



**STUDIES ON THE SOCIO-ECONOMIC STATUS OF  
THE DIFFERENT STAKEHOLDERS INVOLVED  
MARKETING CHANNEL OF MARINE FISHES IN  
COX'S BAZAR REGION**

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Session: 2020-2021

A thesis submitted in the partial fulfillments of the requirements for the degree of  
Master of Science in Fishing and Post-Harvest Technology

**Department of Fishing and Post-Harvest Technology**

**Faculty of Fisheries**

**Chattogram Veterinary and Animal Sciences University Chattogram-4225,  
Bangladesh**

**December 2022**

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**This is to certify that we have examined the above Master's thesis and have found that is complete and satisfactory in all respects, and that all revisions required by the thesis examination committee have been made**

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## ACKNOWLEDGEMENT

First and foremost, thanks to ALLAH S.W.T. for His mercy and guidance for giving the strength to complete this thesis. Even faced with some difficulties in completing this research work, I still managed to complete it.

I would like to express my sincere gratitude to my research supervisor Dr. Md. Faisal, Associate Professor, Department of Fishing and Post-Harvest Technology, CVASU, Chattogram, for the continuous support of my M.S. study and research. For his patience, motivation, enthusiasm and immense knowledge, I feel proud to do a research work under his constructive, useful and effective supervision.

I would like to express my hearty appreciation and immense indebtedness to my co-supervisor, Dr. Mohammed Nurul Absar Khan, Professor, Department of Fishing and Post-Harvest Technology, CVASU, who given best help with his valuable suggestion, enthusiastic review and fruitful comments in the correction of the manuscript.

It is also a great pleasure for me to express my cordial gratitude to our honorable and respected Vice-chancellor, Professor Dr. A.S.M Lutful Ahasan and Professor Dr. Mohammed Nurul Absar Khan, Dean, Faculty of Fisheries. CVASU for given me golden opportunity to work and study in this institution.

I humbly thankful to Prof. Dr. Zonaed Siddiki, Co-ordinator, Advanced Studies and Research (CASR), CVASU, for funding to complete my research work.

Last but not the least; my father Md. Faridur Rahman who keeps blessing from heaven and my mother Jahanana Begum. I am forever indebted to my beloved parents and all family members for their blessing, tremendous sacrifice when it was most required and endless support with the strongest inspiration. I am also thankful to all of my friends, junior and well-wishers for their continuous encouragement to achieve golden success.

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## **ABSTRACT**

The fishermen community is an integral part of the coastal areas of Bangladesh which is mostly dominated by small-scale or artisanal fishermen. This study was conducted in three landing places of Cox's Bazar, Ukhiya and Teknaf with the objectives of identifying the challenges faced by the small-scale fishermen involved in the artisanal fishery and identifying the marketing channel of marine fishes. Several survey methods were adopted including the distribution of questionnaires to the fisherman; interviews with coastal inhabitants, use of PRA, RRA tools and direct field visits. The survey results indicated that there are different environmental and socio-economic factors such as lack of employment opportunities, health facility, and conflicts among stakeholders influencing the livelihood significantly. Middle aged people of 30 to 45 years old were mostly involved in artisanal fishing and most of them were illiterate ranging from 30% to 82% in various study point. Most of the families were medium type and having daily income less than 250 TK. Teknaf shows highest number of poor stakeholders. Major fishing activities are beach seine, set bag net, trammel net, bottom gillnets (doba jal), long lining and gill netting. July to August was the peak season in those areas for fishing. In this situation, different ecological as well as socio-economic challenges make the fishers more vulnerable in their livelihoods.

Key words: Livelihood, Artisanal, Socio-economic, Marketing channel

## CHAPTER ONE INTRODUCTION

Millions of people's livelihoods and work depend heavily on fish, Bangladesh's second-most valuable agricultural crop. Fish culture and consumption so have significant effects on the economy and availability of food. "Mache Bhate Bangali" or "Fish and Rice Makes a Bengali" is a common nickname for Bangladeshis (Ghose, B., 2014).

Bangladesh's marine fishing industry greatly supports the country's economy and food and nutrient security. With a total production of 46.21 lakh MT in FY 2020-21, Bangladesh, one of the world's top fish producing nations, is lucky to have potential water resources. Marine fisheries account for 14.74 percent of the total fish production. Through direct revenue, employment, and foreign exchange, after achieving independence in 1971, Bangladesh made great strides in the fisheries industry. With a total production of 4.621 million MT in the fiscal year 2020–21, Bangladesh is one of the top fish-producing nations in the world. These fishing-related industries sustain at least 3.57% of the nation's GDP and provide more than one-fourth, or 26.50%, of the GDP from agriculture. In Bangladesh's socioeconomic and rural economies, the fishing sector is remarkably important. More than 11% of Bangladesh's overall population depends on the fishing industry for a living. With a per capita consumption of 62.58 g/day compared to a target of 60 g/day, Bangladesh is now a self-sufficient fish-producing nation, supplementing almost 60% of the total animal protein consumed daily by her population. Fish, shrimp, and other fisheries goods, which make up 1.39% of all exports from Bangladesh, are a significant source of foreign currency gains. The nation will earn BDT 398515.00 lakh in 2019-20 through the export of around 70.95 thousand MT of fish and fisheries products (DoF 2021, 2020).

Bangladesh's fishing industry faces both opportunities and difficulties. Since a few decades ago, the economy has been more and more dependent on the fishing industry, one of the most productive and dynamic sectors. More than 12% of the almost 170 million people, including women, depend on various full- and part-time activities in the fishing industry for their living. Bangladesh produced enough fish to meet its own needs, with per capita consumption exceeding the goal of 60 grams per day to reach 62.58 grams (BBS, 2016)

The fisheries industry in Bangladesh can be broadly divided into three sub-sectors: a) inland open water bodies (for capture fisheries); b) inland closed water bodies (for aquaculture); and c) marine waters (for offshore and coastal small-scale fisheries) (Alam & Thomson, 2001). Together, these three subsectors support the nation's fish output. Only 28.16 percent of the total fish produced is produced by inland capture fisheries, while 57.1% is produced by inland culture fisheries. Despite the availability of marine waters, the marine industry barely contributes 14.74% of the nation's total fish production (DoF, 2020-21). Fisheries resources are abundant and plentiful in Bangladesh. The country's vast and diverse fisheries resources can be roughly classified into two categories: inland fisheries and marine fisheries. The two sub-groups of inland fisheries are again designated as inland capture and inland culture. Rivers and estuaries, beels, floodplains, the Sundarbans, and Kaptai Lake are included in the inland capture fisheries, whereas ponds, seasonal cultured water bodies, baors, shrimp/prawn farms, crab, pen cultures, and cage cultures are included in the inland culture fisheries. Once more, industrial (trawl) and artisanal fishing are included in marine fisheries. With sovereignty over almost 118,813 sq km of the Bay of Bengal, Bangladesh has access to immense maritime water resources teeming with biodiversity. The marine fishing

industry, which employs more than 220 industrial trawlers and more than 67,000 artisanal vessels, contributes only around 14.90% of the nation's 6.71 lakh MT of fisheries production in 2019–20. Of the entire marine production, artisanal small-scale fishing accounts for 82.86%, or 5.56 lakh MT, and large industrial fishing for 17.14%, or 1.15 lakh MT. Since 1983–1984, when the total marine capture was 1.65 lakh MT, it has grown to 6.71 lakh MT in FY 2019–20 (DoF 2020, 2019).

More than half of the fish caught in inland and marine waters worldwide comes from small-scale fisheries (FAO 2010). About 25–27 million people are employed full- and part-time as small-scale fishers in the developing countries, while an additional 60–70 million people are involved in post-harvest activities (BNP 2009). Since small-scale fisheries are key sources of food for the human population and play a considerable, if little quantified, role in reducing global poverty, they are a crucial lever for achieving the Millennium Development Goals (Jentoft et al. 2011; Pomeroy & Andrew 2011; Heck et al. 2007). Small-scale fisheries are therefore too significant and vital to be ignored (Chuenpagdee 2011; Jentoft et al. 2011). However, small-scale fisheries are vulnerable to habitat degradation, overfishing, overcapacity, conflicts over resources and sites, climate change and variability, as well as globalization, to name a few, regardless of the geographic settings (Jentoft & Eide. 2011; FAO 2010; Pomeroy 2012). Small-scale fishers typically struggle with living and working in dangerous areas, having their rights and representation in policy arenas inadequately defined, and constantly fighting for survival in circumstances that are out of their control (Jentoft et al. 2011; Pomeroy & Andrew 2011; FAO 2010).

With 475 marine species, Bangladesh has a vast diversity of fisheries (Billah et al. 2018). As a result, the nation is now among those that produce enough fish on its own. In Bangladesh, where artisanal fishing accounts for more than 90% of marine harvesting, marine fisheries account for about 15% of the country's overall fish production (Billah et al. 2018). Fish and fishing resources are essential for boosting socioeconomic conditions by ensuring food security, reducing poverty, fostering decent employment, and generating foreign exchange (Billah et al. 2018). Climate change, habitat loss, and other anthropogenic impacts have a significant impact on this significant sector (Jackson et al., 2001; Diaz & Rosenberg 2008, Halpern et al. 2008). Bangladesh's circumstance is more depressing due to a lack of policy execution and law enforcement (Billah et al. 2018). Two outcomes of the policy intervention are the creation of relevant policies and the application of current policies (Andrew et al. 2007, Pomeroy & Andrew 2011). A comprehensive institutional and regulatory framework as well as efficient marine governance are lacking in Bangladesh (Akhtar et al. 2017). However, due to marketing challenges, natural disasters, and increased engagement of commercial fishers, the number of artisanal fishermen is declining alarmingly fast (Rahman 2017). Because of this, they are losing income while also having to spend a large portion of it on clothing and food. They are facing enormous challenges during fishing time (Akhtar et al. 2017).

According to FAO 2007, A person's abilities, resources (cultural and psychosocial), and requirements for a source of support determine their lifestyle. Fishermen's communities defend their way of life from adjacent water bodies by capturing fish, trading fish, drying fish, protecting aquatic life, and weaving nets. They are among the most vulnerable and marginalized communities in Bangladesh as a result of their low income. The lowest of the poor are sometimes denied access

to many basic requirements and are considered to be fishermen who risk their lives by going out in adverse weather to capture fish to meet the demand for animal protein. Most of them experience food insecurity. They are always battling for their life. Fishing communities continue to dominate in coastal areas, particularly in emerging nations. Fishing communities continue to make up the majority of the poor in coastal locations, particularly in emerging nations. Living conditions for fishermen are by no means ideal; they are unable to catch fish all year round due to limited access to the water body. Livelihood is made up of the capacities, resources, activities, and access to those things that collectively define the standard of life attained by each household. Natural, physical, human, financial, and social capital are some of these resources. A livelihood is sustainable if it can withstand stresses and shocks, recover from them, and maintain or increase its capacities and resources in the present and the future without depleting the base of available natural resources (Chambers and Conway, 1992). The sustainable livelihood approach has slowly grown to incorporate its own core values and guiding principles for development initiatives that prioritize eradicating poverty (DFID, 1998). There are numerous strategies to alleviate poverty in rural regions. The framework for sustainable lifestyles includes five key categories of capital: social, natural, financial, physical, and human capital (Scoones, 1998). The core of the approach is a study of capital assets employing fundamental concepts in the context of the environment. It is appropriate to decide on the goals, scope, and importance of improvement in order to enhance the quality of life for future generations, improvements in fighting poverty (Scoones, 1998). Given their financial and other hardships, it is critical to assess if the rural fish farmers' way of life is viable. Furthermore, despite being of great economical, commercial, and ecological importance to Bangladesh's economy, little research has been done on the poor fisherman of northeastern Bangladesh. For progress to be effective, people's quality of life must be improved. People of all kinds, especially the fishing industry, which is the most defenseless. Understanding the local fisherman is crucial and totally required for this improvement. The livelihood of the Bangladeshi fishing community, however, is not well understood. Studies on the socioeconomic conditions of fishermen in Bangladesh have been conducted, but none of them have concentrated on specific data on livelihoods like access to organizations, vulnerabilities to livelihoods, or outcomes. Bangladesh is one of the top producers of fish in the world. For Bangladesh's socioeconomic growth to combat malnutrition, provide foreign exchange, and offer employment opportunities, fish and fishery resources are crucial. Most of the local fishermen lack a number of conveniences. They struggle to survive continually, but since they lack fishing gear, they are unable to earn as much money, and the bulk of them live in poor conditions. The fishing sector in Bangladesh has a great deal of potential to advance socioeconomic growth, economic recovery, reduction of poverty, employment opportunities, food security, and foreign exchange revenues. people of all types, especially the fishing industry, which is the most defenseless. Understanding the local fisherman is crucial and totally required for this improvement. The livelihood of the Bangladeshi fishing community, however, is not well understood. The abundance of wetlands, fish species, and aquatic resources available in this country is fortunate. The majority of our country's water features, such as its rivers, lakes, ponds, floodplains, and marshes, are crucial fishing resources (DoF, 2022). Seasonal flood plain wetlands in our nation remain flooded for three to four months (about from July to November) during the wet monsoon, during which time they produce a significant amount of small fish. Resources (nature, Fishermen's conditions had been worse) and skills make up livelihood.

Fisheries using relatively smaller boats. Artisanal fishing occurs in shallow water normally within 40-meter water depth using mechanical or non-mechanical boats. It refers to small-scale, low technology and low capital fishing practices undertaken by individual fishing households. Many of these households are of coastal or island national groups. These households make short (rarely overnight) fishing trips close to the shore. Artisanal fisheries can be subsistence or commercial fisheries, providing for local consumption or export. They are sometimes referred to as small-scale fisheries.

**OBJECTIVES OF THE STUDY:**

- 1) To observe the fishing activities in different seasons of the year.
- 2) To observe the marketing channel of marine fisheries.
- 3) To evaluate sustainable management strategy.
- 4) To observe socio economic status of different stakeholders involved in artisanal fishing activities.

## **CHAPTER TWO**

### **REVIEW OF LITERATURE**

#### **2.1 Socio-Economic Analysis**

"Coastal and marine livelihoods" need to be understood as incorporating far more than just the direct exploitation of coastal and marine ecosystems by people living nearby, especially if the term "livelihoods" is taken to cover the broad variety of aspects and contributing variables outlined above. Even for people actively engaged in the exploitation of coastal and marine resources, it frequently just constitutes one component of their means of subsistence. It may be more or less significant, but the other options available to them, the numerous direct and indirect elements at play, and the vulnerability environment that they must deal with will all have a significant impact (Townsend, 2004). It is important to understand that livelihoods are dynamic and prone to shocks, changes, and seasonal influences, especially because they heavily rely on having access to natural resources, as is frequently the case for residents in coastal locations. The ability of two individuals to maintain their way of life in the face of shocks and changes is a particularly crucial problem in coastal and marine livelihoods because of the dynamic character of coastal surroundings (Townsend, 2004). In order to build a sustainable fisheries management system that preserves natural resources and raises human well-being while remaining within the limits of the environment's carrying capacity, it is necessary to maintain a balance between social, economic, and environmental benefits and costs (Ostrom, 2009). A significant barrier to managing open-water fisheries resources is the local inhabitants' lack of ecological and environmental understanding (Craig et al., 2004).

Out of the 64 districts in Bangladesh, 19 are coastal (making up one-third of the nation), supporting 36.8 million people (28% of the total population), of whom 52% are impoverished and 41% are under the age of 15. (Islam, 2008a, b; MOWR, 2006; Islam, 2004). Unfortunately, these coastal areas frequently experience both natural and man-made risks and disasters, such as coastal flooding, cyclones, storm surges, erosion, salinity, contamination with arsenic, and pollution. Aside from other risks, coastal people are more vulnerable because of low income levels and inadequate housing and sanitation standards (MoWR, 2005)

In order to understand the socioeconomic status of the fishermen and middlemen in the fish marketing chain in the Cox's Bazar region of Bangladesh, Ahsan et al. (2016) conducted a study. In the research area, the socioeconomic conditions of the fishermen and middlemen were not very satisfactory. It was discovered that 16% of fishermen and middlemen were semi-literate but could only write their names, and roughly 35% of fishermen and mediators were illiterate. A tin shed house with a tin wall was owned by 55% of the households of the fishermen and middlemen. Their research revealed that the majority of fishermen and middlemen made an average salary of between 400 and 500 Tk, and that 66% of them had to borrow money from various sources to keep their businesses operating. The main issues with the marine fish marketing chain included bad roads and transportation, a lack of financing facilities, a shortage of ice, poor training facilities, and a high number of middlemen. For sustainable fish marketing systems, they advocated offering market operators institutional and organizational assistance, government backing, extension services, and training facilities.

Humans are becoming more and more dependent on marine and coastal resources (Berkes et al. 2001). Millions of people throughout the world depend on the fishing industry for a living (FAO,



2010). In 2016, 19.3 million people worked in aquaculture and 40.3 million people were directly employed in the primary sector of capture fisheries and aquaculture, totalling around 59.6 million people. Asia has 85% of the world's population working in fisheries and aquaculture, followed by Africa's 10% and Latin America and the Caribbean's 4% (FAO, 2014).

Rashed et al (2016) found that the majority of fisherman (31% of all fishermen) belonged to the age brackets of 21 to 30 and 31 to 40. There were 3.78 nuclear family members on average each home. The average number of joint family members per home was 7.83. These folks are among the most underprivileged in our society, and some of the nets that fisherman employ have an adverse effect on the fish population. Multiple species, including some rare ones, were caught in each net. The common phenomenon that the fishing villages frequently suffer is poverty and deprivation. They are extremely susceptible to the effects of climate change and natural disasters because of their location, poor economic standing, and little potential for adaptation. Due to the lack of alternative livelihood alternatives, coastal fishing is the main source of income for many fishing communities (FAO, 2014). The majority of Bangladesh's marine fisheries were small-scale (FAO, 2014).

Another survey was conducted in Bogura to better understand the situation of artisanal fishermen in Bangladesh. The current study was carried out to assess the fisher community's means of subsistence along the Jamuna River close to Saria Kandi Upazila in the Bogura area of Bangladesh. Mondal et al. (2016) provided research on the situation of the fishing community on the Jamuna River in Saria Kandi, Bogura from August to December 2015. A well-designed questionnaire was used to collect information from 40 fishermen in the selected area. The poll found that 87% of fishermen were Muslims and that 58% of them were between the ages of 30 and 50. Fishermen had families with an average size of three to four members (65% had a small family, 22% had a medium family, and 13% had a large family). More than 56.5% of fishermen rely only on fishing for their livelihood. 23.5% of people worked in agriculture, 9% in day labor, 5% in cattle husbandry, and 6% in small businesses in addition to fishing. 14 percent of fishermen could only sign their names, while at the elementary, secondary, and tertiary levels of education, respectively, 74%, 10%, and 2% of them were illiterate. Village doctors treated the majority of fishermen (68.5%), followed by the Upazila health complex (21.5%), and MBBS (Bachelor of Medicine and Surgery) specialists with the remaining 10% of the medical workforce. Most people (55%) live in katcha houses with tin roofs, then dwellings with straw roofs (32.5%), semi-pucca houses (9.5%), and pucca houses (only 10%). In comparison to 23% of fishermen with low incomes (35,000-60,000 TK) and 32% of fishermen with high incomes, the majority of fishermen (45%) had a medium yearly income (61,000-120,000 TK) (over 1, 20, 000 TK). A lack of other career options, inadequate educational prospects, a lack of access to credit and sanitary facilities, personal fishing nets, and government assistance like Vulnerable Group Feeding cards may be to blame for the majority of fishermen's subpar living conditions.

According to Mitu et al. (2021), the south-east coast of Bangladesh, notably the Cox's Bazar region, has received considerable support for manufacturing a significant amount of dried fish by enlisting the help of thousands of underprivileged coastal residents. This study used a mixed-methods approach and an Analytic Hierarchy Process to evaluate the socioeconomic characteristics, livelihood plans, and resilience of the people engaged in fish drying on the south-east coast (AHP). Due to their lower levels of literacy, erratic revenues, and labor-intensive

employment, groups engaged in drying were found to be socioeconomically underdeveloped. Apart from the significant use of child labor for fish drying in Nazirertek, female workers were more prevalent than male workers. However, the female employees had less control over their daily pay and reported making USD 3.5–4.89, which was considerably less than the USD 4.1–8.31 paid by the male employees. Very few employees, producers, and traders were found to be self-sufficient through fish drying activities. The livelihoods of the employees, in contrast, were not as stable as those of the processors and traders. The resilience of the community was significantly maintained by dried fish processors and employees, dried fish traders, off-season revenue, a wealth of fish species, fish drying facilities, trader's association, and social relationships in addition to suffering from numerous shocks and limits. The study suggests effective interventions for alternative income diversification strategies, strong community, local government, and government engagement for sustainable livelihoods, and better community resilience.

Among the authors are H. Ali, M.A.K. Azad, M. Anisuzzaman, M.M.R. Chowdhury, and M. Hoque. This study used a variety of methodological tools, primarily questionnaire surveys and participatory rural appraisal (PRA) tools, to evaluate the socioeconomic concerns related to fish farming and the standard of living of the fish farmers in a few selected neighborhoods in Tarakanda upazila of the Mymensingh district from October 2008 to March 2009. Seasonal ponds made up 33.34% of the total, while permanent ponds made up 66.66% of the total, with an average pond size of 0.17 hectares. In addition to having 45% of families with four or more family members, 57.5% of fish farmers were in nuclear households, and 42.5% were in multiple households.

In addition to having 45% of families with four or more family members, 57.5% of fish farmers were in nuclear households, and 42.5% were in multiple households. The majority of fish farmers were between the ages of 31 and 40. An average education level is 8.2 years, and 85% of the population is Muslim. About half of the homes were made of tin, while the remaining third, fourth, and fifth were katcha, semi-pucca, and pucca, respectively. The average monthly income of the farmers was estimated to be BDT 42,500, and 90% of them funded their farming activities out of their own funds, with only 10% relying on loans. Approximately 62.5% of farmers used semi-pucca, 12.5% pucca, and 25% katcha hygienic techniques. Ninety-five percent of farmers had access to electricity, vs. 5% who did not. 10% of farmers used a neighbor's tube well, compared to 90% who used their own. A total of 40% of farmers sought medical attention from kobiraz or village doctors, 45% had access to the Upazila health center, 12.5% went to an MBBS physician, and 2.5% opted not to seek care due to financial constraints. Lack of scientific knowledge, inadequate seed and feed supplies, a lack of money, and a lack of marketing infrastructure were the major barriers to fish farming.

## **2.2 Diversity of Fishing Gears, Craft and Catch Composition**

In a one-year study from July 2016 to June 2017, Nazrul et al. (2018) collected data from 13 coastal fish landing locations in south-east Bangladesh, totaling 32,241.74 MT of landed fish, shrimp, and other resources. The catch peaked in April 17 at 4,787.24 MT, while it dropped to 413.29 MT in July 16. The landing centers headquartered in Cox's Bazar had the highest catch overall. The dominating fishing method, as measured by the weight of the fish, was MSBN fishery (73.45%), followed by SMD (11.75%). The study's conclusions show that 68,364 boats (the average number of boats active fishing days) fished at 13 landing centers over the course of the

study period. The range of active fishing days was 16 to 28, with the highest and lowest activity levels being recorded in Teknaf and Fishery Ghat, respectively.

Between April 2014 and April 2015, Ghosh et al. (2016) conducted studies on the catch evaluation of some artisanal marine fishing gears used in the Cox's Bazar and Teknaf regions. There were found to be 16 different varieties of fishing gear, with the gill net, beach seine net, estuary set bag net, marine set bag net, and trammel net being the most common. According to their research, despite being a legally prohibited fishing technique, estuarine set bag net (ESBN) recorded the highest catch per unit effort (CPUE) (110 kg/gear/day) in July, followed by marine set bag net (MSBN) (105 kg/gear/day) in Cox's Bazar, and the highest CPUE was recorded by ESBN in June at 100 kg/gear/day, followed by MSBN (90 kg/gear/day) in out of 52 fish species,

*Poa (Otolithoides argenteus)*, Churi (*Trichiurus haumela*), Loittyia (*Harpadon nehereus*), Ranga choukha (*Lutjanus johni*), Lal poa (*Johnius argentatus*), Olua (*Coilia dussumieri*), Rup chanda (*Stromateus chinensis*), Foli chanda (*Stromateus argenteus*), and Ilish were the prominent fish species that (*Tenualosa ilisha*). During the study period, they also discovered three significant crab species and 10 commercially significant shrimp species. Most fish species were most readily available in June and July, whereas December and January were lean months. According to this study, *Trichiurus haumela*, *Harpadon nehereus*, and *Coilia dussumieri* were the next most common fish species, followed by *Otolithoides argenteus* as the dominant species.

One of Bangladesh's major marine fish landing facilities, The Patharghata Fishery Ghat, was the site of a survey conducted by Rashed et al. in 2016. The study sought to investigate the various watercraft and equipment utilized by the landing center's fishermen, the types of fish they were catching, and to some extent, their socioeconomic situation. The nets were divided into categories such as Marine Set Bag Nets, Large Mesh Drift Gill Nets, and so forth. These gears' mesh sizes ranged from 1.5 to 3 inches for trammel nets and 2.5 to 16 inches for LMDs. The majority of fishing trawlers was primarily hand-built and propelled by inboard engines. The boats' carrying capacities ranged from 8.82 to 22.05 tons. According to Akter et al. (2017), coastal fisheries resources are essential for sustainable economic development, livelihood security, management, and conservation as one of the key elements of the blue economy and food security. There are, however, few contemporary thorough studies evaluating the richness and composition of faunal diversity from coastal and marine waters. To evaluate the current state of the fish and shellfish taxa that are present in the marine and estuarine waters along Bangladesh's South-Eastern coast, namely in the Chattogram and Cox's Bazar districts, a year-long field inventory was done. Regarding the current perspectives of fishing resources to evaluating the current reality of species compositions, both qualitative and quantitative data were taken into consideration. Based on expert knowledge exchange, secondary document consultation, and internationally accepted acceptable techniques, the gathered taxa (specimens) were identified. 64 taxa in all, comprising 10 species of shellfish and 54 finfish species belonging to 27 families, were identified from the research region. According to family contribution, Sciaenidae had the highest percentage (11%) with 6 species, followed by Gobiidae (9%) and Scombridae (9%) with 5 species each, while Engnaulidae and Cynoglossidae scored (7%) with 4 species each. Pennidae made up (80%) of the shellfish (shrimp) species, represented by 8 species, while Hippolytidae made up (20%), represented by 2 species. In order to ascertain the cost/return structures and economic effectiveness of small-scale marine fishing using the chosen gears in Bangladesh, Akter et al. (2009) designed a study. A total of 90 fishing units (enterprises) were chosen, of which 30 were gill net, 30 were roke net, and 30 were set bag net

fishing firms, to accomplish these goals. Over the course of a year, information was gathered from fishermen and boat owners. The study's conclusions showed that the chosen fishing equipment was quite profitable. For the chosen gears, it was discovered that the gillnet, roke net, and set bag net had respective yearly earnings of Tk. 111,022, 75,525, and 147,241. In comparison to the other two gears, set bag net fishing was found to be more profitable. The majorities of the explanatory factors included in the model were statistically significant and had a favorable impact on improving fishing business income, according to the Cobb Douglas production function analysis.

### **2.3 Marketing Channel Analysis**

A study by Aksan et al. (2016) looked at the value chain analysis and marketing channels for several marine fish species that are present in the Cox's Bazar region of Bangladesh. The marketing channels and value analysis of three marine fish species of significant commercial importance were examined: Pomfret (*Stromateus chinensis*), Jewfish (*Otolithoides argenteus*), and hilsha (*Tenualosa ilisha*) are the three species. The primary, secondary, and retail markets, which involve sales agents, suppliers, wholesalers, commission agents, processors, and retailers, primarily cover the area from fishermen to consumers. Interviews were conducted with 120 fishermen and channel participants. The marketing channel was found to have a big number of intermediaries, and it is thought that this group makes significant profits, which is why fish prices were very high in the end consumer market. Profit and marketing margin were also examined. Marketing Pomfret fish, Jewfish, and Hilsha had respective margins of 21%, 27%, and 27% of consumer purchase price. One of the main issues with the marine fish marketing chain was the lack of adequate roads and transportation infrastructure as well as the high number of intermediaries in the chain. Therefore, it was essential to give market operators institutional assistance, governmental support, extension services, and training facilities for sustainable fish marketing systems.

## CHAPTER THREE

### METHODOLOGY AND STUDY AREAS

One of the most important steps in finishing a thesis is planning. After determining the study's justification and carefully evaluating the available literature, the plan is developed. Writing a scientific article requires not just disclosing the study's conclusions, but also outlining the steps taken to arrive at those conclusions. The latter is referred to as the "Materials and Methods" section in a scientific article. The empirical part of this research work is informed by qualitative fieldwork and, in certain cases, by quantitative data. The fieldwork was carried out in three periods, split over three seasons. Qualitative methods employed in this study include observation and interviews. The purpose of my fieldwork was not to count the opinions or the number of people, but rather to explore the range of opinions and the different representations of the issues. The objective was to maximize the opportunities to understand the different positions and views taken by the members of the communities (Gaskell 2000). During the fieldwork and in the course of analyzing and compiling the data, four 'must' elements were kept in mind: First, the researcher must get close enough to the people and situations being studied during a sufficient period of time and under a variety of circumstances to understand what goes on. Second, the information should be factual and describe what actually went on during data collection. Third, information should comprise a pure description of activities and, fourth, should include direct quotations from oral or written statements of interviewees (Lofland 1971).

#### Part A

#### 3.1 Methods for data collections for livelihood analysis:

##### 3.1.1 Preliminary survey:

A preparatory observation was carried out in the survey area based on secondary data. After that the final survey decision was concluded for study.

**3.1.2 Questionnaire preparation:** A semi-structured questionnaire was prepared for the questionnaire survey (Appendix). The prepared questionnaire was divided into five sections: general information; ecological and environmental features; fishing information; marketing channel of marine fishes and socio-economic condition. Most of the questions related to ecological and socio economic conditions were score based where 0 represent the lowest score and 5 denote the highest score. These score-based questions were quite helpful in case of data analysis especially qualitative data were easily analyzed according to scores given by the participants.

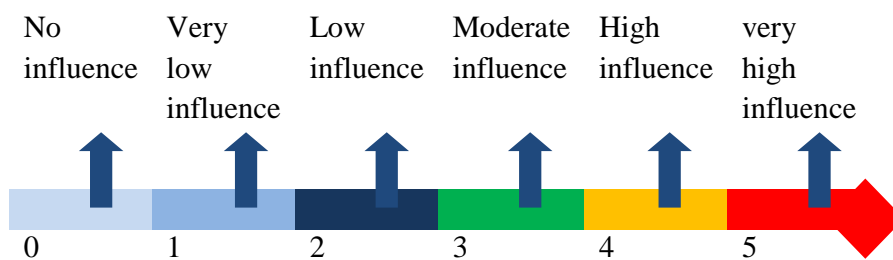


Figure 1: Scoring Scale

For economical analysis, questions were prepared on the basis of desired target about their occupation, other income sources, their savings and also major earning options as well. For

marketing channel survey, we gathered all information via structured and semi- structured questionnaire from BDFC and local trader.

### **3.1.3 Participant and direct observations**

Observing evidence is often useful in providing further information for understanding the context or phenomenon under study (Yin 2009). Fieldwork in each fishing community was started with an observation of fishermen livelihoods. This was combined with some informal conversations that helped me to get acquainted with the fishers and their activities. Considerable time was taken to observe the daily activities of the targeted community. Since participant observation offers a distinct opportunity to get a comprehensive and authentic insight into actual situations from someone inside (Yin 2009; Gittleston & Mookherji 1997), I did participant observations by accompanying the fishers to their fishing areas, particularly to observe the shrimp and prawn post larvae collection activities. I also accompanied them and their catch to local markets or landing sites, to observe price haggling and the setting of marketing channels. All these activities helped me to gain an insight into their daily activities and income, and thereby increase the validity of the collected data.

### **3.1.4 Interviews**

In-depth interview "permits the researcher to explore fully all the factors that underpin participants' answers: reasons, feelings, opinions, and beliefs" (Legard et al. 2003: 141). Hence, a major part of empirical data was collected from in-depth interviews. The interviewees came from different occupational backgrounds, like fishers (e.g. fish harvester, crab collector, shrimp and prawn post larvae collector, fishers with or without boat, fish traders), community leaders, fishing entrepreneurs, experts on fisheries issues, and NGO officials working with fishing communities. Key informant interviews were conducted with knowledgeable and interested person in more than one session. The interviews were semi-structured to allow the interviewees more flexibility. Nevertheless, care was always taken so that the interview process did not miss its track, while allowing that flexibility. In the sampling areas, representative person allowed us to enter their fishing communities, which made data collection easier. In some cases, data collection was challenging, for instance in the Teknaf area, where local fishers were not interested in giving me time and information. Therefore, I had to invest considerable time in finding and convincing fishers to undertake the interviews. Some fishers questioned the benefits of such research for their well-being, citing that many NGOs did such research several times, but that no benefits have yet come. Interview questions were modified, considering the respondents' understanding of the questions. Though preference was given to interviewing in the work places or inside the living areas, we tailored our interview time and place to the physical and mental conditions of the fishers and their availabilities, thus avoiding busy working hours. In most cases, interviews were conducted in their work places during periods with less workload. These periods included times when fishers were netting or repairing their boats or nets. Interviews were also carried out in usual places of gathering such as in tea stall. Special caution was taken when interviewing fisherwomen, considering the prevailing norms of each society.



Figure 2: Collecting information

The interviews were semi-structured to allow the interviewees more flexibility. Nevertheless, care was always taken so that the interview process did not miss its track, while allowing that flexibility. In the sampling areas, representative person allowed us to enter their fishing communities, which made data collection easier. In some cases, data collection was challenging, for instance in the Teknaf area, where local fishers were not interested in giving me time and information. Therefore, I had to invest considerable time in finding and convincing fishers to undertake the interviews. Some fishers questioned the benefits of such research for their well-being, citing that many NGOs did such research several times, but that no benefits have yet come. Interview questions were modified, considering the respondents' understanding of the questions. Though preference was given to interviewing in the work places or inside the living areas, we tailored our interview time and place to the physical and mental conditions of the fishers and their availabilities, thus avoiding busy working hours. In most cases, interviews were conducted in their work places during periods with less workload. These periods included times when fishers were netting or repairing their boats or nets. Interviews were also carried out in usual places of gathering such as in tea stall. Special caution was taken when interviewing fisherwomen, considering the prevailing norms of each society.

### 3.1.5 Secondary documents analysis

Secondary documents were collected for information about situations or events that were not covered by empirical investigation (Hammersley & Atkinson 1995). In the Cox's Bazar, Ukhiya

and Teknaf region, where a good number of NGOs are working on different pressing issues of livelihoods security of resources users, we went to NGO offices to collect different reports and information regarding local communities. Secondary information was also collected from newspaper reports. These secondary data provided information about different activities taken by the Bangladesh Government and various NGOs working for coastal fishers or associated issues like irregularities and corruption involved in resource management etc. Some secondary documents were also retrieved from various internet search engines. These documents were helpful in collecting background information about study areas and also filling small gaps in empirical evidence.

### **3.1.6 Sampling and representativeness**

This study does not aim at quantifying social phenomena and drawing representative conclusions. Accordingly, sampling was not aiming at representativeness, but rather at developing a broad understanding of issues at stake. The study areas cover three geographical settings along the coast of Bangladesh. The Cox's Bazar, Ukhiya and Teknaf Upazila are in the south-eastern part of Bangladesh. The selected communities differ in terms of religion and caste. Diversity in target species, fishing gear and crafts, and fishing ground were also considered in selecting sampling sites. The sample size of the interviews was determined based on the requirement of information and guided by the principle of data saturation (Polit & Hungler 1999; Glaser & Strauss 1967). Respondents were selected by convenience and opportunity sampling in the communities. Within each community, sampling was mainly carried out in the places where the fishers gather. Fish landing sites, open beaches, or river banks for harboring boats, flood protection embankments, markets for selling fish, tea stalls, etc. were found as places for fishers' gathering. In addition, I also visited respective places to interview women and men who usually don't move outside of the communities for different reasons such as disability or illness.

## **Part B**

### **3.2 Data Collection for Catch Assessment:**

#### **3.2.1 Collection of Data**

Data were collected from January 2021 to December 2021 where a total of 320 fishermen were interviewed with a combination of field survey, questionnaire interviews and participatory rural appraisal (PRA) methods *viz.* focus group discussion (FGD). A total of 12 FGD sessions were conducted in the study areas where each group had 10 to 15 persons and duration of FGD was approximately two hours. Thereafter data were cross-checked with proper authorization like Upazila Fisheries Officer (UFO), Manager of BFDC for the accuracy of collected primary data.

#### **3.2.2 Estimation of monthly total catches**

Monthly total catches by types of fishing gear used are to be estimated by areas as follows:

Estimated monthly total catch = (Average catch per fishing unit per day obtained by the gear) × (Total number of fishing operation units per month)

The average catch per fishing unit per month is to be calculated as follows:



Average CPUE per month = (Average catch per trip obtained as an average of observed sample catch data × Average number of trips per fishing unit per month obtained as an average of sample data on the number of trips per month)

### 3.3 Method of data analysis of Socio-Economic Analysis:

In most cases, tape-recorded and hand-written data were transcribed in the evening of the same day, in the field. Such arrangements helped to prevent the loss of data as well as facilitated the verification of data in the following morning with the interviewed communities. In case of contradictory information, explanation was sought while in the field or after returning from the field, via telephone. After the transcriptions, contents were analyzed and themes were identified and classified into variables (Spencer et al. 2003) such as the causes of poverty, coping strategies, etc. for further explanation, by using relevant theories. Calculations were done by SPSS and graphical presentations were done by Excel analysis.

### 3.4 Study area

The study areas of this research are situated near the Chattogram coast along the Bay of Bengal. The main focus was given to select the places on behalf of my research interest. Such places were found among the communities living near the Cox's Bazar, Ukhiya and Teknaf, Bangladesh. Fishermen in this community are mostly involved in direct small scale fishing activities and fisherwomen mainly work as housewives or in fish processing activities. Some fishers were getting their livelihoods from fish drying and fish trade. There are a large number of people live in these two areas. Choosing different research areas provides diverse views and opinions of small-scale coastal fisheries, which vary considerably, depending on circumstances and places. The study took into account the artisanal fisherman in the surrounding area of Cox's Bazar.

### 3.5 Location of the study area:

Area	Location	Latitude	Longitude
Cox's Bazar	Nunia chada	21°28'03.9"N	91°57'49.2"E
	Khuruskhul Uttar	21°30'40.9"N	92°00'07.4"E
	Chaufaldandi	21°31'02.6"N	92°00'40.2"E
	Najirar Tek	21°28'00.4"N	91°56'51.7"E
	BFDC	21°27'07.1"N	91°58'05.3"E
	Jhilwanja, Doria Nagar	21°23'38.1"N	91°59'52.2"E
Ukhiya Upazila	Sonar Para Fishing Community	21°17'17.2"N	92°02'50.3"E
	Inani Fishing Community	21°13'44.6"N	92°02'53.6"E
	Monkhali Fishing Community	21°06'15.9"N	92°06'32.1"E
	Reju Khal Fishing Community	21°17'38.3"N	92°03'02.0"E
Teknaf Upazila	Teknaf Beach Fishing Community	20°50'50.8"N	92°16'16.4"E
	Shamlapur Beach Boat Market	21°04'30.9"N	92°08'04.9"E
	Teknaf Jaliapara Ghat	20°52'05.1"N	92°18'02.0"E

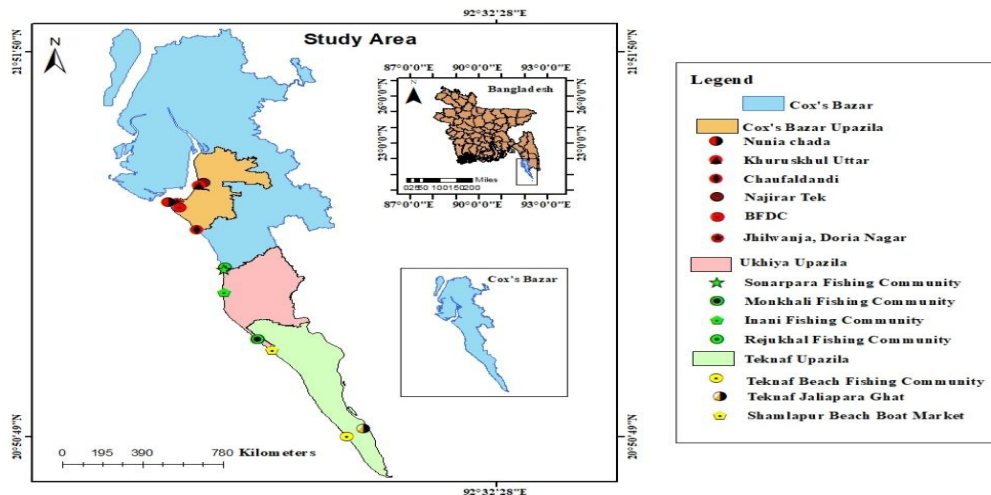


Figure 3 : Study location

### 3.6 Sampling Unit:

Around 320 representatives were being interviewed during this one year long survey of various sorts of occupation where 130, 70 and 120 representatives were being investigated from Cox's Bazar, Ukhiya and Teknaf respectively.

### 3.7 Study period

From January 2021 to December 2021, a one year period was used for this study. During this time, numerous field trips in every month were taken to gather the essential data. First field visit was conducted on 5th to 12th January 2021. Last field visit was conducted on 10th to 13th December, 2021.

### 3.8 Ensuring good scientific practices

#### 3.8.1 Validity and reliability

In designing qualitative research and judging the quality of a research, any researcher should be concern about two important factors: validity and reliability (Patton 2002). Several steps were taken to ensure the validity here. First, interview guidelines were semi-structured but allowed open-ended discussions. The purpose of the interview and research work was described beforehand, so that interviewers were not misguided. Second, as Stenbacka (2001) argues, the understanding of any phenomenon is legitimate if the selected informants are part of the problem of the area, so the study areas were selected carefully to ensure that my research objective addressed the problems of the selected communities. Further, following Stenbacka (2001), all interviewees were free to speak according to their knowledge and perceptions. Nevertheless, I was also careful to identify and stop at the saturation point, where no new information was forthcoming. During the interview process, conversation was tape recorded (where possible), and notes were taken on paper when necessary. To ensure further validity and reliability, transparency and openness was maintained throughout the study period. In each study area, before proceeding to data collection, informal meetings were held with community leaders and elders to explain my purpose and to seek their permission to work with their communities. At the end of the study, preliminary findings were shared with the interviewees for clarification, communication, and cross-checking.

### 3.8.2 Key Interview:

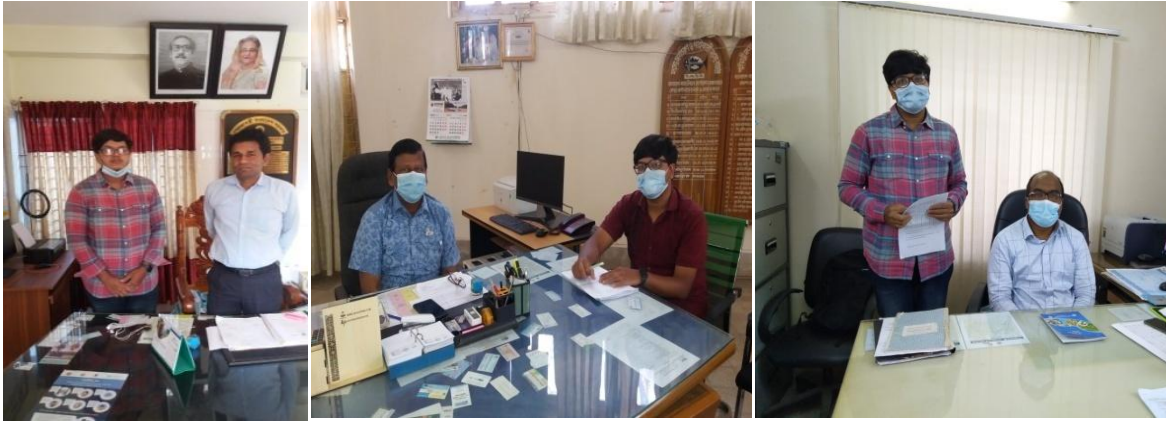


Figure 4: Key interviewing

### 3.9 Limitations

Following Islam (2004), conducting interviews have severe limitations in rural Bangladesh. The concept of an interview as a simple encounter between an interviewer and individual respondents is unlikely in a rural community of Bangladesh. The interview mostly takes place in the presence of other men or women who often interfere in the conversation, thus creating a group response. In reverse cases, a respondent might show little interest or be reluctant to give sufficient time for the interview, or even challenge it. Being unhappy with the activities of different NGOs (who usually visit local communities and do different surveys), many people on the coast are not interested in qualitative interviews, as we experienced. Many fishers do not want to share their perceptions in interviews, as they do not trust strangers. On the first hand, some fishers exaggerated their livelihood constraints with the hope that we would provide aid. The strategy here was to visit them every time and again to build trust. I always performed Cross-checking of the collected data. Some fishers declined to record their voices due to suspicion that we might use their voices for other purposes that might harm them. In such cases, some valuable information may have gone unattended during hand writing, carried out by a research assistant.

### 3.10 Ethical considerations

Ethical behavior in research work not only protects the rights of the individuals or communities interviewed, but also creates a favorable environment to continue scientific inquiry (Hay 2003). Special caution was taken, considering the sensitivity of maintaining the privacy of interviewees during the interviews and data processing steps. Following Yin (2009), in each interview, I disclosed my intention for data collection and gained verbal informed consent before starting interviews. Any form of deception or any potential harmful activities were avoided in the interview process. Privacy and confidentiality was maintained in all cases so that those participating in the interviews would not be unwittingly put in any undesirable positions. Prior permission was taken before photographic documenting of their activities, work places, or houses. Prior permission was also taken before recording the interview by tape recorder. In cases where no permission was granted, a research assistant took down the interview notes. In all cases, the names of the interviewees were withheld.

## CHAPTER FOUR RESULT

### 4.1 Part 1: Socio-Livelihood Analysis:

#### 4.1.1 Age structure

The survey reveals the age group of stake holders involved in the artisanal fisheries. They are classified into five different age groups such as very young aged (less than 20 years), young aged (20-30 years), middle aged (31-45 years), aged (45-60 years) and old aged (more than 60 years). The bar chart illustrates the difference among age groups on the basis of three sampling areas. According to the study's findings, around half of respondents were age group of 31 and 45 in Cox's Bazar Sadar and Ukhiya Upazila, while half of respondents were young age group of 20 to 30 in Teknaf Upazila. Only 2 to 7% of the sampled population was under the age of 20, and only 4 to 5% of respondents were more than the age of 60. Another age group, aged group (45-60), ranges one tenth to one fifth (Figure.1).

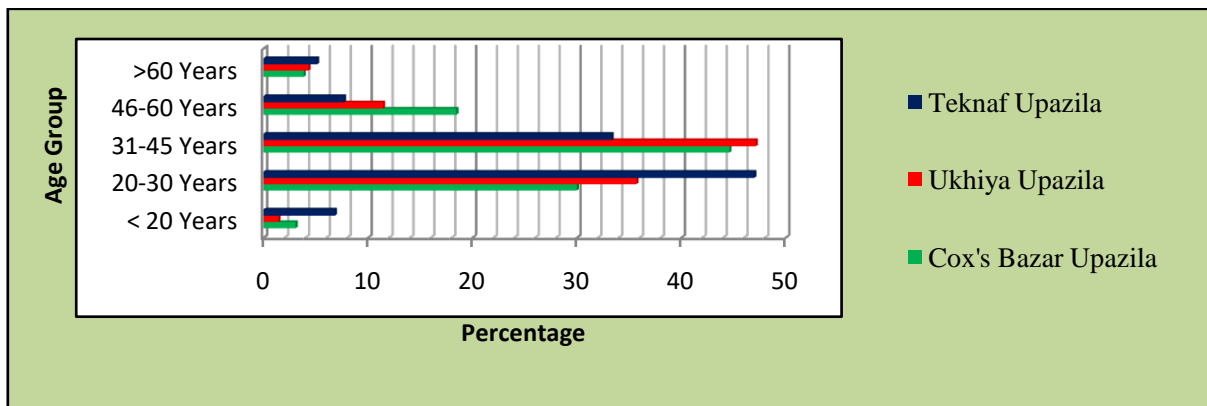


Chart 1: Bar Diagram of Age Group

#### 4.1.2 Gender Group

The survey identifies the gender status of the interviewers and participating artisanal marine fishermen. They are divided into two gender categories: male and female. Study areas are shown by pie charts that show the gender groups in each group. Male shows a large number of majority more than 90% and the highest number of male participate in Cox's Bazar area close to 95%. Other two areas, Ukhiya Upazila and Teknaf Upazila, reveal 91% and 92% of male participant respectively. However, Cox's Bazar represents the lowest female participant around 5% while Ukhiya Upazila shows the highest female number close to 9% and Teknaf Upazila shows 8% of female (Figure 2).

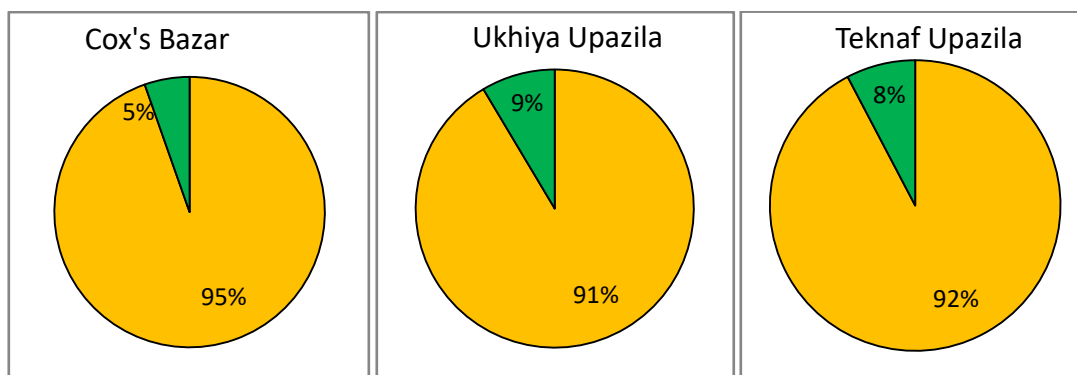


Chart 2: Gender Status of Sampling Areas

#### 4.1.3 Religion Status

Different religionist groups are shown in the following pie charts representing different sampling areas. There are four sub groups under this group which includes Muslim, Hindu, Buddhist/Rakhain and others. Muslim are noticeable in all three groups and occupying more than four fifth among all others. Muslim are occupying in the highest amount in Teknaf area around 87% and other two reason showing 81% and 83% in Cox's Bazar and Ukhiya Upazila respectively. The second most religious group in my sampling areas is Buddhist/Rakhain showing around 15% and 16% in Cox's Bazar and Ukhiya Upazila respectively. The least number of representatives belongs to Hindu religion. They occupied 13% in Teknaf Upazila and 4% and 1% in Cox's Bazar and Ukhiya Upazila respectively (Figure 3).

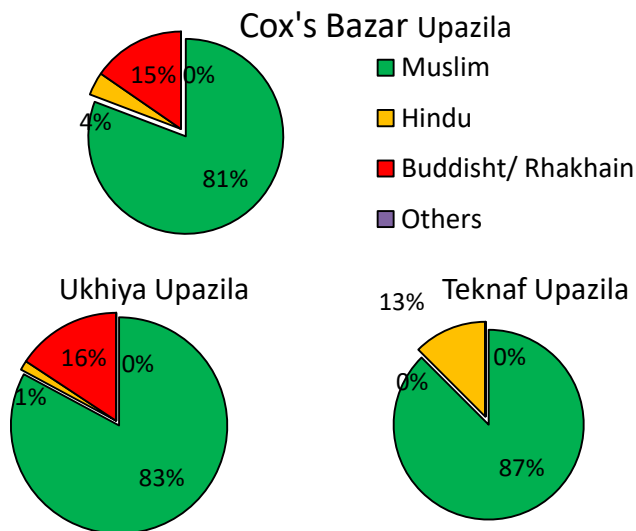


Chart 3: Religion Status

#### 4.1.4 Marital Status:

The following pie charts, which represent separate sampling areas, encompass marital status. This community is divided into three subgroups, including married, unmarried and polygamy. Married group gets the highest number among all three groupings in Cox's Bazar around four fifth and make up more than 70% in other two groups. The percentage of unmarried is the second largest in

the sampling area, where they make up about 27% in both Ukhiya and Teknaf Upazila respectively, with another group exhibiting 18% of unmarried group in Cox's Bazar. Polygamy has the fewest number of elected officials. They held 3% of the population in Ukhiya Upazila and, accordingly, 2% and 1% in Cox's Bazar and Teknaf Upazila (Figure 4).

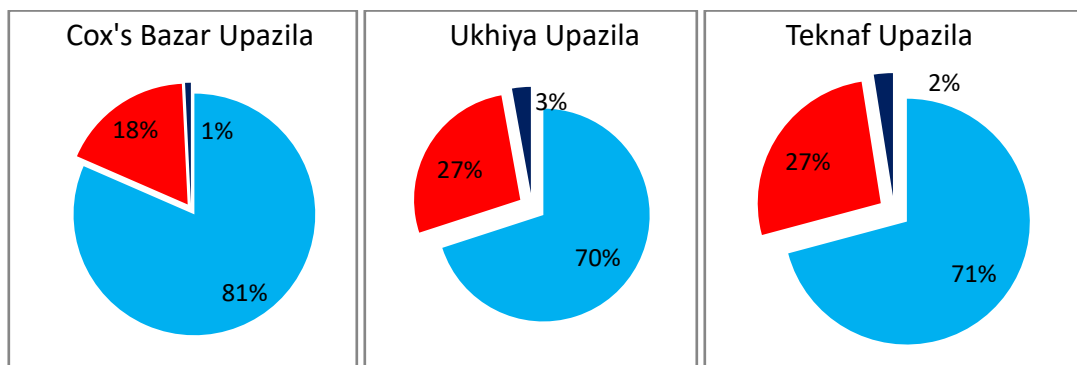
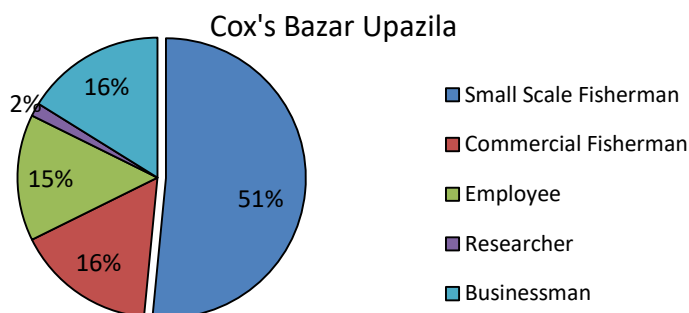


Chart 4: Marital Status

#### 4.1.5 Employment Status:

According to survey questionnaire, majority of the participants are small scale fisherman due to the research demand. There are five different kinds of occupation we are mentioning in this research (i) small scale fishermen, (ii) Commercial fishermen, (iii) Employee, (iv) Researcher, and (v) Businessman. Various types of occupations are showing in this research by three different pie charts showing various occupations. Small scale fishermen covering the highest position in all areas and the highest number of small scale fishermen were interviewed in Teknaf Upazila around 89% another two region show 47% and 51% in Ukhiya and Cox's Bazar respectively. The second-largest occupation group is commercial fishermen which occupy the highest position in Cox's Bazar area around 16% another area Ukhiya covers 10% and there are no commercial fishermen in the Teknaf Upazila. Some employees are also interviewed during our survey. They represent around 15 to 16 percent in different areas but there are only 3% in the Teknaf area. Some Businessman and researcher are also interviewed. We found 16% of businessman in Cox's Bazar and 8% in Teknaf Upazila (Figure 5)



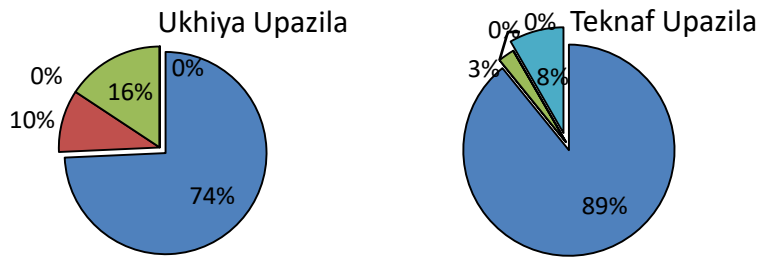


Chart 5: Employment Status in Various Regions

**4.1.6 Educational qualification:**

Educational qualification influences on individual preferences, behavioral patterns, performance, skill and capability. The literacy levels of intermediaries were very low. The majority were illiterate whereas only few fishermen and intermediaries had their education up to primary level and some only can write their name and give a signature. Their children went to school till the primary level and onwards they drop-it for income generation. On the contrary, women were also illiterate who do not even know to read. To examine the literacy status of the marine fishermen and intermediaries, the educational status of the respondents was divided into five categories: (a) illiterate; (b) primary level (Class I-V); (c) secondary level (Class VI-VII); (d) S.S.C. (class up to x); (e) H.S.C. (class XI-XII); (f) Honors ; and (e) Masters or above. Data obtained from the survey revealed that 82%, 39% and 30% fishermen and intermediaries were illiterate in Teknaf, Ukhiya and Cox’s Bazar area respectably and some of them could only write their name, 25% , 21% and 8% have received education up to primary level; 17%, 23% and 4% have received education up to secondary level; 15%, 13% and 6% have completed their S.S.C level in Cox’s Bazar, Ukhiya and Teknaf area respectably and only few less than 5% went beyond higher secondary or above (Figure 6). About 54% children of the fishermen and intermediaries completed primary level of education (up to class V), while the rest (46%) dropped out before completing primary education during COVID pandemic.

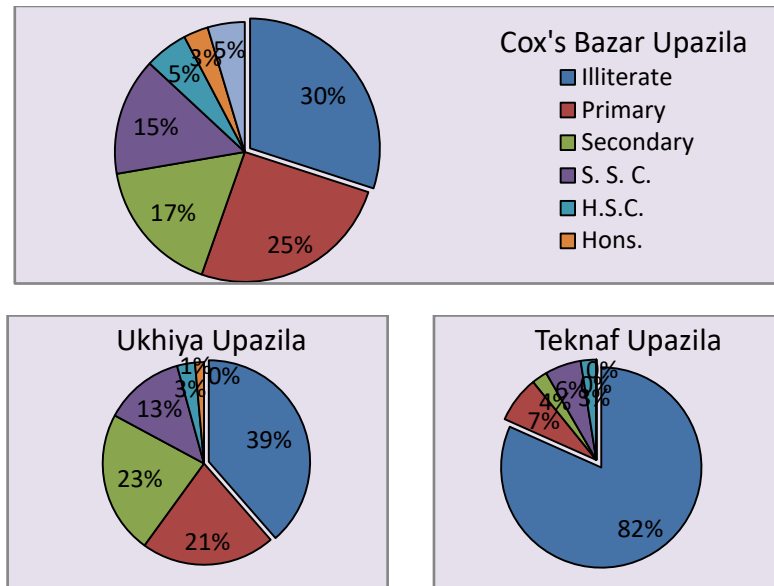


Chart 6: Educational Status in Pie Charts

#### 4.1.7 Family Structure:

Family structure refers to the structure of the individuals who live in a household and consider themselves a family. Families are classified according to the member i.e. small family with one to four members; medium family with five to six members; large family with seven to nine members; and very large family with more than nine members. The family size is related to the income of the fishermen and intermediaries. Family size also determines the family status and the relationship with the families. According to the doughnut charts, medium families show higher number in Ukhiya Upazila around 52.85% another two regions also show higher number of medium family 45.15% and 45% in Cox's Bazar and Teknaf Upazila respectively. The lowest number of small families is shown in Cox's Bazar close to 9.23%. Large and Extended families range 14.29% to 24.17% (Figure 7).

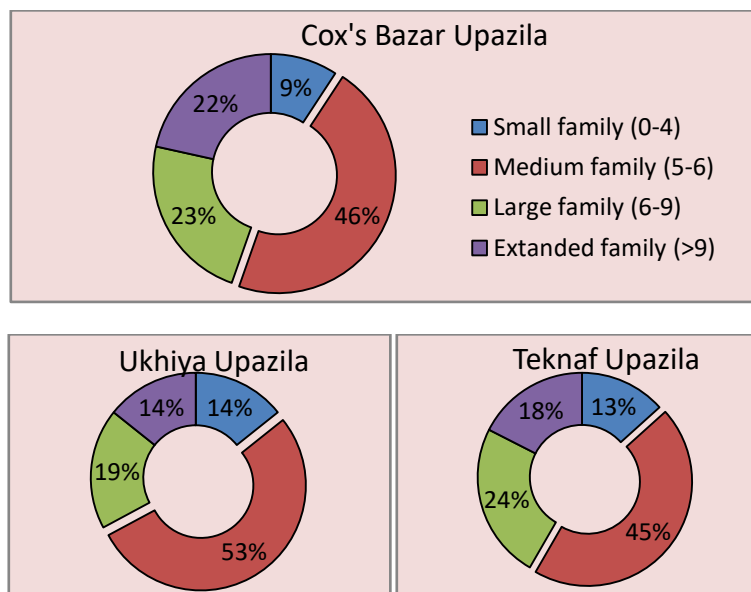


Chart 7: Family Structure in Doughnut Chart

#### 4.1.8 Income Pattern:

Daily income is the most important factor for better understanding of socio-economic condition of the intermediaries. In this survey, five various group of income pattern are shown. They are: (i) Very low income (BDT <250); (ii) Low income (BDT 251-400); (iii) Mid income (BDT 401-600); (iv) Standard income (BDT 601-800); and (v) High income (BDT >800). The daily income of the intermediaries varied from BDT 1 to 1500 and more. During the peak harvesting period, BDT 400-600 per day was earned by 31.54%, 21.43% and 45% fishermen and intermediaries in Cox's Bazar, Ukhiya and Teknaf Upazila respectively. Most of the representatives show the lowest amount of income BDT <250 in Teknaf around 61.67%, another two region Cox's Bazar and Ukhiya also show 17.69% and 31.42% of this type of income pattern. The highest income BDT >800 is shown in the sampling regions ranges from 3% to 8%. Cox's Bazar shows high income around 8% and Teknaf shows 3% of high income. Only 6% representative from Ukhiya Upazila shows this income pattern. According to higher sequentially, standard income BDT 601-800 are shown 14%, 13% and 7% in Cox's Bazar, Ukhiya and Teknaf Upazila's fishermen and intermediaries(Figure 8).



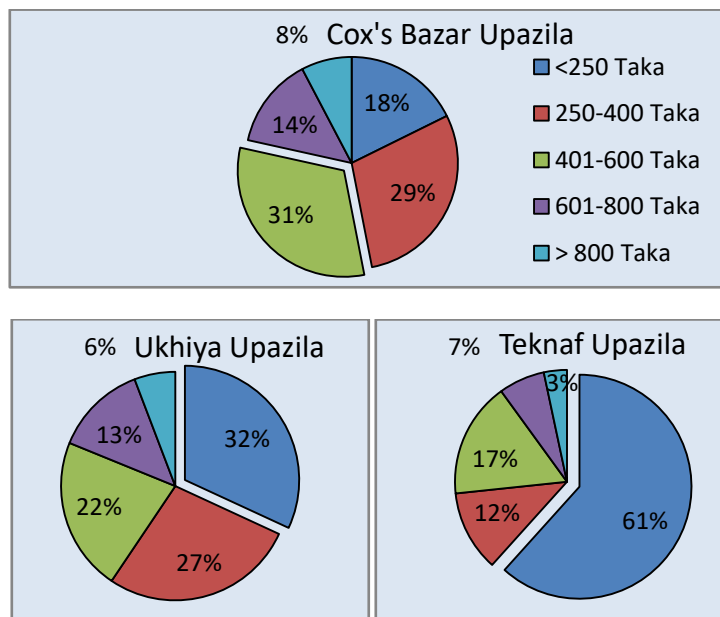


Chart 8: Income Pattern in Pie Chart

#### 4.1.9 Economic Condition

Economic conditions are the present state of affairs in the overall economy of a country or geographical region. It refers to the state of macroeconomic variables and trends in a area at a point in time. Such conditions may include GDP growth potential, the unemployment rate, inflation, and fiscal and monetary policy orientations. Following to the survey questionnaire three different regions are analyzed on the basis of their economical state. The bar chart reveals the information of their economic condition. There are five different types of economical state (i) rich; (ii) middle class; (iii) Lower middle class; (iv) poor; and (v) extremely poor. Teknaf area covers highest number of poor people while the Cox's Bazar and Ukhiya covers only 44% of representative. Meanwhile, extremely poor people shows around 18 to 23% in different religion the most reach economical condition ware observed in Cox's Bazar where are about 10% of representative shows rich economical state and Teknaf shows more extremely poor state around 19% (Figure 9).

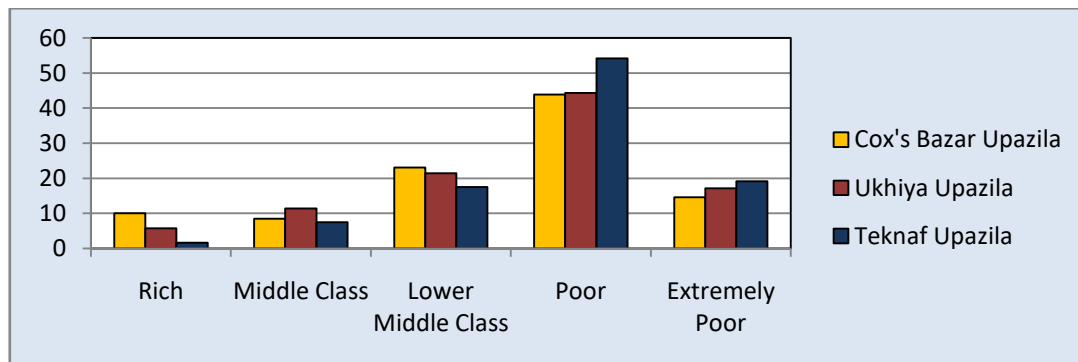


Chart 9: Economic Condition

#### 4.1.10 Earning Member

This pie chart illustrates the survey result conducted on the percentages of earning member distributed into three different areas and there are also some subgroups. The categories here include one, two, three and more than those earning members in those areas. A glance at the chart reveals that Teknaf shows more single earning member around 77% another two areas reveal 57% and 56% respectively. Less number of families is having more than one earning member around like 14%, 37% and 39% are having two earning member in Cox’s Bazar, Ukhiya and Teknaf Upazila respectively while only 4% to 9% of families showing more than two earning members (Figure 19). In column chart, number of earning member more than two are representing close to zero. Overall, the trend of more earning members inferred from the chart clears that the extended families are showing more earning member to balance their expenditure against household income (figure 10).

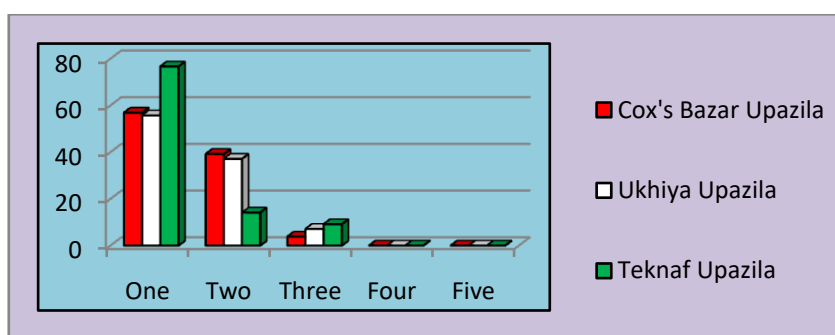


Chart 10: No. of Earning Member in Column Chart

#### 4.1.11. Sanitary facilities

Sanitary facilities mean toilets (including urinals), hand wash basins and units for the disposal of sanitary items. It represents their hygiene condition and also economical state. It was observed that sanitary conditions of the fishermen and intermediaries were very poor. Cox’s Bazar Sadar is showing the highest number of sanitation facilities while the lowest number of sanitation facilities is being shown by Teknaf Upazila. Only 10%, 13% and 28% of representative from Cox’s Bazar, Ukhiya and Teknaf Upazila respectively are living without proper sanitation facilities while most of the representative having their sanitation facilities. Though majority of the representative are showing to have sanitation facilities, the sanitation facilities is not up to the mark (Figure 11).

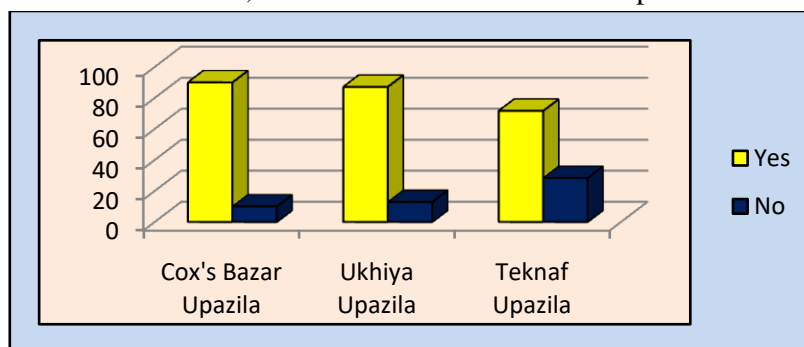


Chart 11: Sanitary Facilities in Column Plot

#### 4.1.12. Sanitary facilities type:

A sanitary facility indicates one's personal hygiene and also economical state from the above structure. We come to know that only few people having good quality of sanitation facilities. Those bar charts reveal the actual scenario of sanitation of those people in three different areas. There are only few representatives who have proper sanitary latrine. Teknaf, Cox's Bazar and Ukhiya show only 24%, 19% and 13% of sanitary latrine. In Cox's Bazar the highest number of latrine are made of bush. In Ukhiya, bamboo made latrine are also highest in number and there are huge number of earthen latrine and a few people are showing to have open field sanitation facilities (Figure 12).

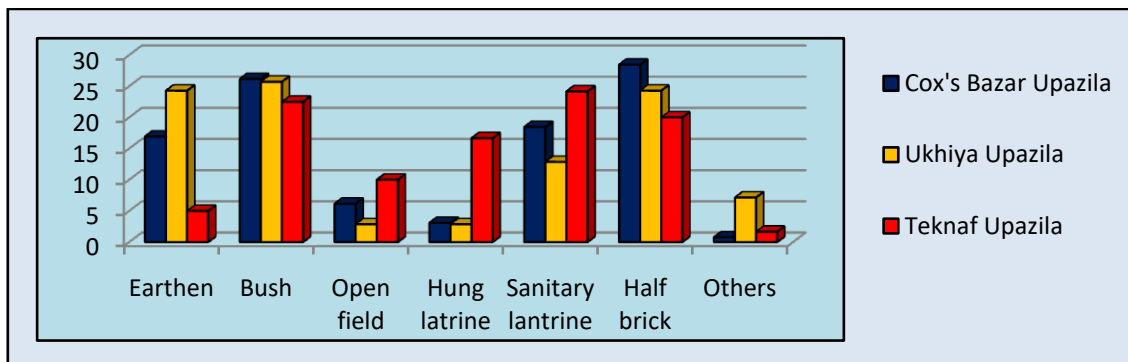


Chart 12: Sanitation type

#### 4.1.13 House Type:

Housing pattern is the indicator of one's economic capacity. The study revealed that 42% stake holders lived in houses made of bamboo with tin shed, 15% lived in Jhupri, 13% lived in semi pucca, 7% lived in Katcha and Earthen, 5% lived in buildings and only 3% in others house like as tin shad with wall or hut in Cox's Bazar. While in Ukhiya, 39% fishermen and intermediaries lived in houses made of bamboo with tin shed, 10% lived in Jhupri, 11% lived in semi pucca, 7% lived in Katcha, 9% in Earthen, 9% lived in buildings and only 4% in others. The highest numbers of tinshed with bamboo are shown in Teknaf around 56%. This area also shows 19% lived in Jhupri, 10% lived in semi pucca, 3% in Earthen and 4% lived in Katcha, hut and others (Figure 13).

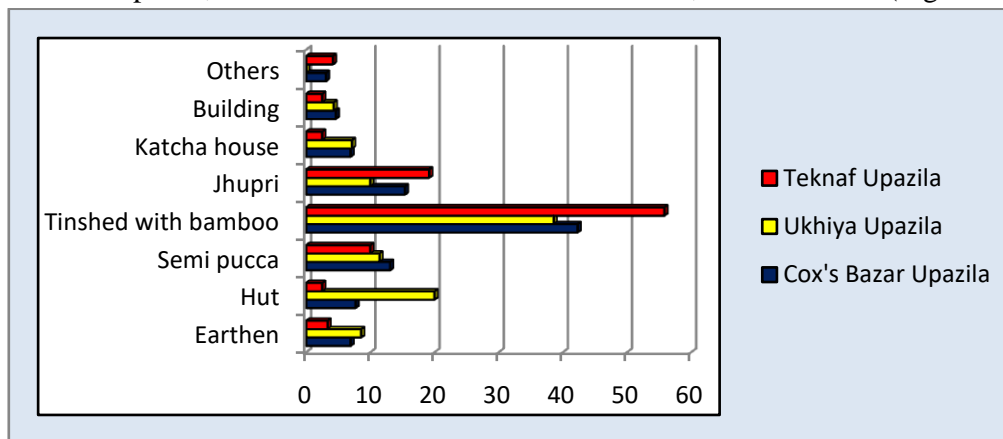


Chart 13: House Type

#### 4.1.14 Common Problem They Faced:

Artisanal fishermen are facing lots of problem now a day. I analyzed common problem faced by those fishermen such as lack of electricity, lack of education, lack of health facilities, lack of working facilities, natural disaster, lack of sanitary facilities, scarcity of food, scarcity of drinking water, insufficient government facilities, social conflict, power of muscleman and scarcity of cooking fuel. The following Pie Charts reveal the actual scenario of those problems. In terms of electricity, we found that about 34%, 29% and 37% of representatives are facing lack of electricity in Cox's Bazar, Ukhiya and Teknaf Upazila respectively. In terms of education facilities, they were showing about 44%, 31% and 25% of lacking education facilities in Ukhiya, Cox's Bazar and Teknaf Upazila. In terms of health facilities, Cox's Bazar, Ukhiya and Teknaf Upazila showed around 35%, 41% and 24% of lack of health facilities in those following areas. For working facilities, we found that around 41% of their representatives faced lack of working facilities while Cox's Bazar and Teknaf Upazila showed it around 32% and 27% of insufficient working facilities. Three areas were showing almost same response to natural disaster ranges from 30 to 38%. The highest number of lack of proper sanitation were about 47% in Ukhiya and the lowest number of sanitation facilities were around 16 % in Cox's Bazar and Teknaf showed around 37% of lack of sanitation facilities. In terms of scarcity of food, Ukhiya also showed the highest number of lack of food about 43% where Cox's Bazar and Teknaf showed around 22 and 35% respectively. For drinking water facilities, they were showing almost similar number of scarcity of drinking water ranges from 32 % to 35%. The highest numbers of social conflict were shown in Ukhiya Upazila about 51% while Cox's Bazar and Teknaf showed 19% and 30%. In terms of insufficient government facilities, those three areas showed almost similar pattern of this problem ranges from 28 to 38%. In terms of power of muscle man, Teknaf showed around 40%, the highest number of this problem while Ukhiya showed 36% and Cox's Bazar only 24% of this problem. Like the all other problems, in terms of scarcity of cooking oil, Ukhiya also showed the highest values in this sector where Cox's Bazar and Teknaf showed only few percent lack of cooking fuel (Figure 14).

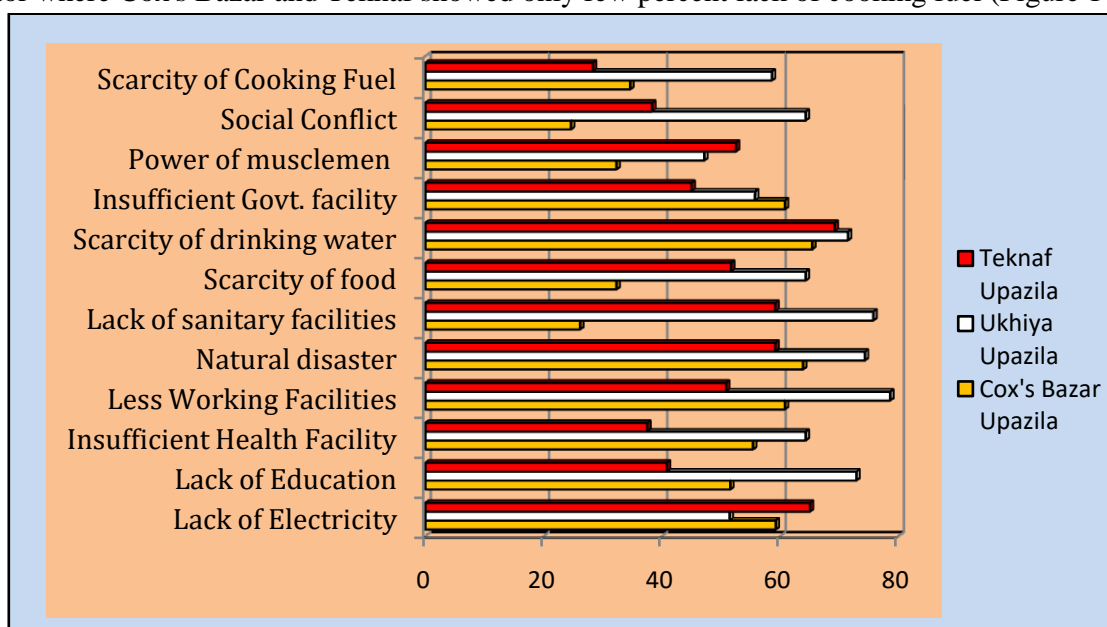


Chart 14: Common Problem They Faced

#### 4.1.15 Facilities Provided by Government

The Bar Chart reveals the actual scenario of the facilities provided by the government. In terms of facilities, I classified the facilities into different sectors like as education facilities, electricity facilities, health facilities, latrine facilities, Government support, supports from NGO, supports during calamities and drinking water facilities etc. 36% of Cox's Bazar representative were showing to have education facilities while Teknaf and Ukhiya showed 35% and 29% respectively. In terms of electricity, Cox's Bazar showed the highest number of electricity facilities about 38% while the other two state Teknaf and Ukhiya showed 32% and 30% of electricity facilities. In terms of health facilities, 36% of Cox's Bazar fisherman having health facilities while Teknaf and Ukhiya showed 30% and 34% of health facilities. Cox's Bazar, Teknaf and Ukhiya showed 43% 28% and 29% of sanitation facilities respectively. For government supports, their showed 36% 35% and 29% in Cox's Bazar, Teknaf and Ukhiya respectively. Supports from NGO varied in those three areas. It ranged from 30 to 38 %. Cox's Bazar showed the highest number of supports during the calamities about 45% while Teknaf and Ukhiya showed only 30% and 25% of supports during calamity. At last, I showed the facilities of drinking water were also varied in different areas. It was higher in Cox's Bazar than other two areas. Cox's Bazar showed 55% of having good quality water facilities from government while other two areas Teknaf and Ukhiya showed only 20% and 25% off of drinking water facilities (Figure 15)

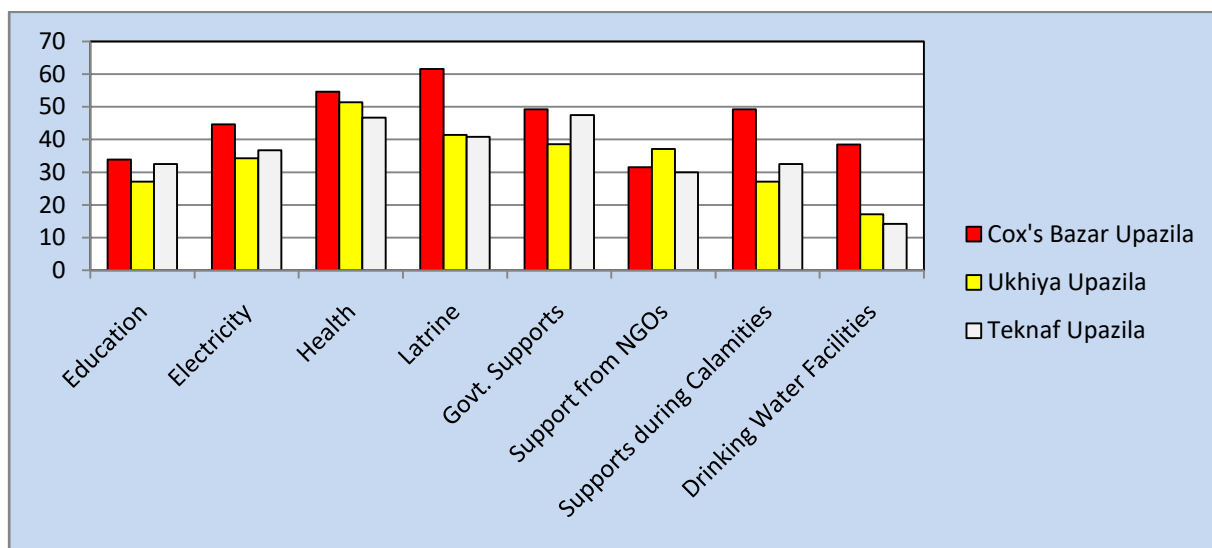


Chart 15: Column Plot of Governmental Supports

#### 4.1.16. Responsible for Risk Management

The artisanal fishermen of those areas are facing many risks in their day to day life. Different organizations are responsible for managing those risks. I categorized into four different group that are mostly responsible for Risk Management. They are government, NGOs, local community and voluntary organizations. To understand the degree of risk management of them, I also categorized for different group of their responsibility 1) higher responsibility; 2) moderate responsibility; 3) Lower responsibility and 4) no responsibility. In those three different areas government played the vital role of risk management. Government played more than a half of risk management in those three areas. in Cox's Bazar, Government covered almost 63%, in Ukhiya it covered 52% and in

Teknaf it covered 57% of risk management. NGOs are also played another Vital role where it covered almost half of the risk and it ranges from 44 % to 50%. NGOs also covered close to 50% of risks. Local community did not perform that much good in risk management it covered less in Cox's Bazar but in Ukhiya and Teknaf it played a good role. In terms of voluntary organization, it partially acted as a good risk management partner of those areas. The degree of Management and degree of responsibilities are totally varied from area to area but in most of the cases government played the most demanding and Vital role to manage all of the risk along with NGOs. The bar plot revealed the actual role of those different organization on the basis of degree of risk management (Figure 16).

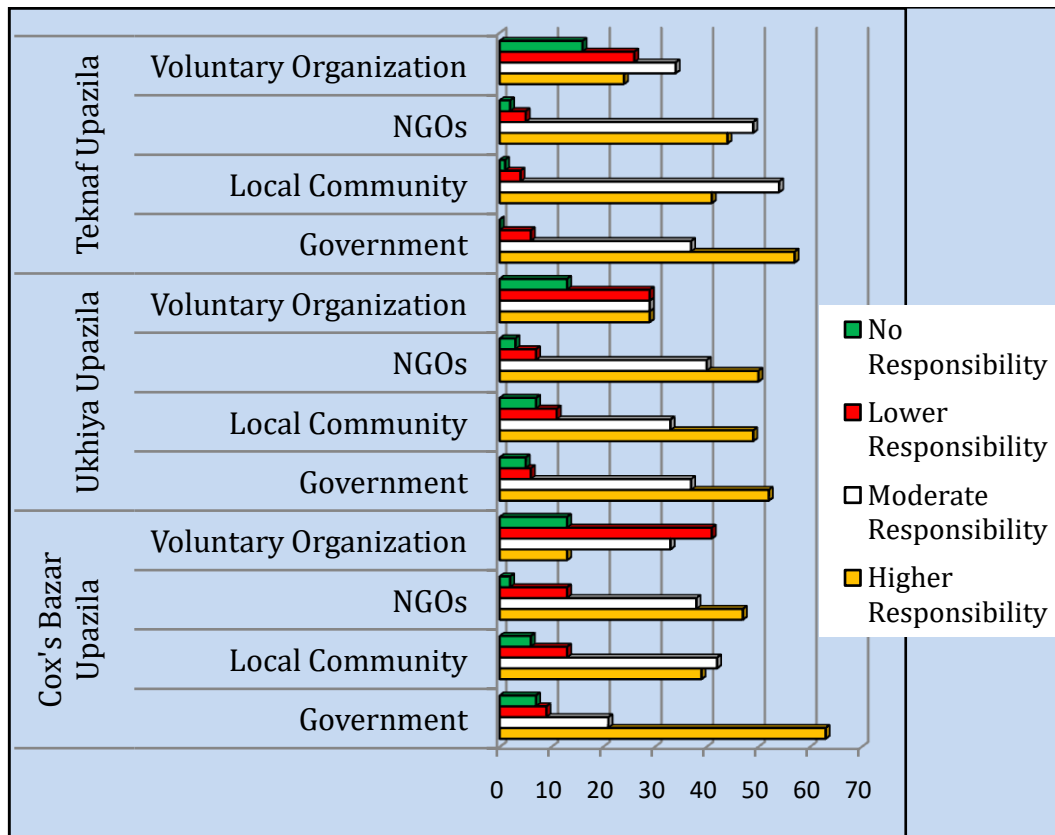


Chart 16: Responsible for Risk Management

#### 4.1.17. Alternative Profession during Different Ban Period

Our study was conducted in 2021 from January to December. In this one year period, I found two different Ban periods along with another and it was just after the pandemic ban period. So the artisanal fishermen were suffering from three different bans period (i) 65 days Ban period; (ii) Hilsha Ban period and (iii) Covid Ban period. They were been disturbed by those periods and different kind of alternative professions were choose to survive in those Ban periods. They earned their livelihood by working as a day laborer, rickshaw puller, boat maker, working in agricultural field, small businessman, working in grocery shop, fry collector or remain idle.

Those professions were varied from area to area and on the basis of different Ban period people are mostly remain idle in Hilsha ban period. As it is a very small term period near a month. People can

lead their livelihood happily in this Ban period by their savings. A small portion of fishermen are facing some troubles in this small period of Ban period. But the most of the artisanal fishermen are facing the problem of 65 days ban period. According to their saying, due to lack of subsidy or any other governmental or Non-governmental help, it was very hard for them to survive following this long period of time and it was just after the pandemic Covid pandemic Period. There were a long term of Ben period and the fishermen were prohibited to go to sea for fishing. After that people were trying to move on another 65 days ban period hampered their life a lot. The pie charts reveal the actual alternative professions were chosen by them during those kind of Ban periods. People were performing various occupations in Cox's Bazar as there are huge job facilities for those kinds of artisanal fishermen. They performed all kind of various activities in those 65 days ban period while only 23% of fishermen were remaining idle. But the alternative occupations were not very much popular in Ukhiya and Teknaf. People were idler in those areas ranges from 34 to 41%. Hilsha Ban period is really a small Ban period near a month. Most of the people are remain idle in that time more than half of the fishermen were remain idle and the highest numbers of inactive fishermen were observed in Teknaf near 70%. According to they are saying, it was pretty tough for them to survive during covid-19 period due to lack of subsidy and other necessary supplement. So, more than half people where remain inactive or were not able to find any suitable job for them. They are totally dependent upon the government subsidy E and other NGO supports only few people where try to do various kind of work to survive (Figure 17)

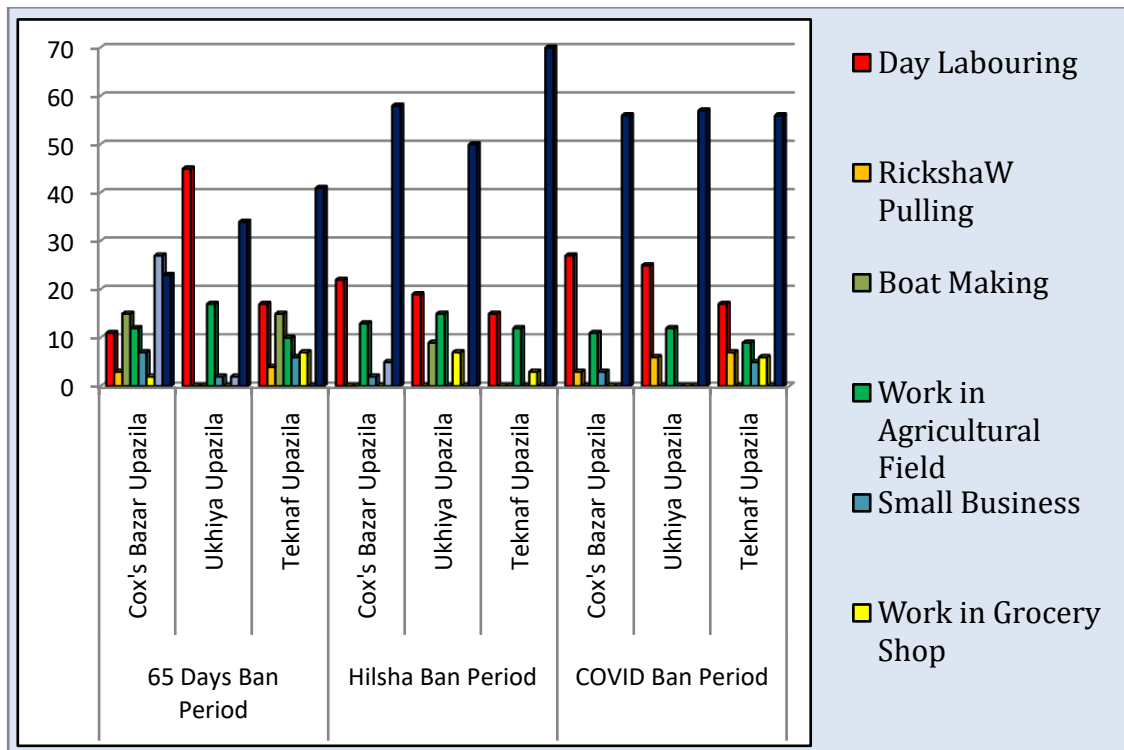


Chart 17: Alternative Profession during Different Ban Period

#### **4.1.18. Crisis They Faced in Last 12 Months:**

In my thesis work, I tried to find out the specific crisis were faced by them in last 12 month or in my study period. I find out some basic crisis were faced over the 12 months period. They were social conflict, flood, excessive rain, drought, salinity, landslides/ erosion, cyclone, less fish catch, diseases, accident, death of family member, death of earning member, divorce, lost job, theft, robbing of nets and boats by pirates, physical/mental torture, religious conflict, dowry, child/women trafficking, boat sunk, political conflict and others, I tried to classify those following crisis into 5 major categories (i) maximum occurrence, (ii) medium occurrence, (iii) minimum occurrence, (iv) rarely occurrence and (v) no occurrence. Social conflict were mostly occurred in those areas. in terms of flood and excessive rain, they also faced medium occurrence of those crisis. Drought was rarely occurred in those areas. Salinity is a great problem in those areas.

Maximum salinity were observed in Ukhiya. Landslides/erosion is also a major problem of those areas as those area are surrounded by Hills. So landslides/erosions are most commonly occurred in those areas in last 12 months ranging from 37 % to 42%. Cyclone or other types of natural disasters are randomly occurred in those areas. Less fish catch is the most major crisis for them. Due to various factors like as changing ocean current changing biodiversity the amount of fish are declining nowadays. Diseases were also played an important role in those areas. The fishermen also faced job losing during last 12 month periods. They were also been theft and some fishermen also faced Robbing of nets and boats by pirates by local thief. Physical/mental torture, religious conflict, dowry, child/women trafficking were also so occurred in those areas. They were occurred in pretty much common pattern in various ratios. Boat sunk, political conflict and other issues were also shown minimum to medium occurrence in those areas. (Figure 18).



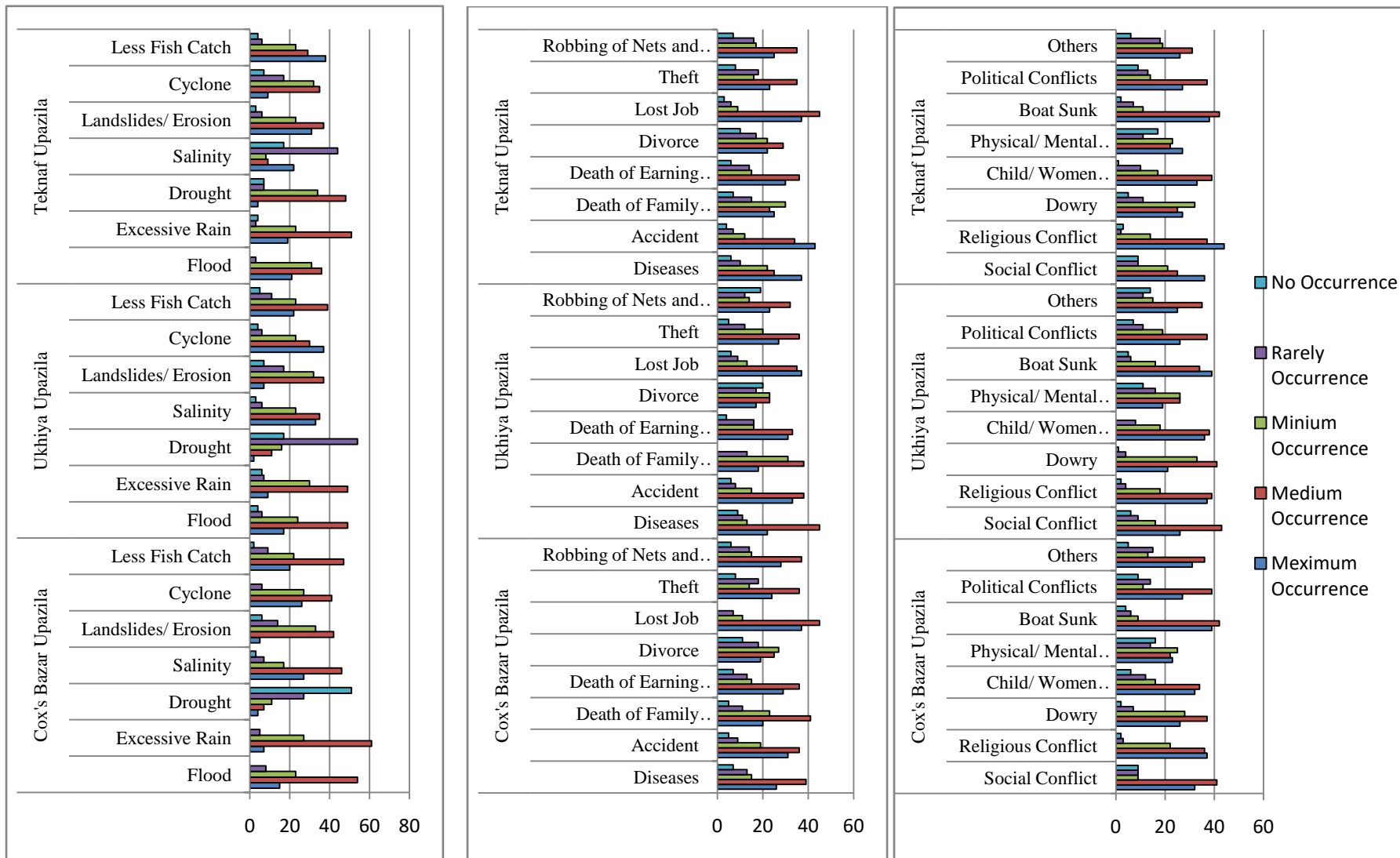
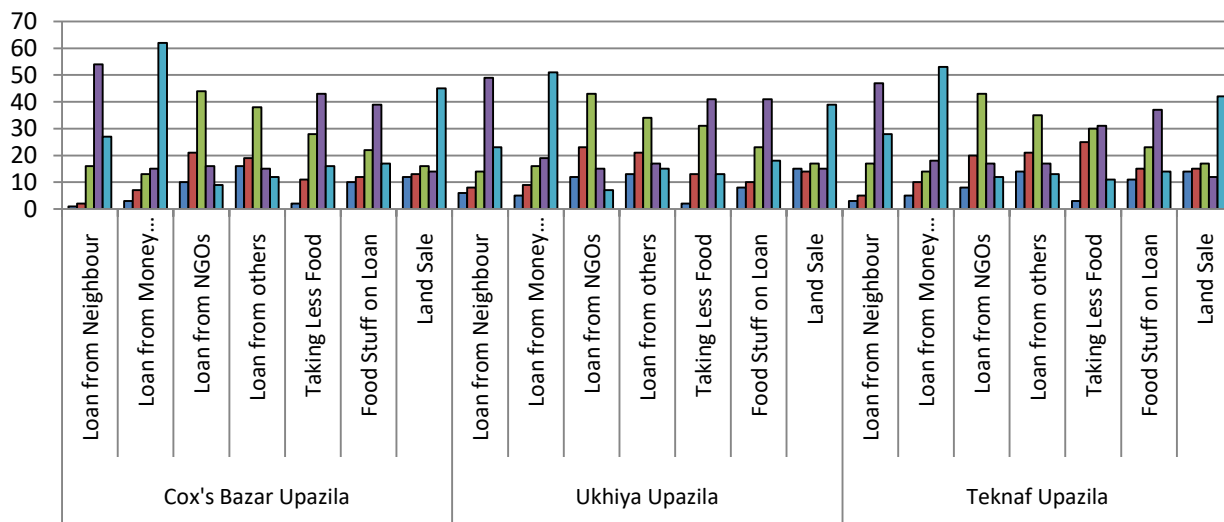


Chart 18: Crisis They Faced in Last 12 Months

#### 4.1.19. Tackling Crisis:

Fishermen are mitigating their crisis by adopting various factors like as loan from neighbors, loan from money Lender, loan from NGOs, loan from others, taking less food, food staff on loan, land sale, land lease, fishing equipment lease, fishing equipment sold, big trees sold, livestock/poultry sold, excessive physical labour, gold or other valuable item sale, use of savings, child labour, home state land sell, bagging, displacement/migration, change of profession and by others. Fishermen were more prone to take loan from neighbors, money Landers or from other sources to fight against their problems. They would like to take loan randomly. They used to take loan from neighbors close to 47 to 54% for minimum use. They also took loan from neighbors in maximum way. Money lenders are very much available in Cox's Bazar. So people would like to take loan from money lender in Cox's Bazar close to 62% in maximum way. Loans from NGOs or others were varied from area to area and also from the availability of those NGOs or other sources. People were prone to take less food stuff to mitigate their crisis. They showed 32% to 45% of taking less food in medium use while 11% to 16% were taken in maximum use. Land sale was used as maximum level to mitigate this crisis. In Cox's Bazar and Teknaf Upazila, the fishermen of those areas were prone to sale their land more than Ukhiya. The bar chart and Pie charts and Pie Charts are clear evidence of those data (figure 37 and 38). In terms of land lease, fishing equipment lease, fishing equipment sold or big trees sale, they showed a wide variety of intentions of those criteria medium use. Those factors were very much common to all fishermen. Land lease and fishing equipment lease were occurred in maximum way in Cox's Bazar and Ukhiya while fishing equipment lease were also done in maximum way in three distinct areas simultaneously. The pie chart and column diagram also reveals that information (Figure 39 and 40). Livestock poultry sold, physical labour, gold or other valuable items sale were also pretty much common to the fishermen to mitigate those crises. They were mostly used those as medium pattern. Use of savings, child labour, home state land sell and bagging were also seen to be occurred in those areas. There were close to no bagging intentions of those fishermen. Use of savings was the most common occurring incidents to tackle the crisis. child labour and homestead land sale along with displacement migration, change your profession are also seen to be occurred to mitigate all of those following crisis mentioned via above the pie chart and bar diagram (Figure 41 and 42).



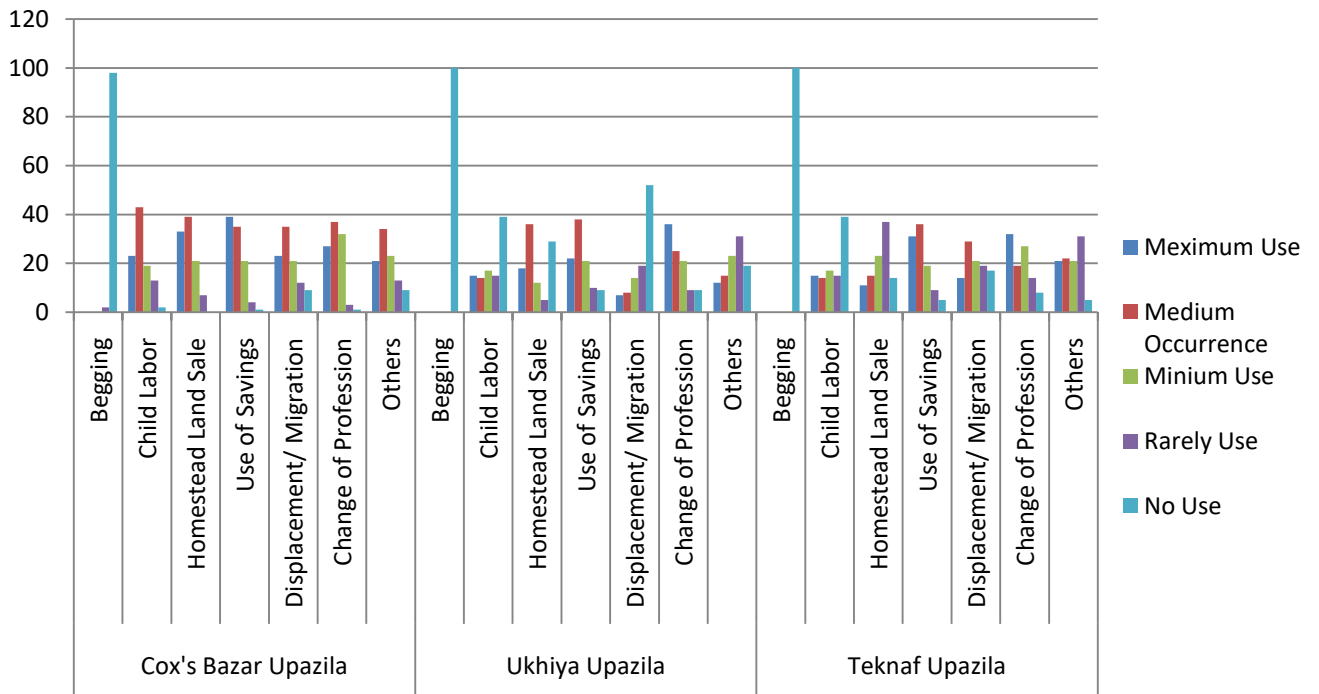
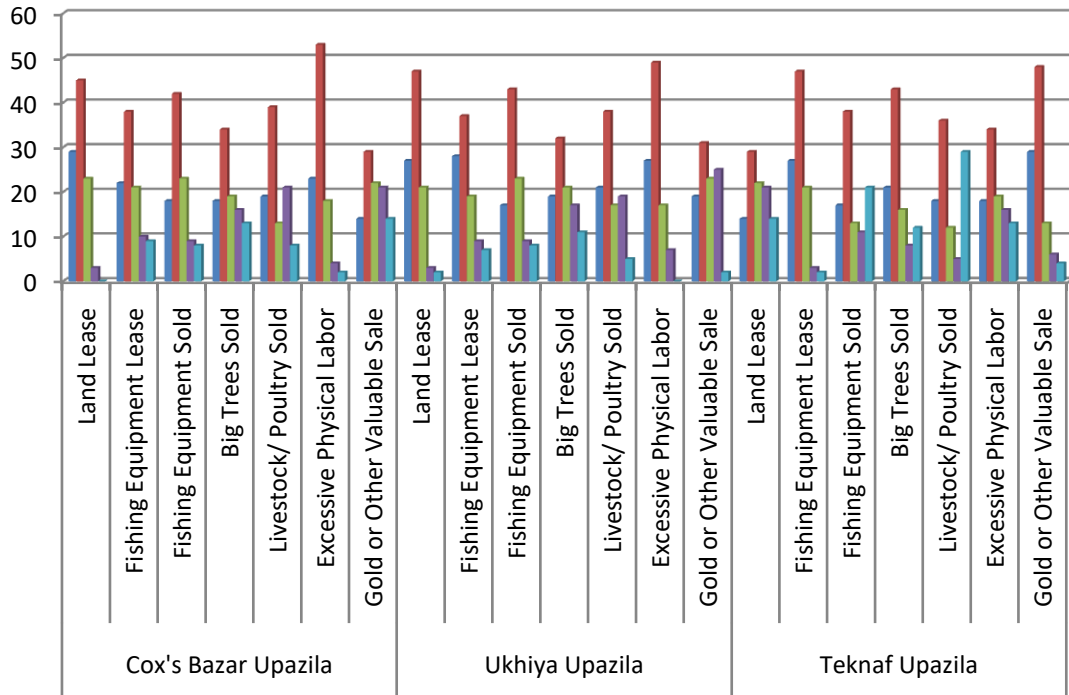


Chart 19: Tackling Crisis

## **4.2 Part B.**

### **Fishing Gears, Crafts, Available Fish Species and Catch Composition:**

Depending on the fish species, their compositions, and their ways of operation, there were basically three types of nets found to operate out of Cox's Bazar. Estuaries were the primary use-case for these instruments, which also included Marine Set Bag Nets, Trammel Nets, and Gill Net (LMD). On open water, they were occasionally referred as Large Mesh Drift.

#### **4.2.1 Commonly Used Fishing Nets:**

On the basis of net, there are variations in species composition, mesh size, depth, length, and capture width. The assortment of nets comes in a variety of styles, each with a distinct mesh size, depth, length, and capture species composition.

##### **1. Maitta Jal:**

Maitya fish, commonly referred to as Indian mackerel, was largely collected with a particular form of net called a maitta jal or maitya jal (*Rastrelliger kanagurta*). Another type of fish, the Churi or Small head Hair tail fish, was also caught using the net (*Eupleurogrammus muticus*). The net measured around 2000 meters in length and 16 meters in width. Between 4.15 and 4.25 inches is the mesh size. The net was made of cotton twine. To operate the net, 6 to 8 workers are often needed.

##### **2. Hangor (Shark) Jal:**

Long net used for drifting, with one edge attached to the boat. The name implies that hangor was captured using a net (sharks). The length of the net ranged from 2500 to 3000 meters, with a width of 12 meters. The mesh size exceeded the typical 12 inches. It took 15 to 20 people to handle the net. Although several shark species were caught using the net, Star Spotted Smooth Hounds (*Mustelus manazo*) were the most commonly reported because of their great economic value. Other species include the Leopard Stingray (*Himantura undulate*) and the Lakhua (*Leptomelanosoma indicum*).

##### **3. Trammel Net:**

Other names for them were trammel nets and three-layered pocket nets. Trammel nets were three-paneled bottom-set gill nets with an outer and inner loose panel with a mesh size of 265 mm and 2.25 m, respectively (50 mm). These nets were controlled by a non-mechanized, open, wooden dinghy boat that was 8 to 10 meters long. With the use of sinks and floats, specialized bottom gill nets known as trammel nets were lowered to the ocean floor. There were mainly two types of trammel nets to be found in Cox's Bazar's sampling regions. They were called Tong Jal and Pondora Jal, respectively.

#### **4. Pondora Jal:**

Pondora Jal was not employed as regularly as other nets. The 350-meter length and 8-meter width of the net were also measured. The mesh was only 1.5 inches wide. Small-sized fish and shrimp were caught with the net. Six to eight guys were needed to run the net.

#### **4. Tong Jal:**

Tong Jal was a very tiny kind of net, measuring about 10 meters long and 6 meters broad. The mesh size of the net was 3–4 inches. With this net, most estuary rivers were used. Only one or two men may operate the net. Additionally, a medium-sized Hilsha Shad was caught using this net.

#### **5. Ilish Jal:**

The name of the particular type of net known as Ilish Jal was derived from the primary species that was caught, the hilsha fish. The net was made from cotton twine. Both in terms of length and width, this net was huge. The length of the net is between 1250 and 2500 meters. Its width ranged from 10 to 25 meters. When compared to Vasha jal and Ton Jal, the mesh size of the net was medium, measuring between 3-3.5 inches. Seven to ten fishermen were needed to run each net.

#### **6. Vasha Jal:**

Primarily used to catch Hilsha Shad, the Vasha Jal is a rectangular-shaped net (*Tenulosa ilisha*). The net had a 4-4.5 mesh size, was 20–25 meters in width, and was composed of white cotton thread. This net measures 42-45 meters. To handle this net, it needed five to six guys. The majority of relatively small vessels use this net. Along with Hilsha fish, other species including Croakers and Pomfrets were also caught in the net.

#### **7. Cast net (Jhaki jal):**

In remote areas of water, cast nets are operated from land. Conical net's top is secured with a strong rope. Several iron or lead weights are attached along the edge. Holding the rope in one hand, the fisherman gently tosses the net over the water, forcing it to settle fully stretched on the water's surface. Due to weights tied to the margin, the net steadily falls to the bottom while becoming entangled with a variety of fish, including immature seabass and prawn. The net is pulled with the aid of rope.

#### **8. Ton Jal:**

Ton Jal was a smaller hilsha capturing net made of cotton thread than Vasha Jal. It is 7 to 10 meters deep and 12 to 15 meters long. The mesh size of the net is 2.5–3 inches. The hilsha, which are normally little fish, were also caught in the net. A fishing boat is used to operate one net. Three to four guys were required to handle the net. This net is mostly used for education in the estuary area. Rita (*Rita rita*) and Bata were found in the net (*Liza subviridis*).

#### **9. Moda Jal:**

This specific type of net was made with broad cotton thread. In general, the net only netted separate fish species. Lakhua and Lined Silver Grunter (*Pomadasys hasta*) were these

(*Leptomelanosoma indicum*). The length varied between 400 and 500 meters, and the breadth was 12 meters. The mesh had a diameter of 12 inches. 10 to 15 people were involved in running the net.

#### **10. Marine Set Bag Nets (MSBNs):**

In deeper waters, marine set bag nets, or MSBNs, are employed. In the region, the nets were referred to as Behundi Jal. These had dimensions of 8–40 m in length, 5–30 m for the opening mouth, and 12–25 mm for the cod end mesh. Both mechanized and non-mechanized crafts employ MSBNs. In non-mechanized boats, smaller nets were used, and vice versa. Pre-adults and adults made up the majority of the fish and shrimp species that MSBN captured. Loitya (Bombay duck), Chingri (Shrimp), Poa Mach (Goatee Croaker), and many more species of animals were caught in the nets.

#### **11. Lakkha Jal:**

The name Lakkha Jal was inspired by the main species Lakhua that was captured. The net was created with 60-inch-long cotton thread. The net measured 5000 meters in length and 12 meters wide. The mesh was 12 to 16 inches in size. From 8 to 10 tons for the smallest catch to 30 to 100 tons for the largest, the catch varied. The net was left in the open water to drift for around 5 to 6 hours. Although the placement merely takes an hour, the hauling of the net takes more than 10 hours. 20 to 22 men were needed to handle the net (Casting and Hauling). Other species of every type were also trapped in the net together with the Lakhua.

#### **12. Lal Jal:**

Cotton yarn in red was used to make the net. The largest net measured 10,000 meters in length and 15 meters in breadth. The larger mesh size was between 4 and 8.5 inches. The larger mesh size was between 4 and 8.5 inches. The carrying capacity of the Pondora Jal and Tong Jal net was up to 100 tons. Depending on Lakkha Jal, the catch varies. 22 men were needed to run the net. Both the lugging and the setting up of the nets take more than 10 hours. The net's main target species was Hilsha Shad (*Tenulosa ilisha*). But several other species were also trapped in the net. Examples that were pertinent were Indian Mackerel, Chinese Pomfret, and Moon fish, Ribbon fish, Goatee Croaker and Bombay Duck etc., among others.

#### **13. Char Shuta Jal:**

The Char Shuta Net was another hilsha catching net. In the Ghat, one of the biggest nets was found. The net had a length of 10,000 meters and a width of 12 meters. The mesh was 2.5–3 inches thick. The hauling time and place were the same as in Lal Jal. There was no change in the carrying capacity. The net was made of white twine. There were roughly 18 to 20 men running the net. The same species that Lal Jal caught were also caught together with hilsha.

#### **14. Koral jal (Gill net):**

To catch seabass, local fisherman in the Cox's Bazar area developed the Koral jal, a modified version of the massive meshed gill net. Along the vertical wall of the net, a mesh hole is positioned

in a straight line for entangling adult seabass. Many different parts are joined together to form long nets. The floats and sinkers are attached using plastic ropes that are also used as head ropes and weight.

**15. Behundi jal (Set bag net):**

A behundi jal is a net with two extensions that has a conical form. Traditionally, nylon ropes that have been knotted are used to create the net. The mouth of the net is extended and fastened to the tide using iron, wood, or bamboo. Fish are contained in the net's center pouch.

**16. Thella jal (Push net):**

This bamboo net, also known as Fenni jal, has a modest mesh size and a triangle frame. Lagoons and the shallow outside edges of floodplains are where it is most frequently employed. It is scooped out of the water after being lowered into it. Prawns, small fish, and fish fry are caught with the mosquito net-based net.

**17. Kukuru jal (Drag net):**

In seaside locations, a kukuru jal, or fine mesh density seine net, is widely used. Two bamboo poles are attached to the net's ends. The plastic floats are fastened with the top rope. The two fishermen operating the net hold the bamboo upright.

**18. Tana Ber jal (Shore Seine net):**

In coastal or beach locations, a fine-meshed seine net known as a "ber jal" (Fig. 2e) is usually used. Once this net has completely encircled the region of the water body, the fish are then caught by dragging up the ground rope from the center of the water.

**19. Char Ghera jal (Set Barrier net):**

Char ghera jal is used to catch fish from accreted river banks that are submerged at high tide. Wooden poles are inserted into the soil bed at a distance of three to four feet in order to support the net during high tides.

**Seasonality of Different Nets:** Seasonal variations affect how different nets are used. Using an Illish net during Hilsha Shad season was a given. The use of various nets during various seasons is described by the seasonality map shown below (Table 5).

Table 1: Seasonality map of different nets

	J	F	M	A	M	J	J	A	S	O	N	D
Ilish Jal			■	■		■	■	■	■	■	■	
Lal Jal						■	■	■	■			
Lakkha Jal	■	■	■	■	■	■				■	■	■
Char Shuta Jal		■	■	■		■	■	■	■	■	■	
Behundi Jal	■	■	■	■	■	■	■	■	■	■	■	■
Hangor Jal	■	■	■	■	■	■	■	■				
Moda Jal	■	■	■	■	■	■						
Ton Jal					■	■	■	■	■	■	■	
Vasha Jal					■	■	■	■	■	■	■	
Current Jal	■	■	■	■	■	■	■	■				

**Some Minor Nets:**

Other small forms of nets were present in the sample sites. These nets were mostly used as side netting in the boats. Their efficiencies were quite good, notwithstanding the uncertainty of their mesh sizes.

1. **Current Jal:** This kind of nylon twine net normally measures 25 meters in length and 5 meters in breadth. The mesh size is relatively modest to accommodate fish of various sizes. The bulk of those fish, including Edur Leizza (*Coryphaenoides woodmasoni*), Hilsha (*Tenualosa ilisha*), Nailya (*Dussumieria acuta*), Loittyia (*Harpadon nehereus*), and Nailya (*Tenualosa ilisha*), are collected in nets with various mesh sizes (Encyclopedia of Flora and Fauna of Bangladesh- Marine Fishes, 2009).
2. **Baba Jal:** The net is between 150 and 250 meters long, with a diameter of around 4 meters. The mesh size was typically 3 inches. The net was made of "Nali Shuta," a very fine thread. The main species that are caught in this net include Hilsha (*Tenualosa ilisha*), Nailya (*Dussumieria acuta*), Loittyia (*Harpadon nehereus*), Edur Leizza (*Coryphaenoides woodmasoni*), Phaisa (*Thryssa mystax*), and Churi (*Eupleurogrammus mulicus*). Marine Fishes: An Encyclopedia of Bangladeshi Flora and Fauna, 2009).
3. **Chikon Jal:** Part of this is "Nali Shuta." The length of the net is from 900 to 1000 meters, and its width is around 7 to 8 meters. The mesh is 4 inches in size. It may be used by several creatures, including Kata Machh (*Arius arius*), Chapa (*Scomberoides commersonianus*), Maittya (*Rastrelliger kanagaruta*), and others. (Marine Fishes, 2009; Encyclopedia of Flora and Fauna of Bangladesh).



Table 2: Different Nets Based on Their Operation

Different Nets based on their Operation	Net Local Name	Cost (BDT)	Mesh Size (cm)	Life span (Yrs)	Fish size & Season	No. of Fishermen needed	Species Caught
Large Mesh Drift Gill Nets	Vasha Jal	2 lacs	4-4.5	2-5		5-6	Illish
	Ton Jal		2.5-3	5-6		3-4	Illish, Rita, Bata, Chepta Bailla
	Koral Jal	1.5-1.8 lacs	15 cm	8-10	Adult, March to May	8-10	Asian seabass
	Illish Jal		3-3.5	5-10		7-10	Illish
	Lakkha Jal		12-16	5-7		15-20	Lakkha/Lakhua, Datina, Ranga Chokkha, Chapa, Modhu Guizza, Med Gada/ Medha, Chembali, koral, Ranga Koi, Hangor, Kamot, Haush, Maitta, Tuna Machh
	Lal Jal		4-8.5	6-7		3-4	Illish, Maitta, Rupchanda, Tekhchanda, Gorachanda, Akali Chanda, Churi, Poa, Tak Chanda, Ranga Koi, Chulerdandi, Loitty, Hangor, , Kamot, Haush, Choukka Hangor, Talia, Burum Maitta, Shurma Maitta, Rocket Maitya
	Maitta Jal		4-4.15	2-3		6-8	Maitta, Churi, Chotpoti
	Hangor Jal		12	1-3		15-20	Hangor, Kamot, Lakkha/Lakhua, Titamarmari, Haush, Saplapata

	Moda Jal		12			10-15	Datina, Lakkha/Lakhua
	Char Shuta Jal		2.5-3			15-20	Illish, Maitta, Rupchanda, Tekhchanda, Gorachanda, Akali Chanda, Churi, Poa, Tak Chanda, Ranga Koi, Chulardandi, Loitty, Hangor, , Kamot, Haush, Choukka Hangor, Talia, Burum Maitta, Shurma Maitta, Rocket Maitya
Trammel Net	Pondora Jal		1.5			6-8	Chulardandi
	Tong Jal		3-4			1-2	Illish
Marine set bag nets (MSBNs)	Behundi/ Bendi Jal	1,00,000- 1,50,000	Not definite	4-5 years	Juvenile Sept. to Dec	2-6	Loiitty, Chingri, Poa, Seabass
Push net	Fenni jal/ Thela jal	200-1000	0.5	Up to 3 years	Larvae/ Juvenile Monsoon	1	Multi-fishery
Cast net	Jakhi jal	5000 to 10000	0.6 to 1.25	1-3 years	Juvenile All seasons	1	Multi-fishery
Drag net	Kukkuru jal	10,000	1.0-2.0	3-4 years	Juvenile, Sept. to Dec.	2	Multi-fishery

Shore seine	Tana Berjal	10,000	1.0-2.3	3-4 years	Juvenile, Sept. to Dec	8-12	Multi-fishery
Stake net	Char ghera jal	80,000 - 1,00,000	0.8-1.0	4-5 years	Adult/ juvenile Sept. to Dec.	1-2	Multi-fishery
Single hook & line	Mela Barshi	300-500	Monofilament	Varies	Adult/ Adult, pre Aug.- March	01	Asian seabass
Long line (2000-3000 hook)		50,000 - 60,000	5-6 Nos Steel hook	4-5 years	Adult, pre/adult Sept.- March	10-12	Multi-fishery

#### **4.2.2 Fishing crafts used for harvesting the fish in Bangladesh:**

This investigation revealed that there are no production statistics for Bangladesh, despite Asian fish being a highly coveted and well-liked coastal species there. The marine fish is a well-known and enticing species to all fishermen due to its high market value. The market price is influenced by body weight. As a result, Bangladesh's fish populations are under a lot of fishing pressure. In the focus group discussion, the fishermen and traders asserted that the primary reasons for Bangladesh's declining fish supply were overfishing and habitat loss brought on by severe sedimentation. Bangladesh mostly used automated techniques and gear to catch Asian fish. In Bangladesh's coastal and offshore seas, wooden boats were used to catch fish instead of more traditional gear like dugout canoes and bamboo rafts. Fish are generally harvested in Bangladesh utilizing various types of fishing vessels from the coastal and offshore areas.

**4.2.2.1 Non-mechanized artisanal fishing boat:** These boats are covered by wooden or bamboo frames. Smaller boats are used in coastal rivers, canals, and estuaries (such the Kosha and Dingi nauka). A kosha nauka is a common, inexpensive rural boat with a flat bottom and half-split bamboo decking. fishing in tiny tidal rivers and canals. It is propelled by long oars or bamboo poles. A dingi nauka is a small rowboat. Most common and popular in Bangladesh. Sell at a discount. The hull of this small, pointed-bow boat is supported by ribs and cross beams. The decking and the hulls are both made of wood. One or more fisherman row with long oars and/or a sail.

**4.2.2.2 Motorized country boats and dingi boats:** Commercial fishing primarily uses medium-sized vessels. Transporting caught fish is another purpose for these vessels. Powered Dingi, Sampan, and Balam boats, for instance. Similar in construction and design to non-mechanized Dingi, motorized Dingi boats are larger in size and driven by marine engines. Cox's Bazar and the Teknaf area are home to the crescent-shaped boats known as sampan fish boats. Front head of Sampan is lofty and curved, while backside strait. These Sampans, which are medium-sized fishing boats now, were once permitted to sail in any direction with the tide but had to come back with the following. The fundamental purpose of the form has been lost with the development of the marine engine. Balam fishing boat's bow and stern are slightly elevated. The sides are constructed by attaching boards to the hull's dug-out section. These automated boats may be used all year round and with any sort of equipment.

**4.2.2.3 Wooden Fishing Vessel:** The trawlers, as seagoing automated fishing boats are known locally, are built from the best planks and contain a cabin, a kitchen, and restrooms. These fishing boats have to be licensed by the Mercantile Marine Department and are outfitted with the required lifesaving gear. They may retain the catch fish in their insulated cold storage facilities for up to 15 days. These large boats are available in a range of sizes.

Table 3. Fishing boats used for fish harvesting in coastal areas of Bangladesh

Boat name	Size (m)			Bottom (shape & type)	Engine Power	Carrying capacity	Man power	CPUE of the Boat	Life span	Gear used
	Length	Width	Depth							
Wooden Fishing Vessel	11-18	3-4	2-3	Rounded, Advance motorized	20-45 HP	10-15 tons	10-20	2-4 fish/haul/day	10-12 Yrs.	Gill net, SBN, Purse seine
Balam boat	10-15	3-4	2-3			10 Tons	8-10	1-3 fish/haul/day	8-10 Yrs.	Gill net, Drift net Long line
Crescent Shape Sampan	8-10	2-2.5	1-2	Rounded, Mechanized	20-36 HP	NA	8-10	1-2 fish/haul/day	8-10 Yrs.	Seine net Gillnet
Dingi nauka	5-6	2-2.5	1	Rounded, Mechanized	18-20 HP	NA	6-8	2-6 juvenile fish/haul/day	7-8 Yrs	Seine net, ESBN
Dingi nauka	6-7	1.5-2	1	Rounded, Non-mechanized	NA	NA	1-2	3-4 fish/day	5-6 Yrs	Hook & line, Stake net
Kosha nauka	6-7	1.5-2	1	Flat, Primitive	NA	NA	1-2	1-2 fish/ day	4-5 Yrs.	.Hook & line, ESBN

#### 4.2.3 List of Fish (Table 4):

Sl. NO.	Local name	Scientific identity	Common name	Cox's Bazar		Ukhiya		Teknaf	
				Monsoon	Winter	Monsoon	Winter	Monsoon	Winter
1	Coral, Vetki	<i>Lates calcarifer</i>	sea bass, Barramundi	C	A	C	A	C	A
2	Baila, Chewabele	<i>Apocryptes bato</i>	Gobi mudskipper	F	C	F	C	F	C
3	Bangada	<i>Atropus atropos</i>	Cleftbelly trevally	F	A	F	A	F	A
4	Bishtara	<i>Drepane longimana</i>	Sickle fish	F	A	F	A	F	A
5	Boiragi / Olua	<i>Coilia dussumieri</i>	Gold spotted grenadier anchovy	C	A	C	A	C	A
6	Boiragi / Olua	<i>Coilia neglecta</i>	Neglected grenadier anchovy	C	A	C	A	C	A
7	Chamila	<i>Gonialosa manmina</i>	Ganges river gizzard shad	C	A	C	A	C	A
8	Champa	<i>Rastrelliger kanagurta</i>	Indian Mackerel	C	A	C	A	C	A
9	Char bele	<i>Platycephalus indicus</i>	Indian flathead	C	A	C	A	C	A
10	Chewa	<i>Trypauchen vagina</i>	Burrowing goby	C	A	C	A	C	A
11	Churi	<i>Lepturacanthus savala</i>	Savalaihairtail	C	A	C	A	C	A
12	Dahuk	<i>Boleophthalmus boddarti</i>	Blue-spotted Mudskipper, Boddart's goggle-eyed goby	C	A	C	A	C	A
13	Fatra	<i>Raconda russeliana</i>	Smooth back herring	C	A	C	A	C	A
14	Folichanda	<i>Pampus argenteus</i>	Silver or white pomfret	C	A	C	A	C	A

15	Gogo/ borguni	<i>Terapon jarbua</i>	Jarbuaterapon	C	A	C	A	C	A
16	Goru mash	<i>Dussumieri aacuta</i>	Rainbow sardine/ Common sprat	C	A	C	A	C	A
17	Guizza	<i>Netuma thalassina</i>	Sea cat fish	C	A	C	A	C	A
18	Hangur	<i>Carcharias dussumieri</i>	White cheek shark	A	A	A	A	A	A
19	Haturihangur	<i>Eusphyra blochii</i>	Hammer headed shark	F	C	F	C	F	C
20	Hundra, Tulardandi	<i>Sillaginopsis panijus</i>	Flathead silago	C	A	C	A	C	A
21	Ilisha	<i>Tenualosa ilisha</i>	Hilsa shad, Hilsa	C	C	C	C	C	C
22	Kamila	<i>Congresox talabonoides</i>	Indian pike conger	F	C	F	C	F	C
23	Kharu	<i>Pisodonophis boro</i>	Rice-paddy eel	C	A	C	A	C	A
24	Kuchia	<i>Monopterus cuchia</i>	Cuchia	F	C	F	C	F	C
25	Kukurjeeb	<i>Cyanoglossus cyanoglossus</i>	Bengal tongue sole/ tonguefish	C	A	C	A	C	A
26	Kukurjeeb	<i>Cyanoglossus lingua</i>	Long tongue sole	C	A	C	A	C	A
27	Kukurjeeb	<i>Cyanoglossus arel</i>	Large scale tongue sole	F	C	F	C	F	C
28	Kukurjeeb	<i>Plagusia blochii</i>	Tongue sole	C	A	C	A	C	A
29	Lakkha	<i>Eleutheronema tetradactylum</i>	Blunt-nosed salmon, giant threadfin	F	A	F	A	F	A
30	Lakkha	<i>Leptomelanosoma indicum</i>	Indian threadfin	C	A	C	A	C	A
31	Lalpoa/ Vola fish	<i>Pennahia argentata</i>	Silver jaw fish	C	A	C	A	C	A
32	Loitta	<i>Harpadon nehereus</i>	Bombay-duck	C	A	C	A	C	A

33	Maittya	<i>Scomberoides guttatus</i>	Indo-Pacific king mackerel	C	A	C	A	C	A
34	Nunabaila	<i>Acentrogobius cyanomos</i>	Gobi	C	A	C	A	C	A
35	Phasa/ Moduphasa	<i>Setipinna phasa</i>	Scaly hairfin anchovy	C	A	C	A	C	A
36	Photo poa	<i>Lutjanus erythropterus</i>	Crimson snapper	C	A	C	A	C	A
37	Poa	<i>Johnius carutta</i>	Karut croaker	C	A	C	A	C	A
38	Poa	<i>Johnius belangerii</i>	Belanger's croaker/ Jewfish	C	A	C	A	C	A
39	Poa	<i>Johnius dussumieri</i>	Sin croaker	C	A	C	A	C	A
40	Poa, Jewfish	<i>Panna microdon</i>	Panna Croaker	C	A	C	A	C	A
41	Poa, Large fin poa	<i>Johnius macropterus</i>	Big-snout croaker/ Large-	C	A	C	A	C	A
42	Potka	<i>Chelonodon patoca</i>	Milkspotted puffer	C	A	C	A	C	A
43	Pungus	<i>Pangasius pangasius</i>	Pangas catfish	F	C	F	C	F	C
44	Raja chewa	<i>Odontamblyopus rubicundus</i>	Red eel goby	C	A	C	A	C	A
45	Rupchanda	<i>Pampus chinensis</i>	Chinese silver pomfret	C	A	C	A	C	A
46	Saplapata	<i>Dasyatis zugei</i>	Pale-edged Stingray	C	A	C	A	C	A
47	Sea mola	<i>Stolephorus indicus</i>	Indian/ Hardenberg's anchovy	C	A	C	A	C	A
48	Surma	<i>Thunnus albacares</i>	Yellow fin tuna, Yellow finned albacore	C	C	C	C	C	C
49	Surma	<i>Auxis thazard</i>	Frigate tuna	C	A	C	A	C	A



50	Taposi	<i>Polynemus paradiseus</i>	Paradise threadfin	C	A	C	A	C	A
51	Tulardanti	<i>Sillaginopsis domina</i>	Gangetic Sillago	C	A	C	A	C	A

#### 4.2.4 List of Shrimp (Table 5)

SI. NO.	Local name	Scientific identity	Common name	Cox's Bazar		Ukhiya		Teknaf	
				Monsoon	Winter	Monsoon	Winter	Monsoon	Winter
1	Bagda chingri	<i>Penaeus monodon</i>	Giant tiger shrimp	A	A	A	A	A	A
2	Bagda chingri	<i>Penaeus japonicus</i>	Shrimp	A	A	A	F	A	A
3	Baghatara chingri	<i>Parapenaeopsis culptilis</i>	Rainbow shrimp	C	F	C	F	C	F
4	Brammhani chingri	<i>Macrobrachium dolichodactylus</i>	Golda river prawn	C	C	C	C	C	F
5	GuraIcha	<i>Macrobrachium mirabile</i>	Short leg prawn	F	C	F	C	F	C
6	Harina Chingri	<i>Metapenaeus monoceros</i>	Brown Shrimp	A	C	A	C	A	C
7	Honni chingri	<i>Metapenaeus brevicornis</i>	Yellow shrimp	C	F	C	C	C	C
8	Karnafuli chingri	<i>Palaemon karnafuliensis</i>	Karnafuli shrimp	C	F	C	F	C	F
9	Sada icha	<i>Penaeus semisulcatus</i>	Green tiger prawn	A	A	C	A	A	A
10	Siberian icha	<i>Exopalaemon styliiferus</i>	Roshna prawn	A	C	A	C	A	C

\*Here: Abundant (A) – a lot of or plenty, Common (C) - frequently available, Few (F) – present but not frequently available

### 4.3 Fishing equipment based on depth of operation

This study found that marine set bag nets (MSBN) and estuary set bag nets (ESBN), which were used in waters up to 25 meters and 20 meters, respectively, were the two most frequently used fishing techniques in the analyzed locations. Beach seine net, drift gill net, big mesh drift gill net, and trammel net were all found to be employed up to 30 meters, 20 meters, 30 meters, and 10 meters, respectively (Figure 43). Artisanal fishing gear may be employed down to a depth of 10 meters, according to Hussain (2010). This research demonstrated the usage of fishing equipment at depths between 10 and 30 meters. This is due to improvements in modern fishing technology making it easier to fish in a range of water depths. Due of their propensity to catch more fish, the fishermen frequently are diving deeper.

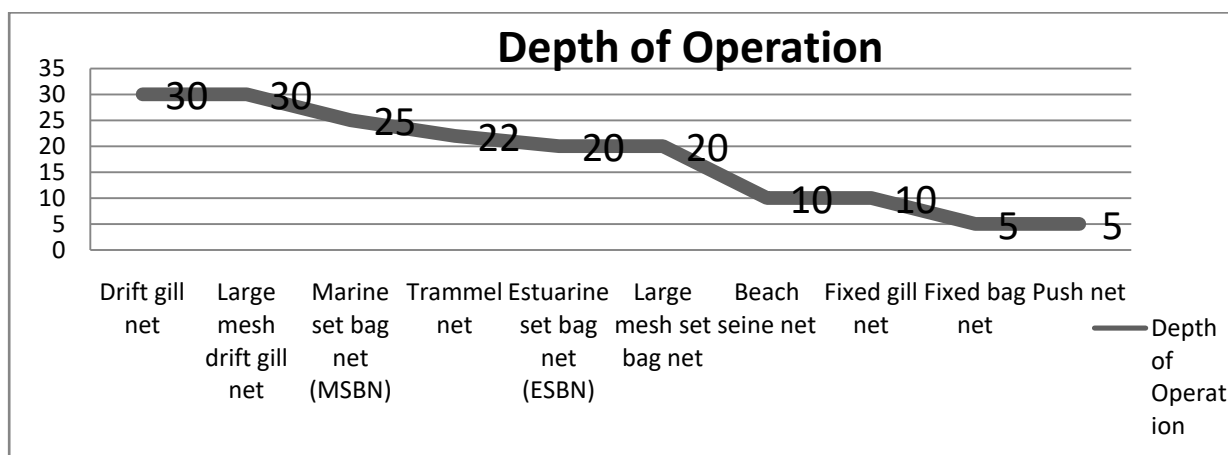


Chart 20: Depth of operation

### 4.4 Average daily catch using different types of fishing equipment

Fishermen in Cox's Bazar, Ukhiya, and Teknaf used a range of fishing gear to gather data on the seasonal shift in species abundance. In Cox's Bazar, July and January had the highest and lowest catch per unit effort (CPUE), respectively. Other two regions showed few variations from this. The ESBN recorded the highest CPUE (110 kg/gear/day) in July, while other nets registered 105 kg/gear/day, 98 kg/gear/day, 100 kg/gear/day, and 90 kg/gear/day, respectively, for the MSBN, beach seine, gill net, and trammel net. The beach seine had a CPUE of 70 kg/gear/day, the ESBN had a CPUE of 75 kg/gear/day, the MSBN had 80 kg/gear/day, and the gill had a 75 kg/gear/day.

Location	Cox's Bazar					Ukhiya					Teknaf				
Month	ES BN	Gill net	MSB N	Trammel net	Beach seine	ESB N	Gill net	MSB N	Trammel net	Beach seine	ESBN	Gill net	MS BN	Trammel net	Beach seine
January	80	78	82	72	75	75	73	80	70	70	70	65	65	70	70
February	82	80	83	76	76	80	78	80	75	75	75	70	68	70	65
March	85	82	85	80	82	82	80	82	80	78	75	70	70	75	70
April	90	85	90	85	85	84	82	88	85	80	80	75	85	78	70
May	105	92	95	83	94	90	90	92	90	90	90	80	100	83	85
June	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
July	90	110	108	92	101	95	100	105	95	98	80	95	88	90	85
August	90	90	92	85	89	90	95	98	90	85	75	90	80	82	90
September	85	88	81	83	85	88	90	90	85	82	73	85	80	82	85
October	80	85	84	85	82	85	85	85	82	80	80	82	75	80	80
November	78	82	79	82	82	80	80	75	78	78	75	80	70	75	78
December	75	79	74	78	78	78	75	70	75	75	73	70	65	70	75

Table 6: Average daily catch using different types of fishing equipment

### **4.3 Part 3: Marketing Channel Analysis:**

#### **4.3.1 Marketing System of Marine Fish**

The marketing system functions through a group of middlemen who carry out practical commercial tasks in a chain structure from the producers to the ultimate consumers. Fish suppliers (beparies), fish brokers (aratdars), and fish retailers may be considered the three main types of business entities that make up the fish marketing system. Fishermen who come ashore with their haul are the only source of fish for Beparies (also known as "Forsay" locally). Aratdars often purchase their goods from beparies and are found in small numbers at district (or expanded) markets and in large numbers in major cities, like as Dhaka. Then, fish merchants get their goods from an aratdar, a bepari, or, if it's more convenient, directly from the producer at the landing spots. Through these types of intermediaries, the fishing industry's whole marketing role is carried out (Fig. 1). More than 95% of the fish produced in the nation is handled by the private sector in this network of business ties that connect fish growers with fish consumers.

The series of middlemen that harvested fish passes through as it travels from farmers to consumers is referred to as the marketing channel. Depending on the type and quality of fish advertised, the availability of marketing services, and the current social and physical context, this channel may be brief or lengthy. To identify the marketing channels used in the marketing of marine fish, the principal species (Table 1) that account for more than 80% of the marine fish marketed were chosen for the current study. Both frozen and dried fish were taken into account for domestic and international markets. In addition to producers, sellers of various categories are demonstrated to engage in the marketing channels of marine fishes in the research regions in the distribution channels of frozen and dried fish (Figs. 2 and 3). Producers (fishermen), beparies, aratdars, merchants, processing facilities, and export agencies are among the market players.

#### **Producers**

The fish producers in Cox's Bazar frequently sell their catch from the boats at the fisheries ghats or fish landing points. There are a select few producers that can transport their fish to wholesale markets (arat) in the town or district markets because they have several boats and a big amount of catch. The producers occasionally go to district markets during the peak season to sell their fish for a greater price. At landing stations and, to a lesser extent, through inter-district aratdars, processing facilities, and agencies, the majority of producers typically sell their goods to beparies.

#### **Beparies**

Professional marine fish dealers known as beparies buy fish from producers and then sell their consignments to retailers via aratdars or commission brokers. They often buy fish from the farmers at landing places and transport their goods to various arats centers for sale. Beparies manage over 70% and 52% of the produced dry and frozen fish, respectively. They are well-organized. There are typically 10 to 40 parties of these beparies in each inter-district wholesale market, with at least 12 to 20 people in each party. They are seasoned businesspeople with extensive knowledge of fish marketing. The majority of businesses use temporary workers to participate in fish marketing

operations. Beparies who buy fish from fisheries ghats or landing hubs sell it through aratdars and pay auditors a commission of 3–5% for doing so.

### **Aratdars**

The aratdar is a commission agent who works from a set location and assists beparies in selling their goods. He or she typically charges a predetermined fee of 30 to 40 taka per \$1,000 in sales income. An aratdar tries to sell fish at greater prices since commission is imposed on sales earnings. Different district headquarters house 20 to 35 aratdars. They grade items in addition to offering short-term storage facilities. They pay brokers in cash and, the majority of the time, provide fish on credit to merchants. Aratdars do not split any fees from brokers or merchants. They use wage earners and employees to carry out tasks including loading, unloading, weighing, grading, etc. They often handle more fish than beparies do. On the condition that the beparies sell fish via them, the aratdars frequently provide loans to beparies.

A bepari may accept payments from many aratdars, in which case he splits his product sales and uses other aratdars to market it. About 70% of marine fish produced is sold by auction through aratdars, according to beparies and aratdars. Several aratdars in landing stations buy fish that may be exported straight from the producers (Fig. 49). The most significant part of aratdars' business is that they facilitate the sale of fish by earning commission rather than actually buying it. In the Asadganj dry fish market, Kleih et al. (2003) discovered 24 aratdars who were taking 2% commission from the Beparies. Aratdars are organized and require a license to conduct business.

### **Retailers**

The final link in the chain of marine fish marketing is the retailer. They primarily purchase fish on credit from the aratdars, but they also occasionally pay cash, and then they sell it to the customers. The consumer buys their fish needs from the fish merchant, who gets their supply from aratdars and beparies (Fig. 50).

## **4.3.2. Marketing Channel of the Most Available Marine Fishes:**

### **Marketing Channel of Pomfret Fish:**

Four chains were found to be involved in the marketing of pomfret fish. As part of marketing chain I, pomfret fish were transported from fishermen to a landing center, a depot, and a processing plant. Pomfret fish was dried in the second stage of the marketing process before being offered to nearby, faraway, and export markets, and then customers. Pomfret fish from fishermen was sent to a distant customer as part of marketing chain III via a landing center, a distant fisher, a distant wholesaler, and a distant retailer. In marketing chain IV, local wholesalers and merchants sold pomfret fish to consumers after it was captured by fishermen (Figure 45).

### **Marketing Channel of Loytia:**

Numerous media were employed in the marketing of Bombay duck. Bombay Duck's original marketing network linked fishermen with local customers via aratdar, a neighborhood market, a local wholesaler, and neighborhood stores. In marketing chain II, Bombay duck was moved from

the fisherman to the drying yard via the intermediary, sometimes referred to as the aratdar or assembler. Through a distant distributor and a distant merchant, dried Bombay duck was sent from the drying yard to clients who lived a long way away. As part of marketing chain III, dried Bombay duck from the drying yard was distributed and sold locally through a distributor and store. Chain IV of marketing involved the direct delivery of dried Bombay duck to the overseas market (Figure 47).

#### **Marketing Channel of Hilsha:**

Three marketing chains for the promotion of hilsha were found. Hilsha fish was sent from the fishermen to the processing plant, depot, and export market as part of marketing chain I. Hilsha fish was transported via landing centers, distant paikers, far wholesalers, and distant retailers in marketing chain II from fishermen to distant customers. Through marketing chain III, Hilsha fish was distributed from fishermen to local wholesalers and retailers and then sold to local customers (Figure 46).

#### **Marketing Channel of Ribbon Fish:**

For ribbon fish, there were several marketing channels available. Aratdars, or intermediaries, assisted fishermen in moving their ribbon fish to the drying yard in marketing chain I. Local customers, distributors, and retailers received dried ribbon fish from the drying yard. As part of marketing chain II, dried ribbon fish from the drying yard was distributed to a far customer through a far wholesaler and a far retailer. Dried ribbon fish was sent straight from the drying yard to the export market in marketing chain III. As part of marketing chain IV, ribbon fish from fishermen were distributed to remote customers through landing centers, paiker/aratdar, wholesalers of the distant market, and retailers of the distant market. Ribbon fish from local fishermen was sold to local customers in marketing chain V through intermediaries, local marketplaces, local wholesalers, and local retailers (Figure 48).

#### **4.3.3 Marketing Channel of Frozen Marine Fish:**

There were numerous marketing outlets for frozen marine fishes but a basic channel is shown here (Figure 49).

#### **4.3.4 Marketing Channel of Dried Marine Fish:**

In all of Bangladesh's coastal regions, drying marine fish is a fairly frequent coastal activity, and dried fish is in demand on both the domestic and global markets. This study also took into account the marine dried fish's marketing channel. The accompanying figures 50 and 51, respectively, depict marine fish drying techniques and marine fish marketing channels.

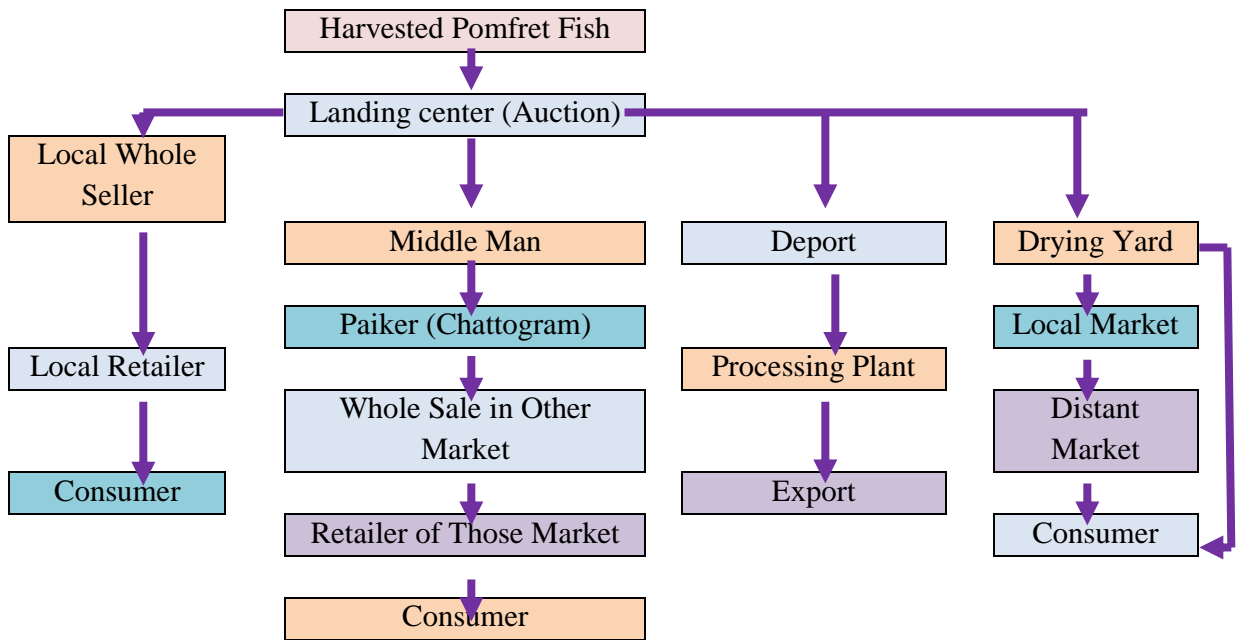


Chart 21: Flow Diagram of Marketing Channel of Pomfret Fish

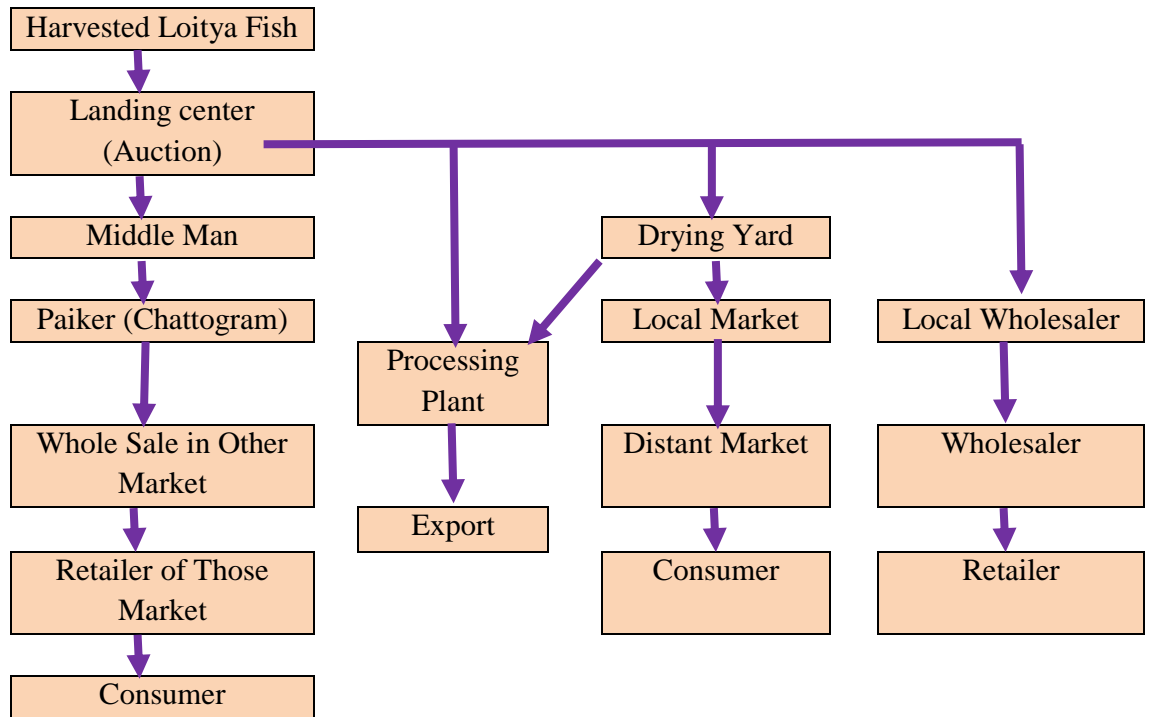


Chart 22: Flow Diagram of Marketing Channel of Hilsha Fish

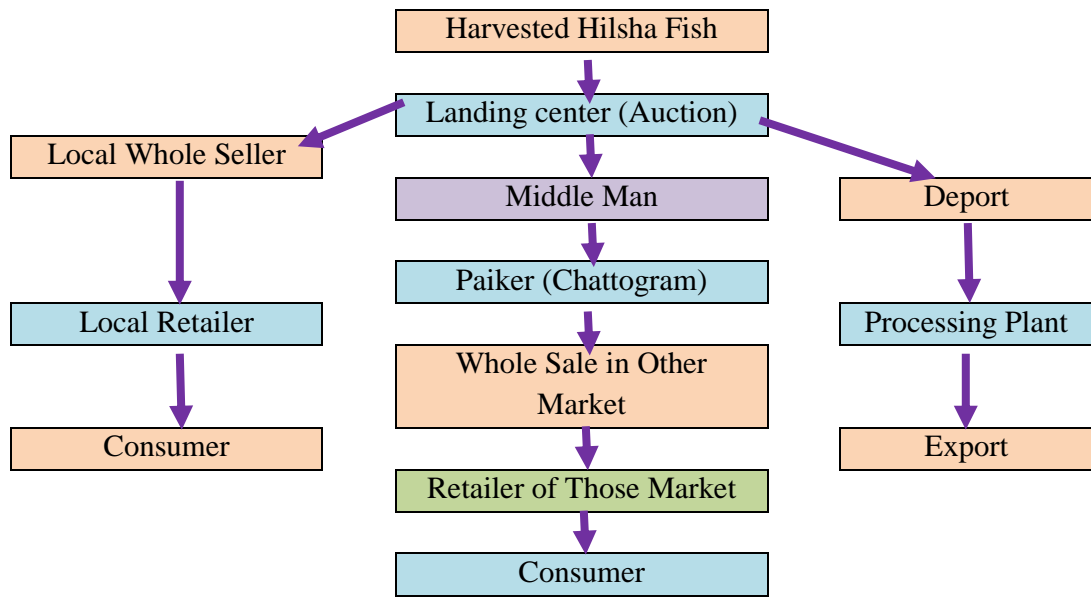


Chart 23: Flow Diagram of Marketing Channel of Loytia Fish

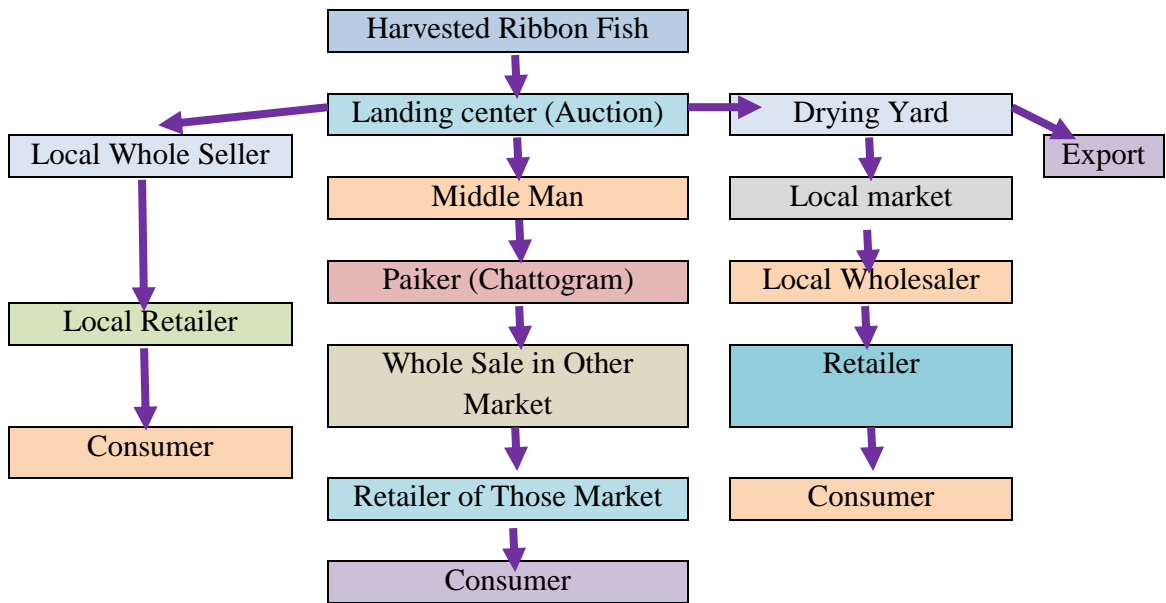


Chart 24: Flow Diagram of Marketing Channel of Ribbon Fish



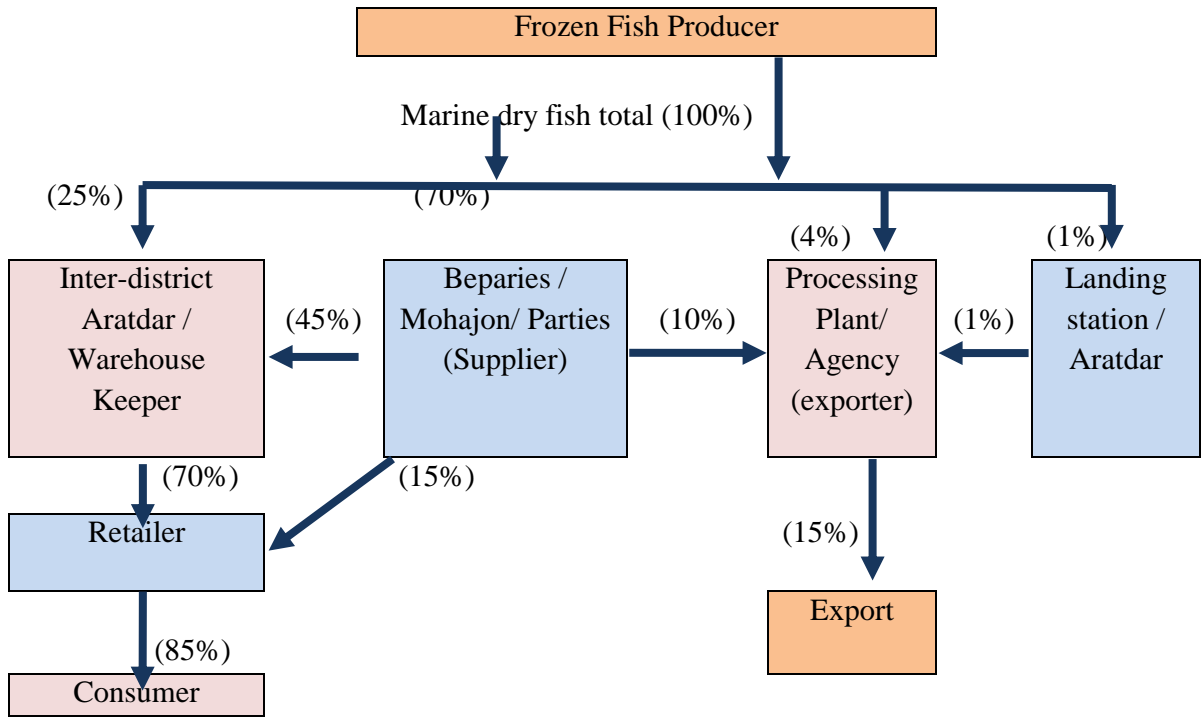


Chart 25: Channels of distribution of frozen fish

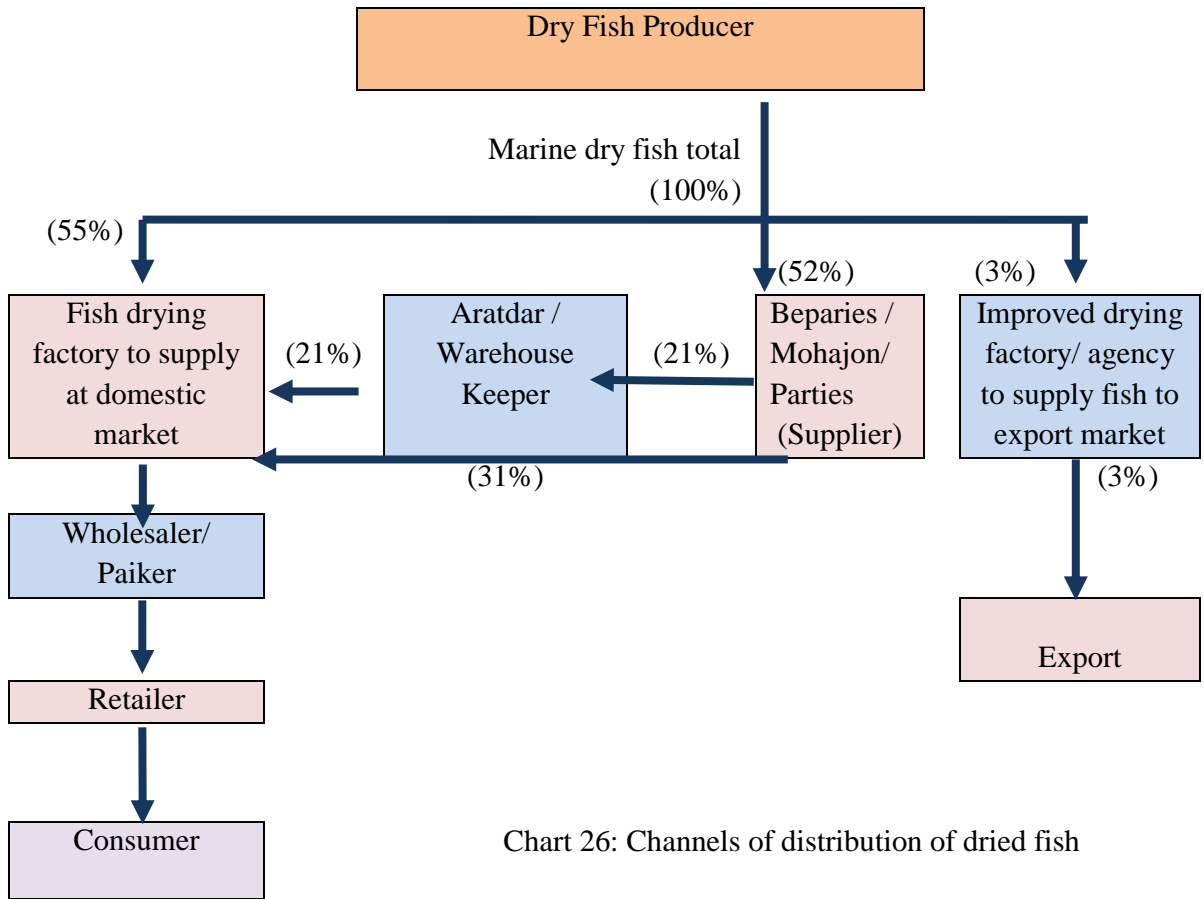


Chart 26: Channels of distribution of dried fish

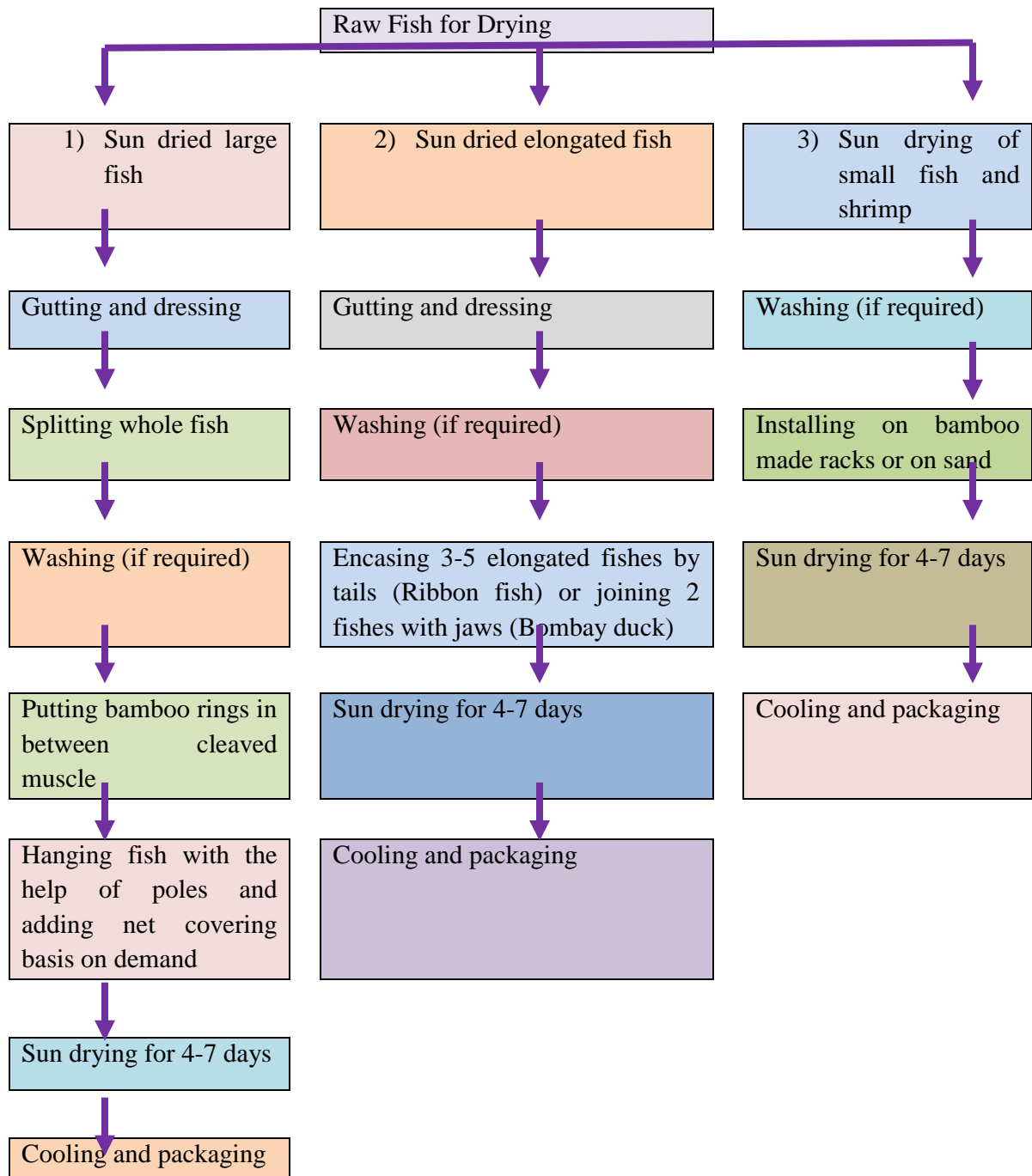


Chart 27: Flowchart for the three categories of traditional marine fish drying in Cox's Bazar region. (1) Drying large fish in the sun; (2) drying elongated fish in the sun; and (3) drying small fish and shrimp in the sun.

Bangladesh boasts a large range of fisheries, including 475 marine species (Billah et al. 2018). Few species from this large fish abundance are in high demand in the dried fish market because of their taste and accessibility. The following is a list of fish species used to prepare dried fish (Table 7).

Table 7: Fish species used for dried fish processing

SI. NO.	Local name	English Name	Scientific name
1	Rup chanda	Chinese Pomfret	<i>Stromateus chinensis</i>
2	Foli chanda	Silver Pomfret	<i>S. cinereus</i>
3	Lal poa	Silver jewfish	<i>Johnius argentatus</i>
4	Rupali poa	Belanger's croaker	<i>J. belangerii</i>
5	Kala pool bolpoa	Black spotted croaker	<i>Protonibea diacanthus</i>
6	Loijja poa	Panna croaker	<i>Panna microdon</i>
7	Churl	Ribbon fish	<i>Trichiurus haumela</i>
8	Riksha fish	Riksha fish	<i>Riksha sp.</i>
9	Loitty	Bombay duck	<i>Harpodon nehereus</i>
10	Lal choukya	Red snapper	<i>Lutianus johnii</i>
11	Nuna Baila	Celebes goby	<i>Glossogobius celebius</i>
12	Murguilla	Bartail flathead	<i>Platycephalus indicus</i>
13	Gutimbaila/Gutumach	Rough flathead	<i>Grammoplites scaber</i>
14	Futki chapa	Talang queenfish	<i>Scomberoides commersonianus</i>
15	Kawya mach	Torpedo scad	<i>Megalaspis cordyla</i>
16	Malabar mouri	Malabar trevally	<i>Carangoides malabaricus</i>
17	Nilambori	Japanese scad	<i>Decapterus maruadsi</i>
18	Pekhom Mouri	Indian threadfish	<i>Alectis indica</i>
19	Dhom mach	Whipfin silver-biddy	<i>Gerres filamentosus</i>
20	Samudrik koi	Tripletail	<i>Lobotes surinamensis</i>
21	Rangga koi	John's snapper	<i>Lutjanus johnii</i>
22	Lal pansa	Malabar blood snapper	<i>L. malabaricus</i>
23	Lowkka	Indian threadfin	<i>Leptomelanosoma indicum</i>
24	Topshi	Paradise threadfin	<i>Polynemus paradiseus</i>
25	Tailla	Fourfinger threadfin	<i>Eleutheronema tetradactylum</i>
26	Buna chingri	Goldlined seabream	<i>Rhabdosargus sarba</i>
27	Datina	Silver grunt	<i>Pomadasys argenteus</i>
28	Sadadatina	Saddle grunt	<i>P. maculatus</i>
29	Gutidatina/nakkoro	Indo-Pacific king mackerel	<i>Scomberomorus guttatus</i>
30	Surma / Maitta	Kawakawa	<i>Euthynnus affinis</i>
31	Bommaitta	Indian mackerel	<i>Rastrelliger kanagurta</i>
32	Chomppa	Double spotted queen fish	<i>Scomberoides lysan</i>
33	Chapa	Flathead sillago	<i>Sillaginopsis panijus</i>
34	Tulardanddi	Ten pounder	<i>Elops machnata</i>

35	Korati chela	Long tongue sole	<i>Cynoglossus lingua</i>
36	Kukurjib/ bashpata	Indian tongue sole	<i>Cynoglossus macrolepidotus</i>
37	Kukurjib / assh sole	Big eye ilisha	<i>Ilisha megaloptera</i>
38	Chowkka / Faishsha	Long jaw thryssa	<i>Thryssa setirostris</i>
39	Dati Fasha	Dussumier's thryssa	<i>Thryssa dussumieri</i>
40	Pati Fasha	Gold spotted grenadier anchovy	<i>Coilia dussumieri</i>
41	Oluya	Elongate ilisha	<i>I. elongata</i>
42	Ram Chowkka	Kelee shad	<i>Hilsa kelee</i>
43	Gurtailish / fuittailish	Giant tiger shrimp	<i>Penaeus monodon</i>
44	Bagda chingri	White shrimp	<i>P. indicus</i>
45	Chaga / chaka chingri	Crystal shrimp	<i>Farfantepenaeus brevirostris</i>
46	Motka chingri	Yellow shrimp	<i>Metapenaeus brevicomis</i>
47	Chali chingri	Jinga shrimp	<i>M. affinis</i>
48	Bara chaka	Shrimp	<i>Penaeus sp.</i>

## CHAPTER FIVE

### DISCUSSION

The purpose of this study was to illustrate the socio-economic status of the artisanal fishermen in the Cox's Bazar, Teknaf and Ukhiya areas as well as to identify the features of small-scale fishing in the area along with the marketing channel of marine fishes.

#### 5.1 Fishing crafts and gears

According to the report, the artisanal fisheries in Cox's Bazar areas employed four different types of fishing gear. Ilish jal, Lakkha jal, set bag net, and gill net were among them. Gill net and set bag net were the two most often utilized nets in the survey. The outcome is consistent with Mohiuddin et. al (1984) 's findings, which indicated that the set bag net was the most significant fishing gear in the coastal region, landing roughly 45% of the entire catch while gill nets caught 35%. Gill nets and behundi nets (set bag nets) were often utilized along Bangladesh's coastline, and the results are consistent with those of FAO (1985), which used four important types of gear.

The various fishing equipment and methods were used to categorize the tools and crafts (Brandt, 1984). According to the study, there are primarily three different types of nets, of which 9 types are large mesh drift nets, 2 are trammel nets, and 1 is a marine set bag net. Overall, 5 gill, 2 seine, 1 fixed purse, 1 cast, 1 dip, 1 lift, and 2 drag nets were discovered in the Megna River estuary (Siddique et. al, 2013). At Hatiya in the district of Noakhali, various fishing nets, such as fixed purse nets, gill nets, dip nets, and cast nets, are employed (Shafiul et. al, 2014).

According to reports, the project areas of Chandpur, Halda, and Ichamati utilised a total of 21 distinct types of gears. Seine net, spawn collecting net, gill net, hand net, giant cast net, drag net, cast net, fixed purse net, fixed net, push net, hook and line dip net, brush shelter (jag), bamboo trap, and drift net were the different categories for the gears (Chong, 1979). The three floodplains employed four types of fishing equipment (Chanda, BSKB and Haiti Beel). These were 5 kinds and 14 subtypes of fish traps, 5 types of hooks and lines, and 4 types of spears or harpoons. There were also 7 types and 20 subtypes of fish nets (Rahman et al., 1993).

East Pakistan (now Bangladesh) divided its fishing equipment into three categories: nets, traps, and wounding gears (Ahmed et al., 1954), but in Cox's Bazar, Ukhiya and Teknaf, there were primarily two types of fishing gears: nets and longlines. There were primarily three different types of traditional fishing boats: Balam Nauka, Dinghi, and Chandi, which were used in estuary areas and marine waters respectively (Karim et al., 1979). At Hatiya, a variety of boats including Chandi, Kosha, Balam, Tempu, and Dinghy Nauka were in use (Siddique et. al, 2013). In Kaptai Lake, there were four fishing boats: the Bara Nauka, the Dinghi Nauka, the Ekgaichya Nauka, and the Bhela or Raft (ARG, 1986).

Fishing vessels like the Donga, Bachari, Kosa, Chandi, and Dinghi were utilized in Bangladesh's north-east, particularly in the larger Sylhet and Mymensingh regions (CIDA, 1993). Balam Nauka, Chandi Nauka, Dinghi Nauka, Kosha Donga or Konda, and Rafts were among the seven types of fishing vessels employed in the Megna, Padma, and Jamuna Rivers (BCAS, 1989). In various parts

of the Megna River, Chandi Nauka, Kosha Nauka, Dinghi Nauka, and motorized boats were run. In the lower part of the river, 50% of the fishing boats were motorized (Moula et al., 1993).

Only one type of wooden automated fishing boat was discovered in Ukhiya. The Chandi Nauka were discovered in Teknaf, but they weren't utilized for fishing instead, they were employed to transport bamboo baskets filled with fish at low tides, when the water level was so low that the fishing boats couldn't reach the landing site.

Rashed et al. (2016) discovered four different types of fishing gear, including the Chor jal (enclosure net), tiny gill nets, beach seines, and estuarine set bag nets (ESBN), were employed in the Naaf River for fishing. These findings are comparable to those of the current study. According to Sarowar et al. (2009), cast net fishing is the method used by the most fishermen in the Khulna region, followed by Seine net, drag net, current net, and push net. The differences in the tools that are utilized may be brought on by geographical preferences and modes of subsistence.

The current investigation discovered the combination of inboard motors and wooden plant-made Chandi and Balam boats in small-scale fisheries. The findings of the current study are consistent with those of FAO (1985), which identified the Dinghi, Chandi, and Balam as the three primary types of traditional boats used in coastal artisanal fisheries.

## **5.2 Socio economic characters**

According to the current study, all individuals who engaged in artisanal fishing in study areas were men dominated with a minority women group. In a research by Mridula et al. (2015) in the southwest, it was discovered that 82% of the male respondents and 18% of the female respondents were actively engaged in fishing. According to a study by DoF (1993) on several coastal regions in Bangladesh, 90 out of every 10 fishermen were men. The study's findings demonstrated strong relevance. These findings may be attributable to women who are more involved in domestic duties and who, as a result of trafficking and other socioeconomic issues, cannot afford to go fishing on a big scale.

45%, 47% and 33% of the fishermen questioned for the current study were between the ages of 31 and 45 and 30%, 36% and 47% of the fishermen questioned for the current study were between the ages of 20 and 30. According to the findings, there were the most fishermen in classes between 20 and 45. According to Ahmad (1996) in Tangail and Ahmad (1999) in the coastal region, 66% and 70% of respondents were above 40. According to Mridula et al. (2015) research, 45% of fishing professionals are in the 16 to 30 age range, while just 4% are in the 61 to 75 age range. According to Minar (2012), fishing is most popular among individuals aged 31 to 40, where it is least popular among those aged 41 to 68. In a different research, Kostori (2012) found that 36% of the fishermen in Chanal beel were between the ages of 20 and 30. These results are consistent with those of the current study.

According to the present research, 81%, 83% and 87% of fishermen were Muslims, followed by 4%, 1% and 13% of Hindu fishermen in Cox's Bazar, Ukhiya and Teknaf respectively where Buddhist fishermen were found 15% and 16% in Cox's Bazar and Ukhiya respectively. The

outcome is comparable to Ahmed (1999), who performed research in coastal regions and discovered that 68% of fishermen were Muslims. 32% of the fishermen in the Sundarbans were Hindu (Ahmad, 1999). In the Tangail area, Ahmed (1999) found that 57% of the fishermen were Hindu. Therefore, this study has no bearing on the current investigation.

According to the current survey, 70% to 80% of fishermen were married, while the remaining 27% to 18% made up the remaining fishermen were unmarried and polygamy or divorced marital status is low in amount. The percentages of married fisherman noted by Ahmad (1996) in Tangail, Mannu (1999) in Kuakata, and Shamima (2000) in Gallamari were 94%, 92%, and 70%, respectively. According to Momotaz's (2009) research on the socioeconomic status of small indigenous species beneficiaries in three places, 53 (84%) of the fishermen were married, while the remaining 16% were single.

According to the results of the most recent study, most of the households were medium ones having five to six family member ranging from 45% to 55%. Large families (7-9 members) were also prominent ranging from 19% to 24%. Small families (1 to 4 members) and extended families (more than 9 people) occupied less than 22% to 14% and 13% to 9% in various study areas. The outcome contrasts significantly with Mamun's (2011) research of Kaptai Lake, which indicated that only 41% of fisherman lived in nuclear families and that majority of them (59%) belong to joint families. the average number of people living in a single family is 4.17, while the average number of people living in a joint family is 6.22. In the case of single families, the average family size was lower than the national average of 5.6 people per dwelling. Dissimilarities might result from unique alterations made to the research.

The fishing community's homes in the current study area were mostly made of tin sheds. Jhupri and semi pucca houses were available in those areas. The result is comparable to the result of Shamima (2000), who performed a survey in the Gallamary fishing hamlet revealed most of the fisherman's floor materials 94% were Katcha. According to CPP (1996), tin made up 89.23% of the roof materials of the fisherman's homes. According to Ahmad (1999), the fishermen lived in substandard housing that was composed of mud and a certain type of wood leaf. As a result, the current study is comparable to those investigations.

Most of the fisherman in the study region had access to electricity. The outcome differs from that of Shamima (2000), who found that 20% of the fishermen in Khulna's Gallamary fishing hamlet used electricity. The present study's findings are consistent with those of Momotaz (2009), who found that 90% of fisherman had access to power and just 10% did not. In contrast to Hossain's (2009) investigations, which revealed that 95% of fisherman had access to power, the current study indicates that 5% of fishermen did not have this access.

According to the current survey, all of the fishermen in Cox's Bazar region have lack of literacy. The findings diverge from those of the Hannan research (1994). Hannan (1994) found that among the coastal fishing population of the Kalapara Upazila, 96.97 percent of the fishermen were literate at various levels of schooling. As the outcome of the current study is comparable to the study of Ahamed (1999) in the estuary regions of 10 literacy rate 25% and 23%, respectively, the difference may be due to the availability of amenities in the study area.

Most of fisherman in the current research region had access to drinking water but the purity of it is a question. It was made easier by the tube-well. The study's findings are consistent with those of Mridula et al. (2015), who found that water directly impacts a fisherman's health. However, only 89% of fishermen who responded to the survey used tube well water for drinking, compared to 3% who used pond water, 7% who used river water, and 1% who used other sources of water for drinking and other daily activities (cooking, bathing and washing). Although most of the ladies who were produced in the research location drank water, this does not imply that every single one of them had a tube well.

### **5.3 Marketing channel analysis:**

In this study, we sought to shed light on the current state of the marine fish marketing industry. For marine fish captured in artisanal fishing, many kinds of marketing systems have been established. The marine fish marketing chain was found to involve a variety of intermediaries, including wholesalers, commission agents, beparies, aratdars, paikers (local market, distant market), and retailers. The marketing strategies for different species differed. As an example, some fish had an extensive marketing chain with several middlemen, whereas other fish had a small marketing chain (e.g., a local retailer market). The value chain and marketing channels for the nation's marine fishing goods have already been covered in a number of studies (Sabur et al., 1977; Islam et al., 2001; Islam et al., 2006; Nayeem et al., 2010b; Haque et al., 2015; Ahsan, 2016).

Fish, both frozen and dried, enjoy a sizable market in Bangladesh. Fish are dried using a variety of methods. In Bangladesh, traditional sun drying of fish is a significant fish preservation technique. Fish is exposed to the sun and wind by being placed in trays, on racks, or even on the ground, according to Bala and Mondol (2001) and Reza et al. (2009). Immaculate et al. (2013) and Uddin et al. (2014) have noted that depending on packing and storage circumstances, dried fish products can keep quality for up to 3-6 months. According to Alam et al. (2007), inadequate icing during harvest was the main cause of the low quality of the raw materials utilized for conventional drying. Our study highlighted the marine fish marketing chain from producer to consumer, and a number of additional studies corroborated what we found.

The marketing system was thoroughly studied by Ahmed et al. (2007), who found that manufacturers had limited control over marketing and supply chain management and were instead tightly controlled and monopolized by large merchants and brokers, which led to domestic market pricing distortion. According to Reza et al. (2005), the selling of sun-dried fish in Bangladesh's coastal area involves a total of six middlemen. The author identified five marketing channels, via all of which the intermediaries mentioned above were engaged in the promotion of dried fish. Samad et al. (2010) and Flowra et al. (2010) made somewhat related discoveries (2009) In Bangladesh's Nilphamari area, Monir et al. (2013) discovered four routes for the selling of dried fish.

In the Khulna area, Ara et al. (2010) discovered two marketing channels for catch fishing, both of which used standard middlemen. Wholesalers, Aratdars, middlemen, and retailers were among the intermediates that Shamsuddoha (2007) and Reza et al. (2005) discovered in Cox's Bazar. Along



the survey, six marketing channels were observed by Biswas (2001) and Amin et al. (2012). Biswas (2001) researched the marketing of dried fish from Cox's Bazar to Dhaka, while Amin et al. (2012) studied the marketing of marine fishes (frozen/fresh/dry) in the southeast coastal belt of Bangladesh.

In the research region, marine fish processors and middlemen encountered a variety of issues. Inadequate capital, natural disasters, a lack of scientific understanding and technology, unstable prices, a lack of suitable storage facilities, a lack of physical marketing infrastructure, a lack of marketing information, etc. were among the identified issues. High marketing expenses were mostly caused by the marketing system's functional inefficiencies. The proportion of the wholesale price that went to producers and processors was not low, and this may be raised even more by upgrading marketing infrastructure and getting rid of pointless, ineffective, and exploitative intermediaries.

There were also suggestions for actions to help the problem. Given that fish includes a significant quantity of protein, the government should take the lead in promoting the faster growth of this industry, for example, by implementing rules that will reduce the number of intermediaries and provide contemporary, safe methods for drying fish. Results for dried fish sold in the coastal regions of other emerging nations including India, Sri Lanka, and Nigeria were more or less comparable (Murray and Little, 2000; Ismail et al. 2014; Payra et al. 2016).

## **CHAPTER SIX**

### **CONCLUSION**

Bangladesh is a growing nation where fishing plays a significant role in the economy. The majority of the marine fishing business is made up of artisanal fishing in coastal regions, however the socioeconomic backgrounds of these fishermen are unsatisfactory. Both their potential for earning money and their level of education were inadequate. Every day, these fishermen put their lives at danger to make a living, yet no one knows about their plight. They are the unsung coast heroes.

Both fish for our dried fish sector and fish with significant export potential are caught by artisanal fishermen. For the duration of the prohibition, they are not even given a VGF card. The government should take some significant actions by establishing various management policies and by offering more protection during the fishing prohibition seasons. This may be accomplished through the provision of the VGF card. Government and NGO involvement is also crucial, especially when it comes to the provision of non-formal education, microcredit, and health services.

## **Recommendation and Future Perspective**

- Ban period should be managed in accordance with the spawning season of marine fishes.
- Bank, NGO's and other financial institutions should provide soft loan facilities for the small scale fisherman.
- Government should give VGF card to the real fisherman but not the political persons.
- Set gill nets are used relentlessly in the coastal area and those are need to be identified.
- Future researcher can be done on the amount of by catch in every effort and proper information about the by catch in Bangladesh.

## CHAPTER SEVEN

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## APPENDIX

**Date :**

**Time:**

**Area: Cox's Bazar/ Ukhiya / Teknaf**

### APPENDICES A: GENERAL INFORMATION

Name of the interviewer:

1. Address	Village	
	P/S	
	P/O	
	District	

2. NID No.

3. Gender:  Male (1)  Female (2)

4. Religion :

Muslim (1)	Hindu (2)	Buddhist/ Rakhain(3)	Christian (4)	Others (5)
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5. Marital status:

Married (1)	Unmarried (2)	Polygamy (3)
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6. Occupation:

Small scale fisherman (1)	Commercial fisherman (2)	Employee (3)	Researcher (4)	Businessmen (5)
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7. Educational background

Under class five (1)	Under class eight (2)	S.S.C (3)	H.S.C (4)	Hons. (5)	Masters (6)	No education (7)
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8. Number of family member:

9. Family structure	Small family (0-4)	Medium family (5-6)	Large family (6-9)	Extended family (>9)
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**APENDICES B: ECOLOGICAL AND ENVIRONMENTAL FEATURES**

1) How long you live/catch/sell (fish) in/from this area?

0-5 years	
5-10 years	
10-15 years	
15-20 years	
More than 20 years	

2) During your experience what kinds of change you observe for fish species?–

<b>Fish species has been changed</b>	0	1	2	3	4	5
<b>Fish number has been changed</b>	0	1	2	3	4	5

\*0= no change, \*1= very little change, \*2= little change, \*3= moderately change, \*4= highly change \*5= very highly change

3) Do you observe any kinds of pollution in that water body?

Yes / No

4) If yes, mention the degree of observed pollution-

<b>Oil pollution</b>	0	1	2	3	4	5
<b>Municipal sewage</b>	0	1	2	3	4	5
<b>Household waste</b>	0	1	2	3	4	5
<b>Street drainage</b>	0	1	2	3	4	5
<b>Dumping from boat</b>	0	1	2	3	4	5

5) During your experience what kinds of environmental change do you observe in fishing/ market/ area-

<b>Temperature increase</b>	0	1	2	3	4	5
<b>Salinity</b>	0	1	2	3	4	5
<b>Rainfall pattern</b>	0	1	2	3	4	5
<b>Intensity of rainfall</b>	0	1	2	3	4	5
<b>Water level</b>	0	1	2	3	4	5
<b>Tide pattern</b>	0	1	2	3	4	5

\*0= no change, \*1= very little change, \*2= little change, \*3= moderately change, \*4= highly change

6) Do you think destructive fishing is practiced in this area? Yes / No

7) If yes, mention the degree of destructive fishing-

0	1	2	3	4	5
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\*0= no practice, \*1= rarely practice, \*2= little practice, \*3= moderately practice, \*4= highly practice

8) What kinds of gears are used fishing?

<b>Gear types</b>	<b>Rank</b>					
Trawl net	00	01	02	03	04	05
ESBN	00	01	02	03	04	05
Mosquito net	00	01	02	03	04	05
Seine net	00	01	02	03	04	05
MSBN	00	01	02	03	04	05
Gill net	00	01	02	03	04	05
Others	00	01	02	03	04	05

\*0= no use, \*1= rarely use, \*2= little use, \*3= moderately use, \*4= highly use, \*5= very highly use

9) In which depth, the gears are operated?

Gear name	Depth

10) Mesh size of the used net of catch-

Net name	Size

11) What kinds of fishes were less available at past but are available at present in this area?

Fish name	Fish name

12) What kinds of fishes are less available at present but were available at past in this area?

Fish name	Fish name

13) What kinds of fishes are found at present but were not found at past in this area?

Fish name	Fish name

14) What kinds of fishes/organisms (by catch) are found at present in shrimp trawler?

Name	Name

15) What kinds


of

fishes/organisms (by catch) are found at present at present in fish trawler?

Name	Name

**APENDICES C : CATCH INFORMATION**

1) What is your primary fishing activity

Only fish catch	
Only fish sell	

2) Variation of fish/shrimp abundance according to seasons -

Season	Rank				
Summer	0	1	2	3	4
Rainy	0	1	2	3	4
Autumn	0	1	2	3	4
Late Autumn	0	1	2	3	4
Winter	0	1	2	3	4
Spring	0	1	2	3	4

\*0= no abundance, \*1= little abundance, \*2= moderate abundance, \*3= high abundance, \*4= very high abundance

3) Variation of fish/shrimp abundance according to months:

Season	Rank				
January	0	1	2	3	4
February	0	1	2	3	4
March	0	1	2	3	4
April	0	1	2	3	4
May	0	1	2	3	4
June	0	1	2	3	4
July	0	1	2	3	4
August	0	1	2	3	4
September	0	1	2	3	4
October	0	1	2	3	4
November	0	1	2	3	4
December	0	1	2	3	4

\*0= no abundance, \*1= little abundance, \*2= moderate abundance, \*3= high abundance. \*4= very high abundance

4) How many people are needs for an operation?

5) What kinds of vessels are used during operation?

Boat	Engine boat	Trolling	Dingi nouka	Khosa nouka
Chandi nouka	Sampan	Dunga	Trawler	

6) Average amount of by catch caught per operation-

Types	Amount
From shrimp trawler	
From fish trawler	

7) Catch composition according to the size (Percentage)-

Present catch composition			
Very large size	Large size	Medium size	Small size

Past catch composition			
Very large size	Large size	Medium size	Small size

8) How many days interval between two fishing operation?

2-5 days	5-10 days	10-20 days	20-30 days	More than 30 days

9) How many fishermen are engaged in fishing in your area? (Put the tick)

10-15	15-30	30-50	50-70	70-100	More than 100

10) Total coast in each trip- (Put the tick)

No cost	500-1000 tk.	1000-2000 tk.	2000-3000 tk.	3000-5000 tk.	More than 5000 tk.

11) Is there any market demand for by catch? Yes / No

If yes, who are the main buyers?

Group of buyers	Ranking		
Rakhain people	01	02	03
Local people	01	02	03
Shrimp farm	01	02	03
Lime industry	01	02	03
Buyers from other district	01	02	03

\*1= Principle buyers, \*2= seasonal buyers, \*3= occasional buyers

12) Mention the price of by catch :

Size	Price/Kg
Big size	
Medium size	
Small size	

13) What are the main by catch species in the landing center?

Local name	Scientific name

14) What are the main by catch species in the market?

Local name	Scientific name

### **APENDICES D : SOCIO-ECONOMIC CONDITION**

1. Economic condition

Rich (1)	Middle (2)	Lower middle (3)	Poor (4)	Extreme poor (5)

2. Total earning member of the family:

One (1)	Two (2)	Three (3)	Four (4)	More than four (5)

3. House type:

Earthen	
Hut	
Semi pucca	
Katcha house	
Tinshed with bamboo	
Tinshed	
Jhupri	
<u>Buliding</u>	
<u>Others</u>	

4. Common problem they faced

Problems Lack of Electricity facility	
Lack of educational facility	
Less working facility	
Natural disaster	



Lack of sanitary facility	
Scarcity of food	
Scarcity of drinking water	
Insufficient Govt. facility	
Power of musclemen insufficient health facility	
Social conflict	
Scarcity of cooking fuel	
Others	

5. Facilities provided by the Government: (Put the tick)

Education	Electricity	Heath	Latrine	Govt. Supports	Drinking water facility	support from NGOs	Supports during calamities

6. Do you have latrine in your house? Yes/ No

If yes, types of latrine: (Put the tick)

Earthen	Bush	Open field	Hung latrine	Sanitary latrine	Others

7. What about the source of drinking water?

Tube well/ Supply Tap water/ River/ Pond/Well/ Channel

8. What are the alternative occupations do you choice during off season? (Put the tick)

Day laboring	
Rickshaw pulling	
Boatman for transportation and tourism	
Work in agricultural field	
Small business	
Work in grocer shop	
Fry collection	
Fuel Wood collection	
Boat making	

9. According to your opinion, who is responsible for managing risks associated with ecological and socio-economic challenges?

Authorities	Rank			
Government	01	02	03	04
Local community	01	02	03	04
NGOs	01	02	03	04
Scientist	01	02	03	04

\*1= higher responsibility

\*2= moderate responsibility

\*3= lower responsibility

\*4= no responsibility

Voluntary organization	01	02	03	04
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10. Are there any conflicts among the stakeholders? Yes / No

If yes, mention the degree of conflict

Stakeholders	Rank			
Fishermen-fishermen	01	02	03	04
Fishermen-trader	01	02	03	04
Fishermen-dealer	01	02	03	04
Fishermen-boat owner	01	02	03	04
Fishermen-gear owner	01	02	03	04
Fishermen-farmer	01	02	03	04
Fisherman-creditor	01	02	03	04

\*1= strong conflict  
 \*2= medium conflict  
 \*3= less conflict  
 \*4= no conflict

11. What kinds of trends are influencing in fishing?

Types of shocks	Rank			
Flood	00	01	02	03
Drought	00	01	02	03
Cyclone	00	01	02	03
Illness of fishers	00	01	02	03
Others	00	01	02	03

\*1 = mild impact  
 \*2= medium impact

12. What kinds of seasonality factors have significant impact in livelihood of the fisherman?

Factors	Impact ranking		
Of fishing	01	02	03
Of price of musel and oyster	01	02	03
Of employment opportunity	01	02	03
Shortage of food	01	02	03

\*1 = mild impact  
 \*2= medium impact

13. What kinds of shocks the people of you r area are faced regularly?

Types of trends	Impact ranking		
Increasing the number fisherman	01	02	03
Competition among the fisherman	01	02	03
Environmental change	01	02	03
Lack of law enforcement	01	02	03

\*1 = mild impact  
 \*2= medium impact

14. Crisis and coping strategies?

What sort of crisis you faced in last	Rank				
Flood, excessive rain	01	02	03	04	05
Drought	01	02	03	04	05

Salinity	01	02	03	04	05
Landslides/ erosion	01	02	03	04	05
Cyclone	01	02	03	04	05
Less fish catch	01	02	03	04	05
Diseases	01	02	03	04	05
Accident	01	02	03	04	05
Death of family member	01	02	03	04	05
Death of earner	01	02	03	04	05
Divorce	01	02	03	04	05
Lost job	01	02	03	04	05
Theft	01	02	03	04	05
Robbing of net and boat by pirates	01	02	03	04	05
Social conflicts	01	02	03	04	05
Religious conflicts	01	02	03	04	05
Dowry	01	02	03	04	05
Child / women trafficking	01	02	03	04	05
Physical / mental torture	01	02	03	04	05
Boat sunk	01	02	03	04	05
Political conflicts	01	02	03	04	05
Others	01	02	03	04	05

\*1= maximum occurrence  
\*4= medium occurrence  
\*3= minimum occurrence  
\*2= rarely

### 15. Crisis tackling

How did you tackle those crisis	Rank				
Loan from neighbor	01	02	03	04	05
Loan from money lender	01	02	03	04	05
Loan from NGOs	01	02	03	04	05
Loan from others	01	02	03	04	05
Taking less food	01	02	03	04	05
Food stuff on loan	01	02	03	04	05
Land sale	01	02	03	04	05
Land lease	01	02	03	04	05
Fishing equipment lease	01	02	03	04	05
Fishing equipment sold	01	02	03	04	05
Big trees sold	01	02	03	04	05
livestock / poultry sold	01	02	03	04	05
Excessive physical labor	01	02	03	04	05
Gold or other valuable sale	01	02	03	04	05

\*5= mostly use  
\*4= moderate use  
\*3= less use

Begging	01	02	03	04	05
Child labor	01	02	03	04	05
Homestead land 'sale	01	02	03	04	05
Use of savings	01	02	03	04	05
Displacement / migration	01	02	03	04	05
Change of profession	01	02	03	04	05
Others	01	02	03	04	05

16. Their expectations from Govt.

Expectations	Rank				
Allowance	01	02	03	04	05
Creation Job facilities	01	02	03	04	05
Rehabilitation	01	02	03	04	05
Salvation	01	02	03	04	05
Health facility	01	02	03	04	05
Education facility	01	02	03	04	05
Sanitation facility	01	02	03	04	05
Drinking water facility	01	02	03	04	05
Security	01	02	03	04	05

\*1= high expectation  
\*2= medium expectation  
\*3= least expectation  
\*4= occasional

17. Is there any effect of fishing ban period in Socio-economic condition? Yes/No

18. How do you survive during fish ban period?

19. Is there any effect of Hilsha fishing ban period in Socio-economic condition? Yes/No

20. How do you survive during Hilsha fish ban period?

21. What is your income during Hilsha fishing period?

## **BRIEF BIOGRAPHY THE AUTHOR**

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