected areas as sporadic. I did not observe any medical camps on my visits to the area in September 2009 (three months after the cyclone), October 2009 and March 2010, although some NGOs were distributing a small number of oral saline and water purification tablets to the people in high and severely affected villages. Health facilities were severely understaffed and were barely able to provide even the most basic health care services due to the damage to the roads and the disruption of power, water and sanitation services (KII#UNOK).

After the disaster, the major public educational institutions temporarily ceased their principal activities and the institutions were used as temporary shelters for the homeless (KII#UNOK). Thus, little education was delivered in the affected areas for an extended period from May to September 2009 after the cyclone. By October 2009 only a few schools had started functioning but many of the school-age children were

engaged with household work instead of going to school (KII#PST). Basic school facilities including books and furniture had been destroyed and this contributed to non-attendance along with considerable concern about communication and transportation issues (KII#UNOK; PST). The disruption to education during this period for the students was a setback that would never be recoverable. A teacher interviewed in Koyra No. 3 Village (KII#PST) described the schools being marooned in a sea of saline water after the cyclone. After remaining closed for about five months, the schools opened but only a few children attended classes and they played around and went home early. Their education was hampered as books, school furniture and all other facilities were destroyed due to the prolonged flooding caused by Aila. He reported that many school-going children left the locality and those who remained dropped out from school and helped their parents in household tasks and work.

7.3.2.5 Impact on Social Assets

The first 10 to 15 days after the cyclone were crucial for survivors. They remained without government or NGO help before the relief machinery began to move with substantial quantities of relief goods, which did not happen until the second week of June. During this time, the “first” responders who acted as potential sources of material help and services were neighbours, family members and other community members who had also been impacted by the same events.

During the cyclone itself, higher income households with houses with brick walls and concrete roofs (called “pucca” houses) provided shelter to hundreds of neighbours as their houses were capable of withstanding the wind and tidal surge (Table 7.6). Many respondents remained in their neighbours’ house for several days

before they were able to return to their original homestead or build alternative makeshift shelters. The higher income households also provided food to their poor neighbours immediately after the cyclone. From a livelihoods perspective, the social assets built up over time by these households made protective shelter available to save many lives.

In Koyra Sub-District, key informant interviews with the Chief Sub-District Administrative Officer (KII#UNOK) and elected Union Council Chairman from South Bedkashi (KII#CBU) revealed that the law and order situation actually improved in areas affected by Cyclone Aila and was better than in other parts of the district. Participants in the focus group discussions in Jorshing Village and Koyra No. 3 Village (FGD#CVB; CVK) also felt that the law and order situation was well under control due to community support and networking. They also described how many community members provided physical support to rebuild their makeshift huts to get them through the immediate crisis and many existing conflicts were set aside, at least during the period of crisis, as a way of surviving after Cyclone Aila.

However, by the time of my visits five to ten months later, I observed that the strength of the social networks and institutional arrangements to support cyclone victims was starting to dwindle. It appeared that the availability of community-level support was decreasing gradually due to the prolonged period of tidal flooding and uncertainty associated with the embankment reconstruction. I observed that local well-off households who used to provide patronage support to the poor households (see Chapter 4, Section 4.3.2) realised their own vulnerability to the extended inundation of their shrimp farms too late and migrated, at least temporarily, to other

places. Those who remained were no longer able to help their poorer neighbours due to extensive damage and uncertainty about their own future income. Even many well-off families were by then dependent on the government and NGO relief support for immediate survival. My observation was that the leadership associated with the patronage systems was temporarily broken down and some of the traditional village leaders were more concerned with their own survival by competing for scarce relief materials than with their social obligations. Therefore, Cyclone Aila had destabilised social relationships. The participants of the focus group discussions in Koyra No. 3 Village and Jorshing Village stated that most households cancelled or postponed the celebration of ceremonies such as birthdays, anniversaries and the Eid Islamic festival after the end of Ramadan. Weddings were seldom scheduled because the families of young women were unable to make the necessary preparations (FGD#CVB; CVK; FCVK).

7.3.3 Factors Causing Vulnerability to Cyclone

7.3.3.1 Conditions of the Coastal Embankment

The collapse of large sections of the embankments separating the prawn farms from the tidal rivers was the primary cause of the huge devastation of crops and property damage following the tidal surge, as revealed by the focus group participants in Koyra No. 3 Village and Jorshing Village (FGD#CVK; CVB; FCVK) (Figure 7.7).

In a key informant interview, a government official from the Bangladesh Water Development Board (BWDB) working in Koyra Sub-District (KII#SOWDB) said that inadequate drainage infrastructure, illegal habitation and poor maintenance were weaknesses that had generally accumulated leading to the destruction of extended sections of the embankment during Cyclone Aila. He blamed the shrimp farmers who

had created holes in the embankment to pipe salt water from the rivers into their shrimp farms for weakening the embankment structure. These sluices or cuts had left weak zones and low spots in the embankment defences. He stated that flows through uncontrolled sluices that lacked protective wing walls were rapidly eroded at both ends, leading to slipping and collapse of the embankment.



Figure 7.7: (A & B) A collapsed embankment after Cyclone Aila (October 2009) and (C) an abandoned embankment during the dry season in Jorshing Village, a severely affected area of Koyra Sub-District (March 2010)

The participants in the focus group discussions in Koyra No. 3 Village and Jorshing Village (FGD#CVB; CVK) had different views. They explained that the embankments that protected them from the intrusion of saline water had broken in scores of places, mostly at the points where pipes (locally called “gois”) had been illegally set beneath the embankment to bring saline water into the shrimp ponds. These embankments had not been maintained or repaired for a long time. The focus group participants alleged that the owners of the shrimp farms managed to set these

pipes by bribing the Water Development Board officials. According to these participants, poor maintenance of the embankments, built 40 years ago, as well as their gradual weakening by pipes used for shrimp farming, had exacerbated the impact of the storm and made them more vulnerable.

7.3.3.2. Inadequate Cyclone Shelters

This study found that the residents were aware of the cyclone warning system despite the fact that Cyclone Preparedness Programme (CPP) dissemination activities did not exist in Koyra Sub-District. Most of the respondents said they had obtained accurate and timely information about the cyclone from radio and television. In addition, the Union Council members disseminated warning messages at the grassroots level using microphones, loud speakers and sirens as well as keeping the radio on to directly receive warnings.

Despite this awareness, only 27% percent of the respondents went to a formal cyclone shelter centre during Cyclone Aila (Table 7.8). Other respondents either used informal shelters, such as neighbours' houses (19%), or remained at their own home (36%), which may or may not have been built to withstand a cyclone. A few sat out the storm in a mosque, community school or nearby market. However, 11% survived in localities where the risk was much higher, such as trees, boats, on roof tops or on the open embankment.

Table 7.8: Type of shelter taken during Cyclone Aila in Koyra Sub-District

| Place of shelter | N (%) | Distance to Nearest Cyclone Shelter (m) | |
|-------------------|---------|---|--------|
| | | Mean | Median |
| Own home | 89 (36) | 2333 | 2000 |
| Cyclone shelter | 66 (27) | 742 | 500 |
| Neighbour's house | 46 (19) | 2924 | 3000 |
| Community school | 11 (4) | 1727 | 2000 |
| Tree | 12 (5) | 2625 | 2000 |
| Embankment | 9 (4) | 2011 | 2000 |
| Mosque | 5 (2) | 2000 | 2000 |
| Boat | 5 (2) | 1220 | 1000 |
| Nearby market | 5 (2) | 1900 | 1500 |
| Roof top | 1 (-) | 1500 | 1500 |
| Total | 249 | 1955 | 2000 |

The average distance to a cyclone shelter was nearly two km from all households (Table 7.8), and over 3 km for the respondents for whom the shelter was too distant (Table 7.9). Nearly 9% of the respondents did not have time to reach the shelters although they lived just 1.5 km away from the cyclone shelter. Only 13% of respondents felt they had no need of a cyclone shelter. In addition, 8% of the respondents did not make any attempt to go to the cyclone shelters as they knew from previous experience that the centres would be full and dominated by the people who lived nearer by.

Table 7.9: Reasons for not going to a shelter during Cyclone Aila in 5 villages surveyed in Koyra Sub-District

| Reasons | N (%) | Distance to Nearest Cyclone Shelter (m) | |
|--------------------|---------|---|--------|
| | | Mean | Median |
| Too far | 85 (46) | 3024 | 3000 |
| Poor communication | 17 (9) | 1853 | 2000 |
| Lack of time | 17 (9) | 1559 | 1500 |
| Already full | 14 (8) | 2536 | 2250 |
| Flooded | 13 (7) | 1192 | 1000 |
| Indecision | 14 (7) | 2607 | 3000 |
| No need | 23 (13) | 1623 | 1000 |
| Total | 183 | 1312 | 2000 |

One participant described his circumstances in the focus group discussion in Koyra No. 3 Village (FDG#CVK); he stated that he and his wife did not go to the cyclone shelter as it was nearly 4 km from their house. From previous experience, he knew the cyclone shelter would be full and they would not be able to be accommodated. He decided to stay home as it didn't look like a fierce storm and the wind was not as strong as in previous cyclones. But, he reported, in no time the house was full of water and the walls started to collapse. His wife clung on to him and they were driven out of the house. They were in waist-deep water. The current was so strong that he struggled just to stay afloat. They managed to grab hold of a branch of a tree and hung onto it all night until the storm passed.

All 13% of respondents who felt they had no need to take shelter lived in “pucca” houses (Table 7.8). Nearly 9% of the respondents failed to take shelter because of poor communication and might have done so if they had known earlier that the cyclone was coming; by the time they knew, roads to the cyclone shelters had been

damaged or blocked by uprooted trees. Other respondents (7%) were caught in the storm surge while on their way to the shelters. About 7% of the respondents were unable to make a decision in time, thinking that the approaching cyclone would not be particularly strong and they would be safe at home. Some women who answered the household survey reported that they failed to take shelter because the household head was away and they felt that it was inappropriate for them to go to the cyclone centres without the consent of the head of the family. Some respondents stayed at home until they had finished preparations, by which time it was too late.

Some focus group participants and key informant interviewees across all the locations mentioned that the number of cyclone shelters was inadequate for the population. The focus group participants in Koyra No. 3 Village (FGD#CVK) said that the only formal cyclone shelter close to the village was situated nearly 4 km from the village and was not sufficient for the people in the adjoining community. Participants of the focus group discussion in Jorshing Village (FGD#CVB) reported that they had one cyclone shelter to accommodate 2000 people and the rest of the people had to take shelter in other places. They further believed that the existing shelters were not properly located and there were no arrangements to store food and drinking water in the shelters for either people or livestock and poultry. Many people were reluctant to leave home out of concern for domestic animals, household assets in general and the loss of their means of livelihood. In addition, the cyclone shelters had little food, almost no drinking water and completely inadequate sanitation facilities. Despite these privations, I observed that some people were still living in cyclone shelters 10 months after Cyclone Aila crossed the coast (Figure 7.8).



Figure 7.8: Some displaced households in Jorshing Village severely affected by Cyclone Aila were still living in cyclone shelters 10 months after the cyclone

7.3.3.3. *Fragile Housing Structures*

Houses built on a foundation of earthen plinth and with walls made of mud, Goran, Bera or wood were damaged or destroyed by the tidal surge (Table 7.7) although I found that very few roof tops had been blown away by the wind. The focus group discussions with affected people in Jorshing Village and Koyra No. 3 Village (FGD#CVB; CVK) revealed that the households lost other household property because dwellings collapsed and damaged their belongings such as furniture, clothing and cooking and eating utensils. The mud from which the walls were built simply dissolved into the floodwaters forcing their occupants to build temporary shelters on any high ground available. In the next section, I discuss the coping strategies that the households adopted and their income during the post-cyclone period.

7.3.4 Post-Cyclone Income and Coping Strategies

The results showed that nearly 90% of affected people in severely and highly affected areas received relief from the government due to the heavy loss of assets (Table 7.10). Immediately after Cyclone Aila, the government provided gratuitous relief to nearly all households in severe and highly areas affected by the cyclone for two months. After the initial damage and needs assessment, the government distributed 20 kg rice per household per month in severely affected areas and 10 kg per household per month in highly affected areas through the Vulnerable Group Feeding program.

Table 7.10: Income sources during the post-cyclone period in Koyra Sub-District (N and %))

| Income Source | Cyclone Exposure | | | χ^2 value | P-value |
|---|------------------|---------|---------|----------------|---------|
| | Severe | High | Low | | |
| A. External Support | | | | | |
| Transfer-based | | | | | |
| Government gratuitous relief ² | 88 (97) | 73 (99) | - | 232 | P<0.001 |
| Vulnerable Group Feeding | 88 (97) | 73 (99) | - | 232 | P<0.001 |
| Home construction grant | 19 (21) | 15 (20) | - | 20.1 | P<0.001 |
| NGO-basic necessities | 65 (71) | 50 (68) | - | 109 | P<0.001 |
| Grant from relative | 12 (13) | 5 (7) | - | 11.9 | P<0.01 |
| Wage-based | | | | | |
| Food or cash for labour | 42 (46) | 37 (50) | - | 59.1 | P<0.001 |
| B. Coping-Based | | | | | |
| Loan | | | | | |
| Loan from informal sources | 35 (39) | 12 (21) | 9 (16) | 21.7 | P<0.001 |
| Loan from government agency | - | - | 1 (1) | 2 | NS |
| Loan from NGO | 4 (4) | 7 (10) | 15 (18) | 8.6 | P<0.05 |
| Loan from relative | 7 (8) | 6 (8) | 2 (2) | 3 | NS |
| Selling assets | | | | | |
| Selling land | 2 (2) | 3 (4) | 1 (1) | 1.4 | NS |
| Selling livestock | 3 (3) | 23 (31) | 4 (5) | 36.08 | P<0.001 |
| Selling ornaments | 3 (3) | 2 (3) | - | 2.7 | NS |
| Withdrawing savings | 1 (1) | - | - | 1.7 | NS |
| Fishing in waterlogged areas | 25 (28) | 48 (65) | - | 80.1 | P<0.001 |
| Migrated to outside the village | 1 (1) | - | - | 1.7 | NS |
| C. Occupation-Based | | | | | |
| Agriculture | - | - | 33 (39) | 74.7 | P<0.001 |
| Shrimp farming | - | - | 30 (36) | 67 | P<0.001 |
| Sundarbans forest resources | 53 (58) | 17 (23) | 21 (25) | 29.1 | P<0.001 |
| Services | 4 (4) | 3 (4) | 10 (12) | 5.1 | NS |
| Trade and business | 10 (11) | 4 (5) | 12 (14) | 3.4 | NS |
| Daily labour | 2 (2) | 1 (1) | 19 (23) | 29.9 | P<0.001 |
| Begging | - | 1 (1) | - | 2.4 | NS |

Additional external support was provided by the Food for Work and Cash for Work (CFW) activities that were sponsored by the government and NGOs. These programs

² Since 1973 Ministry of Food and Disaster Management (MOFDM) has been implementing food-based Gratuitous Relief (GR) Program every year based on Bangladesh government support. The main objective of this program is to provide relief support in kind (rice/wheat) immediately after the natural and man-made disasters (cyclone, floods, tornado, fire, river-erosion, tidal surge, earthquake etc.) to only worst affected distressed and poor persons/households.

provided external support in exchange for labour in the reconstruction of roads and embankments. Men and a few women (Figure 7.9) from about 46% of the severely affected and 50% of the highly affected households undertook FFW/CFW activities during the dry season following the cyclone. In contrast, only 11 households were employed as wage labourers in the government-sponsored rehabilitation activities during the wet season although the government made a very large allocation of food to reconstruct the embankment and roads. The FFW and CFW programs were introduced to restore the infrastructure and provide income as some forms of employment in paid labour disappeared immediately after the cyclone.



Figure 7.9: Some people including female workers participated in the FFW/CFW activities in Jorshing Village in Koyra Sub-District, but most workers were male

The study found that borrowing money was the most common coping measure, with 51% of all households in the severely affected areas and nearly 40% in the highly affected areas borrowing money. In this regard, informal sources which included moneylenders (39% in the severely affected areas and 21% in the highly affected areas) were the highest loan providers followed by friends/relatives (8% each) and NGOs (4% and 10%). Only one household borrowed money from a government

agency in the least affected areas. Relatives, neighbours and family friends helped cyclone-affected families by providing loans and other assistance, or affected families were able buy food from local shops on a credit basis. Dependency on informal sources was higher than on NGOs and other formal credit providers. A number of leading NGOs that dealt with micro-credit also operated in the study area but micro-credit disbursement was stopped by the NGOs because many households were leaving the area or because of the uncertainty of the repayment of existing loans as few income opportunities existed after the cyclone. Some households borrowed money from multiple sources simultaneously and used one source to repay another, thus entering into a ‘vicious circle’ of borrowing.

Selling productive assets such as livestock was also a common coping strategy among the rural poor. Only 3% of the severely affected households made distress sales of livestock compared to 28% of the highly affected households during the wet season. During the dry season, 2% and 4% of the households sold land in the severely and highly affected areas, respectively, compared with just one household in the least affected areas. Only three households and two households in the severely and highly affected areas, respectively, had to sell ornaments compared with none in the least affected areas. In the severely affected areas, one household was forced to withdraw savings from the bank for survival. All the households that made a distress sale of livestock accepted a value that was about 20% less than the normal market price. One household head migrated outside the village during the wet season but returned in the dry season when the government-sponsored food-for-work activities became operational.

The focus group discussions in Jorshing Village and Koyra No. 3 Village further identified some coping strategies which were not identified by the household survey (FGD#CVB, CVK, FCVK). For instance, almost all the households in the affected areas ate irregularly and reduced the amount of food they ate during each meal. Several households lived on just one meal a day, as they were solely dependent on food aid from the government. Households modified their diet by consuming more fish and fewer vegetables. A majority of the households reduced their daily expenditure on less urgent items such as clothes and children's education.

Before Cyclone Aila, each household tended to have several income-generating activities but there were far fewer options after the cyclone. While households that depended on the Sundarbans as their primary livelihood strategy still earned an income from mangrove forest resources, income from agriculture and shrimp farming fell to virtually nothing in the severe and highly affected areas but continued as normal in the less affected areas. Very few households were able to return to their commercial business after the cyclone in the severely and highly affected areas and there were very few sources of paid labour.

The income portfolios of the households following the cyclone were divided into the categories of external support, coping strategies and occupations, as presented in Table 7.11. The average total income was estimated at US\$773 and US\$794 for the severely and highly affected households, respectively, but was about 25% higher for the least affected households (US\$1,127). Income was significantly different at the 5% level. In the severely affected areas, mangrove forest resource collection contributed the most to household income (41%) followed by external support (24%)

and coping strategies (23%). Households in the highly affected areas depended more on coping strategies (56%) for survival after the cyclone as these areas were dominated by agricultural cropping with few people collecting mangrove forest resources. For the least affected areas, which remained protected by the embankment after the cyclone, occupations contributed nearly 95% of income after the cyclone.

Table 7.11: Mean income from different sources following Cyclone Aila, Koyra Sub-District (% within total income)

| Income Category | Cyclone Exposure | | | F-value | P-value |
|-------------------------------|------------------|-----------------|-------------------|--------------|-------------------|
| | Severe | High | Low | | |
| External support | | | | | |
| Transfer-based | 135 (18) | 85 (11) | - | 74.42 | P<0.001 |
| Wage-based | 47 (6) | 76 (10) | - | 23.46 | P<0.001 |
| Sub-total | 182 (24) | 161 (21) | - | 82.85 | P<0.001 |
| Coping strategies | | | | | |
| Loan-based | 116 (15) | 64 (8) | 55 (5) | 3.69 | P<0.05 |
| Selling assets | 29 (4) | 260 (33) | 7 (1) | 12.69 | P<0.001 |
| Fishing in water-logged areas | 33 (4) | 121 (15) | - | 40.35 | P<0.001 |
| Migrated away from area | 1 - | - | - | 0.87 | NS |
| Sub-total | 179 (23) | 445 (56) | 62 (6) | 20.14 | P<0.001 |
| Occupations | | | | | |
| Agriculture | - | - | 357 (32) | 27.12 | P<0.001 |
| Fisheries | - | - | 196 (17) | 20.6 | P<0.001 |
| Sundarbans forest resources | 313 (41) | 136 (17) | 121 (11) | 12.96 | P<0.001 |
| Service | 59 (8) | 22 (3) | 141 (13) | 1.64 | NS |
| Trade and business | 36 (5) | 27 (3) | 176 (16) | 3.45 | P<0.05 |
| Daily labour | 5 (1) | 1 - | 74 (7) | 16.25 | P<0.001 |
| Begging | - | 2 - | - | 1.19 | NS |
| Subtotal | 412 (55) | 188 (24) | 1065 (96) | 17.5 | P<0.001 |
| Total | 773 | 794 | 1127 | 3.19 | P<0.05 |

Table 7.12 presents the results on the income of the different groups before and after the cyclone in comparison to the total loss. For the 27 shrimp farming households that lost assets, the average income in the 10 months after Cyclone Aila was US\$625, less than 64% of the pre-cyclone income. The 65 households who collected resources lost assets worth an average of US\$611, but their post-Aila income increased by over 45% following the cyclone. The 42 households for whom the primary occupation of the household heads was wage labour lost an average of US\$510, but their post-cyclone income increased by 19%. The decline in the proportion of income coming from agriculture and shrimp farming was most marked in the severely and highly affected areas as these sectors were largely destroyed by the cyclone.

In the severely affected sites the mean income of the higher income group was five times that of the lowest income group. Following the cyclone the income of the lowest income group had risen by about 40% and that of the highest income third more than halved. Although the poorest group was still less wealthy, their income was now three-quarters that of the highest income group. Furthermore the lowest income group, at the time of the study, had income from both government programs and resource collection whereas the highest income group continued to have none, a situation that continued for at least a year after the study was complete. This contrasted with the low impact areas where the differential between the poorest and the wealthiest groups changed little following the cyclone.

Table 7.12: Losses sustained and income changes among people in Koyra Sub-District, in the 10 months before and after Cyclone Aila

| | Cyclone Exposure | n | Loss Sustained | Income before Cyclone | Income after Cyclone | Change of Income (%) |
|--|------------------|-----|----------------|-----------------------|----------------------|----------------------|
| Primary Occupation Groups¹ | | | | | | |
| Shrimp farming | Severe | 27 | 5949 | 1773 | 625 | -64 |
| | Total | 27 | 5949 | 1773 | 625 | -64 |
| Daily labour | Low | 15 | 139 | 382 | 438 | +15 |
| | High | 22 | 622 | 480 | 580 | +20 |
| | Severe | 5 | 1135 | 451 | 559 | +24 |
| | Total | 42 | 510 | 441 | 527 | +20 |
| Sundarbans resource collection | Low | 17 | 162 | 434 | 614 | +41 |
| | High | 15 | 582 | 481 | 711 | +47 |
| | Severe | 33 | 856 | 548 | 792 | +43 |
| | Total | 65 | 611 | 503 | 728 | +45 |
| Agriculture farming | Low | 11 | 532 | 1030 | 1146 | +11 |
| | High | 20 | 3432 | 1429 | 668 | -53 |
| | Total | 31 | 2403 | 1287 | 837 | -35 |
| Combined agri- and shrimp farming | Low | 17 | 1014 | 1029 | 1146 | +11 |
| | High | 1 | 6163 | 1817 | 4440 | +144 |
| | Total | 18 | 579 | 418 | 588 | +5 |
| Income Groups | | | | | | |
| Lower income | Low | 39 | 145 | 389 | 547 | +40 |
| | High | 35 | 709 | 416 | 589 | +41 |
| | Severe | 29 | 1005 | 462 | 641 | +39 |
| | Total | 103 | 579 | 418 | 589 | +41 |
| Middle income | Low | 20 | 386 | 698 | 824 | +18 |
| | High | 15 | 827 | 654 | 664 | +1.5 |
| | Severe | 27 | 1462 | 699 | 780 | +12 |
| | Total | 62 | 961 | 688 | 766 | +10 |
| Higher income | Low | 25 | 989 | 2248 | 2273 | +1 |
| | High | 24 | 4671 | 2647 | 1174 | -55 |
| | Severe | 35 | 5709 | 2215 | 877 | -60 |
| | Total | 84 | 4007 | 2348 | 1377 | -41 |

1. Based on primary occupation of household head (details in Table 7.3)

In the next section, I consider the vulnerabilities caused by the cyclone from a livelihood perspective and the coping strategies adopted by the households

considering the strengths and capacities of the different income and occupation groups to adapt (or cope) to the sudden change in circumstances brought about by the cyclone.

7.4 Discussion

7.4.1 Vulnerabilities Caused by Cyclone Aila

Vulnerability has been associated with the loss or degradation of assets; these losses impact on welfare and create lower future income flows, consumption and investment (Moser, 1998; Reardon and Vosti, 1995). Cyclone Aila resulted in both the loss of household assets and the loss of income and made the affected communities vulnerable. For almost all the households, the cyclone was a severe shock and made them vulnerable as they lost all or most of their productive assets especially in the highly and severely affected areas. The impact of natural shock will be persistent if it destroys assets or changes risk perceptions and preferences (Carter et al., 2007; Van den Berg, 2010). Gentle and Maraseni (2012) observed in Nepal that changing weather patterns had significantly challenged livelihoods through resource degradation, food security and increasing social inequalities.

The higher income households in the study area were more vulnerable in both relative and absolute terms as the average damage costs in absolute terms were significantly greater for the higher income households and their coping capacity was also lower than that of the lower income households, reflected by the fact that the post-cyclone income was significantly lower for the higher income households than their pre-cyclone income. However, the relationship between income and damage costs (and hence vulnerability) appeared to be more complex in the Aila-affected

areas than the literature would suggest. Brouwer et al. (2007) found that the average damage costs due to flooding in Bangladesh in absolute terms were significantly higher for wealthier households but the relative proportion of the flood damage costs in total household income was significantly lower for wealthier families. They also found that the coping capacity of wealthier families was greater than the coping capacity of poorer households. Hurricane Mitch was found to have had a similar effect in rural Honduras, with the magnitude of loss being over 15 times greater among the higher income households than among the poorest, although the households in the lowest wealth quintile were relatively worse off with their few assets reduced by 18%, compared to just 3% for those in the upper wealth quintile (Morris et al., 2002).

From the perspective of individuals in the communities in my research, livelihoods, not hazard events, were the primary source of vulnerability. Local manifestations of vulnerability were linked to factors such as heavy dependence on shrimp aquaculture. Cutter and Emrich (2006) studied the changing face of vulnerability along the Hurricane Coasts and found that the dependence on a single economic sector increased vulnerability because there were no alternative sources of employment if that sector sustained long-term damage. Following the 1991 Pinatubo eruption, Gaillard (2008) noted that a predominant factor in the capability of the local communities to overcome the disaster was the diversity of their pre-disaster livelihoods. The rural economy in Koyra Sub-District suffered serious disruption from Cyclone Aila, primarily because of the economy's dependence on shrimp farming and related business activities. In the region affected by the cyclone, shrimp farming constituted 40% of all employment before Cyclone Aila (Kumar et al.,

2010). Shrimp farmers suffered the most damage, both in absolute and relative terms, and their income was reduced by about one-third due to the cyclone. Thus, the relatively recent replacement of agriculture by cash-earning shrimp production led large shrimp farmers into bankruptcy due to the damage to the shrimp farms and significant reduction of post-cyclone income compared to the pre-cyclone income. Additional vulnerability existed because market-based coping strategies like crop or shrimp insurance had not been introduced in Bangladesh. In Vietnam, shrimp aquaculture had been found to increase the overall wealth of the shrimp farmers with trickle-down effects benefiting the population as a whole; however, the shrimp farmers were tying up capital in an inherently risky venture as their shrimp farms were seriously exposed to storm impacts (Kelly and Adger, 2000).

Cyclone Aila devastated all the drinking water sources (ponds and tube wells) as the tidal surge associated with the cyclone had contaminated all fresh water sources with polluted saline water. Households were vulnerable to diseases due to the lack of minimum life sustaining requirements like water and sanitation. Inadequate medical facilities became costly for the affected people and they were more vulnerable as government medical services were unavailable due to the disruption of communication and destruction of roads and embankments. Mallick et al. (2011) studied the impact of Cyclone Aila in Gabura Union of Shyamnagar Sub-District and found that 78% of the affected people had no permanent sanitary arrangements after the cyclone. Such conditions led to sickness. As Alam and Collins (2010) noted in relation to the vulnerability of Cox's Bazar and the Chittagong District of Bangladesh, diarrhoea, dysentery, fever and nausea were widespread after a cyclone making it even harder for people to cope.

The cyclone also had long-term negative impacts on livelihoods as it had displaced people from their original homesteads and forced them to relocate to makeshift houses built on the damaged embankments or roads. The flooding persisted long after the cyclone had damaged their dwellings. Many households probably expected such a move to be temporary but were forced to remain there for at least 10 months. The International Organization for Migration (IOM) (2010) estimated that 5,533 families in Koyra Sub-District were still displaced in November 2009. Natural hazards typically result in localised and temporary displacement but only rarely result in permanent migration (Oliver-Smith, 2005). However, since Cyclone Aila, about 1200 families in Koyra Sub-District have emigrated permanently with about 1500 families migrating temporarily (Kumar et al., 2010). Others were reported to have migrated across the nearby border to India (Gain, 2010). Hutton and Haque (2004) found that people displaced by river erosion were likely to experience substantial socio-economic impoverishment and marginalisation. I noted that almost all the poorest people in the severely affected areas had lost their houses, as often happens when cyclones affect impoverished communities (Gaillard et al., 2009).

Certain practices simultaneously increase vulnerability in a disaster situation. Cyclone Aila had a greater impact as there was a wide diversity of assets lost because of the breaching of the embankment and a failure to reconstruct it in a timely manner. The effects of the flooding gradually led to the shock of a disaster for those living in the region due to the slow livelihood recovery with many areas staying under water for extended periods. It was not possible for government programs and NGOs to reach all the cyclone victims during relief distribution due to the wrecked

embankments that caused poor communication. As reported by Mallick et al. (2011), the effect of Cyclone Aila was far worse than it might have been because the excavation of tunnels throughout the embankment had been allowed to persist unchecked for decades. In Cox's Bazar and the Chittagong District in Bangladesh, it was found that the embankments may also have been weakened by the construction of settlements on the top of what was public space by landless people (Alam and Collins, 2010).

In the context of the study area, Cyclone Aila stretched social institutions and structures; this made the affected households more vulnerable as it diminished social capital and put increased pressure on the capacity of others to help victims in the subsequent months. Social capital was a vital coping strategy for some people immediately after the disaster. However, because Aila was a regional disaster affecting multiple communities, many nearby communities competed for goods, personnel, supplies and communication, with the poorest communities tending to miss out. The erosion of social capital meant that the patronage systems that normally provided protection, credit and access to resources were also disrupted at the very time when they were most required and people were most dependent on each other. Thus, the short-term (10 month) income gap between the lower and higher income households tended to be smaller after the cyclone, and some patron-client arrangements changed. While new patrons were likely to emerge to replace those who had slipped irrevocably into poverty, the new patrons would not have the same history as those they replaced and may be less resilient when placed under pressure. Therefore, it could be argued that social capital is not useful in the face of prolonged disaster or climate change-related shock, as such events would affect all

the households in a community. Thus, while Bangladeshis are remarkably resilient in the face of natural disasters, my results are consistent with the argument by Devereux (1999) that informal safety nets are effective mechanisms when dealing with minor idiosyncratic shocks but are less effective when shocks are severe and community-wide. Such a pattern is consistent with the finding by Brouwer et al. (2007) that prolonged flooding in Bangladesh had a negative impact on the already fragile social networks and institutional arrangements. In Sri Lanka, it was identified that the strong social relations among fishermen in the southern part of the country were severely damaged following the 2004 tsunami (De Silva and Yamao, 2007). Social networks can offer very limited relief and are rapidly exhausted by major shocks (Khandlhe and May, 2006). Carter et al. (2007) found that local social mechanisms left poor Honduran households quite vulnerable to asset shocks in the long-term after Hurricane Mitch. Carter and Castillo (cited in Carter et al., 2007) studied Hurricane Mitch and found that recovery from Mitch was faster in communities characterised by high levels of pro-social norms of trust and altruism. Interestingly, only a subset of households seems to actually benefit from the pro-social environment, suggesting that there may be processes of exclusion that prevent all households from benefiting from socially-mediated accesses to insurance and capital (Carter et al., 2007).

The immediate response of many people on hearing Cyclone Aila was approaching was to consider going to a cyclone shelter. But only 27% of the surveyed households did so. Similarly, Mallick et al. (2011) found that almost 90% of the respondents they surveyed in Shyamnagar Sub-District had no access to cyclone shelters during Cyclone Aila. Like Mallick et al. (2011), I found that that distance to the nearest cyclone shelter was the most important determinant in the decision to seek refuge

there and unless a cyclone shelter was within 500 m of a house, local people did not take refuge. Similarly, Paul and Rahman (2006) found that the people they interviewed from Sandwip and Hatia Islands off the south-east coast of Bangladesh were able to travel no more than 0.5 to 1 km to reach a cyclone shelter during cyclones in 1991 and 1997. Paul (2009) also reported that during Cyclone Sidr, in 2007, nearly 17% of respondents rushed to shelters, but had to return to their homes because many of these facilities were already full and/or overcrowded.

Paul (2012) showed that trust in warning messages was a very important determinant in the decision to seek refuge in safer shelters during Cyclone Sidr. Although cyclone shelters played an important role in saving lives and property, existing literature indicates that local residents tend to remain in their houses for various reasons such as indecision due to disbelief in warnings, conservativeness, love of their domestic goods, elites dominating access to the shelters, a feeling of safety and security at home, inactive management committees of cyclone centres (Alam and Collins, 2010; Dasgupta et al., 2010; Paul, 2010; Paul, 2012; Paul and Rahman, 2006). All these observations are consistent with the findings of my study.

7.4.2 Coping Strategies

To recap, a coping strategy is one that includes the ability to maintain consumption in times of disaster (Ellis, 1998), in which people act within the limits of existing resources (Alam and Collins, 2010) in unusual, abnormal and adverse situations (Wisner et al., 2004).

The communities affected by Cyclone Aila relied on social capital in the form of receiving shelter, relief and food assistance from community members, which was

most apparent immediately after the disaster. Many of those affected by Cyclone Aila were able to find shelter in the “pucca” housing of their neighbours. Communities started to pull together immediately to maintain law and order themselves, as there was no possibility of getting support from the police or government administration because of damage to infrastructure and the communication network. This is a strongly embedded value in the Bangladesh society with the informal leadership within the community remaining operational in the post-disaster period, contributing physical and financial aid, food and other material support (Alam and Collins, 2010). Similarly, immediately after the Indian Ocean tsunami in 2004 the first humanitarian support came from within villages in Kerala, India (George, 2008) and from neighbouring communities in Southern Sri Lanka (De Silva and Yamao, 2007). The cyclone that hit the coast of Orissa in India in 1999 was so catastrophic that some communities experienced a ‘levelling’ effect where people from different castes and social groups were forced to work together simply to survive in its aftermath, resulting in a significant reshuffling of social relations in some communities (IMM, 2001). More normally, however, it is reported in rural Ghana that, although all households may lose assets, household heads that have a profession or are more educated offer assistance to more vulnerable households (Dasgupta and Baschieri, 2010). These examples from poor countries are all in sharp contrast to the reported looting frenzy unleashed in New Orleans during and in the aftermath of Hurricane Katrina (Khan and Rahman, 2007).

After the cyclone had passed, coping strategies were concentrated on accessing food, water and shelter. Water, although polluted, was locally accessible while shelter was cobbled together on embankments and other high sites. Food, however, had to come

from outside. Mallick et al. (2011) reported that 38% of people in Shyamnagar Sub-District did not get any emergency relief after Cyclone Aila and Paul and Rahman (2006) found that over half the residents of Sandwip and Hatia Islands in Bangladesh received no government assistance after Cyclone Sidr; however, in the present study, I found that government and NGO food aid was distributed fairly effectively in the severely and highly affected areas. The government gratuitous relief and VGF programs to distribute food-grain to affected households following the cyclone were well-targeted by the government to ensure food security and to maintain nutritional status, especially of children and women. The targeting of food aid in this way not only assists the most vulnerable (Morris and Wodon, 2003) but also helps stem price-hikes in local markets (del Ninno et al., 2001). The constant flow of disaster aid and its proper distribution by the government and NGOs were found to be the main reasons why tornado victims in north-central Bangladesh did not migrate (Paul, 2005).

The Food for Work/Cash for Work programs were also effective in providing employment in public works in exchange for cash or food transfers and created a targeted safety net that generated purchasing power among the affected households. The FFW programs that focused on rebuilding embankments and repairing roads were important for survival after Cyclone Aila and acted as coping strategies during periods of increased stress. The FFW and CFW programs helped the poor in particular. The employment of women as wage labourers to rebuild infrastructure was significant, particularly for the poorest households. Therefore, the cyclone created opportunities for additional income for households with lower socio-economic status and thus enabled these households to maintain or improve their

livelihoods. In the rural villages of Bangladesh, where women's activities are largely confined to within the household, exceptions are made during the disaster periods to permit women to engage more openly in daily living activities (Alam and Collins, 2010). Mallick et al. (2011) found that middle class families neither sought relief nor engaged in labouring activities because of psychological barriers associated with their social status, which increased their vulnerability.

External support provided by the government, NGOs and relatives also helped to mitigate the suffering of many people and helped them to return to normal livelihoods as soon as possible. Rodriguez et al. (2006a) found that the disaster relief generated by NGOs was extremely important and contributed to meeting many of the communities' basic needs after the Indian Ocean tsunami in India and Sri Lanka, even if it did not compensate for all losses (Morris et al., 2002; Paul, 2006). However recovery can be slow. Even three years after Cyclone Sidr, people strongly expressed their desire to receive further relief and support for re-building livelihoods (Paul and Routray, 2011). However, there also needs to be effective monitoring of the impact of aid to ensure corrective measures and to avoid the development of relief dependency by disaster victims, as has happened in many places (Wilk and Kgathi, 2007). It also needs to be monitored to prevent it falling into the wrong hands. On some occasions after a disaster in Bangladesh, many people have received more emergency assistance than the monetary damages they incurred from a given disaster (Paul, 1998a, 2003, 2006).

In this study I found that borrowing and selling were by far the most important coping mechanisms of the households sampled, in terms of both the value of the resources and the number of households that borrowed or sold assets. Borrowing can

serve as a safety net and can be both formal and informal. However, I found that opportunities to borrow from informal sources like friends and family members, which used to be without any interest, were largely unavailable to overcome financial constraints after Cyclone Aila. This was because the cyclone affected everyone in the community and many well-off households immediately left the village for safe shelter in other places. Affected families therefore mainly coped with the financial crisis with the help of informal credit from moneylenders or bought basic food or non-food items from local shops on a credit basis. The inability to access such assets traps the poor in a persistent cycle of chronic poverty.

Similarly, households adjusted to the shock of the 1988 floods in Bangladesh by reducing expenditure, selling assets and borrowing (del Ninno et al., 2001) with around 70% of the affected farmers in Bangladesh mitigating their income and asset losses by selling land, livestock, and other belongings following a disaster (Haque and Zaman, 1994). For example, Brouwer et al. (2007) found that rich families in a village lent money to flood-affected local residents during a flood in Bangladesh in 2004. Borrowing was also found to be the second-most prevalent coping strategy that households employed after flooding in Limpopo Province, South Africa (Khandlhela and May, 2006). Masud-All-Kamal (2013) found that informal credit and migration were the main coping and recovery strategies in response to Cyclone Aila.

Households became more vulnerable because they had no access to the credit provided by the NGOs. Even 10 months after Cyclone Aila, NGOs provided almost no loans at all. Rather, a number of leading NGOs that dealt with micro-credit and were operating in the study area stopped providing micro-credit after the cyclone.

The existing literature suggests that NGOs can play an important role in the coping response to natural disasters by distributing relief and subsidising micro-credit in flood-affected regions in Bangladesh (Zaman, 1999). Brouwer et al. (2007) also observed that formal credit institutions gave little assistance to flood-affected households in Bangladesh. While this may reduce the financial risk of the organisations concerned, it contrasts with the image they propagate as caring for the poor and vulnerable.

Selling productive assets is a common coping strategy for maintaining consumption among households during times of natural shock. Affected households have little control over the events that impact on their livelihoods and are forced to focus on daily survival and risk-avoidance whilst discounting the future by selling asset. In this study, asset sales were also observed among the affected households in the high and severely affected areas although not to a large extent as most households had few assets to sell after the cyclone. A lack of fodder and drinking water forced some households to sell livestock at a reduced price but this was largely in the highly affected area. Presumably, most livestock in the severely affected areas died before they could be sold; on the other hand, being areas almost entirely devoted to shrimp farming, there may have been fewer stock to sell in the first place. Households who didn't have any remaining assets made household-level adjustments as a coping strategy such as eating fewer meals and buying only inexpensive foods. Cutting non-essential expenditures and changing dietary habits are other coping strategies, as noted in Bangladesh (Paul and Routray, 2010), in South Africa (Khandlhela and May, 2006) and in Sulawesi, Indonesia (Keil et al., 2008). Analysing data from a drought in Zimbabwe, Hoddinott (2006) found that poorer households tended to asset

smooth in the face of drought-induced income losses, while wealthier households sold assets and smoothed consumption. Dorosh et al. (2004) found that although households managed to smooth their consumption and maintain total expenditures after the 1998 flood in Bangladesh, this came at the cost of high indebtedness.

Most households borrow money primarily to meet food consumption needs and emergencies for survival rather than investing to return to pre-cyclone livelihoods. The subsequent need for increased access to credit to generate new wealth is then likely to be particularly problematic if NGOs refuse to provide credit. In the study area, micro-credit organisations had stopped providing new loans since Cyclone Aila and pushed for the repayment of previous loans, which had the effect of delaying recovery and the return to normal livelihood activities. Instead, the only recourse available for many households has been to borrow money at exorbitant rates from moneylenders, putting further negative pressure on household economies and increasing their net losses.

Erosive coping strategies (Warner et al., 2012) may assist in the short-term but inhibit the long-term prospects and can trap the poor in a persistent cycle of poverty. In the study area, several coping strategies such as selling assets for consumption appeared to be pushing households towards indebtedness and risks. Selling of any asset by a household can be considered a marker of household vulnerability, indicating that the household has had to make the strategic decision to forgo future income and asset accumulation in return for a quick capital injection into the household finances. Thus, selling assets in distress does not represent a strategy conducive for the long-term security of the household, and sales after a cyclone are

indicative of particularly vulnerable households. Some households took their children out of school after Cyclone Aila, both to cut the costs associated with education and to increase household labour supply. In addition, the reduction in food consumption as a coping mechanism combined with the inadequate sanitation and drinking water facilities led to substantial increases in illness and a discounting of future human capital. Van den Berg (2010) stated that destruction or distress sales of productive assets following a hurricane or any natural hazard could induce people with relatively remunerative livelihoods to choose more defensive strategies which allow them to survive, but at a permanently lower welfare level than before. Jakobsen (2012) found that Hurricane Mitch pushed more households toward the lower end of the asset equilibrium and thus to a higher risk of being caught in the poverty trap.

7.4.3 Income Groups and Their Ability to Cope with the Cyclone

Although lower income households are usually considered the more vulnerable to climate-induced natural hazards than wealthier households, they have fewer assets to lose. By contrast, the incomes of higher income households in the study area dropped after Cyclone Aila and few were willing to undertake the work normally done by lower income households, leaving them dependent on other family members or having to move out of the region. Thus, Cyclone Aila created opportunities for growth for the lower income households that reduced, at least temporarily, the disparity in wealth and power between the lower and higher income groups or between the landless or land-rich households in the study area. Thus, in this case, the coping capacity of the lower income households was greater than that of the higher income households because the relative proportion of the cyclone damage costs in

total household income was significantly higher for the higher income households. For the lower income, functionally landless group, agriculture and shrimp farms had never been an option. As such, they depended much more on selling their labour to other farmers or to non-farm sectors. They readily took the opportunity to sell their labour to the FFW/CFW schemes and, in many cases, husband and wife worked together.

Thus, my results are in contrast to other studies from Bangladesh and other places in the world. Paul and Routray (2010), for example, analysed the impact of flooding in Bangladesh and found that people in lower income groups were the most vulnerable as they were more likely to cope with the situation by disposing of their few assets, while people in the high and upper middle income groups were able to cope without selling their assets. After Cyclone Sidr, the higher income group managed hardship without selling their valuables and were readily able to help themselves. They were thus less vulnerable than the lower and middle income households (Paul and Routray, 2011). Likewise, during the severe cyclone in Bangladesh in 1991, it was poor people living on low-lying, recently-formed islands along the coast who suffered the highest loss of life (Hoque, 1991). The reason that Cyclone Aila was different was that people could restart rebuilding their livelihoods immediately after the other cyclones whereas, after Cyclone Aila, the prolonged flooding due to collapse of coastal embankments (section 7.3.3.1) and the failure of authorities to repair embankments after two years (Section 8.5.1, chapter 8) destroyed the asset base of the higher income households and hindered a return to their previous livelihood activities.

Brouwer et al. (2007) showed that households with lower incomes and less access to productive natural assets faced higher exposure to the risk of flooding. Similarly, Rayhan (2010) showed that poverty and exposure to idiosyncratic floods were positively and highly significantly correlated in Bangladesh, while households with higher levels of education, headed by a male and owners of a dwelling place were found to be less vulnerable. Similarly, Jakobsen (2012) found that poor households were worse off after Hurricane Mitch. The 2004 Asian tsunami also had its greatest impact on the poor, as they had the fewest resources and their ability to recover was the weakest (Pomeroy et al., 2006). In a study of villages in the Krishna Delta of Andhra Pradesh, India, in the 1980s, it was found that marginal farmers, landless people and fishermen suffered the most from cyclones (Winchester cited in IMM, 2001). In each case, households who owned more assets were generally less vulnerable to shocks, and poverty and marginalisation were directly related to the impacts of climate-based natural hazards (Adger, 2006; Ellis, 2000a; Gentle and Maraseni, 2012; Jakobsen, 2012).

7.4.4. Importance of Mangrove Forest for Coping with Cyclone

The impact of a shock is most persistent if it destroys assets or changes risk perceptions or preferences (Carter et al., 2007; Van den Berg, 2010). In the immediate aftermath of Cyclone Aila, there was an equalising effect of the disaster on the class structure of the affected people. Agricultural farmers and shrimp cultivators had many more productive assets before Cyclone Aila and suffered most damage, in both absolute and relative terms. The shrimp farmers lost nearly ten times as much as the poorest sector of society and had less capacity to recover to pre-cyclone levels; in fact, this recovery was virtually impossible since reconstruction of

the coastal embankment was delayed for two years meaning that saline water remained in the fields. Some shrimp farms were destroyed permanently. Thus, the shrimp farmers suffered catastrophic losses. In contrast, the mangrove resource collectors lost far less in absolute terms after Cyclone Aila and were able to rebuild their lives more quickly. The mangrove resource collectors relocated rapidly, built makeshift houses and re-started their resource collection activities almost immediately after the cyclone had passed – indeed, lacking any assets, they were obliged to. Once aid funds arrived, they were also able to increase the amount they earned outside their resource collection income through labouring and other paid rehabilitation work.

Households relying on resource collection from the Sundarbans forest were barely affected by the cyclone in terms of income from mangrove resources because their two major assets, namely, skills and labour, continued to generate income in the Sundarbans following Cyclone Aila. Unlike the shrimp farmers, few of the productive assets of the poorest households were destroyed by the cyclone as they did not own land, livestock or business and most of the boats and nets essential for resource collection remained intact. The income derived from the mangrove resources thus remained stable during the period of prolonged flooding.

The mangrove resource collectors also benefited from a relaxation of Forest Department restrictions on the collection of mangrove resources following Cyclone Aila. Informally, the Forest Department allowed wood to be collected free of cost to reconstruct makeshift house or to establish a relocated house. This was in contrast to the response to Cyclone Sidr in 2007, following which there was a ban on all forest

extraction for two years. A senior forest department official said that entry to the forest was relaxed immediately after Cyclone Aila and even official permission was provided to extract fuelwood for those districts adjacent to the Sundarbans where the devastation had been greatest. This permission was not allowed in the less affected district of Bagerhat to the east. The fishermen benefited from an increase in the production of shrimp and other fish from mangrove areas following the breaches of the embankments that inundated the shrimp farms. Similarly, it was found that the access to forest land, if not to exportable forest products, made a difference to the ability of households to cope following Cyclone Mitch in north-east Honduras (McSweeney, 2005), and equitable land distribution after the disaster created a window of opportunity (McSweeney and Coomes, 2011).

Many people from higher and middle income households not only lacked experience to adapt to their new circumstance but also lacked the physical fitness required to collect mangrove resources or undertake manual labour. They were also trapped by societal expectations associated with their previous level of wealth so that they felt labouring work was beneath them. As found in rural Nicaragua (Van den Berg, 2010) and rural Ghana (Dasgupta and Baschieri, 2010), wealthier households coped through asset liquidation, meaning that those households sold off durable assets rather than undertake physical labour, accumulating losses rather than looking for new opportunities to tide themselves through the crisis.

7.4.5 Climate Change and Future Vulnerabilities

Cyclone Aila sent the message that prolonged tidal flooding, as may be expected to happen more frequently under climate change, can stretch a local community beyond

its ability to cope and make the community members more vulnerable. Climate change is likely to exacerbate the impact of cyclones on Bangladesh as they are likely to be more frequent. The generally accepted rate of sea level rise for Bangladesh is put at between 3 mm a⁻¹ and 6 mm a⁻¹ in most published sources (Bhuiyan and Dutta, 2012; CEGIS, 2006; SMRC, 2003). From 1970 to 2001, average temperatures in Bangladesh were estimated to have increased by 0.125°C/yr, which almost equalled the rate of global warming (SMRC, 2003). The Intergovernmental Panel on Climate Change (IPCC) Third Assessment (2001) concluded that the regional frequencies of tropical cyclones may not change whereas the peak intensity may increase by 5% to 10% and precipitation rates may increase by 20% to 30%.

Knutson et al. (2010) have also suggested that there will be increases in the frequency of the most intense cyclones, and increases of the order of 20% in the precipitation rate within 100 km of the storm centre due to climate change, all of which are likely to increase the vulnerability of Bangladesh to cyclones and storm surges (Khan et al., 2000; Singh et al., 2001; Dasgupta et al., 2009). An analysis of the impacts of climate change and sea level rise on cyclonic storm surge floods in Bangladesh (Karim and Mimura, 2008) showed that, for a storm surge under 2°C sea surface temperature and 0.3 m sea level rise, the area at risk of flooding would be 15.3% greater than the present risk area and the depth of flooding would increase by as much as 23% within 20 km from the coastline. Huq et al. (1995) estimated that 11 million people (11% of the total population of Bangladesh in 1989) would be displaced by a sea level rise of 1.0 m which would inundate 17% of the country. Using contemporary figures, 35 million people from 19 coastal districts would be

displaced (Rabbani, 2009). The Sundarbans Delta has undergone a net erosion of 170 km² of coastal land in the 37 years from 1973 to 2010 (Rahman et al., 2011b).

Coastal systems have been subject to higher rates of sea level rise in the evolutionarily-recent past than are predicted for the next century, notably during the melt-water pulse following the last Ice Age when, from 14,600 to 14,300 years BP, sea levels rose by about 20 metres in as little as 200 years (Stanford et al., 2006). Coastal species also persisted through extended periods when sea levels were higher than today, both during the last interglacial period 125,000 years BP when, globally, sea levels were probably 6.6 m higher than today (Kopp et al., 2009). Because mangroves actively trap the sediment emerging from river systems, the Sundarbans mangrove forest may be able to keep pace with sea level rise. The same is not true of the adjacent coastal settlements without increasing investment. Thus, the mangroves may become more, not less, important as the increasing frequency of natural disasters arising from cyclonic flooding drives resource collectors to increase extraction rates with increasing frequency.

7.5 Conclusion

Cyclone Aila damaged household assets, reducing household wealth as well as future productive capacity. The cyclone created circumstances that changed the shape of the pre-cyclone livelihoods of the households. Livelihoods were put at risk due to asset depletion, resource degradation, isolation and remoteness and inadequate basic services. The cyclone-affected households were hard-hit in terms of food sufficiency, access to infrastructure and education, human life protection, livelihoods and displacement. The dominance of shrimp aquaculture in the local economy, the

degraded condition of the coastal embankment and construction style of the local housing all played key roles in exacerbating the effect of the disaster. Both government agencies and NGOs did much to support basic survival. However, many affected households could not recover due to a loss of livelihoods and a loss of productive assets and still required food, cash and livelihood support some years after the cyclone. Nevertheless, the findings in this study suggested that households were able to commence the process of self-recovery due to external support and coping mechanisms. The higher income households were the least able to take up the opportunities for growth that were created after the cyclone, with shrimp or agriculture-based occupation groups being more vulnerable than the poorer mangrove resource collectors or wage labourers. Therefore, the lower income households in coastal Bangladesh, and particularly in the Sundarbans eco-region, could demonstrate greater adaptability and resilience in the face of climate change-induced disaster than the wealthier members of their community.

Understanding the impacts and coping strategies following a cyclone such as Cyclone Aila is highly relevant for climate change adaptation policy. In the long-term, the delay in repairs to the embankment caused major problems, but cyclones such as Cyclone Aila may be portents of the change to come and the Bangladesh Government may need to consider adaptation through a managed retreat from highly vulnerable sites. In the meantime, the provision of credit will be essential for local economies to rapidly return to a self-sustaining state. NGOs providing credit should be assisted to maintain this facility. The alternative is higher and stronger embankments, active maintenance and strict policing of embankment use or the disaster will simply be repeated. In the next chapter, I present an overview the

policies and management actions of the institutions which influence the livelihoods of people using forest resources, involved in the shrimp fishery or coping with disasters.

Chapter 8: Improving Livelihoods – Policy and Practice

Chapter 8: Improving Livelihoods – Policy and Practice

8.1 Introduction

In the previous chapters, I addressed the livelihood assets, vulnerabilities and strategies of the households surrounding the Sundarbans. In Chapter 4, I examined the households' assets, livelihood strategies and poverty context and find that the households were vulnerable due to a lack of assets. In Chapter 5, the household dependence on forest resources was examined along with the vulnerability factors that impact on this dependency, such as the rights to forest resources, exploitation and discrimination by traditional moneylenders and the operation of pirates in the region. In Chapter 6, I observed that the inequality among households through the expansion of shrimp aquaculture was also significant in the vulnerability context of the study area along with other factors, such as lack of crop-based agriculture opportunities and loss of the ability to farm livestock. In Chapter 7, I explained that a cyclone is an external shock which impacts on livelihoods, and I described the coping strategies of the households in relation to cyclones. Policies and institutions are an important part of the sustainable livelihoods framework that can strengthen or limit sustainable livelihoods (Chapter 2), and understanding the policies and institutions that influence the study area is the focus of this chapter.

Before proceeding, it is necessary to define the terms to be discussed. Here, I draw on the definitions of policies, institutions and organisations as proposed by Dovers (2005) in the context of environmental and sustainable development policy. According to Dovers (2005:12), policies are a “position taken and communicated by

governments- ‘avowals of intent’ that recognises a problem and in general terms state what will be done about it”; institutions are “persistent, predictable arrangements, laws, processes or customs serving to structure political, social, cultural or economic transactions and relationships in a society. They may be informal or formal and allow organized, collective efforts around common concern”; and organisations are “manifestations of institutions, such as specific departments, associations, agencies and so on”. Policy is mediated and implemented through institutions and organisations (Shankland, 2000) where the key institutions are legislators and regulators, and the key organisations are the agencies that deliver government services and enforce the law and regulations (DFID, 2000).

The responsiveness of policies and institutions is important in order to mitigate the negative effects of trends on livelihoods and overall asset status and thereby reduce people’s vulnerability (Allison and Horemans, 2006). Changes or transformations of policies and institutions arise from looking at the consequences of development efforts from a local-level perspective and making the links from the micro-level, situated particularities of poor people’s livelihoods to the wider-level institutional and policy framings at district, provincial, national (meso-level) and international (macro) levels (Scoones and Wolmer, 2003). Formal and informal organisations and institutions can influence or hinder livelihood outcomes (Ahmed et al., 2010). Policy outcomes influence people’s choices of livelihood strategies by changing their perceptions of the opportunities and vulnerabilities (Shankland, 2000). Vulnerability is the result of many factors, some of which relate to policies and institutions (DFID, 2000). Cannon (1993) defined organisational vulnerability as the lack of strong national and local institutional structures. Vulnerability occurs as a result of weak

institutions at the government level. Corruption, defined as “efforts to secure wealth or power through illegal means – private gain at public expense” (Lipset and Lenz, 2000:112) can make rural people more vulnerable as it changes the access to natural capital on which people depend.

The aim of this chapter is to examine the intentions and impacts of the policies and management actions relating to forest resources, the shrimp fishery and disaster management, which either promote or inhibit the livelihood activities of the people who depend on the resources in the Sundarbans study area. The main research question focuses on the policies related to local livelihoods in the study area (chapter 1). This chapter covers the following research questions in order to address the main research question and fulfil the aims of the chapter:

- 1) What are the roles of the forest-related polices and institutions in improving the livelihoods of the forest resource users at the local level?
- 2) To what extent do the existing policies and institutions of shrimp management promote or inhibit livelihoods in the study area?
- 3) What are the roles of national and local governments and NGOs in disaster management and assisting local people to cope with the adverse outcomes of cyclones?
- 4) What initiatives are likely to improve livelihoods, given the findings of this research?

Each research question is addressed in this chapter in detail, with the results and discussion related to each question presented in individual sections. In the final section, specific recommendations are provided for approaches that would enable households to enhance and diversify their livelihoods along with suggestions for various policy interventions related to forest resources, shrimp aquaculture and natural disasters.

8.2 Methods

A range of methods were used to examine the relevant policies and the roles of the various government agencies and NGOs in order to analyse the impacts on the livelihoods of the households surrounding the Sundarbans (Chapter 3). These issues were also explored through the focus group discussions in communities where livelihoods were either being promoted or inhibited by policies and institutions, and through interviews with key informants from within the government offices directly involved in policy implementation and NGOs that worked with the community and government. The results of the focus group discussions and interviews were coded according to themes related to forest resources, shrimp aquaculture and disaster management policies and agencies.

Five focus group discussions were carried out with different mangrove resource collector groups in order to identify the key rules involved in the resource collections and their implementation reality, and to explore how each of the policies related to Sundarbans forest management created constraints or problems for their livelihoods. One focus group discussion was conducted with Forest Department field-level officials and key informant interviews were held with higher forest officials working

in the Sundarbans in order to gain information on the forest management structure and its strengths and weaknesses, and the rules and regulations associated with management and their impact on livelihoods. On the basis of this information, realistic and sustainable solutions to overcome those constraints could be proposed. Moreover, key informant interviews were held to discuss these issues with two former pirates, a widow of a wildlife victim, moneylenders who financed resource extractions, the officer-in-charge of a local police station and the Sub-District CEO (Appendix D, Part A provides details on the questions, dates and places of the interviews and other information about the participants).

To analyse the policies that governed shrimp aquaculture and their impacts on local livelihoods, I carried out two focus group discussions with shrimp farmers and non-shrimp farmers, one focus group discussion with shrimp farm labourers, caretakers and a temporary depot owner. Moreover, key informant semi-structured interviews were held with two senior Fisheries Department officials, two local government elected representatives, four government officials belonging to other departments, one manager of a local bank, an NGO worker and a large shrimp farmer (Appendix D, Part B). These focus group discussions and key informant interviews explored the long-term impacts of shrimp aquaculture that created constraints or problems for livelihoods, and highlighted questions related to present shrimp management in addressing these impacts along with suggestions for better management.

In addition, I carried out nine semi-structured interviews with key informants and five focus group discussions, one solely with women, at the community level in Koyra Sub-District (Appendix D, Part C) in order to examine the roles of national

and local government agencies and NGOs in disaster management particularly in relation to Cyclone Aila. Moreover, nine key informant semi-structured interviews were held on this topic, involving two government officials, one local government sub-district council officer, four union council elected representatives, one NGO worker and a primary school teacher. These key informant interviews and focus group discussions explored questions related to the policies in place for disaster management, whether measures were undertaken as per the guidelines, the strengths and challenges for disaster management at the sub-district level, and the role of NGOs and government organisations in cyclone preparedness and relief and rehabilitation after a cyclone.

Secondary data were collected from government agencies and NGOs, including reports, publications, national policy papers, legislation, and related government management prescriptions on forestry, fisheries and disaster. The policies were reviewed and their impacts were assessed by consideration of a number of key issues. The actual implementation of the resource collection procedures and bans on certain resource collections in the Sundarbans were analysed within the context of local livelihoods. Government policies promoting the expansion of shrimp aquaculture were analysed in relation to the impacts on local livelihoods. Finally, relief and rehabilitation activities in the cyclone-affected areas and the role of government, NGOs and other agencies in restoring livelihoods were analysed. Details on the analysed policies are provided as Appendix D.

During the discussions and interviews, some participants were unwilling to speak about sensitive issues such as alleged corruption related to the rebuilding of

embankments and distribution of relief after Cyclone Aila. Government officials and local government representatives responsible for such activities were also reluctant to give information on these sensitive issues. In order to fill some of the gaps in information from the government personnel interviews, I drew on articles published in national newspapers during the study period from 2009 to 2012 and analysed supplementary evidence particularly on corruption issues related to Cyclone Aila relief, embankment rebuilding and Sundarbans management. In addition, to assess policies and their implementation reality in relation to local livelihoods, I relied on the personal observations that I gathered throughout the field data collection period.

8.3 Policies and Institutions for Sundarbans Forest Management

This section presents an overview of the responsibilities of the Forest Department in managing the Sundarbans Reserved Forest. Forest-related policies and their impacts are described in detail. The impacts of management actions on livelihoods and resource conservation are also discussed in this section.

8.3.1 Responsibilities of the Forest Department

The Forest Department is primarily responsible for the management and conservation of the plant, wildlife and aquatic resources which lie within the domain of the Sundarbans as vested by the Forest Act of 1927. I learned about the structure of the Forest Department in managing the Sundarbans through key informant interviews with departmental officials (KII#ACFCR; DFOWD). The Conservator of Forest, Khulna Circle has an office in Khulna and is responsible for administration of the whole Sundarbans. At the time of this study, there were 1169 officers and staff

working under the Conservator of Forest in the management of the Sundarbans. Two Divisional Forest Officers, one each for Sundarbans West Division and East Division, worked under the Conservator of Forest and were responsible for all administration of the Sundarbans Reserved Forest including operational plans, staff performance, revenue collection, budgets, and execution of the Forest Act. Sundarbans West Division is divided into the Khulna and Satkhira Ranges and Sundarbans East Division is divided into Chandpai and Sarankhola Ranges located at the periphery of the Sundarbans. Each range is headed by one Assistant Conservator of Forest who works under the Divisional Forest Officer. These range offices had subordinate offices such as station offices, patrol posts and camp offices in and around the entire Sundarbans Reserved Forest (Figure 8.1).



Figure 8.1: A forest patrol office inside the Sundarbans forest and forest guards patrolling the forest

8.3.2 Forest-Related Policies

The broad mandate of the Forest Act is to protect, conserve and implement management prescriptions with respect to the flora and fauna of the Sundarbans. As well as this legislation, there are a number of other regulations, laws and orders that have been issued under the legal back-up of the Forest Act to control the use of forest resources (including fish, plants and shrimp fry) and the collection and use of those resources in the Sundarbans. The Forest Act confers legal responsibility on the Forest Department to manage the aquatic resources which lie within the domain of the forest. The policies, their main intentions and the actual or potential impacts of these policies on local livelihoods in the region are summarised in Table 8.1. The assessment of the impacts drew on the results presented in Chapters 5, 6 and 7 along with additional sources of information.

Table 8.1: Forest-related policies and impacts on management and livelihoods

| Policy Measure | Main Intention | Impact on Livelihoods |
|--|---|--|
| Forest Act of 1927 | To grant the government the power to establish reserve forests. The Sundarbans was declared a “Reserved Forest” under this Act. | Primarily extinguished all rights and privileges of the traditional forest-dependent communities in the region and brought forest under more formal control of the state exclusive of local people from residing inside the forest reserve area (FGD#SFWC; SSFC; SCC; SFiC). |
| | To prohibit illegal resource collection, hunting, shooting, fishing, poisoning of water, or setting of traps or snares within the reserve area. | Power to impose penalties placed the Forest Department in an advantageous situation, which they manipulated extensively to regularise rent-seeking for their personal gain (KII#GTCU; secondary data). Resource collectors became “targets” of forest criminal cases (KII#FWT; NGOM). |
| Bangladesh Wildlife Preservation (Amendment) Act of 1974. Order No, 1/For-92/77/1122; 7 October 1977 | Three wildlife sanctuaries were created in the Sundarbans in order to conserve biodiversity. | In the three wildlife sanctuaries, all logging, fishing and collection of non-timber forest products are prohibited (Article 23(2)) which restricts and reduces the areas available for resource collection (FGD#SFWC; SSFC; SCC; SFiC). |
| Sundarbans Forest Transit Rule (1959) | To establish permit and revenue procedures for collecting permissible forest resources such as fish, crab, golpata, honey. | Complex permit and resource collection procedures enabled the moneylender to control resource collections and forced poor harvesters to work under the formal control of moneylenders (discussed in Chapter 5, Section 5.3.5.1). |
| Moratorium on Tree Felling (Notification No. Sha-2/MOEF-192/90/580) (MOEF, 1989) | To protect plant biodiversity and forest degradation. | Moratoriums forced resource collectors to act illegally and/or pay bribes to Forest Department officials (FGD#SFWC; SSFC) or confiscation of boats or nets and implicated in forest criminal cases (KII# FWT). |
| Canals Closure Regulation (1989) (SDFO, 1989) | To protect aquatic biodiversity and continue species regeneration. | 18 canals located outside the sanctuaries were open for resource collection until 1989. Canal closure for aquatic biodiversity put further restriction on aquatic resource collections (FGD#SFiC). |
| Compensation Policy for Casualties Caused by Wildlife (2010) (MOEF, 2010) | To provide financial security to the victims or victim's families. | Compensation provided security in the form of financial capital to wildlife attack victims (KII#ACFCR; DFOWD); or can be a source of rent-seeking for forest officials (observation). |

8.3.3 Impact on Livelihoods

The Forest Act established the government's legal ownership of the forests by extinguishing all the rights and privileges of the traditional forest-dependent communities. Prior to the British colonial period, the Sundarbans was truly a frontier region (Blair, 1990) with a weak state presence. The forest, watercourses and sea were an open-access, common pool resource. During the British colonial period, the conversion of the Sundarbans forest for the spread of agricultural cultivation and human settlement generated revenue under the purview of the Permanent Settlement Act of 1793 (Bhattacharya, 1990; Richards and Flint, 1990) and nearly 2,790 sq km was reclaimed and cleared by 1873 (Richards and Flint, 1990). Act VII of 1878 constituted “Reserved” and “Protected” forests for every province in British India. By 1890, there were 4,095 sq km of reserved forests in Khulna District. By 1938, the total reserved forest area had reached 6,000 sq km, which was essentially the same reserved forest area maintained by Bangladesh upon independence in 1971 (Richards and Flint, 1990).

During the colonial period, reclamation efforts by clearing forest land were achieved by landlords hiring woodcutters and labourers from the eastern coast and other regions. After the initial phase, the majority of the immigrant workers who were lower order Muslims and Hindus settled in the Sundarbans (Richards and Flint, 1990; Danda, 2007). With time, they built a profound relationship with the Sundarbans for their livelihood and culture. The resource collectors believed the Sundarbans was a sacred place, a gift of the God and they maintained many traditional beliefs and performed rituals before entering the forest. They believed “Bonbibi” (Goddess) and “Peer-Awlias” (the spiritual leader of the Muslim community), using their

miraculous powers, would protect them from attacks by tigers and other wild animals in the Sundarbans. They also tried to satisfy them by offering food and other religious activities. When the resource collectors went to the forest, their wives at home followed a number of traditional rituals such as praying for the safe return of their menfolk; for example, they did not take off their “nakful” (ornaments worn in the nose), didn’t use oil in the hair or did not wash the earthen floors of the home (Roy, 2007; Kabir and Hossain, 2008).

The forest, watercourses and sea remained as open-access common pool resources. With the establishment of the Indian Forest Service in 1865, a Deputy Conservator of Forests was sent to the Sundarbans in 1873 to establish toll stations and issue licenses (Danda, 2007). The export of timber from the forest was regulated through the establishment of forest stations on the main timber export routes from the forests. Starting in 1931, the Forest Department exercised its control on fishing within the waters of the Sundarbans through the collection of tolls, taxes and rents from fishing boats and fishermen (Achaya and Kamal, 1994). In 1972, the maximum capacity was set to 500 mounds, then later to 300 mounds (one mound is equal to 37.34 kg) in order to make harvesting of products more accessible to a larger number of people. In 1986, the level was again set to 500 mounds except for winter fishing at Dubla Island where there were no limits (Govt. order no.-XII/For-13-38/85/40, dated 15-01-1986). A moratorium on fuelwood collection from major plant species was imposed in 1989 except for occasional permission such as the collection of goran (*Ceriops decandra*) in Koyra region of the Sundarbans following the devastation caused by Cyclone Aila. In 2007, to compensate the loss and early recovery of the Sundarbans due to Cyclone Sidr, all forest products harvesting was banned except for a few

minor products such as fish, honey and bee wax. In 2009, when the forests came back to a reasonable condition, the golpata harvest was permitted.

The forest policy often resulted in the resource collectors engaging in illegal activities within the sanctuaries. Three wildlife sanctuaries, namely, Sundarbans West (9,069 ha), South (17,878 ha) and East (5439 ha) covering an area of 32,386 ha, were established in 1977 under the Bangladesh Wildlife (Preservation) (Amendment) Act of 1974. The area of the wildlife sanctuaries was extended to 139887 ha by the government in 1996 (Notification No. MOEF (sec-3)/7/96/147, dated 06-04-1996), covering 35% of the area of the forest. Within the sanctuaries, all logging, fishing and the collection of non-wood forest products were prohibited, further restricting access to resources for forest-dependent communities. The restrictions were not implemented with any clarification of property rights and options for forest-dependent communities which could have reduced extraction pressures on the remaining sites (Roy et al., 2012).

The Sundarbans Forest Transit Rule (1959) established permit and revenue procedures for collecting forest resources from the Sundarbans. The collection of resources was administered through a complex system of boat loading certificates, royalties based on the type and amount of resource, number of days permitted to stay inside the forest, the place from where the resources were collected, and the number of resource collectors. This approach to resource collection tended to bring mangrove resources into the sphere of the more formal control of moneylenders, where, almost invariably, the poor were at a disadvantage compared to the moneylenders who were

better equipped with social and financial capital to deal with these institutional arrangements (as discussed in detail in Chapter 5, Section 5.3.5.1).

The livelihood needs and rights of the resource-dependent households were not incorporated into the policy and institutional interventions. This was further evidenced during a key informant interview when the Assistant Conservator of Forest (KII#ACFCR) stated that the Forest Department did not have any livelihood support policies in place for the resource collectors who were affected by the resource collection restrictions imposed by moratoriums and bans. The moratoriums on the felling of all trees, shrimp fry and other resource collections from the sanctuaries in the Sundarbans were imposed without measures to provide an alternative source of income for the resource collectors. In the present study, it was found that nearly 50% of the total income of the lower income households surrounding the Sundarbans came from the illegal collection of resources from the forest (Chapter 5, Section 5.3.5.2). A ban on forest resource collections forced them to act illegally or collect resources by paying bribe money to the forest officials in order to mitigate the dramatic negative impact on their livelihoods.

The concentration of power under the Forest Act increased the oppressive power of the forest bureaucracy and had become an instrument that could be used for the harassment of the people living around the reserve forest by officers of the Forest Department. The resource collectors stated that the failure to provide bribe money would make them more insecure and vulnerable as they would face a criminal charge under the Forest Act along with the confiscation of the tools and vessels used in committing the offence (FGD#SFWC; SCC; SSFC; SiFC). Most violations were

punishable under the Act, leading to court cases with minimum fines of Tk2,000 (US\$29) and maximum fines of Tk50,000 (US\$727), the forced payment of compensation for destroying the forest resource and/or imprisonment from two months to 5 years. The law stated that a criminal case would be accepted by the magistrate court only if a complaint was filed by an authorised officer of the Forest Department. The filing and investigation of forest criminal cases was made the prerogative of the Forest Department, which issued prosecution offence reports, compound offence reports or undetected offence reports. All criminal forest cases had to go through the Forest Department and these officials manipulated this requirement extensively to seek bribe money. A fuelwood trader in Baiddamari Village in the study area had 18 criminal cases against him because he failed to pay bribe money to the forest officials, as stated in a key informant interview (KII#FWT).

The Compensation Policy for Casualties Caused by Wildlife (2010) (MOEF, 2010) envisaged that wildlife victims (from tiger or crocodile attacks) would receive compensation from the Forest Department. From a livelihoods perspective, this policy was very important. The Chandpai Range Forest Officer (KII#ACFCR) explained that the Ministry of Forest and Environment formulated and approved this compensation policy in 2010 in order to compensate the victims of human-wildlife conflicts in Bangladesh, particularly the Sundarbans. Illegal forest collectors would not be eligible to seek compensation under this policy. In the event of a resource collector's death while visiting the forest with legal permission obtained from the Forest Department, the department would provide compensation of Tk100,000 (US\$1,453) to the family of the victim. In the case of being injured in a wildlife

attack, the injured victim would receive Tk25,000 (US\$363). Divisional forest officers would make the decision and issue compensation money to the families of the victims on the basis of the assessment report submitted by a committee led by a Forest Department official. My personal observation after hearing resource collectors' comments about the performance of the Forest Department was that such bureaucratic procedures created barriers to providing compensation money and created opportunities for the forest officials to seek bribes in exchange for making paperwork and other necessary arrangements consistent with the guidelines.

8.3.4 Implications of Management Actions

The resource collectors stated that the Forest Department officials operating in the Sundarbans used resource collections as an opportunity to earn bribe money from resource harvesters. Corruption in the form of bribes paid to forest officials was so pervasive that it exacerbated livelihood risks, and led to the failure of conservation efforts as revealed by resource collectors during the focus group discussions. According to the resource collectors, the payment of extra money on top of the permit fees fixed by the Forest Department was a regular phenomenon in the legally-permitted harvest of resources such as fish, crab and golpata collection activities. In one key informant interview, a golpata trader reported that he paid Tk18,000 (US\$262) in bribes for each extraction trip and he harvested 2-3 times more resources than legally permitted as determined by forest officials when issuing permits for resource collections (KII#GTCU). Transparency International Bangladesh (in The Independent, 2011a) reported that fishermen paid bribes totaling Tk230 million (US\$3.3 million) and timber traders paid bribes totaling Tk62.5 million (US\$0.9 million) a year to officials and local influential persons in order to

collect resources from the Sundarbans. However, during the focus group discussions held in this study, Forest Department officials stated that field-level staff rarely received any funds for maintaining the office building and logistics. They had to manage their expenses with contributions from the resource extractors, which was an attitude that ultimately regularised the corruption (FGD#CSFO).

Forest policies and institutions have failed to consider the vulnerabilities (discussed in detail in Chapter 5) of forest-based livelihoods. The Forest Department failed to protect the resource collectors and their officials working inside the forest from the hands of pirates. During focus group discussions, Forest Department officials stated that in June 2009, one forest guard was killed by pirates and in 2005 and 2006 two patrol offices were looted by pirates in the Sundarbans (FGD#CSFO). The resource collectors blamed the Forest Department officials for sheltering pirates at the offices inside the Sundarbans and believed that the coordination and collective efforts among the Forest Department and law enforcing agencies especially the police were not adequate to maintain law and order and control piracy. Insufficient cooperation between the Forest Department and the police made the resource collectors and even the Forest Department officials more vulnerable to the pirates' attacks.

The Forest Department was a bureaucratic organisation which managed the forest using a command and control approach through policing and licenses (Millat-e-Mustafa, 2002). The protectionist approach to conservation without safeguarding livelihoods was the strategy adopted by the Forest Department in Bangladesh, but the effectiveness of protectionism has been questioned by many researchers and practitioners. The protectionist approach of simply declaring an area to be a protected

area has not been successful in stopping the steady loss of biodiversity (Fox, 2007) and has been proven problematic because of its denial of the role that forests and forest resources play in the lives of local people (Cunningham et al., 2011). The Forest Department officials in the study area lacked technical knowledge and information regarding recent developments in non-timber forest product management and marketing, payment for ecosystem services, carbon trading and potential ecotourism initiatives that could assist with both livelihoods and conservation (FGD#CSFO).

8.4 Policies and Institutions for Shrimp Management

Bangladesh shifted its development strategy during the last two decades towards export-oriented shrimp farming activities through a number of policies and regulations. At the time of this study, the shrimp sector of Bangladesh was characterised by a multitude of institutions, including 17 ministries and divisions, and 28 departments and agencies that had some management responsibility for shrimp aquaculture (Khatun, 2004). The Ministry of Fisheries and Livestock (MOFL) was responsible for the implementation of policy matters related to fisheries including shrimp farming, and, as the frontier wing of the ministry, the Department of Fisheries had the mandate for the transfer of technology, quality control of shrimp products, administering shrimp expansion projects, and the provision of policy advice to government for developing the shrimp industry (KII#ADFO). A separate institutional structure for the management of the shrimp sector, called the Central Shrimp Cell, was established within the Department of Fisheries in 1994 (KII#ADFO). This arrangement had no implementation in practice as it had not been extended to the district and sub-district levels. Among other agencies involved in the

shrimp sector, the Ministry of Land (MOL) was also important and was responsible for the lease of government land for shrimp aquaculture (KII#ADFO; UNOM), the Bangladesh Water Development Board was responsible for embankment management, and the Ministry of Finance promoted investment and other types of financial support for the shrimp industry.

Shrimp Culture Regulation Committees were established by the Ministry of Fisheries and Livestock at the divisional, district and sub-district levels in 1986 and functioned until 1998 (MF-2 (miscellaneous) -2/86/97, dated 17-02-1986). In 1998, a government order installed Shrimp Resource Development and Management Committees at divisional, district and sub-district levels and modified their responsibilities and duties (DA-4/2(66)/93-97/01, dated 01-01-1998). The efforts to manage the shrimp culture by forming various committees at different levels had no doubt made important contributions to shrimp farm registration, increasing the shrimp yield and quality control (KII#SFOM; ADFO). The responsibilities and duties of these committees were aimed to expand aquaculture and to encourage its export and development. The Shrimp Resource Development and Management Committees at different levels are described in more detail as Appendix E.

8.4.1 Shrimp-Related Policies

The key policy documents related to shrimp farming which have influenced local livelihoods in the Sundarbans area are summarised in Table 8.2.

Table 8.2: Policies related to shrimp aquaculture in Bangladesh and impact on livelihoods

| Policy | Main Intention | Impacts on Livelihoods |
|--|--|---|
| Shrimp Mohal Management Policy, 1992 (Govt. Order Bhumi/sha-8/Chingri/227/9 1/217) (MOL, 1992) | Production increases and envisages government-owned and private-owned agriculture lands being converted into shrimp farming if found suitable for shrimp cultivation. | Owing to the conversion of land for shrimp cultivation, local farmers had lost income from agriculture and livestock, land leasing had replaced share cropping, government-owned lands were acquired by the wealthy shrimp farmers denying access to landless people (FGD#SNSF;SU/CU; KII#UAOM – details in Chapter 6). |
| Protection and Conservation of Fish Rules 1985 (MOFL,1985) | Ban on shrimp fry collection in the coastal waters and estuary was designed to protect the fry resources of shrimp, fish and zooplankton. | Ban penalised the lower income households and potentially could eliminate their principal livelihood opportunity as these households earned 35% of their annual income from shrimp fry (household survey data – details in Chapters 5 and 6). |
| Govt. Order: Cabinet Division/ DA-4/2(66)/93- 97/01, dated 01- 01-1998 (CD,1998) | The guidelines brought shrimp farming under formal control of Shrimp Resource Development and Management Committee and ensures small farmers' rights in the shrimp farming area. | Small land owners forced to lease or sell their land and became landless; conflicts arose between small and large shrimp farmers and between paddy and shrimp farmers (FGD#SNSF SU/CU; KII#UAOM – Chapter 6). |
| Bangladesh Bank. ACSPD Circular No.2 and 3, dated 01- 06-2009 (BB, 2009a,b) | To regain livelihoods of shrimp farmers, government postponed recovery of previous loans and issued new loans for shrimp farming. | Shrimp farmers faced extensive loss due to damage from Cyclone Aila (household survey –details in Chapter 6). Such incentives would help to regain livelihoods of the shrimp farmers in the cyclone- affected areas (KII#UNOK) |
| Embankment and Drainage Act, 1952 | The Act was aimed to protect embankments and therefore protect livelihoods from tidal surge and saline water intrusion. | Illegal cuts caused embankment collapse, leading to permanent flooding following cyclone and destroyed livelihoods (KII#SOWDB; FGD#CVB; CVK – details in Chapter 7). |

8.4.2 Impact on Livelihoods

Landless households lost access to government-owned (khas) land as well as government-owned water bodies which were important assets for survival (Chapter 6, Section 6.3.7.3). The first policy on shrimp management was the Shrimp Mohal (Estate) Management Policy of 1992, issued by the Ministry of Land (Govt. Order Bhumi/sha-8/Chingri/227/91/217) (MOL,1992). This policy allowed the conversion of agricultural lands to shrimp farms. A clear legal and institutional position on the change of land use to shrimp aquaculture contributed to the loss of traditional agriculture and related activities in the study area. Government-owned land was leased to shrimp farmers under this policy in violation of the rights of landless people as the khas lands were meant to be given to the landless according to the Agricultural *Khas* Land Management and Settlement Policy, 1997 (KII#UNOM; UAOM). In Khulna Division, nearly 300 hectares of government-owned land had been leased out legally for aquaculture (KII#ADFO).

Cuts, due to shrimp aquaculture, made the embankments collapse which resulted in permanent water logging following Cyclone Aila and impacted heavily on the livelihoods of the affected people (see Chapter 7, Section 7.3.3.1). The Bangladesh Water Development Board was responsible for maintaining and protecting the embankments. Under the Embankment and Drainage Act of 1952 (Section 19), temporary watercourses can be cut through embankments with due permission from a BWDB engineer (see Appendix E for details). However, a government order issued in 1986 by the Ministry of Fisheries and Livestock (MF-2 (miscellaneous) -2/86/97, dated 17-02-1986) and a Cabinet Division Order in 1998 (Cabinet Division/DA-

4/2(66)/93-97/01, dated 01-01-1998) allowed shrimp farmers to take saline water by establishing permanent sluice gates across embankments upon approval from the BWDB. In a key informant interview, a BWDB Assistant Engineer who was in charge of monitoring the embankment reconstruction activities in Koyra stated that nearly 10,000 to 12,000 illegal sluices had been made in the embankments for shrimp cultivation in the south-western region without BDWB approval (KII#SOWDB). The shrimp management committees at the sub-district level had not considered monitoring embankment protection as part of their activities (KII#SFOM).

After Cyclone Aila, the government postponed loan repayments and offered new loans to help restart shrimp farming and regain livelihoods. As found in this study, the shrimp producers were vulnerable to natural disturbances in the long term and vulnerable to climate-based shocks. Shrimp farming was badly affected and suffered extensive loss due to the cyclone (Chapter 7). However, the affected shrimp farmers could not utilise these facilities due to the embankments remaining broken, with the BWDB failing to rebuild the embankments more than one year after Cyclone Aila (FGD#CVB; KII#CBU UNOK).

Due to the phenomenal expansion of shrimp hatcheries in Bangladesh, the government stopped importing shrimp fry from abroad and imposed a ban on shrimp fry collection from natural sources. A new rule (8(1A)) was added to the Protection and Conservation of Fish Rules (1985) (MOFL, 1985) to prohibit shrimp fry capture in the estuaries and coastal waters of Bangladesh. The ban was established due to the extensive use of monofilament fixed set bag nets which caught shrimp fry as well as the fry of other non-target species. The destruction of non-target species was

observed across the study area (Chapter 6, Section 6.3.7.4). It was reported that law enforcement agencies such as the Coast Guard and forest and fisheries officials sometimes monitored fry catching activities and seized and destroyed boats and nets which were used to catch shrimp fry and fined fry collectors for collecting illegal resources (FGD#SSFC; KII#SFOM). My personal observation was that the ban merely served to criminalise some of the poorest members of society, resulting in the need to pay bribes so that officials would overlook infractions, with little impact on fry capture.

The government's promotion of alternative shrimp fry sources made shrimp fry collectors more vulnerable, due to the availability of market-based alternative sources. The sourcing of fry from hatcheries as an alternative to the natural seed source was another livelihood challenge. Approximately 55 hatcheries for Bagda shrimp and 70 hatcheries for Golda shrimp had been established in Bangladesh, mainly in the Khulna region, due to soft credit and other facilities provided by the government (Gammage et al., 2006). Usually, the price for natural seed was comparatively higher than the price for fry from the hatcheries. The shrimp hatcheries were increasingly producing better quality fry and selling it at lower prices than the price of the wild shrimp fry (KII#SFOM). Shrimp fry collectors were not able to make good profits as the market determined the price and the prices fluctuated depending on demand and supply. The collectors' earlier monopoly on price determination had gradually been taken over by the market.

The practice of leasing out land for the purpose of shrimp farm establishment had increased substantially and contributed to reduced access to the land through

sharecropping and leasing (Chapter 6, Section 6.3.7.3). This affected lower income households due to their poverty and inability to pay the leasing fees. The government adopted a soft credit policy, such as low interest loans provided from financial institutions at the sub-district level, for the purpose of intensifying shrimp farming, and this had the effect of increasing the rents demanded for leased land. Therefore, in most cases, the access of lower income households to the shrimp land became more limited. According to the manager of the local agriculture development bank (KII#MBKB), which was the main lending institution supplying credit for shrimp farming against land ownership or lease agreements, farmers had the opportunity to take loans of Tk42,000 (US\$610) per acre to meet the costs of shrimp farming in 2009. The loan amount was high compared to the actual cost of Tk6,000-13,000 (US\$87-189) per acre (Chapter 6, Section 6.3.3). In Mongla Sub-District in the 2009-2010 financial year, loans totalling nearly Tk1,600 million (US\$23.3 million) were disbursed among the shrimp farmers (KII#MBKB). Unexpended parts of the loans were used by the rich shrimp farmers to establish shrimp-related businesses, non-farm trading and buying and leasing lands, creating further inequality and landlessness.

Agricultural lands were converted into shrimp enclosures arbitrarily without considering the opinions of surrounding agriculture farmers, resulting in conflicts between shrimp and paddy farming (Chapter 6, Section 6.3.7.2) due to the poor implementation of policy. One of the legal mandates of the Shrimp Resource and Development Management Committees at the sub-district level, as fixed by Government Order (Cabinet Division/DA-4/2(66)/93-97/01, dated 01-01-1998), was to grant permission for shrimp farming expansion. According to the instructions of

the government order, at least 86 percent of the surrounding land owners needed to provide consent before any permits could be provided to convert agricultural land into shrimp farm. It was reported by the respondents in this study that this instruction had been ignored and never implemented by the sub-district's committee (FGD#SNSFSU/CU; KII #UAOM).

8.4.3 Implication of Management Actions

It was evident that many paddy lands had been converted into shrimp farming, causing the loss of traditional agriculture, livestock and associated services. The power to compensate the paddy cultivators for the losses caused by shrimp farming due to the intrusion of saline water was not included within the jurisdiction of the Shrimp Resource and Development Management Committees at the sub-district level (KII#SFOM). With help from the Agriculture Department, small shrimp farmers had tried to return to the cultivation of rice and other crops (FGD#SNSF). According to a Sub-District Agriculture Officer (KII#UAOM), these efforts had failed due to the lack of support from the Department of Fisheries which had encouraged the increased conversion of agricultural land into shrimp farms. He further stated that the shrimp policies did not have any guidelines to facilitate crop-based agriculture and uphold the interests of rice farmers.

The absence of any strong mechanisms to monitor the conflicts that arose due to shrimp farming expansion further supported the untrammelled development of the industry. The vulnerabilities generated by the shrimp farming (see Chapter 6, Section 6.3.7) were rarely addressed by the Shrimp Resource and Development Management Committees working at the sub-district, district and divisional levels as evidenced in

minutes of the committee meetings (Batiaghata Sub-District (23 July 2008), Khulna District (23 March 2008) and Khulna Division (6 April 2010) meeting minutes of the Shrimp Resource and Development Management Committee). Conflicts between the lessee (user) and lessor (owner) over land rent issues were very common in the shrimp farming areas but the committees were not empowered to determine land rent and did not have any mechanisms to resolve this kind of conflict. I observed that the meetings of the committees were infrequent. There were no clear guidelines in the law or regulations regarding the resolution of such disputes. The committees referred any dispute to the local government representative for traditional and informal conflict management in order to resolve the disputes (KII#SFOM). However, these kinds of traditional structures for conflict resolution were sometimes perceived to favour the rich and politically well-connected (FGD#SNSFSU/CU).

In a key informant interview, the Sub-District Fisheries Officer (KII#SFOM) reported that his department used to provide extension services at the shrimp farm level. Fisheries officers provided services for farm registration, quality assurance, disease prevention and training. They inspected the shrimp farms from time to time and provided guidance and training on relevant rules and regulations to all the licensed shrimp processing plants regarding quality assurance, traceability, hazard analysis and food safety activities. He said, however, that it was very difficult to supervise such vast areas with limited manpower. According to a Sundarbans shrimp fry collector (FGD#SSFC), the fisheries officers rarely provided training for fry catchers and traders to help them improve catching methods to reduce by-catch and use better handling, storage and transport techniques. There were also allegations that some fisheries officials granted shrimp farm licenses in return for the payment of rent

and that they helped many large farm owners to secure land for lease (FGD#SNSFSU/CU).

A report by the Environmental Justice Foundation (2004), titled “Desert on the Delta”, found that poor governance and minimal regulatory oversight of Bangladesh’s shrimp aquaculture had led to conflicts over land rights and access to resources, exacerbating the occurrence of brutality and conflicts in shrimp farming. No enforcement provisions existed to control the illegal occupancy of government lands and the unauthorised and unregistered shrimp farm operations; nor had proper guidelines been developed to reduce the social and environmental impacts of the industry (Swapan and Gavin, 2010). Bangladesh signed the UN Food and Agriculture Organisation Code of Conduct but no significant efforts had been made to comprehend the provisions of the code in relation to shrimp aquaculture development either in areas of national jurisdiction or responsible practices at the production level, so huge gaps continued to exist in enforcement (Alam et al., 2005). Gammage et al. (2006) found that policies in Bangladesh relating to shrimp farming were generally never or rarely implemented properly, as there was insufficient coherence in these laws and an absence of supporting regulations and ordinances. Huitric et al. (2002) made a similar observation in Thailand where the development of legislation had been slower than the development of the shrimp industry and where contradictory policies had arisen. Rivera-Ferre (2009) also made this observation in a review of export-oriented shrimp aquaculture in developing countries.

In the context of the study area, the livelihood vulnerabilities precipitated by shrimp cultivation had arisen due to policy and institutional failures. Market liberalisation of shrimp farming as a result of structural adjustments and pro-active government policies appeared to have encouraged economic incentives, such as low interest credit, export promotion, investment to implement hazard control and food safety standards, import privileges, tax breaks and easy access to land, in order to stimulate the shrimp farming and related activities directly and indirectly (Alam and Pokrant, 2009; Akhter, 2010; Bhattacharya et al., 1999; Deb, 1998; Khatun, 2004; Maniruzzaman, 2006; Paul and Vogl, 2011; Pokrant and Bhuiyan 2001; Pokrant and Reeves, 2001). There was no policy in place to mitigate the vulnerabilities caused by shrimp aquaculture. Economic incentive policies had been implemented to increase opportunities through structural transitions in the rural livelihood system; however, these opportunities remained beyond the reach of the landless lower income households, who were a substantial portion of population, and thus faced serious livelihood threats in the study area. The next section considers the policies and institutions related to disaster management and their implications for livelihoods.

8.5 Policy and Institutions for Disaster Management

At the time of this study, the Standing Order on Disasters (SOD) (GOB, 2008b) was the main national government management guideline to manage disasters in Bangladesh, with the Disaster Management Act and National Disaster Management Policy still in the draft stage (personal communication with Joint Secretary, Ministry of Food and Disaster Management). The SOD delineated the functions, duties, coordination and actions for disaster management committees at the national and local (district, sub-district and union) levels, for different phases including the

warning period, response (hazard onset) and post-hazard relief, recovery and early development. The SOD was developed to detail the preparedness, response and recovery mechanisms of key stakeholder agencies in responding to a disaster.

The Ministry of Food and Disaster Management (MOFDM) had responsibility for coordinating the government's disaster management efforts. After any natural disaster like a flood or cyclone, the MOFDM performed the role of clearinghouse for the coordination of all relief supplies, and as the primary granter of permission to district and sub-district administrations to start relief activities in the disaster area. The Disaster Management Bureau and the Department of Relief and Rehabilitation were created under the MOFDM for the implementation of policy related to disaster management.

Relevant bodies at the national level included the National Disaster Management Council chaired by Prime Minister, the Inter-Ministerial Disaster Management Coordination Committee chaired by the Minister of Food and Disaster Management, and the National Disaster Management Advisory Committee headed by the Prime Minister's nominee which played a vital role in policy formulation such as updating the SOD.

At the implementation level, the District Disaster Management Committee chaired by the Deputy Commissioner of the affected district, the Upazila (Sub-District) Disaster Management Committee (UzDMC) chaired by the Sub-District CEO and the Union Disaster Management Committee (UDMC) chaired by the Union Council Chairman under the guidance of the SOD and the close supervision and monitoring

of the MOFDM. These multi-stakeholder committees were designed to represent government, communities and civil society.

8.5.1 Role and Function of Institutions in the Recovery of Livelihoods of Cyclone-Affected People

The lack of a well-coordinated appeal immediately after Cyclone Aila in May 2009 meant that few potential donors were attracted and only a few NGOs began working in the affected areas. This limited the number of people who could benefit from post-cyclone relief and participate in rehabilitation activities to rebuild livelihoods. According to the SOD (GOB, 2008b), the MOFDM should call on foreign and private agencies to participate in the disaster preparedness, emergency response and recovery programs. One NGO official working in the cyclone-affected Koyra Sub-District (KII#NGOK) stated that since the government did not acknowledge the true picture immediately after the cyclone, local NGOs could not initiate any targeted program because the local NGOs were obliged to approach the international NGOs and donor agencies themselves for funds. The Joint UN Multi-Sector Assessment and Response Framework (2010) identified that the relatively low number of casualties, the localised nature of the affected areas and the available relief resources were the reasons for the Bangladesh Government's decision not to make an international appeal for assistance following Cyclone Aila.

In the case of the 2004 flood, the government was initially confident to deal unaided with the post-disaster recovery but it then made an emergency appeal through the UNDP Dhaka Mission for international assistance when the impacts worsened (Khan and Rahman, 2007). In the case of Cyclone Sidr (2007) the government immediately

sought international support, and foreign countries and international organisations sent contributions in the form of relief to the focal point of the disaster (Alam and Collins, 2010). In the Philippines, Gaillard et al. (2009) also found that the availability of funding was dependent on a declaration of a “state of calamity”. In Aceh, Indonesia, only two international NGOs were permanently working in the region before the tsunami struck; however, within a few weeks of the call for international aid, more than 500 NGOs and international aid agencies established missions there (Gaillard et al., 2008). Bosher (2007) noted that local NGO networks increased due to the presence of international NGOs during the relief stages of large-scale disaster events in India.

Negligence and corruption among the local disaster management committees were also reported to have negative effects on the recovery of livelihoods immediately after the cyclone. The role of the UDMC was to collect statistics on the loss incurred in the local area and send the statistics to the UzDMC (GOB, 2008b). The locally elected union council members collected information about the losses incurred due to Cyclone Aila at the village level. The UDMC checked and compiled the statistics and sent the information to the District Disaster Management Committee through UzDMC for relief and rehabilitation. The damage assessment was done rapidly and there were allegations of exaggerated assessments for the supporters of the union council members who did the assessments (FGD#CVB; CVK). During the focus group discussions (FGD#CVB; CVK; FCVK), cyclone victims claimed that the local government bodies failed to maintain neutrality when distributing the relief materials as they showed preferential treatment for their relatives and political supporters. The cyclone victims complained that they often received relief goods in less quantity than

they were supposed to receive. Local political interference led to unfair selection and deprived the real victims of their fair share (FGD#CVB; CVK).

The role of the UzDMC was to take necessary measures so that people could return to their homes soon after the disaster occurred (GOB, 2008b). After Cyclone Aila, the UzDMC did not provide any direction to settle the displaced households, with some households still displaced a year after cyclone (Chapter 7, Section 7.3.2.1). In addition, both the UzDMC and UDMC were responsible for ensuring that injured people received fair and just treatment from health service providers (GOB, 2008b). The focus group discussions with cyclone victims (FGD#CVB; CVK) and personal observations revealed that, from September 2009 to August 2010, there were no medical teams working in the affected areas to provide medical assistance to cyclone victims. At that time, the cyclone victims had become more vulnerable to water-borne and skin diseases (Chapter 7, Section 7.3.2.4), which impacted on their health.

The household surveys found that almost 30% of the affected households in the severely and highly affected areas did not receive any NGO relief. According to the SOD (GOB, 2008b), the NGO Affairs Bureau should instruct NGOs to assist in the evacuation of the affected people to safer places, the provision of medical services and the distribution of relief; in addition, the Coordination Committee of NGOs relating to Disaster Management would ensure the coordination of disaster management and relief work between the government and non-government agencies (Appendix E). According to the focus group participants, the relief support provided by the NGOs after Cyclone Aila did not cover all the affected households and was inadequate to meet the demand (FGD#CVB; CVK). The affected households had no

access to loans owing to “unofficial” close-out periods imposed by the NGOs, thus causing further delays to livelihood recovery. The participants further stated that NGO rehabilitation services based on existing micro-credit programs were very limited in scope or were suspended because the members’ permanent earning sources had been diminished and there was uncertainty on the part of the NGOs about the likelihood of recovering the loan. Gehlich-Shillabeer (2008) pointed out that during the 1998 and 2004 floods, NGO loan repayments were at best postponed until flood waters had receded. Matin and Taher (2001) found that NGOs were particularly concerned about limiting loans to existing group members so that those in most need of support were often forgotten.

The combination of embankment maintenance and cyclone preparedness activities could have built a cyclone-resilient community but both were found absent in the areas affected by Cyclone Aila. According to the SOD, the role of the Bangladesh Water Development Board was to protect sluice gates and repair breaches, leakages and weak points in embankments during the disaster and in the post-disaster stage. According to the cyclone victims (FGD#CVB; CVK), the BWDB had failed to repair the damage to the embankments in the affected areas even one year after Cyclone Aila. Breaches of the embankment had widened due to the delayed response in embankment reconstruction which caused permanent flooding, leading to more destruction on land, destroying more valuable assets, and delaying rehabilitation activities to regain livelihoods on its feet. In other parts of Bangladesh, the community-based Cyclone Preparedness Program (CPP) delivered by the Red Crescent Society trained people to be better prepared against cyclones. CPP volunteers were trained to develop leadership qualities, management skills and first

aid. There was no CPP presence in Koyra Sub-District which was badly affected by Cyclone Aila (KII#UNOK). Without the availability of CPP activities, communities did not receive any formal training to better cope with cyclones.

8.5.2 Implications of Management Action

The response from the MOFDM to overcome this disaster was not adequate and was poorly coordinated, causing a delayed response. According to the SOD instructions, the MOFDM was responsible for reconnaissance and the collection information about loss and damages immediately after any hazard. The MOFDM failed to carry out a rapid field assessment of the damages and required emergency response following Cyclone Aila (KII#UNOK). Several local government elected representatives in Koyra Sub-District (KII#CBU; M5BU; M6BU; M3KU; VCUPK) claimed that poor decision processes were evident due to the lack of congruence between conditions “on the ground” in the disaster areas and the national decision-making bodies based in Dhaka. They blamed higher officials in the MOFDM for being too slow to understand the scale of the devastation caused by Cyclone Aila and having no trust in the assessment of damages made by the locally elected representatives. Key informants (KII#CBU; VCUPK) stated that the Armed Forces and Navy were not deployed with as great a presence as they might have been, and that the MOFDM should have made the decision to deploy the Armed Forces as part of a speedy mobilisation of state resources to bring relief to the affected areas. Army medical teams along with foreign medical teams provided medical care during and after cyclones in 1991 and 2007 (Paul, 2010). As noted above, this type of assistance was largely absent during the period following Cyclone Aila.

It can be concluded that the assessments by the MOFDM officials were inconsistent with the actual gravity of the damage and livelihood loss caused by Cyclone Aila. This created a barrier to seeking international support immediately after the cyclone and ensuring the rehabilitation of the livelihoods of the affected people. The MOFDM did not declare Cyclone Aila as an “incident of national significance” and delayed requests for international assistance until two months after the cyclone made landfall when it was realised that rehabilitation costs would exceed expectations, as revealed by the secondary data. A number of newspaper reports criticised the MOFDM indecision over seeking international aid for Cyclone Aila victims. The Financial Express (2009) on June 1 reported that, following an inter-ministerial meeting the previous evening, the Minister of Food and Disaster Management had welcomed any foreign aid to deal with the huge losses incurred by Cyclone Aila. However, The Daily Star (2009a) on June 2 reported the Minister’s announcement of a cabinet decision on June 1 that Bangladesh would not make any appeal to the international community for the rehabilitation of the people affected by Cyclone Aila. In contrast, The Daily Star (2009b) reported on July 20 that the Minister had appraised the losses caused by Cyclone Aila and begun to seek development partners help for mid-term and long-term solutions.

Inconsistencies on the ground resulted in some households receiving more relief while some households did not receive any. According to SOD, the Sub-District and Union Disaster Management Committees should have coordinated all the government and NGO relief activities in the sub-district in such a manner that social justice was ensured in relief distribution (GOB, 2008a). The relief efforts of the NGOs were also hampered by political wrangling, as locally elected representatives

used political criteria to prioritise certain communities and forced NGOs to act according to their prescriptions, according to an NGO official in a key informant interview (KII#NGOK). On the contrary, UDMC members in key informant interviews (KII#M5BU, M6BU, M3KU) complained that NGOs did not consult with the local government representatives in order to assess the scale of the impact and identify the worst affected households. Studies have revealed that households in Bangladesh often fail to receive any actual relief due to corruption, dishonesty and political bias (Mallick et al., 2011; Paul and Rahman, 2006). Régnier et al. (2008) investigated the post-tsunami experience in Indonesia and India and maintained that post-disaster relief did not reach everyone due to the diversion of relief due to client-patron relationships or corruption.

Cyclone Aila raised long-term questions concerning government capacities to mitigate hazards, rebuild the infrastructure, and facilitate the economic recovery of affected households. In general, the government response to the problems caused by disasters has changed little from the traditionally adopted approach to provide temporary relief materials such as food, clothes and medicine. Most of the relevant organisations failed to act in accordance with the overarching SOD, and the result was the failure to enhance the livelihood recovery of the affected people. My personal observation was that with so many departments and committees for disaster management, there was no coordination mechanism for a better response at the time of an emergency. Local government elected representatives (KII#CBU; M5BU; M6BU; M3KU) reported that they were aware of the SOD but had not gone through the guidelines and did not know how to use that book. They stated they were pessimistic about coping with unforeseen contingencies, and not confident about

making swift decisions under emergency conditions; rather, they just tried to follow the command of the higher government officials. O'Brien et al. (2006) found that capacity-building programs for disaster risk management were often narrowly focused on the creation of disaster policies, and the administrative arrangements lacked strong implementation procedures and capacity.

8.6 Opportunities for Improving Livelihoods in the Sundarbans

In a livelihoods approach, assets dictate a household's ability to implement strategies to cope with shock events (Moser, 1998; Sanderson, 2000) and increasing assets can act as a shield in times of loss (Chambers and Conway, 1992). A sustainable strategy for disaster reduction must therefore focus on activities to help the vulnerable build assets (Vatsa, 2004; Wisner et al., 2004). Major factors behind upward economic mobility in Bangladesh included remittances sent from family members working abroad, accumulation of land, engagement in non-farm occupations and the accumulation of non-land fixed assets (Hossain, 2009). Owusu et al. (2011) suggested that increasing the access of rural households to financial capital, education and infrastructure helped to boost the availability of non-farm work in Botswana.

Development agencies have encouraged a stronger focus on assisting the poor to build up their asset endowments, thereby allowing the poor to construct their own routes out of poverty (Arnall et al., 2010). The Char Livelihood Project, funded by DFID, AusAid and the Government of Bangladesh and implemented in northern Bangladesh, used an innovative program described as “asset transfer”; more than 55,000 families were given access to cash to purchase assets of choice (mainly

livestock) with which to generate income to help them lift themselves out of poverty (Scott, 2009). Scott (2009) maintained that the increases in asset ownership were accompanied by improvements in food intake, the ability to educate children, the ability to pay the costs of healthcare and improved social standing within the village and in intra-household relations.

Fox and Mustafa (2013:7) linked rural livelihoods and conservation in co-management initiatives in Bangladesh and suggested that “no one strategy will work everywhere and, indeed, probably no one strategy can work on its feet at any given site”. Given the complex and diverse conditions of people, the unique eco-region of the Sundarbans requires special attention in order to address ecological sustainability and distributional equity, and to overcome the main barriers that undermine livelihoods. In the following sections, I discuss recommendations which I believe will facilitate the attainment of sustainable development goals in the Sundarbans eco-region. The recommendations are presented by reference to each of the five asset categories in the sustainable livelihood approach, namely, physical, human, financial, natural and social assets.

8.6.1. Physical Assets – Strengthened Embankments and Improved Housing

In general, the Sundarbans region is remote and physically isolated due to poor transportation services, poorly connected rural roads and lack of electricity (Chapter 3). The lack of these physical assets compounds the geographical distance of the Sundarbans communities, makes them highly resource-dependent and reduces their access to alternative livelihoods (KII#ACFCR; personal observations). Clean water,

efficient energy, health facilities, educational institutions and affordable public transport need to be prioritised in order to help the population access services, to attract more tourists to the eco-region, and to provide better access to job markets, especially to non-farm activities. These needs were commonly expressed by all the key informant interviewees and focus group participants. In a study of rural Tanzania, Ellis (2000a) found that proximity to roads and services increased non-farm self-employment and remittance income in household income portfolios. Reforms and investment efforts need to be undertaken in rural areas, including rural roads, electrification, and drinkable water and sewage systems (Escobel, 2001).

The two main physical assets, namely, strengthened embankments and improved housing, must be specifically considered in order to build resilience against natural disasters. A coastal embankment with appropriate heights and slopes is a viable adaptation strategy and a very important physical asset against cyclones, especially with projected increases in cyclone intensity due to climate change (Dasgupta et al., 2010). In the focus group discussions, the participants stated that the embankment has a significant bearing on the sustainability of the Sundarbans people as it protects them from surges and it works as a road for establishing communication with other places (FGD#CVB; CVK; Figure 8.2). In a key informant interview, the BWDB Assistant Engineer in charge of monitoring embankment construction opined that afforestation with suitable tree species could withstand the onslaught of cyclonic winds, protect the embankment from wave erosion, check the surge water, and at the same time, improve the economic condition of the people through employment. The management of climate extremes often involved the building of dykes to protect human settlements from the impacts of storm surges (Von Storch et al., 2008). There

is evidence that the embankments in the coastal areas of Bangladesh have provided an effective buffer during the storm surges associated with cyclones and have reduced the damage to property and loss of life (GOB, 2008a; Islam et al., 2011b; Mallick et al., 2011; Mallick and Rahman, 2008; Paul and Rahman, 2006; Paul, 2009; Paul, 2012).



Figure 8.2: Newly-built embankment (with appropriate height) is important to protect people and property in the study area against tidal surge

It was found in this study that existing “pucca” houses (with concrete roofs and brick walls) saved the lives of the neighbours who didn’t have strong houses (Chapter 7). The cyclone victims showed a strong preference for brick built houses (FGD#CVB; CVK). From the livelihoods perspective, a stronger house is an important physical asset; being resistant to strong winds would not only enable the people to feel safe at home but would also mean less destruction to the housing stock and livestock. Government should pilot the provision of credit or subsidy scheme for house strengthening including the design of a low cost house erected with storm-resistant techniques (KII#UNOK; NGOK). Mallick and Rahman (2008) calculated that for the cost of one cyclone shelter, about 250 strong houses could be built or structurally

strengthened. Dasgupta et al. (2010) estimated that a revolving fund of \$200 million would be sufficient to extend subsidised housing credit and encourage the construction of brick built houses with concrete roofs in accordance with the proper building codes; these houses, in turn, would serve single or multiple family cyclone shelters during storm surges.

8.6.2 Human Assets – Building Capacity through Education and Training

I observed that the households in general started out at a comparatively disadvantageous position with a very low average level of education among the earning members. They also lagged behind in comparison with national standards in raising the level of education of children (Chapter 4). There had been a progressive expansion of industrial activity in Mongla but people in the study area with low levels of literacy and skill were not able to access employment opportunities. Education helps skill formation, resulting in higher marginal productivity through engaging in more remunerative jobs (Abdulai and CroleRees, 2001). As the level of education increases, social and human capital may become more complementary and in better balance (Grootaert et al., 2002). Education and capacity building for skills development are the best investment for the poor, and could equip future generations with the potential to be gainfully employed outside the Sundarbans.

Apart from gaining income and employment, education will enhance conservation in the Sundarbans. The poor level of education among resource collectors negatively affects conservation as it leaves them without the skills and knowledge necessary to follow the resource collection procedures properly (Roy et al., 2013a). Households

with relatively higher educated heads were less vulnerable to floods (Rayhan, 2010) and cyclones (Paul and Routray, 2011) as higher education helped them to understand weather forecasts and gave them the ability to implement coping mechanisms. The people of the Sundarbans would be able to take advantage of the opportunities available in the port city of Mongla and Khulna industrial area if they have education, skills and training. Barbier (2007) observed that human capital investment in education and training could improve outside employment prospects for mangrove-dependent households in Thailand. Garnett et al. (2007) emphasised the need for external investment in human capital in order for communities to shift from natural resource extraction to knowledge-based industries that do not remove resources from the immediate environment.

8.6.3 Financial Assets – Micro-Credit and Insurance

Lower income households throughout the study area typically had minimal savings and were usually unable to access formal credit due to the lack of collateral and so had become dependent on informal moneylenders for credit during an emergency and for income-generating activities (Chapter 4). Resource collectors and cyclone victims (in focus group discussions) and government and non-government agencies (key informant interviews) identified a critical need for the introduction of credit options that are easy to access, do not require collateral and could replace the informal credit system run by the moneylenders. This credit could be provided in the form of micro-credit by NGOs, rural banks and cooperative societies to be used for both asset replacement and working capital and even to establish non-farm income or other alternative livelihood activities during normal times and immediately after a cyclone.

Insurance schemes in particular appeared to be a promising option for providing support to victims of cyclone and wildlife attacks. During the focus group discussions, the resource collectors suggested that the private company insurance premium (Chapter 4, Section 5.3.5.5) which was aimed to provide livelihood security for the resource collectors could be paid by the Forest Department from the revenue generated from the forest. In a key informant interview, a ranger from the Chandpai Range supported this suggestion but stated that such a decision could only be made by the Ministry of Environment and Forest with permission from the Ministry of Finance. In the cyclone-affected areas, cyclone victims wanted insurance facilities to cover the potential loss of assets and incomes. According to the Sub-District CEO (KII#UNOM), such type of insurance was yet to be established in Bangladesh. I recommend that policy measures should be framed to collect insurance premiums from forest revenue and shrimp farming tax in order to secure the livelihoods of resource collectors and shrimp farmers. Regarding the provision of post-flood relief, Brouwer et al. (2007) suggested that NGOs operating in Bangladesh could potentially facilitate insurance services to provide support to the poorest sections in the community to cover disaster-related material damage, health care and unemployment. Wang et al. (2012) endorsed the design of insurance plans for migrant needs in China against typhoon-related hazards. Burby (2006) suggested a major reorientation of the US National Flood Insurance Program from insuring individuals to insuring communities after the devastation of Hurricane Katrina.

8.6.4 Natural Assets – Securing tenure and access

Access to the natural assets in the study area, namely, the mangrove forest resources, is important for a livelihood strategy based solely on mangrove forests. Harvesting mangrove forest-related products can be easily converted into financial resources by selling fish, crabs, fuelwood and shrimp fry, or converted into physical resources such as the use of trees or palm leaves for construction, and for subsistence such as the household consumption of fish. The Sundarbans was managed as a limited access commons due to the *de jure* status whereby access was governed by the rules and regulation of the state. The resource collectors did not have secure or easy access to resources due to the complexities of the rules and regulations which forced them to operate under the control of moneylenders and made them vulnerable. Vulnerability is closely linked to access to resources because these are a principal means by which people reduce their vulnerability (Baumann, 2002).

Roy et al. (2013b) found that conflicts between forest-dependent communities and foresters were caused by policy failures due to the absence of power-sharing arrangements. In another study, Roy et al. (2013a) found that the state property rights regime misused *de jure* rights and was less interested in ensuring community participation in conservation by the allocation of *de facto* rights in the Sundarbans. They proposed that *de facto* rights for forest-dependent communities in the Sundarbans would increase the likelihood of participation in mangrove conservation and create the momentum to stop corruption in the Forest Department. Roy et al. (2012) suggested an alternative property rights regime to address the missing link between conservation and the livelihood security of forest-dependent communities in

the Sundarbans. However, this would require amendments to the Forest Act. The legal recognition of local entitlements to mangrove resources could reduce social vulnerability and help to achieve the goals of forest management through change in more desirable directions (Glaser et al., 2003).

Roy et al. (2013a) found that both legal and illegal harvesters were strongly willing to contribute to better conservation of the Sundarbans; they proposed more community involvement in mangrove management as the Forest Department had failed to conserve the forest. Due to the failures of many state forest departments, India had shifted from state property regimes to common property regimes (Kumar and Kant, 2005). Community-based social forestry (such as woodlots, agroforestry and strip plantations) had been introduced in Bangladesh in the early 1980s and had proved to be extremely successful in the expansion of forest cover, benefiting thousands of poor people from the income of felling social forestry plantations (Muhammad et al., 2005; Salam and Noguchi, 2005). Community engagement can ensure the mutual monitoring and enforcement of rules as communities can impose significant costs on deviant behaviours in order to guarantee the enforcement of collective actions (Ballet et al., 2007). Porter-Bolland et al. (2012) looked at 40 protected areas and 33 community-managed forests in order to assess the long-term maintenance of forest cover in the tropics and found that the community-managed forests presented lower and less variable annual deforestation rates than the protected forests.

8.6.5 Social Assets – Building Community-Based Organisations

In the context of the study area, lower income households had very low representation in the local political forums, community-based organisations and NGOs. Their access to resources was determined by the extent of their social interactions and relationships with local moneylenders or political patrons who exerted favourable influence and exploited poor clients for their personal gain. The resource collectors depended on patron-client relationships to acquire access to resources, to protect themselves from being punished by the Forest Department or attacked by pirates, or to gain social safety nets or economic advantage.

The formation of Sundarbans user community groups such as fishermen organisations or shrimp fry collector organisations could provide collaborative opportunities for increasing incomes and ensuring safety, as expressed by resource collectors during the focus group discussions (FGD#SFWC; SCC; SSFC; SiFC). I think a broad and effective association could move towards more equitable use of resources by reducing the incentive for corrupt officials to extract bribes from illegal producers, and enabling the poor to make their voices heard in local decision-making or to gain equitable access to the Sundarbans resources.

Islam et al. (2011a) found that community-based fisheries management in Bangladesh had empowered the poor fishers to determine their access rights to fisheries resources and diversify their livelihood options in other sectors due to strong facilitation by local community-based organisations, NGOs and the Department of Fisheries. Investing in social capital was found to be a sensible

strategy for poor households in Burkina Faso where memberships of local associations contributed to higher household welfare levels (Grootaert et al. 2002).

CPP delivered by the Red Crescent Society is a community-based volunteer program that takes leadership roles in response to a cyclone disaster and facilitates safe evacuation to cyclone shelters, relief and rehabilitation efforts (Alam and Collins, 2010; Mathbor, 2007; Paul, 2009). CPP volunteers are committed to serving humanity on a voluntary basis and are grateful for the social recognition of their efforts to help others (Mathbor, 2007). Rawlani and Sovacool (2011) found that community-based adaptation to climate change through a coastal afforestation program was able to build various types of adaptive capacity in Bangladesh. Community-based disaster prevention was recommended in the mountainous areas of Taiwan for hazard mitigation (Chen and Huang, 2012). Community-based organisations can be successful as they have a better understanding of the local social conditions, local practices and knowledge; in addition, the particular experience and coping strategies of community-based organisations during a crisis are vitally important for the formulation of adaptation strategies (Vincent et al., 2010).

8.6.6 Diversification of Livelihoods

Livelihood diversification is defined as the process by which rural households or individuals construct or engage in diverse portfolios and social support capabilities in order to survive and to improve their standards of living (Ellis, 1998). Ellis (2000b: 289) maintained that diversification “has positive attributes for livelihood security that outweigh negative connotations it may possess”. Allison (2004) pointed out that diversification and risk-spreading behaviour are common features of livelihood

strategies. The diversity of assets and livelihood strategies can help households deal with poverty by giving them a range of possible insurance options or coping strategies (Paumgarten, 2005). Cross-sectoral and multi-occupational diversity of rural livelihoods may be needed to reduce rural poverty (Ellis and Biggs, 2001). Studies conducted in the Sundarbans region (Akon, 2013; Sarker, 2011; Zohora, 2011) recommended alternative income-generating activities in order to reduce dependence on forest resources and moneylenders. Other studies (Frankenberger, 2002; Hossain, 2009; Islam, 2010; Sen, 2003) in similar contexts in Bangladesh have recommended the introduction of livelihood diversification opportunities for poverty eradication. During the present research, various suggestions and options were raised by community members, NGOs and government officials for the achievement of sustainable livelihoods and poverty eradication among the households in the Sundarbans regions.

The potential of crab fishery is vast in the surrounding areas of the Sundarbans as crab can be cultured in shrimp farms (KII#SFOM; Islam, 2010). In a key informant interview, a Sub-District Fisheries Officer stated that the Department of Fisheries had trained nearly 25 crab collectors in crab fattening. Crab collectors wanted to start crab fattening as crabs grow very fast and can be sold for income as soon as two months after initiating the fattening activities. Moreover, a marketing chain for exporting crabs was already well-established in the Sundarbans region (FGD#SCC).

Frankenberger (2002) suggested that shrimp fry collectors surrounding the Sundarbans had the possibility to earn income from shrimp nurseries as more than 70 per cent of the shrimp farms did not have nurseries on their farms. The technology is

simple and the risks are relatively low due to the short production cycle. Philcox et al. (2010) also suggested alternative opportunities for income generation for fry collectors and the minimisation of the negative environmental impacts for the sustainable development of shrimp aquaculture in the Indian part of the Sundarbans.

Diversification into shrimp nurseries and crab fattening options would need to deal early and forcefully with land ownership issues as lower income households in the Sundarbans were found to be largely landless. For these income-generating activities, government land should be distributed among lower income landless households (KII#UNOK; SFOM; ACFCR). Foster et al. (2011) discussed the constraints to escaping rural poverty in developing countries and suggested that increased land holdings often had higher poverty-reducing potential in Bangladesh where most land was divided among small operations.

One study suggested that community-based tourism enterprises could be successful in achieving conservation and livelihood aims in the Sundarbans region as the surrounding villages were appropriate locations for small-scale resorts due to their proximity to the forest areas (Islam, 2010). Islam (2010) stated that such resorts along with allied activities such as producing local goods for tourists and employing local guides and helpers would create more job opportunities.

Outside forest and shrimp-dependent livelihoods, diversification into labour-based non-farm activities has high potential in the Sundarbans region, due to its proximity to the Mongla sea port and industrial areas. Outside the eco-region, employment in the garments sector could provide viable options for lower income households and

resource collectors showed keen interest in working in this sector during the focus group discussions. The best potential for job creation lay with training in garment factories in Dhaka or other industries located in Mongla (KII#UNOK; SFOM; ACFCR). In Bangladesh, households have been found to be able to move out of poverty and accumulate assets faster by diversifying their livelihood strategies into non-farm activities and reducing their dependencies on farm activities (Sen, 2003; Hossain, 2009).

8.6.7 Transforming Structures, Policies and Processes

Allison and Horemans (2006) argued in favour of transforming policies and institutions to achieve sustainable livelihoods. Policies and institutions should incorporate good governance practices to eradicate corruption. Corruption related to bribe-seeking by forest officials during resource collections and political patronage related to disaster relief distribution were tightly intertwined with the local livelihoods in the study area. Corruption tends to generate wealth while producing new poverty and social inequalities at the same time (Anwar, 2008). Freeman et al. (2004) confirmed that governance problems have a broadly debilitating effect on pathways out of poverty in rural livelihoods. In the Cameroon, Alemagi and Kozak (2010) suggested that the effective enforcement of regulations along with the promotion of accountability, transparency, rigor and local democracy must be directed at collusive corruption in order to reduce illegal logging activity. Kolstad and Søreide (2009) identified rent-seeking and patronage as two main forms of corruption and suggested that the right incentives should be provided to the persons in the resource sector in order to prevent corruption practices in natural resource management. Similar suggestions are also applicable in the Sundarbans context.

After an in-depth study of Cyclone Aila, I recommend that future government disaster management policies should decentralise disaster management at the local level. In Bangladesh, none of the sub-districts had viable disaster plans. Both the Sub-District and Union Councils should be provided with the power to prepare and implement their own disaster plans including financial authority for proper disaster management under a legal framework. Various examples from developing and developed countries have shown that improving local planning for disasters can help the relevant agencies respond quickly and can help to build resilient communities.

In the Philippines, local government units had the power to allocate five percent of their internal revenue allotments for disaster relief, rehabilitation and reconstruction through what was known as the calamity fund (Torrente et al., 2008). Burby (2006) analysed the paradoxes of government policy in respect to Hurricane Katrina and suggested that disaster losses can be minimised if local governments prepare comprehensive plans that pay attention to hazard mitigation. Kusumasari and Alam (2012) also suggested increasing the capability of local government to manage a natural disaster in Bantul, Indonesia.

During the focus group discussions, the resource collectors emphasised the urgent need to address the implications of a resource collection ban on their livelihoods. They urged that alternative income-generating activities should be established before putting such restrictions on resource collections. They further said that current law and regulations in relation to forest resources focused on what was prohibited rather than on what is or what ought to be promoted. In the Sundarbans, this would require

legal changes to give the community more livelihood support through forest activities and expanding the forest revenue to provide training on resource collections, providing collateral-free loans for buying tools for resource collections, providing free medical services to the local forest-dependent people, and potentially grant them legal recognition through amendments to the Forest Act. This could increase the level of compliance by resource users and promote best-use practices. Research has found that incentive-process policy instruments have been more successful compared to regulatory-process policy instruments in sustainable resource conservation (Gauldin, 2003).

In terms of the management of shrimp resources in Bangladesh, some recommendations such as tax charges on shrimp farming (Bhattacharya et al., 1999), rationalising of current laws (Afroz and Alam, 2013) and providing benefits and equity from the shrimp farming to the local communities (Braaten, 2003) have been made in different studies. Coastal land zoning might identify the appropriate areas for shrimp farming and areas that need to be protected, including inter-connecting tidal rivers, creeks and mangrove forest (Azad et al., 2009). Shrimp culture should be restricted between January to July as salinity is generally high at that time, but rice can be grown from August to December when the salinity is low due to heavy rainfall (SRDI, 2006; Islam et al., 2003). Since land is a scarce resource in Bangladesh, yield should be increased by better management practices by integrating shrimp farming with rice cultivation (Gammage et al., 2006) and converting existing large farms into smaller units each of 1 ha (Islam et al., 2005) or adopting organic (Paul and Vogl, 2013; Rahman et al., 2013b) and ecohydrology-based (Sohel and Ullah, 2012) shrimp farming systems. In light of Cyclone Aila, I recommend that

mandatory embankment protection fees should be charged on shrimp farming; the revenue from these fees could be utilised for embankment maintenance in order to protect local livelihood security.

8.7 Conclusion

In this chapter, it has been revealed that the policies related to forest, shrimp aquaculture and disaster were inconsistent, inappropriate and ineffective in respect of livelihoods in the Sundarbans study area. The gap between policy intention and implementation remained wide. Forest laws and regulations were ineffectual as they often did not stop illegal resource extraction, inefficient as the regulations didn't promote any alternative income sources for the resource collectors, and self-defeating as these regulations created the conditions for rent-seeking behaviour among forestry officials. Improper government incentives, such as soft credit and leases of government land, had promoted the unsustainable growth of shrimp farming which only benefited large shrimp farmers. In contrast, the lack of a policy framework to protect the interests of rice farmers had led to the displacement of traditional farmers and reduced their income-earning sources. Disaster management institutions had failed to act according to the policy guidelines and failed to provide better livelihood rehabilitation opportunities to the cyclone-affected people. The actions of national and local government agencies and NGOs were inadequate in their efforts to restore livelihoods after cyclone. The findings of this study support the final recommendation for a comprehensive approach with multiple interventions working simultaneously to establish a meaningful and sustainable asset base for the households surrounding the Sundarbans forest. Only such a comprehensive and multi-pronged approach can secure livelihoods and create resilient communities in the face of natural disasters.

Chapter 9: Conclusion

Chapter 9: Conclusion

9.1 Introduction

This thesis was a study of the dynamics of the rural livelihoods of the people living adjacent to the Sundarbans mangrove forest system in Bangladesh. The study examined the distribution of household assets, livelihood strategies and vulnerabilities, and livelihood outcomes of rural households in eleven villages in two locations in the subdistricts of the Mongla and Koyra located to the north of the Sundarbans Reserve Forest. The contributions of the rich and diverse mangrove forest resources and the development of shrimp farming, and the livelihood vulnerabilities associated with these sectors, were examined. The research also included a detailed assessment of the type and extent of damage to livelihoods due to a cyclone in 2009 and the implications for household vulnerability.

Policy responses around these core areas (mangrove resource management, shrimp farming and natural disasters) were evaluated in the context of the impacts on livelihoods. The research applied the sustainable livelihoods framework. The main method applied was primarily detailed structured household surveys but also included other methods including semi-structured key informant interviews, focus group discussions, and an analysis of the government policies and legislation related to forest resources, shrimp aquaculture, and natural disasters and associated vulnerability.

This study contributes both theoretically and empirically to the literature on rural livelihoods in developing countries, and could inform planning and management of the mangrove forest for improved livelihoods of the poor in the study area. The objective of the discussion presented in this chapter is to recapitulate the key conclusions of each of the five main chapters (and associated research questions). The major contributions of this thesis to the understanding of livelihoods from a theoretical, methodological and policy perspective are also discussed along with some recommendations and opportunities for future research.

9.2 Key Findings

In this section, the main research questions (as presented in Chapter 1, Section 5) are addressed explicitly.

How are livelihoods structured, and what are the key factors underpinning them?

The objective of the research presented in Chapter 4 was to investigate the components of livelihoods assets and livelihood strategies as they varied with household annual income in six villages (Joymony Ghol, Joymony Katakhali, Joymony Sankirchar, Baiddomari, South Bashtola, Bururia) in Mongla Sub-District surrounding the Sundabarns mangrove forest. The analysis was conducted across three groups of 88 households each, namely, “lower income” (US\$177-796), “middle income” (US\$805-1,506), and “higher income” (US\$1,509-18,963). In the study villages, there was a high degree of inequality among households regarding the ownership of livelihood assets. These households were also more vulnerable to

stresses imposed from outside. Lower income households in the study area were vulnerable as they had low human assets (little or no formal education), few physical assets (poor tools or equipment for production or processing, lack of productive land, lack of proper housing), minimal financial assets (lack of cash or savings, poor access to credit, dependence on moneylenders), few natural assets (ownership and access to little or no land, few livestock), and limited social assets (in a patron-client relationship system).

Fewer assets equate to greater vulnerability (Morris et al., 2001; Moser, 1998) because assets can generate income, provide the resources needed to live comfortably, and enable households to cope with stress. Lower income households had a low diversity of assets, which in turn was associated with lower potential for substitution between assets and activities; that is, the lower income households had low adaptive capacity. Vulnerability is closely linked to poverty (Allison et al., 2009) and is often viewed as simply identical to a state of poverty (Alwang et al., 2001) or as an indicator of the likelihood of falling into a poverty trap in the future (Lok-Dessallien, 1998). The findings showed that the lack of a viable and sustainable asset base made these lower income households more vulnerable and the resultant vulnerability caused poverty.

The livelihood strategies of the households in the study area were dominated by either the use of forest resources, involvement in shrimp farming and non-farm activities (such as trade, business or selling labour) or a combination of these activities. Most households, across all three income levels, engaged in at least some mangrove forest resource collection or shrimp farming activities. Lower income

households were dependent on mangrove forest resources with some paid labouring work in shrimp farm or non-farm activities, such as working as labourers in the government-sponsored Food for Work program. The paid work of the lower income households often involved risk and low remuneration. With few skilled work opportunities and low incomes, these households invested little in their human capital.

Livelihood outcomes are the outputs achieved from livelihood strategies, including income, a strengthened asset base and improvements in aspects of wellbeing. The study found that improvements in assets such as acquiring land, increasing income from shrimp farming, trade, business and remittances, and the accumulation of non-land assets, were mostly associated with higher income households. As discussed in Chapter 2, livelihood outcomes improve wellbeing (DFID, 2000) which includes social, mental and spiritual aspects of the quality of life as well as physical aspects and income (Cahn, 2006). In regard to the incidence of poverty based on income, 43% of total households in the study area were below the national lower poverty line and 55% of the households were below the upper poverty line – more than twice the national rural level (21%). All households in the study area fell into the category of absolute poverty. These households would be unable to purchase a bundle of goods and services to satisfy the basic needs of life as calculated by the traditional income-based measurement of poverty.

In general, this study found that household poverty and their vulnerabilities were closely linked and strongly influenced the livelihoods in which households were engaged in the Sundarbans.

How important are the mangrove resources in shaping the structure of livelihoods?

The objective of the research reported in Chapter 5 was to determine how dependence on forest resources varied with household income, the socio-economic factors that influenced dependence on income from forest resources, the role of forest incomes in poverty alleviation, and the vulnerability of livelihoods associated with forest resource collection in villages in Mongla Sub-District.

On average, a major portion of the annual income in lower and middle income households (74% and 48%, respectively) came from forest resources, whereas forest resources contributed only 23% of the annual income of the higher income households.

On average, the legal and illegal collection of mangrove resources contributed 24% and 50%, respectively, to the total income of lower income households (Chapter 5, Section 5.3.2). Households with less forest income engaged in more shrimp farm and non-farm income generation activities. Households with higher total income had lower and less variable forest dependence. However, while the lower income households had the highest relative forest income, the higher income households had a higher absolute income derived from forest resources. The result is consistent with several empirical studies of the economic importance of forests to rural households that, while poor households are relatively more dependent on forest resources, the better-off households tend to have a higher total forest income (Babulo et al., 2009; Cavendish, 2000; Fisher, 2004; Kamanga et al., 2009; Mamo et al., 2007; Yemiru et al., 2010).

Ownership of a boat and a large number of nets for catching shrimp fry was associated strongly with greater income from forest products. Male-headed households had more forest income than female-headed households. There were negative correlations between forest income and the area of homestead and shrimp farm land, the total value of physical assets and the number of livestock among households.

Income from the Sundarbans mangrove forest also helped to reduce income inequality and poverty. If we assume households are unable to access income from other sources and we subtract forest income from their current incomes, the proportion of people in the study area living below the lower poverty line would increase from 43% to 65%. While it is not possible to predict with certainty the households' choice of activities should forest income be unavailable, this calculation suggests that the forest income was keeping a significant proportion of the households (22%) in the communities surrounding the Sundarbans mangrove forest above the poverty line. The Gini coefficient was highest when forest income was excluded (0.52), showing that the addition of forest income to the household income reduced the measured income inequality by 27% (Chapter 5, Section 5.3.4). The finding that forest income lowered income inequality is consistent with the findings in other studies from other regions of the world including China, Ethiopia, Malawi and Benin (Anderson et al., 2006; Babulo et al., 2009; Cavendish, 2000; Heubach et al., 2011; Kamanga et al., 2009; Vedeld et al., 2004; Yemiru et al., 2010).

From a livelihoods perspective, vulnerability includes the capacity to respond to trends, shocks and seasonality (DFID, 2000). Chambers (1989) described

vulnerability as having an external side, which encompasses the risks, shocks and stress to which an individual is subjected, and an internal side which encompasses defencelessness, meaning a lack of means to cope without experiencing damaging loss. For the forest-dependent households in the study area, the interaction between resource collections and external influences revealed a pattern of vulnerability. The collection of mangrove forest resources did not provide regular income due to the seasonality of the mangrove resources, the death or injury of resource collectors due to wildlife attacks, and the need to pay rent to Forest Department officials and ransoms to pirates. The need for loans to buy equipment for harvesting resources, namely, nets and boats, had created opportunities for middlemen to exploit the mangrove forest resource collectors. Reduced access to forest resources due to use restrictions had forced lower income households to exploit natural resources illegally. The resultant criminal court proceedings made them more vulnerable.

How important is shrimp aquaculture in governing the structure of livelihoods?

The objective of the research presented in Chapter 6 was to understand the contribution of shrimp-based income to the household income portfolios among the different income groups in six villages in Mongla Sub-District. The research also aimed to identify the socio-economic factors necessary to engage in shrimp farming from a livelihood perspective, as well as the nature and extent of the vulnerabilities that had been created by this sector.

The rapid changes in the landscape due to the conversion of agricultural land to shrimp aquaculture had increased the opportunities for the higher income households

and some middle income households in their study area to increase their income. For the higher income group, the shrimp income was the most important source of income, contributing 46% to the total household income. In the middle income group, the shrimp income contributed 26% (Chapter 6, Section 6.3.4). In the lower income households, shrimp farming accounted for only 8% of income, most of which came from paid labour on the shrimp farms. Among the households with higher total income, the variability in shrimp income dependence was also higher in relation to both absolute and relative terms.

Ordinary least square analysis showed that the ownership of shrimp farm land was the single largest factor determining the households' income from this sector. Higher income households with more land gained more income from shrimp aquaculture in comparison to the lower income landless households. The higher income households used their land as collateral to get loans from credit-providing organisations. The age and education status of the household head, amount of homestead land owned, the number of livestock and value of mobile phones were not significantly correlated with shrimp income.

The inclusion of shrimp income in household income increased the measured income inequality by 36%. The findings demonstrated that incomes from shrimp farming and shrimp-based enterprises were not evenly distributed; rather, participation in these activities caused income inequality, leading to greater income disparities between the higher and lower income households. A similar observation was found by Adger (1999) in regard to shrimp farming in Vietnam.

Livelihoods can be made more or less vulnerable by long-term trends, with not all trends being negative or causing increased vulnerability (DFID, 2000). The trend of converting land from rice farming to shrimp aquaculture had positive outcomes for the higher income households in the study area who owned land, whereas the large majority of households experienced greater livelihood vulnerability. The findings in this research indicated that the rapid conversion of agricultural land into shrimp farms created multiple stresses on local livelihoods. Loss of income traditional subsistence-based agriculture and livestock activities (only 1-3% of the total income for all three income groups), loss of access to government-owned land and the resultant environmental degradation associated with the shrimp boom had taken a heavy toll on food security. These changes also affected the social relations that had traditionally operated as a buffer against the impact of climatic variability.

What are the impacts and responses to cyclones?

Cyclones are a major natural hazard in the study area and likely to increase in intensity due to climate change. The objective of the research presented in Chapter 7 was to analyse the impacts of cyclones on households assets and to identify the cyclone coping strategies in five villages (Jorshing and Patakhali, Koyra No.3 and Koyra No.2, and Jaigirmahal) representing severe, high and low affected areas across 249 households) in Koyra Sub-District following Cyclone Aila in 2009. A detailed assessment was made of the various factors that influenced the vulnerability of the households to cyclones.

In the sustainable livelihoods framework, vulnerability is characterised as the impacts of and ability to cope with trends, shocks and seasonal events (DFID, 2000).

Shocks are typically impacts that are sudden, unpredictable and traumatic (Chambers and Conway, 1992) such as cyclones and floods. In the disaster and climate change-related literature, vulnerability is defined either: (i) in terms of the amount of (potential) damage caused to a system by a particular climate-related event or hazard (Jones and Boer, 2003); or (ii) as a state that exists within a system before it encounters a hazard event (Allen, 2003). The present research found that cyclones pose serious threats to livelihoods, as they entail the loss of extensive human, physical, financial and social assets, sometimes irreversibly. The threats posed by cyclones, particularly in relation to displacement and loss of income, can easily jeopardise the livelihoods of the households in the study area. Damage to property led to the loss of other assets due to the use of borrowing and forced sale as coping strategies. The use of these strategies made households highly vulnerable and aggravated poverty. The vulnerability of the communities in the study area villages in Koyra to the impacts of cyclones was linked to the weakness of the embankments which arose because of a lack of maintenance and the installation of illegal sluice gates to allow saline water to enter shrimp farms. Other factors linked to the vulnerability were the lack of cyclone shelters and cyclone resistant housing, and the heavy dependence on shrimp farming.

The impacts of Cyclone Aila on higher income households (ranging from US\$1,163 to US\$19,622) in Koyra Sub-district included the loss of assets which constituted a bigger relative shock than for the lower income households (ranging from US\$218 to US\$581) because it was coupled with a large reduction in income after the cyclone. In this study, the higher income households were identified as the most vulnerable and least resilient to cyclones. In contrast, the lower income household members,

mainly mangrove resource collectors and day labourers, were able to commence resource collection reasonably quickly and re-establish their livelihoods. The claim that the poor (in this case, resource collectors and day labourers) are likely to suffer more than the wealthy (shrimp farmers) when disaster strikes was not supported in this study, in contrast to other studies set in Bangladesh (Brouwer et al., 2007; Paul and Routray, 2010; Rayhan, 2010) or other places in the world (Carter et al., 2007; Gentle and Maraseni, 2012; Morris et al., 2002; Jakobsen, 2012; Pomeroy et al., 2006). The reason might be that the higher income households failed to focus on livelihood recovery during the prolonged flooding after the cyclone due to delays in reconstructing the embankments; it may also be explained by the fact that the present research did not investigate the experiences of members of higher income households who left the study area immediately after the cyclone. The difference may also be related to the timeframe of the study period. The present research covered a short period after Cyclone Aila (10 months immediately after the cyclone); in contrast, Brouwer et al. (2007) studied the impacts of floods in 2004 with data collected in 2005, Rayhan (2010) researched the impacts of floods in 2005 with data collected within two weeks of the flood event, and Paul and Routray (2010) studied the regular, sudden and rapid effects of flooding on households.

How do policies relate to local livelihoods in the study area?

The objective of the research presented in Chapter 8 was to examine the intentions and impacts of the policies, laws, rules, bans and management actions relating to forest resources, shrimp fisheries and disaster management, which either promoted or inhibited the livelihood activities of the people who depended on the resources in the two study areas.

The research found that the centralised revenue-earning management of the Sundarbans mangrove forest did not sufficiently acknowledge the links between livelihoods and the conservation of resources. Protectionist policy approaches, such as bans on resource collection and the implementation of complex permits and resource collection rules and procedures, restricted the rights of local forest-dependent communities, enabled moneylenders to control resource collection, and forced resource harvesters to work under the formal control of the moneylenders. Bans on forest resource collection made the lower income group vulnerable to the threat of criminal charges by Forest Department officials who also extracted rent for their personal gain. The lowest income households in Mongla Sub-district had a high dependence on forest resources for income, and a ban on collection penalised these households and eliminated their principal livelihood opportunity. As a consequence, the full potential of ecosystems as a wealth-creating asset for the poor – not just a survival mechanism – was compromised by both the authorised and unauthorised practices of Forest Department officials. The Forest Department generally lacked the capacity to manage the Sundarbans mangrove forest in relation to both securing livelihoods of the resource dependent households and conservation of the forest.

This study found that economic incentives, such as soft loans, leases on government-owned land and subsidies, had promoted the unsustainable growth of shrimp farming. These incentives had led to the widespread conversion of agricultural land to shrimp aquaculture, causing huge reductions in agricultural and livestock-based livelihood activities. Lower income households that owned no land consequently lost access to other lands due to the loss of sharecropping opportunities and the reduced

availability of government-owned land for common access. The Department of Fisheries was responsible for shrimp farm management but failed to act according to policy guideline (Government Order: Cabinet Division/DA-4/2(66)/93-97/01, dated 01-01-1998). According to the guideline, at least 86 percent of the people in a shrimp farming area needed to support an application before any permits were granted for shrimp cultivation in an area; this requirement had never been adhered to in the study areas, leading to conflicts between relatively wealthy shrimp and much poorer crop farmers. According to the guidelines, permission had to be obtained from the Bangladesh Water Development Board before establishment of sluice gates to allow ingress of the saline water needed by the shrimp farms. This rule was not properly monitored and implemented by Department of Fisheries. The unplanned and uncontrolled construction of sluice gates caused the collapse of embankments following Cyclone Aila. This led to long-term flooding of formerly productive land with severe negative impacts on livelihoods (Chapter 7 Section 7.3.3.1). With their existing resources and administrative power, Department of Fisheries failed to manage the shrimp sectors properly which caused serious livelihoods threats to all households in the Mongla and Koyra Sub-Districts.

The research presented in Chapter 8 also revealed that the policy responses such as Standing Order on Disaster (2008) in relation to disaster management in Bangladesh were not focused on the existing vulnerabilities, which potentially turned a natural hazard into a disaster. The present management failed to address the complex problems of disaster management (including pre-disaster preparedness, relief and post-disaster rehabilitation activities) according to the guidelines set out in the Standing Order on Disaster (2008). The response from the Ministry of Food and

Disaster Management working at the national level to overcome the impact of Cyclone Aila was not adequate or well-coordinated, delaying embankment reconstruction for more than one year after the cyclone and resulting in poor public service delivery to these communities. Sub-district councils, union councils and NGOs working at the field level failed to implement interventions across all sectors after Cyclone Aila, resulting in the loss of livelihoods and delayed livelihood recovery. Although disaster management should be based on multi-stakeholder engagement, it was found in the research there was no coordination among the different agencies and there was a lack of comprehensive community involvement. The weaknesses in the institutional approach were rooted in the lack of a collective decision-making culture in planning, in resource sharing and in implementing policies and programs. All these factors negatively impacted on the ability of households in the Koyra Sub-District to recover their livelihoods following the Cyclone Aila disaster.

9.3 Overall Conclusion and Contribution to Livelihood Research

The livelihood strategies of the households in the Sundarbans eco-region were limited because these households were vulnerable to external shocks and stresses due to their limited asset base particularly in relation to community-based assets such as drinking water, sanitation, education and health facilities, infrastructure and services. High paying and stable formal employment, business or remittances were limited though communities had strong social cohesions especially during times of disaster and community programme. The livelihood strategies of the higher income households displayed particular advantages that helped them to achieve not all but some livelihood outcomes. Most households in the study area lived below the

poverty line (US\$17-21 per capita per month) to even in the absence of crisis events, and traditional measures of poverty based on income showed that even the households lived above upper poverty line with relatively high incomes were not achieving wellbeing due to vulnerabilities associated with their livelihoods and due to lack of education, health, infrastructure and other basic facilities such as drinking water and electricity. As a livelihood strategy, participation in shrimp aquaculture offered potentially greater cash income compared to agricultural farming. As shrimp cultivation expanded throughout the Sundarbans eco-region for the last two decades, subsistence-based livelihood strategies related to agricultural crops and livestock declined across villages that has impacted households' food security. The reliance of households on market to buy rice – the staple food – had created insecurity as households had to depend on cash income in order to avail themselves of food.

The local livelihoods were also vulnerable because households had failed to spread their risks in order to avert the impact of a disturbance in any one sector. The research showed that the livelihoods of the communities surrounding the Sundarbans were extremely vulnerable due to the lack of secure access to the mangrove resources, dependence on moneylenders, the prosecution of forest criminal charges and attacks by pirates and wildlife. Due to the negative effects of shrimp aquaculture, many of the poor had lost work as agricultural labourers or sharecroppers, or lost access to government-owned land; they took up fry collection and became vulnerable to the risks associated with illegal collection due to government bans on the collection of shrimp fry from natural sources. Thus, the lower income households failed to overcome the changes brought about by the establishment of shrimp aquaculture in the region and became marginalised in terms of livelihood options.

The vulnerabilities associated with forest resource collection had limited the ability of the lower income households to increase their livelihood assets and diversify their livelihoods. The findings demonstrated that, in contrast, the cyclone had exposed the vulnerability of the higher income households through impacts that were likely to increase due to climate change. Households can remain highly vulnerable to shocks and external changes even when their incomes were well above the average local income (Béné, 2009) if they fail to compensate for income shocks (Nielsen et al., 2012; Vatsa and Krimgold, 2000).

Allison (2004) pointed out that diversification and risk-spreading behaviour are common features in rural livelihood strategies. Allison and Ellis (2001: 379) noted that “the most robust livelihood system is one displaying high resilience and low sensitivity; while the most vulnerable displays low resilience and high sensitivity”. Low resilience against natural disaster obviously limits sustainability (Berkes, 2007) and economic resilience is a major way to reduce losses from disasters (Rose, 2007). As demonstrated, some higher income households pursued shrimp-based livelihood strategies and were well-off by local standards but these households were also more vulnerable to cyclone impacts as the damage to shrimp farms is high when cyclones occur. By contrast, while the lower income households faced vulnerabilities associated with mangrove resource collection, forest resource collectors, as an occupation group, were more resilient against natural hazards than shrimp farmers.

The research applied a holistic approach to the analysis of livelihoods in the study area, built on an understanding of the connectedness and inter-relationships between their major components (assets, activities, strategies, policies and processes, and

livelihood outcomes). Using the sustainable livelihoods framework (DFID, 2000) made it possible to analyse the complex livelihoods of the coastal Sundarbans people by integrating the contributions of mangrove forest resources, shrimp aquaculture and exposure to natural hazards (cyclones) to household livelihoods and demonstrating how these different elements interacted.

Without an appreciation of the inter-connectedness of the components, interventions into any one particular sphere run the risk of having unintended negative ‘knock-on effects’ on other components of the system (Carney et al., 1999). Many studies in the Sundarbans region have focused on examining information related to one aspect of livelihoods – either forest resources (Akon, 2013; Getzner and Islam, 2013; Sarker, 2011); shrimp (Ahmed et al., 2008a; Islam et al., 2003; Islam et al., 2005; Swapon and Gavin, 2010) or cyclones (Mallick et al., 2011; Masud-All-Kamal, 2013;) resulting in a fragmented rather than holistic understanding of livelihoods. In the examination of the role of shrimp aquaculture in livelihoods, this study found positive livelihood outcomes for higher income households and negative livelihood outcomes for lower income landless households. By integrating the results from the analysis of natural hazards and their impacts, this study found that people in the Sundarbans region did not consider shrimp aquaculture to be a positive livelihood activity and that damaged embankments from extensive shrimp farming had prolonged the impact of Cyclone Aila on livelihoods. Therefore, through a combined analysis of shrimp aquaculture and natural hazards using the sustainable livelihoods framework perspective, the study found that the shrimp farmers in the region were less resilient and more vulnerable to the effects of a cyclone than other groups in the region.

9.4 Recommendations for Livelihood and Natural Resource Management

In considering the contribution of this research to natural resource management policy, the results identified a weak link between livelihoods and natural resource management that creates negative impacts on sustainability. This research investigated the scale and complexity of conflicting issues related to the policies that influence the livelihoods of the households surrounding the Sundarbans mangrove forest. Based on this investigation, the following broad recommendations for improving sustainable livelihoods in resource-dependent communities and natural resource management are provided:

- There is a need to develop a unifying legal framework in the study area which encompasses all aspects of sustainable shrimp aquaculture and natural resource management. It is clear from the research that the current bans on resource collection (Moratorium on Tree Felling, Ban on Shrimp Fry Collection) from the Sundarbans and resource collections procedures have negative impacts on the livelihoods of the poor who are most dependent on forest based resources for their livelihoods.
- The Forest Act, 1927, The Bangladesh Wildlife (Preservation) Amendment Act (1974) should be amended to acknowledge and protect the rights of the resource-dependent communities and to enhance their capacity to act as resource custodians. One way to do this is to provide incentives to establish long-term links between livelihoods and resource conservation. In recent decades, strategies for livelihoods and biodiversity conservation around the world have moved away from a protectionist approaches (Adams, 2004) to

integrated conservation and development approaches (Sayer et al., 2007; Sayer, 2009), landscape trade-offs between conservation and development (Rodriguez et al., 2006; Sunderland et al., 2008), market-based approaches to conservation (Adams and Hutton, 2007) and payments for environmental services (Pagiola et al., 2005; Wunder, 2008).

- The government should consider “land use zoning,” policy which may be a way to deal with the shrimp issue so that interest of agricultural farmers can be protected. For lower income landless households to have access to land-based resources to enable them to participate in subsistence-based agriculture and livestock activities, mechanisms have to be devised to raise at least one staple crop per year in the shrimp farming areas.
- The investigation carried out in this research provided information about the impacts and vulnerabilities related to cyclones in the study area. This provided an indication of the future impacts and vulnerability that can be expected to worsen due to climate change (Bhuiyan and Dutta, 2012, Dasgupta et al., 2009; IPCC, 2007, 2001; Pethick and Orford, 2013; Rahman et al., 2011b). Cyclone Aila was a mild cyclone compared to cyclones predicted under climate change and the Bangladesh Government may need to consider adaptation through a managed retreat from highly vulnerable sites. The alternatives include the construction of higher and stronger embankments, and the active maintenance and strict policing of embankment use; otherwise, the Cyclone Aila disaster will simply be repeated.
- Disaster and climate change adaptation policies such as Standing Order of Disaster should incorporate an understanding of the vulnerabilities of coastal areas to natural hazards and measures should be implemented to ensure that

local governments have viable community-based disaster management plans within a legal framework.

9.5 Future Research

The sustainable livelihoods framework applied in this research identified the key assets that the households surrounding the Sundarbans use and access to enable livelihoods. However, this research was not able to cover all the areas related to the complex socio-political and economic dynamics of households' livelihoods as this research focused primarily on income in determining income groups and describing livelihood outcomes and poverty. Further research should explore the non-material aspects of livelihoods and wellbeing (e.g. Weerantunge et al., 2013), such as culture, social status, intra-household relationships and happiness aspects of households' livelihoods. Future research could also make a more informative categorisation of households based not just on income and the current situation, but including all aspects of livelihoods as well as the past and likely future changes to a household's livelihood. As suggested by Mensah (2012), such an approach could include the household-based understanding of institutional evolution and livelihood formation through micro/macro-interventions. The comparison between livelihoods in the Sundarbans region and other areas in Bangladesh especially the riverine areas or other coastal areas around the world with similar socio-ecological characteristics would also be a useful direction for future research. In a recent study, De Haan (2012) argued that a meta-analysis of multitude livelihood studies through comparative research might challenge existing livelihood theories.

Natural resource and disaster management is a complex issue heavily influenced by the political context at the local and national levels. As this research has demonstrated with some examples (Chapter 8), the illicit use of political power by state officials and community elites can divert significant resources away from the poor. Further research could complement this case study work with an analysis of the wider governance context that increasingly influences natural resource management and local livelihoods (Jones et al., 2013; Lockwood, 2009; Mansourian et al., 2011; Miththapala, 2011; Surkin, 2011; Preece et al., 2013). A political and governance approach to climate-induced disaster management is worthy of discussion since political structures can influence the economic and social roots of vulnerability and may impede appropriate policy responses (Ahrens and Rudolph, 2006; Rijke et al., 2012; Wang, 2013; Okereke et al., 2009). The scope of the present research did not include an in-depth study of the co-management of natural resources or multi-stakeholder-based management approaches (Adger et al., 2005; Berkes, 2009; Carlsson and Berkes, 2005; Folke et al., 2007). More research needs to be in this direction in the Sundarbans in order to analyse the conflicts surrounding the management of natural resources based on the governance-based approach from a political economy or political ecology perspective.

The research reported in this thesis explored the most direct and immediate impacts of Cyclone Aila on the livelihoods of the people in the Sundarbans area. It was not possible to consider the long-term impacts, such as the further hardships caused by the prolonged isolation of the communities from their markets and from essential services, or the extended loss of income due to the persistent flooding after the cyclone. In addition, some families left the region altogether following the cyclone in

2009, and their experiences have not been captured in this research. This study also did not attempt to measure the relationship between poverty and the costs of damage, and it was not possible to assess how many households were thrown permanently into poverty following the destruction caused by Cyclone Aila.

9.6 Concluding Remarks

This thesis investigated the livelihoods of households in two districts surrounding the world's largest contiguous mangrove forest, the Sundarbans. The research specifically aimed to examine aspects of the sustainable livelihoods of households in the Sundarbans communities. The results of this study indicated that rural livelihood systems differed among the different income households in the study area. The eleven villages in which the research was conducted was generally representative of the villages and towns in the Sundarbans eco-region. Therefore, the results of this study could offer some degree of general applicability to other residential areas in the 17 sub-districts surrounding the Sundarbans mangrove forest. I believe that the results of this research can be a valuable resource for improving the livelihoods of the people surrounding the Sundarbans, which is a globally significant yet nationally underdeveloped region, and that the understanding and recommendations informed by the research findings can be applied to similar socio-ecological settings in other parts of the world.

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Appendix A: Livelihood Household Survey in Mongla Sub-District³

A. Identification

1. Identification and location of household

| | |
|----------------------------|--|
| 1. Household name and code | |
| 2. Village name and code | |

Part 1

A. Household Composition

1. Who are the members of the household (HH)?

| Name of HH Member | Relation to HH Head | Sex | Age (yrs) | Education | Marital status | Occupation – Primary | Occupation – Secondary |
|-------------------|---------------------|-----|-----------|-----------|----------------|----------------------|------------------------|
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B. Land

1. Does your household own or have access to land?

| Type of land | Amount Local unit | Amount (Decimals) |
|--|-------------------|-------------------|
| Own homestead land | | |
| Own agricultural land (without share/lease/mortgage OUT) | | |
| Land leased IN | | |
| Land leased OUT | | |
| Khas land (govt-owned land) | | |
| Total land owned | | |

3. Adapted and modified from the Poverty Environment Network household survey prototype questionnaire (PEN, 2008)

C. Household Assets

1. Please indicate the number and value of implements and other large household items that are owned by the household.

| Implement or large household item owned by the household | No. of units owned | Total value (current sales value of all units, not purchasing price) |
|--|--------------------|--|
| 1. Car/truck | | |
| 2. Tractor | | |
| 3. Motorcycle | | |
| 4. Bicycle | | |
| 5. Handphone/phone | | |
| 6. TV | | |
| 7. Radio | | |
| 8. Cassette/CD/ VHS/VCD/DVD/ player | | |
| 9. Stove for cooking (gas or electric only) | | |
| 10. Refrigerator/freezer | | |
| 11. Fishing boat and boat engine | | |
| 12. Plough | | |
| 13. Shotgun/rifle | | |
| 17. Furniture | | |
| 18. Shallow tube-well | | |
| 19. Solar panel | | |
| 20. Deep tube-well | | |
| 21. Others | | |

2. Has anyone in your household taken out a loan in the past 12 months? Yes/No

| Name | Month when loan was taken | Source | Amount (Taka) | Use of loan | Loan status |
|------|---------------------------|--------|---------------|-------------|-------------|
| 1. | | | | | |
| 2. | | | | | |
| 3. | | | | | |
| 4. | | | | | |
| 5. | | | | | |

3. Other household information

| | |
|--|--|
| Type of roof materials used in the house | |
| Materials of the wall of the house | |
| Type of sanitation | |
| Does the household have any tube-wells | |
| If not, where do you collect drinking water | |
| How far do you need to travel to collect water | |

Part 2

A. Direct Mangrove Income (income from unprocessed products)

1. What are the quantities and values of raw-material mangrove products that the members of your household collected for both their own use and sale during the last “gon” (over **the past 15 days**)?

| 1. Forest product | 2. Collect ed by whom? ¹⁾ | 3. Quant ity collec ted ⁽⁵⁺⁶⁾ | 4. Unit | 5. Own use (incl. gifts) | 6. Sold (incl. barter) | 7. Price per unit | 8. Gross value (3*7) | 9. Costs (total) | 11. Net income (8-9) |
|-------------------------|--|---|------------|--------------------------------------|-------------------------------------|----------------------------|-------------------------------|------------------------|-------------------------------|
| | | | | | | | | | |
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B. Mangrove-Derived Income (income from processed mangrove products)

1. What are the quantities and values of processed mangrove products that the members of your household produced during **the past 2 months**?

| 1. Processe d (final) products | 2. Quanti ty produc ed ⁽⁴⁺⁵⁾ | 3. Unit | 4. Own use (incl. gifts) | 5. Sold (incl. barter) | 6. Price per unit | 7. Gross value ^(2*6) | 8. Cost of inputs & hired labour | 9. Trans- port/ marke- ting costs | 11. Net incom e ^(7-8- 9) |
|---|---|------------|--------------------------------------|---------------------------------|----------------------------|--|---|--|---|
| | | | | | | | | | |
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C. Shrimp Aquaculture

1. How much fish did you catch exclusively from the shrimp aquaculture during the last gon/over the past 15 days?

| 1. Type of fish (list local names)* | 2. Area | 3. Own er-ship | 4. Total catch (kg) (5+6) | 5. Own use (incl. gifts) | 6. Sold (incl. barter) | 7. Price per kg | 8. Gross value (4*7) | 9. Costs | 10. Net income (8-9) |
|---|------------|----------------------|------------------------------------|--------------------------------------|---------------------------------|-----------------------|-------------------------------|-------------|-------------------------------|
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
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D. Homestead Pond Fish Culture

1. How much fish did your household catch from homestead ponds (other than shrimp) in the past 2 months?

| 1. Type of fish (list local names)* | 2. Owner ship | 3. Total catch (kg) (4+5) | 4. Own use (incl. gifts) | 5. Sold (incl. barter) | 6. Price per kg | 7. Gross value (3*6) | 8. Costs | 9. Net income (7-8) |
|--|---------------------|------------------------------------|-----------------------------------|---------------------------------|-----------------------|-------------------------------|-------------|------------------------------|
| | | | | | | | | |
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E. Non-Mangrove Environmental Income – Not found in the study area

F. Wage Income

1. Has any member of the household had paid work over **the past two months**?

| 1. Household member | 2. Type of work | 3. Days worked in past month | 4. Daily wage rate | 5. Total wage income (3*4) |
|------------------------|--------------------|------------------------------------|--------------------------|-------------------------------------|
| | | | | |
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G. Income from Own Business (not mangrove/forest or agriculture)

| Are you involved in any type of business? If so, what were the gross income and costs related to that business over the past 2 months? | Business 1 | Business 2 | Business 3 |
|--|------------|------------|------------|
| 1. What is your type of business? | | | |
| 2. Gross income (sales) | | | |
| Costs | | | |
| 3. Purchased inputs | | | |
| 4. Own non-labour inputs (equivalent market value) | | | |
| 5. Hired labour | | | |
| 6. Transport and marketing costs | | | |
| 7. Capital costs (repairs, maintenance, etc.) | | | |
| 8. Other costs | | | |
| 9. Net income (2 – (items 3-8)) | | | |

H. Income from Agriculture – Crops

1. What are the quantities and values of crops that the household has harvested during **the past 2 months?**

| 1. Crops | 2. Total production (3+4) unit | 3. Own use (incl. gifts) | 4. Sold (incl. barter) | 5. Price per unit | 6. Total value (2*5) | 7. Total input costs | 8. Net income (6-7) |
|----------|--------------------------------|--------------------------|------------------------|-------------------|----------------------|----------------------|---------------------|
| | | | | | | | |
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I. Income from Livestock

1. What is the number of ADULT animals your household has now (at the end of four months)?

| 1. Livestock | 2. End number (now) | 3. Price per adult animal | 4. Total end value (2*3) |
|--------------------|---------------------|---------------------------|--------------------------|
| 1. Cows | | | |
| 2. Buffalos | | | |
| 3. Goats | | | |
| 4. Ducks | | | |
| 5. Chicken | | | |
| 6. Other; specify: | | | |

2. What was the net income from animals and animal products and services that you have produced during **the past 2 months?**

| 1. Product/service | 2. Product on (3+4) unit | 3. Own use (incl. gifts) | 4. Sold (incl. barter) | 5. Price per unit | 6. Total value (2*5) | 7. Total input costs | 8. Net income (6-7) |
|-----------------------------------|--------------------------|--------------------------|------------------------|-------------------|----------------------|----------------------|---------------------|
| 1. Meat of cattle/ buffalo/ goats | | | | | | | |
| 2. Meat from chicken/duck | | | | | | | |
| 3. Milk | | | | | | | |
| 4. Eggs | | | | | | | |
| 5. Sale income | | | | | | | |
| a. Cattle/buffalos | | | | | | | |
| b. Goat/sheep/pig | | | | | | | |
| c. Chicken/ducks/ pigeon | | | | | | | |

J. Other Income Sources

1. Please list any other income that the household has received during **the past 2 months**.

| 1. Type of income | 2. Total amount received in past 2 months |
|--|--|
| 1. Remittances | |
| 2. Support from government, NGO or similar | |
| 3. Gifts/support from friends and relatives | |
| 4. Pension | |
| 5. Payment for renting out land (if in kind, state the equivalent in cash) | |
| 9. Other, specify: | |

Part 3

A. Household Membership in Local Institutions

| Affiliation type (Yes/No) | Adult men | Adult women |
|--|-----------|-------------|
| a. Affiliation with political party | | |
| b. Membership in Union council | | |
| c. Membership in the committees of school/college/madrasha/market/mosque | | |
| d. Member of Grameen Bank | | |
| e. Membership of club | | |
| f. Membership of NGOs | | |
| g. Participation in community festival | | |
| h. VGD/RMP/ old age pension membership | | |
| i. Other associations (rickshaw driver, labourer, etc.) | | |
| j. Member of different government organisation | | |
| k. Others; specify: | | |

Appendix B: Calculation of Gini Co-efficient and Poverty

Part A: Calculation of Gini coefficient by covariance formula (Bellu and Liberati, 2006)

This geometrical interpretation based to directly express the Gini Index in terms of the covariance between income levels and the cumulative distribution of income. In particular:

[4]

$$G = \text{Cov}(y, F(y)) \frac{2}{\bar{y}}$$

where Cov is the covariance between income levels y and the cumulative distribution of the same income $F(y)$ and \bar{y} is average income.

Table 1 reports a numerical example to calculate the Gini Index according to the covariance formula [4], included in the text. In this case, the steps are reduced. Step 1 is the same as before: just sort the income distribution by income level. Step 2 asks us to calculate the cumulative distribution function $F(y)$. Step 3 asks us to calculate the two essential parameters to apply the covariance formula: the covariance between income levels and the cumulative distribution function (whose value is 400 in the example); and the mean income level, which is 3,000 income units.

Table 1: A numerical example to calculate the Gini Index with the covariance formula

| STEP 1 | | STEP 2 | STEP 3 | | STEP 4 |
|------------|-------------------------------|--------------------------------|---------------------------------------|---------------------------------|-------------------------------------|
| Individual | A-typical Income distribution | Cumulative Income Distrobution | Calculate the covariance Cov (y,F(y)) | Calculate the mean income level | Calculate Gini by using formula (4) |
| 1 | 1,000 | 0.2 | | | |
| 2 | 2,000 | 0.4 | | | |
| 3 | 3,000 | 0.6 | | | |
| 4 | 4,000 | 0.8 | | | |
| 5 | 5,000 | 1.0 | 400 | 3,000 | 0.267 |

By applying formula [4] in the text, a value of the Gini Index equal to **0.267** can be obtained.

Part B: Calculation of Poverty (BBS, 2011a):

Poverty Lines and Poverty Measures (CBN)

Before describing the methodology for updating poverty lines for HIES 2010, it seems logical to describe the official methodology for setting up the poverty lines for HIES 2005. Poverty lines were estimated using the cost of basic needs (CBN) method, whereby any household with per capita expenditure below a given poverty line is considered as poor. With the CBN method, poverty lines represent the level of per capita expenditure at which the members of a household can be expected to meet their basic needs (comprised of food and non-food consumption). The method followed for estimating the 2005 regional CBN poverty lines and the price indices are described below:

Estimating the Base Year 2005 (CBN) Poverty Lines

Three steps were followed for estimating what it costs a household to meet its basic needs in the base year 2005. First, the cost of a fixed food bundle was estimated. The bundle consists of eleven items; rice, wheat, pulses, milk, oil, meat, fish, potato, other vegetables, sugar and fruits, as recommended by Ravallion and Sen (1996). It provides minimal nutritional requirements corresponding to 2,122 kcal per day per persons – the same threshold used to identify the absolute poor with the direct caloric intake method. The price for each item in the bundle was estimated as the mean of unit values (price per unit) of the item reported by a reference group of households, calculated separately for each of the 16 geographic areas or strata. The food poverty line was computed by multiplying the prices with the quantities in the food bundle. The second step entailed computing two non-food allowances for non-food consumption. The first was obtained by taking the median amount spent for non-food items by a group of households whose per capita total expenditure is close to the food poverty line, which is called the “lower non-food allowance”. The second was obtained by taking the median amount spent for non-food items by group of household whose per capita food expenditure is close to the food poverty line, which is called the “upper non-food allowance”. The third step consisted simply of adding to the food poverty lines the lower and upper non-food allowances to yield the total lower and upper poverty lines for each of the 16 geographical areas (see tableA1).

Updating Poverty Lines for Changes in Cost-of-Living

Price indices for updating the 2005 CBN food poverty lines to 2010 prices were derived by the food price information available in the HIES data sets. The HIES data provides price information of food items that account for more than 60 percent of total household

expenditure. A food price index was computed using the price and budget share of each food item from HIES surveys. The food poverty line of 2005 was first updated with this survey based food price index. The nonfood poverty line was re-estimated using CBN method to account for the changes in nonfood - food ratios. The household survey based food price indices were derived in four steps. First, expenditures on various items in both HIES 2005 and 2010 were divided into 13 groups. These groups were chosen so as to retain as much desegregations as possible (to minimize heterogeneity within categories) as well as to be comparable across the two survey years. Second, unit values (by dividing expenditures by quantity) of the most commonly consumed item within each of the expenditure groups were calculated for each household. For each group, the median of the unit values within each geographic region was calculated. Using the price of the most commonly consumed item within each group and medians (which are more robust to outliers as compared to means) for the summary region-specific unit values helped minimize the problem that the calculated unit values are affected significantly by quality issues. Third, average budget share of the 13 main expenditure groups were calculated for each survey year. Finally, region-specific tornqvist price indices were calculated using budget shares of the expenditure groups along with median prices of the selected items.

Table 2: Poverty lines of HIES-2010 (BBS, 2011a:185)

| Stratum | Division | zf | znfl | znu | zl | zu |
|---------|---------------------|------|------|-----|-------------|-------------|
| 1 | Barisal Rural | 982 | 302 | 503 | 1284 | 1485 |
| 2 | Barisal Urban | 1100 | 320 | 863 | 1419 | 1963 |
| 3 | Chittagong Rural | 1023 | 381 | 664 | 1404 | 1687 |
| 4 | Chittagong Urban | 1064 | 432 | 762 | 1495 | 1825 |
| 5 | Chittagong SMA | 1047 | 432 | 829 | 1479 | 1876 |
| 6 | Dhaka Rural | 958 | 318 | 538 | 1276 | 1497 |
| 7 | Dhaka Urban | 1018 | 296 | 775 | 1314 | 1793 |
| 8 | Dhaka SMA | 1089 | 316 | 948 | 1406 | 2038 |
| 9 | Khulna Rural | 884 | 308 | 551 | 1192 | 1435 |
| 10 | Khulna Urban | 932 | 330 | 748 | 1262 | 1680 |
| 11 | Khulna SMA | 970 | 397 | 669 | 1348 | 1639 |
| 12 | Rajshahi Rural | 957 | 278 | 529 | 1236 | 1487 |
| 13 | Rajshahi Urban | 987 | 325 | 598 | 1312 | 1585 |
| 14 | Rajshahi SMA | 931 | 292 | 625 | 1223 | 1556 |
| 15 | Sylhet Rural | 953 | 287 | 358 | 1240 | 1311 |
| 16 | Sylhet Urban | 992 | 294 | 566 | 1286 | 1558 |

Note: **zf = Food poverty line; znfl = Lower non-food allowance, znu = Upper non-food allowance; zl = Lower poverty line, zu = Upper poverty line**

Appendix C: Household Survey in Cyclone-Affected Koyra Sub-District

Part A: Household Composition

1. Information about Respondent

| | |
|-----------------------------|--|
| Name of respondent | |
| Relation to household head | |
| Village | |
| Sex of the respondent | |
| Age (yrs) | |
| Education | |
| Number of household members | |

2. Household Information

| | |
|--|--|
| Primary occupation of household head | |
| Amount of agricultural land | |
| Amount of homestead land | |
| Yearly income of the household before Cyclone Aila | |
| Roof materials used in the house | |
| Materials of the wall of the house | |

Part B

1. Please provide the following cyclone-related information

| | |
|---|--|
| How did you get the information that Cyclone Aila was approaching? | |
| Where did you take shelter when Cyclone Aila hit in the area? | |
| Distance of the cyclone shelter from your home | |
| What was the reason for not going to the cyclone shelter? | |
| Did you need to relocate your home due to the cyclone? Yes/no If yes, where did you take shelter? And for how long? | |

2. Please provide information about loss and damage of assets due to Cyclone Aila

| Type of asset | Amount of loss/damage | Value in Taka |
|-----------------------------|-----------------------|---------------|
| Agriculture ¹ | | |
| Livestock | | |
| Shrimps | | |
| House | | |
| Fish from other aquaculture | | |
| Fishing equipments | | |
| Boats | | |
| Clothes | | |
| Medical cost | | |
| Business loss ² | | |
| Other (specify) | | |

1 = Agriculture means crops, vegetables, agroforestry products

2 = Business loss means net income loss due to loss of working days.

Part C

1. Please provide information about the “coping strategies” that your household undertook over the last five months

| Coping Strategy | Item received | Quantity | Value (in Taka) |
|---------------------------------------|---------------|----------|-----------------|
| Assistance from the government | | | |
| GR | | | |
| VGF | | | |
| Home grant | | | |
| Food/cash for work | | | |
| Assistance from NGOs (specify) | | | |
| Loans | | | |
| From relatives | | | |
| From moneylenders | | | |
| From government banks | | | |
| From NGOs | | | |
| Donations from relatives/friends | | | |
| Sale of assets | | | |
| Sell/mortgage agriculture land | | | |
| Sell/mortgage jewellery | | | |
| Sell/mortgage livestock | | | |
| Fishing in waterlogged areas | | | |
| Migrated to outside the village | | | |

2. Please provide information about household income from regular occupations/sources over the last five months

| Income Source | Income (in Taka) |
|--------------------------------|------------------|
| Sundarbans mangrove resource | |
| Fisheries other than mangroves | |
| Agriculture/Livestock | |
| Day labour | |
| Service | |
| Trade and Business | |
| Others | |

Appendix D: List of Key Informant Interviews and Focus Group discussions

Part A: Sundarbans Mangrove Resource Management

Table 1: Information on key informant interviewees carried out in Mongla Sub-District during field data collection (September 2009 to August 2010)

| Code for KII | Abbreviation of code | Place and date of KII |
|---------------------|---|--|
| ExP1 | Ex-pirate 1 | Joymony Market 12/03/2012 |
| ExP2 | Ex-pirate 2 | Joymony Market 12/03/2012 |
| DFOWD | Divisional Forest Officer Khulna | Sundarbans West Division Office, Khulna 10/08/2010 |
| ACFCR | Assistant Conservator of Forest, Chandpai Range | Chandpai Range Office, 15/10/2009; 17/08/2010 |
| GTCU | Golpata trader and moneylender | Joymony Market, 03/03/2010 |
| FWT | Fuelwood trader cum moneylender | Baiddomari Market 27/02/2010 |
| NGOM | Co-coordinator, IPAC, Mongla Sub-District | NGO office, located at Baiddomari Market, 14/10/2009; 17/08/2010 |
| WWV | Widow of crocodile victim | Joymony Katakhali Village; 10/03/2010 |
| OCM | Officer-in-charge, Mongla Police Station | Sub-District Police Station, Mongla; 18/08/2010 |
| UNOM | Sub-District CEO | Upazila Complex, Mongla 08/10/2009; 18/08/2010 |

Table 2: Information on focus group discussions carried out in Mongla Sub-District during field data collection (September 2009 to August 2010)

| Code for FGD | Abbreviation of code | Place and date of FGD |
|---------------------|--|------------------------------------|
| SSFC | Shrimp fry collectors from the Sundarbans | Joymony Ghol Village; 18/03/2010 |
| SCC | Crab collectors from the Sundarbans | South Bashtola Village; 21/10/2009 |
| SFWC | Fuelwood collectors from the Sundarbans | Baiddomari Village; 21/10/2009 |
| SFiC | Fishermen of the Sundarbans | Joymony Market; 21/10/2009 |
| SFRC | Female resource collectors of the Sundarbans | Joymony Ghol Village; 19/03/2010 |
| CSFO | Forest Department officials working in Chandpai Station Office, Mongla | Station Office, Mongla; 16/10/2009 |

Checklists for Semi-Structured Interviews/Focus Group Discussions

Forest Resource Base:

Do you think mangrove resources are more important than other resources that are available to you? And why is that so?

What are the main mangrove products for the livelihood of the people in the village and what are the main reasons for collections in the village?

How has availability of the mangrove resources changed over the past 5 years?

If the availability of the most important products has declined, what are the reasons?

Have you noticed any changes to mangrove resources of the Sundarbans?

What factors do you think has contributed to those changes? Whom do you think responsible?

Are those factors internal or external to the Forest Department?

Are those factors internal or external to the local resource collectors/users?

What do you think should be done about it?

Key Trends Associated with Resource Collection in the Sundarbans:

Are there any particular seasons in which resource collections are difficult? Are there any barriers that prevent you from collecting resources from the Sundarbans? What are the risks in resource collections and uses: a) identify the risks involved in mangrove resources collections and uses; b) how do you negotiate with those risks?

Do you get any help from Forest Department in relation to managing these risks?

How are resources being extracted from the Sundarbans? What are the processes? Who are the key actors to manage permission, to get credit, equipment? How much money do different actors earn?

Do the villagers require any permission to harvest the mangrove resources? Does the user have to pay for the permission? If 'yes': who issues this permit? Briefly tell me about steps for resource collections from the Sundarbans.

Which species are normally harvested? Which resources are prohibited for harvesting?

Do the harvesters comply with these regulations? If so, how are these enforced? What could be the reasons for not complying?

Do collectors know about the ban on collections? Do FD officials monitor resource extractions? Is there any conflict between resource collectors and FD officials while collecting banned resources? How could resource collectors manage FD officials and

other law enforcement agencies??

What is the level of compliance with management measures in place on mangrove species at the collectors' level? How effective were the forest criminal cases against violators for illegal logging and fry collections?

Do you think those regulations are sufficient? What should be done for improvement?

Present Management, Policy and Legislation:

What are the government policies in place in relation to the management of the Sundarbans mangrove resources? Who is responsible for enforcing these management prescriptions?

How would you comment on the management of the Sundarbans mangrove forest, which is legally under the Forest Department's tenure?

In what ways do you think the Forest Department helps the resource collectors? Have there been any projects to increase the benefits (in terms of income) that the rural people get from their mangrove resources?

What opportunities are out there, arranged by the Forest Department, for the resource collectors in terms of promoting livelihood support or assisting the sustainable collections of mangrove resources? For wildlife victims?

Do you think the management measures are effective? Can you list the strengths of the present management?

If no, then what are the main weaknesses of the present management system? What measures should be taken against these weaknesses? And how?

What are the things you think should be done and by whom?

What recommendations can you make that would improve your livelihoods and also protect the Sundarbans resources?

Part B: Shrimp Farming, Management and Related Issues

Table 3: Information on key informant interviews (KII) carried out in Mongla Sub-District during field data collection (September 2009 to August 2010)

| Code for KII | Abbreviation of code | Place and date of KII |
|---------------------|---|--|
| SFOM | Senior Fisheries Officer, Mongla | Upazila Office Complex, Mongla, 12/10/2009; 18/08/2010 |
| LSF | Large shrimp farm owner, Sundarbans Union | South Bashtola Village, 13/10/2009; 11/06/2010 |
| UAOM | Upazila Agriculture Officer, Mongla | Upazila Office Complex, Mongla, 18/08/2010 |
| ULOM | Upazila Livestock Officer, Mongla | Upazila Complex, Mongla, 18/10/2009 |
| ADFO | Assistant Director, Divisional Fisheries Office, Khulna | Divisional Fisheries Office, Khuln10/08/2010 |
| MBKB | Manager, Bangladesh Agriculture Bank, Mongla Branch | Mongla Headquarters, 17/08/2010 |
| OCM | Officer-in-charge, Mongla Police Station | Police Station, Mongla; 18/08/2010 |
| UNOM | Upazila CEO, Mongla | Upazila Complex, Mongla, 8/10/2009; 18/08/2010 |
| NGOM | NGO, IPAC, Local Coordinator | IPAC Office, Baiddomari Market, 14/12/2009; 17/08/2010 |
| CCU | Chairman, Chila Union Council | Union Council Office, Baiddomari 13/10/2009 |
| CSU | Chairman, Sundarban Union Council | Union Council Office, 13/10/2009 |

Table 4: Information on focus group discussions carried out in Mongla Sub-District during field data collection (September 2009 to August 2010)

| Code for FGD | Abbreviation of code | Place and date of FGD |
|---------------------|--|---|
| CHCT | 1 temporary shrimp depot owner, 2 shrimp farm caretakers and 3 shrimp farm labourers | Burburia Village, Sundarbans Union 22/10/2009 |
| SNSFSU | Small shrimp farm owner and non-shrimp farmer (2 small shrimp farmers and 2 non-shrimp farmers each from South Bashtola and Burburia Villages) | South Bashtola Village, Sundarbans Union 22/10/2009 |
| SNSFCU | Small shrimp farm owner and non-shrimp farmer (2 small shrimp farmers and 2 non-shrimp farmers each from South Bashtola and Burburia Villages) | Joymony Market Chila Union 22/10/2009 |

Checklists for Semi-Structured Interviews/Focus Group Discussions

Livelihoods Perspectives:

In what ways do you think shrimp aquaculture is contributing to the livelihoods of the rural people? Do you think it has done much?

Why do/don't you make the choice to carry out a shrimp aquaculture/ shrimp enterprise as a livelihood option?

What is your perception about the opportunities and potential provided by shrimp aquaculture? Who benefits most? Who loses the most? Why?

Has shrimp aquaculture changed employment opportunities? Whose former activities were displaced, and by how much, to leave space and resources for the shrimp farming?

Social, Economic and Environmental Impacts:

What impacts and problems do you specifically encounter in the area of shrimp aquaculture? Pls. list positive and negative impacts of shrimp aquaculture.

Were there any conflicts since shrimp farms were developed? For example, within the community, between shrimp farmers and rice farmers, between shrimp farm owners and non-shrimp farmers, between large and small shrimp farm owners?

What institutions and policies (governmental and non-governmental) are required to induce the industry to become socially and environmentally sustainable?

Government Policies and Institutional Role:

What are the objectives/management plans of the Department of Fisheries for shrimp aquaculture management?

Could you please take me through some specific policies initiated for the shrimp sector in the last decade which have had significant impact on shrimp aquaculture expansion?

What are the specific rules and regulations for addressing social, economical, environmental and institutional aspects of shrimp aquaculture?

What are the incentives/facilities that government provides to shrimp industry? What are the impacts of those incentives in the study area?

What monitoring mechanisms have been put in place to monitor shrimp aquaculture activities? Pls. list the problems/conflicts/impacts of shrimp aquaculture that have been resolved in the past year? Clarify what role your organisation is playing in helping to solve problems/conflicts?

Regarding the current constraints to shrimp farming policies – What is the role you expect of governments? Suggestions on policy aspects?

Part C: Cyclone Aila and Disaster Management

Table 5: Information on key informant interviews carried out in Koyra Sub-District during field data collection (September 2009 to August 2010)

| Code for KII | Brief Description of Code | Place and Date |
|-----------------|--|--|
| UNOK | CEO of Sub-District and chairman of UzDMC, Koyra | Upazila complex, Koyra, 30/10/2009; 01/04/2010 |
| VCUPK | Vice chairman, Koyra Sub-District Council | Upazila complex, Koyra, 01/04/2010 |
| CBU | Chairman, South Bedkashi Union | Jorshing Village, 25/10/2009; 26/03/2010 |
| M5BU | Member, Ward 5, South Bedkashi Union Council | Jorshing Village, 25/10/2009; 26/03/2010 |
| M6BU | Member, Ward 6, South Bedkashi Union Council | Jorshing Village, 25/10/2009; 26/03/2010 |
| M3KU | Member, Ward 3, Koyra Union Council | Koyra No. 3 Village, 28/10/2009; 30/03/2010 |
| NGOK | NGO official working in Rupantor | Upazila complex, 02/04/2010 |
| SOWDB | Station Officer, Water Development Board | Jorshing Village 27/03/2010 |
| PST | Local primary school teacher | Koyra No. 3 Village, 28/10/2009 |

Table 6: Information on focus group discussions carried out in Koyra Sub-District during field data collection (September 2009 to August 2010)

| Code for FGD | Abbreviation of code | Date and place of FGD |
|-----------------|---|--|
| CVB | Cyclone victims of severely affected areas (8 participants from Jorshing Village) | Near Steamer Ghat, Jorshing Embankment on 26/10/2009; in a household near the mosque of Jorshing Village on 27/03/2010; South Bedkashi Union |
| CVK | Cyclone victims of highly affected areas (8 male participants from Koyra No. 3 Village) | Jhalmolia Market, Koyra No. 3 Village, Koyra Union, 29/10/2009; 31/03/2010 |
| FCVK | Female cyclone victims of highly affected areas | House of the village doctor, Koyra No. 3 Village, Koyra Union; 31/03/2010 |

Checklists for Semi-Structured Interviews/Focus Group Discussions

Preparedness and Emergency (during cyclone):

What early warning systems are in place? What organisation is responsible for disaster warnings? What are your existing evacuation infrastructures? How about the cyclone shelter?

How are the warnings transmitted to officials and to the population? What are the means of preparation?

When did you begin to make preparations for taking shelter? When the cyclone was in force, where did you take shelter? What barriers limit the responses to these needs, under what circumstances, and with what effects? Were special efforts made to assist socially vulnerable groups?

How adequate was the preparedness? Was the community consulted about cyclone preparedness? Was local government well prepared? Was the community well informed? How effectively were local government's rescue efforts and evacuation performed?

Extent of Damage and Coping:

What were the assets heavily damaged by Cyclone Aila? What were the impacts of the cyclone at the community level such as on education, health and sanitation? How many households were displaced? Where did they relocate to and take shelter?

How have people coped with such change(s) in the past at the community? Were such traditional coping mechanisms visible in the present context?

List 5 practices which contribute to increasing the vulnerability to cyclone. Detail the effect of each practice. What can be done to increase public awareness of the negative effects of such practices?

What are the traditional preparedness and coping mechanisms against disaster risks that already exist in the locality? What are the challenges for those traditional preparedness and coping mechanisms at the community level?

What is the need to overcome those challenges? Could you share some insights and recommendations on how to improve coping with cyclones?

Relief and Rehabilitation:

How were decisions made in relief and rehabilitation? Who was in charge?

How were specific policies on emergency operation implemented?

Was the relief sufficient? How was the quality?

What were the sources of funding for emergency response and relief programs?

What role do community, local government and NGOs play?

What are the gaps in capacities at this stage?

Were resources mobilised adequately? Did the groups who most needed public assistance get it? Was the compensation process equitable and transparent?

In terms of rehabilitation, what are the completed and ongoing livelihood restoration projects undertaken by government and NGOs in the aftermath of Cyclone Aila? How was rehabilitation integrated into community development?

What are the gaps in capacities at this stage?

Policy and Process:

What policies were in place to reduce risks? Are there national disaster management plans and procedures? How were decisions made? Were measures undertaken as per provision of the guidelines?

What is the structure for disaster management at the sub-district level? What are the strengths and the challenges at the sub-district level?

What are seen as the gaps, outstanding needs and requirements for incorporating effective disaster management into local government working plans?

What coordination mechanisms exist at national and sub-district levels? What is the nature of liaison between government disaster management entities with NGOs? What relationships exist now? What factors shaped the existing relationships? Are the NGOs well-equipped and properly resourced for the role? What can be done to improve the coordination at the sub-district level?

List the major adaptive practices/responses which can contribute to increasing the robustness and resilience of the community against cyclone? What should national government/ local government/union council/NGOs do?

Are there any disaster awareness programs being undertaken at the sub-district/community level? What is the disaster management training for government officials/community/NGO workers? Is there training at the community level?

What kind of initiatives would you suggest on policy and legislation in the aftermath of Cyclone Aila at the community and sub-district level in particular? What are the major bottlenecks when taking up adaptation options to mitigate the impact of cyclones?

Appendix E: Policy, Act, Rules and Ministry Orders

Forest Related Act, Rules and Ministry Order:

The Forest Act 1927

Section 3: Power to reserve forest

The Government may constitute any forest-land or waste-land ¹[or any land suitable for afforestation] which is the property of Government, or over which the Government has proprietary rights, or to the whole or any part of the forest-produce of which the Government is entitled, a reserved forest in the manner hereinafter provided.

Section 5: Bar of accrual of forest rights

After the issue of a notification under section 4, no right shall be acquired in or over the land comprised in such notification, except by succession or under a grant or contract in writing made or entered into by or on behalf of the Government or some person in whom such right was vested when the notification was issued; and no fresh clearings for cultivation or for any other purpose shall be made in such land except in accordance with such rules as may be made by the Government in this behalf.

Section 23: No right acquired over reserved forest, except as here provided

23. No right of any description shall be acquired in or over a reserved forest except by succession or under a grant or contract in writing made by or on behalf of the Government or some person in whom such right was vested when the notification under section 20 was issued.

Section 26: Acts prohibited in such forests

26. ¹[(1) Any person who, in a reserved forest-

(a) kindles, keeps or carries any fire except at such seasons as the Forest-Officer may notify in this behalf.

(b) trespasses or pastures cattle, or permits cattle to trespass;
(c) causes any damage by negligence in felling any tree or cutting or dragging any timber;

(d) quarries stone, burns lime or charcoal, or collects, subjects to any manufacturing process, or removes, any forest produce other than timber;

or who enters a reserved forest with fire arms without prior permission from the Divisional Forest Officer concerned, shall be punishable with imprisonment for a term which may extend to six months and shall also be liable to fine which may extend to two thousand Taka, in addition to such compensation for damage done to the forest as the convicting Court may direct to be paid.

(1A) Any person who—

(a) makes any fresh clearing prohibited by section 5; or

(b) removes any timber from a reserved forest; or
(c) sets fire to a reserved forest, or, in contravention of any rules made by the Government in this behalf, kindles any fire, or leaves any fire burning, in such manner as to endanger such a forest; or who, in a reserved forest
(d) fells, girdles, lops, taps or burns any tree or strips off the bark or leaves from or otherwise damages, the same;
(e) clears or breaks up any land for cultivation or any other purpose ²[or cultivates or attempts to cultivate any land in any other manner];
(f) in contravention of any rules made in this behalf by the Government, hunts, shoots, fishes, poisons water or sets traps or snares; or
(g) establishes saw-pits or saw-benches or converts trees into timber without lawful authority,
shall be punishable with imprisonment for a term which may extend to five years and shall not be less than six months, and shall also be liable to fine which may extend to fifty thousand Taka and shall not be less than five thousand Taka, in addition to such compensation for damage done to the forest as the convicting Court may direct to be paid.]

(2) Nothing in this section shall be deemed to prohibit—

(a) any act done by permission in writing of the Forest-officer, or under any rule made by the Government; or
(b) the exercise of any right continued under clause (c) of sub-section (2) of section 15, or created by grant or contract in writing made by or on behalf of the Government under section 23.

(3) Whenever fire is caused wilfully or by gross negligence in a reserved forest, the Government may (notwithstanding that any penalty has been inflicted under this section) direct that in such forest or any portion thereof the exercise of all rights of pasture or to forest-produce shall be suspended for such period as it thinks fit.

Section 55: Forest produce, tools, etc when liable to confiscation

55. (1) All timber or forest-produce which is not the property of Government and in respect of which a forest-offence has been committed, and all tools, boats, vehicles and used in committing any forest-offence, shall be liable to confiscation

(2) Such confiscation may be in addition to any other punishment prescribed for such offence.

Section 69A: Prosecution of forest-offences

69A. notwithstanding anything contained in any other law for the time being in force, the Government may empower any Forest-officer not inferior to that of a Deputy Ranger to appear, plead and conduct the prosecution on behalf of the Government before any Court in any case where a forest-offence is under trial.

The Bangladesh Wildlife (Preservation) (Amendment) Act, 1974

The Government of Bangladesh issued the Bangladesh Wildlife (Preservations) Order, 1973 as Presidential Order No.23 on 27 March 1973, which was amended, elaborated and re-enacted as Bangladesh Wildlife (Preservation) (Amendment) Act, 1974. Three wildlife sanctuaries, covering an area of 32,386 ha, were established in 1977 under the Bangladesh Wildlife (Preservation) (Amendment) Act 1974. These are known as, Sundarbans West (9,069 ha), Sundarbans South (17,878) and Sundarbans East (5439 ha) and were established through Gazette Notification No 1/For-92/77/1122 dated 7 October, 1977 primarily for wildlife conservation. Total area of wildlife sanctuaries was increased in 1996 (Notification No. MOEF (sec-3)/7/96/147 Dated April 06, 1996). Now the Sundarbans East Wildlife Sanctuary is comprised of 31227 ha of area which is 36970 ha and 71502 ha for the Sundarbans South and Sundarbans West Wildlife Sanctuary.

Article 2 (p): A ‘wildlife sanctuary’ means an area closed to hunting, shooting or trapping of wild animals and declared as such under Article 23 by the government as undisturbed breeding ground primarily for the protection of wildlife inclusive of all natural resources, such as vegetation, soil and water.”

Article 23 (1) The Government may, by notification in the officials Gazette, declare any area to be wild life sanctuary.

(2) No person shall-

Enter or reside in any wild life sanctuary; or

Cultivating any land in any wild life sanctuary; or

Damage or destroy any vegetation in any wild life sanctuary or within one mile from the boundaries of a wildlife sanctuary; or

Hunt, kill or capture any wild animal in any wildlife sanctuary or within one mile from the boundaries of a wildlife sanctuary; or

Introduce any exotic species of animal into a wildlife sanctuary; or

Introduce any domestic animal or allow any domestic animal to stray into a wildlife sanctuary; or

Cause any fire in wild life sanctuary; or

Pollute water flowing in or through a wild life sanctuary

The Sundarbans Forest Transit Rule 1959

The current forest transit rule was promulgated on December 26, 1959. This designated as the Sundarbans forest transit rule which contains 15 rules, of which 7 relates to permit procedures, 2 relates to boat measurements and 6 relates to other details of working in the Sundarbans.

- Revenue is collected in the Sundarbans through a system of issuing Boat Loading Certificates (BLC) per boat, royalty per resource, entry permits and other fees, fines.
- Boats used in the harvesting or transportation of produce must have a valid BLC. Officially no new BLCs are given unless permission has been provided from the CCF. Only old certificates are renewed each year. There are 22000 BLCs for resource extraction in the Sundarbans.
- After renewal by the DFO the owner must bring his boat to be registered at definite forest station. All boats entering the Sundarbans must pass through one of 16 revenue stations located on the SRF boundary at all important portals of entry. On return, all resource extractors must exit via the same forest station where they entered the Sundarbans.
- Collection of any forest produce has to be authorized through a FD permit. Permits issued for any harvesting will contain specific details on kind of produce, where it applies and for how long. The permit also specifies the coup office or revenue station to where the produce must be checked. For resource extraction, the amount of people allowed entry and the duration of the permit are determined according to the capacity of the boat as per BLC. Larger boats are allowed to stay longer in the SRF as they require more time to be filled.
- For harvesting products such as goran and golpata, the total permitted extraction, based on the BLC is set in advance. The revenue for extracting the set amount of produce is paid before the actual collection. The boat is then checked again upon return for possible over extraction. For the products golpata and goran, each boat is allocated a coupe or working area inside the SRF by the forest station office at which it registers. The resource harvesters then have to go to the allocated area where the coupe officer will show them which part they can harvest.
- For fish, shrimp, crab or honey and beeswax the permit applies to the number of weeks the resource extractors intend to stay in the forest and the payment for produce extracted is paid on return to the station.
- The collections are to be examined, verified and the permit is to be surrendered in lieu of the surrender certificate at a forest station.
- **Extraction limit:** Until 1972, there were no limits set on the capacity of boats. In 1972, the maximum capacity was set to 500 mounds, then later to 300 mounds in order to make harvesting of products more accessible to a

larger number of people. In 1986 the level was again set to 500 mounds except for Dubla winter fishery where there is no limits (Govt. order no.- XII/For-13-38/85/40, dated 15-1- 86).

- Prohibition of cutting or converting timber without a pass
- Prohibition of transit of forest produces without a valid transit document.

Khal Closure Regulation 1989 (SDFO, 1989)

Some endangered fish species are going towards extinction. To save them, these canals are declared closed for fish breading areas. All should note that in this breading area, no fish catching is allowed. If it occurs, punishment will be taken against the fishermen, officer and staff may be who neglect the rule of fish here.

| Name of the Range | Name of the Canals | No of Compartment where the canal is located |
|-------------------|-----------------------|--|
| Khulna Range | Bhadra Khal | 32 |
| | Sarbatkhali Khal | 32 |
| | Morabhadra Khal | 33 |
| | Haddura Khal | 33 |
| Sarankhola | Alibandar Khal | 1 |
| | Chandeswar Khal | 15 |
| | Dasherbharni Khal | 24 |
| | Katka Khal | 4 |
| | Kochikhali Khal | 6 |
| Chandpai | Koronjal Khal | 31 |
| | Jongra Khal | 31 |
| | Morapassur Khal | 30 |
| | Jhapsi Khal | 29, 30 |
| Sathkhira Khal | Nandabala Khal | 26 |
| | Choto keya khali Khal | 46 |
| | Boro Keyakhali Khal | 46 |
| | Khalishabunia Khal | 46 |
| | Shaplakhali Khal | 46 |

The Compensation Policy for Causalities Caused by Wildlife, 2010 (MOEF, 2010)

5. A person would be entitled to such compensation if he or she is exposed to attacks by tiger, elephant and crocodiles.
6. Only those with legal passage to enter into the forest including government staff can apply for the compensation.

Those who have been attacked outside the forest area or in the permissive areas can apply for compensation

Those who have been entered illegally i.e. without legal permission should not get any compensation

7. The policy has provisions to pay Tk. 100,000 to the dependents of anyone killed in such attacks. Besides, Tk. 50,000 will be paid to a person crippled in similar attacks, and Tk. 25,000 to one who incurred loss of property or crops caused by wildlife.

8. Compensation claims will have to be made along with medical certificates after filing a general diary to the nearest forest range office in the prescribed form within 30 days of the incident. No delayed application would be accepted.

9. The evaluation report drawn up by the investigation team, led by the related forest conservator, and endorsed by the respective forest officer will be sent to the chief forest conservator within 10 days for starting the sanctions. The divisional forest officer will hand over the compensation to the affected claimants.

Shrimp Related Act, Rules and Ministry Order:

The Embankment and Drainage Act, 1952:

Section 19: Construction of temporary dam, road-way or water courses

19. (1) Whenever any person desires that a temporary road-way should be made over, or that temporary water course should be made through, any public embankment, or that a temporary dam should be constructed in any embanked river or public water course, he shall apply to the Engineer or to any person appointed in that behalf by the Engineers.

2) Such Engineer or person shall communicate the application with his opinion to the Project Director of the Authority of the area concerned and shall await the Project Director of the Authority order in respect thereof, unless he thinks that there is special reason for the immediate execution of the work, in which case he may execute the same or cause it to be executed without waiting for the orders of the Project Director of the Authority.

3) The proposed work shall be executed by an officer of the Government or the Authority on the applicant's depositing the amount estimated by the Engineer to be necessary to defray the expenses of, and incidental to, making and removing such road way, or of, and incidental to, making, closing or removing such water course or dam. If the amount deposited is found afterwards to exceed the amount required, such excess shall be returned to the said applicant.

The Protection and Conservation of Fish Rules 1985:

New sub-rule 8(1A) has been incorporated into the Protection and Conservation of Fish Rules, 1895 (S.R.O 289/Law by Ministry of Fisheries and Livestock, Dated 21 September, 2000).

Section 8(1A) “no person shall catch or cause to be caught fry or post larvae of fish shrimp and prawns of any kind, in any form and in any way in the estuary and coastal waters of Bangladesh.”

The Shrimp Mohal (Estate) Management Policy of 1992 (MOL, 1992):

The first and formal policy on shrimp management is the **Shrimp Mohal (Estate) Management**

Policy of 1992 issued by the Ministry of Land, dated 30 March, 1992.

These Shrimp culture regulation appear to be as follows:

The Shrimp Mohal Management Policy emphasizes the need for an appropriate and just land management policy for shrimp culture. It aims not only at production increase but also at the alleviation of the socio-economic conditions of the people. It envisages that land suitable for shrimp cultivation will be declared as Shrimp Mohal, no distinction has been made between government (*khas*) and private lands. The policy highlights following issues:

1. There will be national committee headed by the land minister. There will be three members of parliament nominated by the government, two shrimp farmers, secretaries of fisheries and livestock, forest and environment, land, water resources and agriculture, Joint secretary of Land, divisional commissioners of Chittagong and Khulna.
2. There is a district level committee to identify land use and control mechanism for shrimp culture. Deputy Commissioner is the chairman of the committee. Other members include two shrimp farmers nominated by the government and four government officials at the district level. The tasks of this committee include identification of suitable land for shrimp culture, declaration of “Shrimp Mohal” assessment and management of the lease etc. And forwarding lease recommendations to the ministry of land through the divisional commissioners. The committee also discusses technicalities of shrimp culture and tries to solve all other problems arising out in the process.

Development and Management of Shrimp Resource Committees, 1998

Before 1998:

The Shrimp Cultivation Regulation Committees set up in 1986 at division, district and upazila levels in the Khulna region, which functioned till 1 January 1998.

From 1998:

The Committees on Development and Management of Shrimp Resource at divisional, district and upazila levels were set up as per Cabinet Division Notification dated 1 January 1998, following a decision of an inter-ministerial meeting held in October 1997 to reassess and reorganize various committees on shrimp farming, marketing and export, formed by various ministries/divisions. The following paragraphs elaborate the composition and functions of the Development and Management of Shrimp Resource Committees.

The Divisional Shrimp Resource Development and Management Committee is headed by the Divisional Commissioner and consists of 13 members.¹³ Since September 1998, the minister in charge of the district concerned and one Member of Parliament from the concerned district have been included in the committee as advisers.

The District Shrimp Resource Development and Management Committee, headed by the Deputy Commissioner, also consists of 13 members.¹⁴ Since September 1998 the minister in charge of the district concerned and two members of parliament from the concerned district, have been included in the committee as advisers.

The Sub-district Shrimp Resource Development and Management Committee, headed by the Upazila Nirbahi Officer (UNO), consists of 11 members including Member of Parliament from the concerned sub-district shall be in the committee as adviser.

The scope of work of this committee:

- Cooperate in identifying, appraising and recommending areas that are fit for shrimp cultivation and put forward to the district committee
- Give permission for the erection of gates or for closing or cutting of any essential part of dams subject to approval from Bangladesh Water Development Board.
- protect the interests of small farmers and owners of lands adjacent to shrimp ghers
- prevent coastal erosion; ensure adequate water supply and drainage in shrimp areas
- receiving, examining and forwarding applications for lease of *khas* lands
- carrying out on-the-spot inspections in areas that are fit for shrimp cultivation
- Ensure implementation of the Shrimp Cultivation Tax Act, 1992.

- Registration and preparing updated lists of shrimp farms.

Bangladesh Bank. ACSPD Circular No.2 and 3, dated 2 June, 2009.

- Postponement of Recovery of Agri-loan for Cyclone "Aila" Affected Areas for one year
- Rescheduling of Shrimp Loans for Cyclone "Aila" Affected Areas

Disaster Related Act, Rules and Ministry Order:

Standing Order on Disaster, 2008 (GOB, 2008b):

2.2.8: Co-ordination Committee of NGOs relating to Disaster Management

2.2.8.3 Responsibilities

2.2.8.3.1 Ensure the co-ordination of Disaster Management and Relief work between Governmental and Non-Governmental agencies.

2.2.8.3.2 To ensure the transmission and preservation of disaster related information.

2.2.8.3.3 Identify the co-ordination problems relating to Disaster Management Activities and make recommendations in this respect.

2.2.8.3.4 Carry out related task as advised by NDMC and IMDMCC.

The Upazila Disaster Management Committee (UzDMC)

3.3.5.2. Emergency Response

3.3.5.2.1. Warning Period

3.3.5.2.1.1. Disseminate warning and security messages, evacuate the vulnerable people as per evacuation plan, cast an eye on the last moment check of rescue team and its preparation and take effective measure to minimize gap as a high priority.

3.3.5.2.1.2. Engage trained institutions, volunteers and people in field for effective and rapid dissemination of early warning messages to the vulnerable community and monitor the whole security and warning message dissemination activities.

3.3.5.2.1.3. Visit the pre-determined emergency shelter center and be sure that for essential services and security different organizations and volunteers are alert and ready to provide services.

3.3.5.2.1.4. Review the practicality of water supply sources nearby the shelter center and if necessary, fill the gaps that people can get safe water supply during disaster from these water sources.

3.3.5.2.1.5. Conduct a mock or drill to be ensured that the trained students, youths, with club members and volunteers can prepare water-purification technology at their locality and can supply the victims during emergencies and to monitor that adequate materials are ready to prepare such water-purification technology.

3.3.5.2.1.6. Review the stock of life saving medicines at union level and evaluate its adequacy to supply victims during disaster.

3.3.5.2.1.7. Prepare a checklist of emergency works to-do during disaster and be sure that appropriate materials and people are available for use.

3.3.5.2.2. During Hazard Onset

- 3.3.5.2.2.1. Operate “Emergency Operation Centre (EOC)” at Upazila level to coordinate evacuation, rescue and relief activities.
- 3.3.5.2.2.2. Organize emergency rescue work by using locally available facilities in times of need and if directed assist others in rescue works.
- 3.3.5.2.2.3. Coordinate all relief activities (GO-NGO) in the Upazila in a manner that social justice (on the basis of who needs, what is needed and how much is needed) is ensured in relief distribution;
- 3.3.5.2.2.4. Protect people from upset creating rumor during hazard period by providing them correct and timely information.
- 3.3.5.2.2.5. During hazard ensure security of the local and outside relief workers.
- 3.3.5.2.2.6. Ensure the security of women, children and person with disability during hazard.
- 3.3.5.2.2.7. Take necessary actions to protect environmental degradation by quick funeral of corpses and burying the animal dead bodies.
- 3.3.5.2.2.8. Help people to transfer their essential resources (livestock, poultry, essential food, kerosene, candle, matches, fuel, radio, etc.) to safe places.
- 3.3.5.2.2.9. Enforce Union and Pourashava Disaster Management Committees to prepare water purification technology (tablet) at local level with the help of trained students, youths, clubs and volunteers; and distribute those products at emergency among the people at risk before being caught by diarrhea or other water borne diseases.

3.3.5.2.3. Post-Hazard Period

- 3.3.5.2.3.1. Collect statistics of loss incurred in disaster in the light of guidelines of Disaster Management Bureau and District Disaster Management Committee and send the same to District Disaster Management Committee.
- 3.3.5.2.3.2. Provide data and statement to the District Disaster Management Committee regarding damage, need, received resources and priority for relief and rehabilitation works.
- 3.3.5.2.3.3. Plan the rehabilitation work in a way that essential measures for future risk reduction is well considered.
- 3.3.5.2.3.4. Take steps for distribution of articles for rehabilitation received locally or from Relief and Rehabilitation Directorate and from any other source following the guidelines from Disaster Management Bureau and Upazila Disaster Management Committee.
- 3.3.5.2.3.5. Supervise and keep accounts of the relief and rehabilitation materials distributed and send it to District Disaster Management Committee and donor agency (if the donor provided relief fund).
- 3.3.5.2.3.6. Ensure that due to hazard the people who were displaced can come back to their previous places; in this case, dispute (if there is any) regarding the land of the displaced people should not be an obstacle to come back to the peace after disaster.
- 3.3.5.2.3.7. Counsel the psycho-traumatize people due to hazard with the support of the community and experts.

3.3.5.2.3.8. Ensure that the injured people are getting fair and just treatment from health service providers, if necessary; committee can recommend for Upazila and District level assistance.

3.3.5.2.3.9. Arrange a lesson learning session with the participation of concern institutions and individuals on learning from during hazard and after hazard. Coordinate the disaster relevant activities of different departments at Upazila level.

3.3.5.2.3.10. In addition to the above follow Standing Orders on disaster management related issues and instant orders of appropriate authority.

3.5.4. Responsibilities of Union Disaster Management Committee (UDMC):

3.5.4.1. Risk Reduction

3.5.4.1.1. Ensure that local people are kept informed and capable of taking practical measures for the reduction of risk at household and community level and also disseminate the success stories of reducing disaster risks at household and community level widely among the local people.

3.5.4.1.2. Arrange training and workshops on regular basis on disaster issues and keep the Upazila Disaster Management Committee informed.

3.5.4.1.3. Hold a hazard, vulnerability and risk analysis at Union level.

3.5.4.1.4. Identify the most vulnerable or people at high risk by sex, age, physical ability, social status, occupation and economic status.

3.5.4.1.5. Prepare a short, medium and long term vulnerability reduction and capacity building action plan for the identified high-risk people with active participation of the people at risk.

3.5.4.1.6. Facilitate coordination among the development agencies and service providers through quarterly coordination meeting and take decision about implementation of the action plan for risk reduction as well as review the progress of the risk reduction action plan.

3.5.4.1.7. Raise fund at local level to implement the risk reduction action plan.

3.5.4.1.8. Update the progress of implementation of action plan and other activities and report to the Upazila Disaster Management Committee

3.5.4.1.9. Prepare a Comprehensive Disaster Management Action Plan with a view to enabling local people, Union authority and local organizations to increase the capacity of poor and vulnerable people to enhance their income and other assets for risk reduction and also to take up security arrangement in the perspective of imminent danger related warnings or occurrence of disaster including the issues already mentioned under this paragraph.

3.5.4.1.10. Take steps for capacity building of relevant persons and institutions, union authority, volunteers and people in a way that they can forecast and publicize warnings relating to hazards (cyclones, storms, floods, droughts, tidal surge, tsunami, over-rainfall under-rainfall, water logging, high tide, cold wave etc.) in the quickest possible manner and also inform people about their responsibilities of saving their lives and properties from disaster.

3.5.4.1.11. Build the capacity of local institutions, volunteers and people in a way that they can help and motivate people to adopt disaster (cyclone/ tidal surge/

Tsunami/ Earthquake/ Tornado/ Flood/ Water Logging/ Salinity/ High Tide/ Cold Wave) resistant housing features.

3.5.4.1.12. Build the capacity of local institutions, volunteers and people in a way that they can help and motivate people to adapt with disaster resistant agriculture and other livelihood options.

3.5.4.1.13. Determine specific safe centre/shelter where the population of certain areas will go at the time of need and assign responsibilities to different persons for various services and securities at the shelter/centre.

3.5.4.1.14. Ensure supply of safe water and if necessary other services from specific points near the shelter/centre with the help of Upazila authority.

3.5.4.1.15. Train the students, youths, local club members and volunteers on community based water purification technology. So that during disaster, they can supply water-purifying technology during emergencies in their community until external support reaches the high-risk people.

3.5.4.1.16. Plan for preparing some community Based High land, which can be used as play ground in normal time and can be used as shelter place during disaster period and where livestock, poultry, emergency food, kerosene, lamp, candle, matches, fuel wood, radio and other important resources could be shifted along with the people.

3.5.4.1.17. Stock emergency life-saving medicines at union level (Union Health and Family Welfare Center) for use during disaster.

3.5.4.1.18. Prepare relevant plans for rescue, primary relief operation, and restoration of communication with Upazila Headquarters and local arrangement for rehabilitation of severely affected families.

3.5.4.1.19. Arrange for rehearsals or drills on the dissemination of warning signals/forecasts, evacuation, rescue and primary relief operations (if necessary committee can seek assistance from Upazila Authority).

3.5.4.2. Emergency Response

3.5.4.2.1. Warning Period

3.5.4.2.1.1. Disseminate warning and security messages, evacuate the vulnerable people as per evacuation plan, cast an eye on the last moment check of rescue team and its preparation and take effective measure to minimize gap as a high priority.

3.5.4.2.1.2. Engage trained institutions, volunteers and people in field for effective and rapid dissemination of early warning messages to the vulnerable community and monitor the whole security and warning message dissemination activities.

3.5.4.2.1.3. Visit the pre-determined emergency shelter center and be sure that for essential services and security different organizations and volunteers are alert and ready to provide services.

3.5.4.2.1.4. Review the practicality of water supply sources nearby the shelter/center and if necessary, fill the gaps that people can get safe water supply during disaster from these water sources.

3.5.4.2.1.5. On a minimum scale, conduct a mock or drill to ensure that the trained students, youths, clubs and volunteers can prepare water-purification technology at their locality and can supply to the victims during emergencies and to monitor that adequate materials are ready to prepare such water-purification technology.

3.5.4.2.1.6. Review the stock of life saving medicines at union level and evaluate its adequacy for supply among the victims during disaster.

3.5.4.2.1.7. To prepare a checklist of emergency works to-do during disaster and be sure that appropriate materials and people are available for use.

3.5.4.2.2. During Hazard Onset

3.5.4.2.2.1. Organize emergency rescue work by using locally available facilities in times of need and if directed assist others in rescue work.

3.5.4.2.2.2. Prepare water purification technology (tablet) at local level with the help of trained students, youths, clubs and volunteers; and distribute those products at emergency among the people at risk before being caught by diarrhea or other water borne diseases.

3.5.4.2.2.3. Coordinate all relief activities (GO-NGO) in the union in a manner that social justice (on the basis of who needs, what is needed and how much is needed) is ensured in relief distribution;

3.5.4.2.2.4. Protect people from upset creating rumor during hazard period by providing them correct and timely information.

3.5.4.2.2.5. During hazard ensure security of the local and outside relief workers.

3.5.4.2.2.6. Ensure the security of women, children and person with disability during hazard.

3.5.4.2.2.7. Take necessary actions to protect environmental degradation by quick funeral of corpses and burying the animal dead bodies.

3.5.4.2.2.8. Help people to transfer their essential resources (livestock, poultry, essential food, kerosene, candle, matches, fuel, radio, etc.) to safe places.

3.5.4.2.3. Post-Hazard Period

3.5.4.2.3.1. Collect statistics of loss incurred in disaster in the light of guidelines of Disaster Management Bureau and Upazila Disaster Management Committee and send the same to Upazila Disaster Management Committee.

3.5.4.2.3.2. Take steps for distribution of articles for rehabilitation received locally or from Relief and Rehabilitation Directorate and from any other source following the guidelines from Disaster Management Bureau and Upazila Disaster Management Committee.

3.5.4.2.3.3. Send accounts of materials received to Upazila Disaster Management Committee and donor agency (if the donor provided relief fund).

3.5.4.2.3.4. Ensure that due to hazard the people who were displaced can come back to their previous place; in this case, dispute (if any) regarding the land of the displaced people should not be an obstacle to come back to the place after disaster.

3.5.4.2.3.5. Counsel the psycho traumatic people due to hazard with the support of community and experts.

3.5.4.2.3.6. Ensure that the injured people are getting fair and just treatment from health service providers, if necessary; committee can recommend for Upazila and District level assistance.

3.5.4.2.3.7. Arrange a lesson learning session with the participation of concern institutions and individuals on learning from during hazard and after hazard.

3.5.4.2.3.8. In addition to the above follow Standing Orders on disaster management related issues and instant orders of appropriate authority

4.2.1.7. NGO Affairs Bureau

Disaster Stage

- (a) Direct all NGOs to extend cooperation and help to the Commissioner, Deputy Commissioner, Upazila Nirbahi Officer and Union Parishad Chairman as required.
- (b) Instruct NGOs to assist local administration by the provision of:
 - Evacuation of the affected people to safer places
 - Damages and needs assessments
 - Medical services
 - Transport and distribution of relief stores
 - Communications
 - Holding of instalment payment

Rehabilitation Stage

- (a) Develop and establish a guideline for streamlining the early recovery and rehabilitation activities of the government, international, national and local NGOs and other actors
- (b) Coordinate the early recovery and rehabilitation activities of NGOs
- (c) Maintain a database on the overall contribution of different actors by geographical areas

4.2.2. Ministry of Food and Disaster Management

The Ministry of Food and Disaster Management (MoFDM) is the focal point of the Government for disaster related issues. The Disaster Management Bureau (DMB) will assist the Ministry with all necessary information during normal time, alert and warning stage, disaster stage and post-disaster recovery stage. The Ministry will supply information to National Disaster Management Council and Inter-Ministerial Disaster Coordination Committee and assist them in taking decisions. The Secretary of the Ministry will control the activities of all officials engaged either directly or indirectly for emergency relief work.

Risk Reduction

- (a) Designate a senior staff as the focal point of the Ministry.
- (b) Create and establish national policy, planning and legislative frameworks for comprehensive disaster management in Bangladesh with the following strategic goals:
 - a. Professionalising the disaster management system
 - b. Mainstreaming risk reduction
 - c. Strengthening institutional mechanisms
 - d. Empowering at risk communities
 - e. Expanding risk reduction programming across hazards, risks and sectors
 - f. Strengthening emergency response systems
 - g. Developing and strengthening networks

- (c) Prepare and periodically review and update the National Plan for Disaster Management
- (d) Develop specific guidelines and templates facilitating mainstreaming disaster management principles and practices across hazards, sectors and within national development planning processes at all levels.
- (e) Conduct national, district, upazila and union level hazard, risk and vulnerability assessments and mapping to identify the disaster prone Upazilas and special disaster prone areas under such Upazila and the population likely to be affected by the disaster.
- (f) Coordinate inter-sectoral risk reduction efforts of the government

Emergency Response

Subject to the approval of the Minister, the Secretary will take decisions on the following matters

- (a) Relax any Standing Regulation (Standing Order) on relief distribution in the public interest.

Normal Times

- (a) Review the own Action Plan of the Ministry on disaster management every 3 (three) months.
- (b) Identify the disaster prone Upazilas and special disaster prone areas under such Upazila and the population likely to be affected by the disaster.
- (c) Update the list of foreign and private agencies willing to participate in the disaster preparedness, emergency response and rehabilitation programmes.
- (d) Preserve information regarding food, relief materials and transports usable at all levels during disaster.
- (e) Direct all concerned for ensuring availability of Standing Orders at village, Union, Upazila and District levels.
- (f) Arrange meetings of the National Disaster Management Council and Inter-Ministerial Disaster Management Coordination Committee to assess the disaster preparedness of different Ministries, agencies, departments, local governments, autonomous bodies, CPP, Red Crescent, NGOs, etc.
- (g) Ensure non-stop telecom link of the Ministry with District and Upazila Headquarters.
- (h) Issue necessary orders for proper coordination of steps relating to disaster and response.

Alert and Warning Stage

- (a) Issue orders, for dispatch of relief materials to required places and to keep the transports ready.
- (b) To select a Focal Point in the Ministry and to inform all concerned about his designation and telephone number.
- (c) To direct the Disaster Management Bureau to open Emergency Operation Centre (EOC) of its own, open Control Room at all levels related to disaster activities and also to reactivate the EOC located at MoFDM
- (d) Ensure direct communication with Meteorological Department and issue orders for collection of inputs (warning message and signal) from the department.

- (e) Ensure publicity of warning signals through Radio, Television, Telegram, Fax, teleprinter etc and also inform Ministries, agencies, departments, CPP, BDRCS, NGOs, Deputy Commissioners and other concerned agencies and officials.
- (f) Keep the EOC open day and night.
- (g) Call a meeting of the CPP Implementation Board and inform the decisions to all concerned.
- (h) Inform the Chairman of the National Disaster Management Council, the Prime Minister and the Chairman of the Inter-Ministerial Disaster Management Coordination Committee about the disaster situations and the steps taken to meet them.
- (i) Ensure convening of meetings of the concerned District, Upazila and Union Disaster Management Committees (DMCs).
- (j) Request the Armed Forces Division to keep a helicopter and transport plane ready for reconnaissance of loss and damages and for relief operations.
- (k) Request the Armed Forces Division and the Inland Water Transport Corporation to keep water vessels ready for rescue and relief operations.
- (l) Issue directives to evacuate to safer places for saving life and property.
- (m) Request the Army through Armed Forces Division to be on readiness for speedy mobilisation to the affected areas.
- (n) Inform all concerned, specially the Divisional Commissioners, Deputy Commissioners, Upazila Nirbahi Officers, Union Parishad Chairmen and other concerned agencies about great danger signals and the arrangement to be made in this respect.
- (o) Instruct district and Upazila authorities to requisition required transports for rescue and relief work.
- (p) Arrange for convening of the meetings of the National Disaster Management Council and the Interministerial Disaster Management Coordination Committee.
- (q) In consultation with the Meteorological Department, issue instructions to local administration for evaluation of the people likely to be affected to safer places.
- (r) Ensure issuance of Warning Signals repeatedly through the Bangladesh Betar (Radio) and the Bangladesh Television.
- (s) Ensure non-stop communication with district Control Room, CPP and Meteorological Department.
- (t) Arrange in advance necessary relief materials for the disaster prone areas.
- (u) Designate one Liaison Officer to the Prime Minister's 'co-ordination cell' at the Prime Ministers office.

Disaster Stage

- (a) Request the Bangladesh Navy and Bangladesh Air Force to keep vessels and air planes ready for assessment of loss and damage and rescue operations as soon as weather becomes favourable.
- (b) Request the Civil authorities to assist the Armed Forces Division in respect of relief and rescue operations on the basis of need.
- (c) Coordinate rescue and relief work with NGOs.

- (d) Arrange meetings of the National Disaster Management Council and the Inter-ministerial Disaster Management Coordination Committee.
- (e) Collect information of loss and damage.
- (f) Fix additional requirement of funds and materials for relief and rehabilitation work.
- (g) Collect quickly funds and relief materials for gratuitous relief.

Rehabilitation Stage

- (a) Arrange for housing building grant, test relief and Food for Works programmes.
- (b) Continue emergency rehabilitation work in affected areas until return of normalcy.
- (c) Coordinate rehabilitation programmes.

4.2.5.2 Field Offices of Chief Engineer/Superintending Engineer/Executive Engineer/ Assistant Engineer (Cyclone related) of the Bangladesh Water Development Board.

The officials and staff of Bangladesh Water Development Board shall perform the following duties in their respective areas.

Risk Reduction

- (a) Conduct local level assessment and prepare the local level risk reduction plan in the water sector
- (b) Construct the embankments as per the design approved by the Water Development Board suitable to the local context
- (c) Conduct the situation analysis and maintain a database on the existing infrastructure such as embankments, polders and sluice gates. Carry out regular maintenance work to strengthen the system
- (d) Construct protecting embankments in time and maintaining satisfactory standard after receiving approval of the authority.

Emergency Response

Normal Times

- (a) The Chief Engineer or Superintending Engineer will identify the Disaster Focal Points in their respective offices and inform the Flood Forecasting and Warning Centre (FFWC).
- (b) Arrange to collect special weather bulletins/news and inform all concerned at field level and direct for security steps in embankments and other installations.
- (c) Attend the meeting of the local Disaster Management Committee.
- (d) The Chief Engineer at field level will appoint Liaison Officer for communicating with the local Disaster Management Committee.
- (e) Coordinate and cooperate with civil administration for rescue, evacuation and relief operations and make available implements, materials, transports and technical assistance to them.
- (f) Repair leakage, breaches, holes, weak points in the embankment in their own area and also repair the broken sluice gates. Also keep ready the materials at suitable place for repair purpose.

- (g) Appoint guards for protecting the polders against entry of saline water during tidal bore whipped up by cyclonic storm and also to protect damage to sluice gates.
- (h) Submit reports at regular intervals to higher authority stating the condition of sluice gate, embankment and other works and progress of repair and reconstruction.

Alert and Warning Stage

- (a) Take precautionary steps for protection of the lives of the employees of Water Development Board and secure Board assets, machinery, transports etc.
- (b) Maintain link with the local Disaster Management Committee and coordinate activities with other agencies.
- (c) Give priority to emergency construction of physical infrastructure and repair and maintenance.

Disaster Stage

- (a) Ensure non-stop operation of information centre day and night (24 hrs.) and send liaison officer to the local Disaster Management Committee.
- (b) Inform the information centre of Bangladesh Water Development Board and Control Room of the local administration about any disaster.
- (c) Assist and support the local administration for rescue, evacuation and relief activities.
- (d) Repair any damage, unserviceable installations and supply source by organising technical persons and materials.
- (e) Assess damage/loss and initiate action plan for repair, reconstruction and reinstallation as soon as possible after the recession of water in accordance with the short term and perspective plan of the government.
- (f) Take preventive action on emergency basis through tours in the affected area.
- (g) Request the local civil administration or Disaster Management Committee in case of any difficulty or any exceptional circumstances, the solution of which is beyond the control of own office.
- (h) On exigencies, take any suitable action for the protection of lives and property and evacuation in coordination with the civil administration and Disaster Management Committee.

Rehabilitation Stage

- (a) After assessing the loss/damage, prepare plan and designs, as quickly possible for repair, reinstallation and reconstruction of physical infrastructure, embankments, sluice gates at required places.
- (b) Assist and cooperate with the civil administration in relief activities as far as possible.
- (c) Identify places for the construction of embankments as protective measure against future disasters like tidal bore or floods, prepare plans and request for approval and sanction of funds from the concerned authorities.

