



Sustainability towards the Resilience of Coastal Small-Scale Fishermen: A Case Study on JALADAS of Delipara, Chattogram, Bangladesh

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ABSTRACT

In Bangladesh the people of the coastal area which is also known as zone of multiple hazards are primarily dependent on Agriculture for their livelihood and fishing is the second prime livelihood of coastal community. Coastal small-scale fishermen are very much unprotected towards a number of vulnerabilities which are many-folded and have a sequential impact on person's safety and poverty level. The small-scale fishermen are the poverty-stricken vulnerable members of this stratified society (Bene, C, 2004). To reduce the vulnerability of these coastal small-scale fishing community, it is important to enhance fishers' capacities and capabilities through the reduction of poverty. This research paper has been intended to study on these small-scale fishermen through the case study approach. After a reconnaissance survey on four fishing villages 'Delipara' a traditional fishing village of Hindu 'Jaladas' (artisanal fisherman) was selected for detail study. From the study on the artisanal fisherman of Delipara it is found that for building a resilient fishing community it is essential to develop the socio-economic condition through reducing the poverty of that community. And to do these the following issues needs to be considered a. Improvement of fishing through technology and accessibility to resources, b. Provision for alternative and supplemental livelihood, c. Building a disaster resilient habitat, and d. Integrating livelihood with housing and settlement. This study illustrates the existing vulnerability to risk and shocks of the fisher that interfere the livelihoods of the fishers and will illuminate on different alternative and sustainable livelihoods that can be improvised among these small-scale or artisanal fishing community to increase their level of income.

1. Introduction

Coastal Zone of Bangladesh are frequently confronted by different natural catastrophes like flood, cyclone, earthquake, water logging, salinity intrusion and land erosion. On the other hand, the predicted threats of climate change and sea level rise may exaggerate the severity of the hazard which will become a cause of severe salinity intrusion and permanent inundation at lower part of the country. In Bangladesh the people of the coastal

area are primarily dependent on Agriculture for their livelihood and on the other hand fishing is the second prime livelihood occupation of coastal community. Livelihood which depends on natural resources is always remain in a vulnerable position because of different natural and anthropogenic factors. As an occupation fishing is an unstable and itself a vulnerable livelihood activity. Climatic shocks have killed many fishermen and damage their physical assets, as well as different community infrastructures like school, housing and road

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network etc. in the coastal zone of Bangladesh. Coastal small-scale fishermen are very much unprotected towards a number of vulnerabilities which are multi-dimensional and have a sequential impact on person's safety and poverty level. It is obvious that vulnerability is the consequence of socio-economic condition of a community; as the small-scale fisher are the inferior they have to face manifold spheres of susceptibilities originating from multi-dimensional sources. So that fisher's vulnerability is complexly associated to their poverty, either as a fundamental issue or spontaneous creation from insufficient income. (Bene, C. 2009)

This study illustrates the existing vulnerability to risk and shocks of the fisher that interfere the livelihoods of the fishers before invention of any poverty reduction strategy. The study also illuminates different alternative and sustainable livelihoods that can be improvised among these small-scale or artisanal fishing community and the relationship between the sustainable livelihood approaches and the disaster resilient habitat.

2. Background of the Study

It is obvious that poor income is a major concern for artisanal fishing community in Bangladesh. Externally, these fishermen are exposed to different natural and man-made shocks and oppression. Internally, poor fishers are unprotected because of their illiteracy and they are also relegated and socially excluded because of their social status. Again a few fishermen who are better off households are also sometimes vulnerable because they may not be poor today, but natural calamities can push them into poverty. Thus, even better income from fishing does not mean that their livelihood is sustainable; fishers are rather trapped into a circle of dispossession. It is imperative that, poverty reduction policies should not be done only for reducing poverty but also consider the vulnerable ones to become inferior in respect to their socio-economic condition (Jentofit, S. et al, 2011). Accordingly, the research based on two interrelated concepts. First, it focused on essential elements to protect fishers from vulnerability and shock. And secondly, it focuses on the expansion of fishers' possible alternative and sustainable livelihoods opportunities.

World Bank proposes an agenda to counteract poverty, which was built on three equally important areas: First, it advocates for promoting opportunities by expansion of income generating activities for poor through motivation and progression by increasing their capacity and assets. Second, it targets at the empowerment of the local community through the bottom-up approaches where

central authority will be more responsible and approachable to poor people, and where poor people has more involvement in the administrative progressions which will help in removing the social obstacles that grows from the discrepancies of gender, culture, tradition and communal status. The third one aims at improving safety by dipping the weakness of poor to health hazard, financial obstruction, displacements, natural calamities, and ferocity, as well as helping them to handle with hostile situations.

3. Aim of the paper

The aim of the research is to explore sustainable livelihood strategies through integration of resilient housing and planned settlement with income generating activities in coastal fishing villages. Small-scale fishers engaged in this profession hereditarily and continuing fishing with significant motivation without looking for any other scope of alternative or supplementary livelihood. Considering all these factors the aims of the study has been determined to answer the following questions:

- What are factors that makes the fishers vulnerable to natural hazards, especially tropical cyclones?
- What is the role of resilient housing and planned settlement in DRR?
- What is the scope of alternative and supportive livelihood activities for small-scale fisher by utilizing housing and settlement?

4. Methodology

For the empirical study different methodological approaches were used in this research. The details of the methods which are followed for the research indicated in next page.

4.1 Case Study Approach

This kind of approach concentrates on understanding the underlying forces exist inside the case(s). The case study approach is extensively absorbed by social researcher. In this study, this approach has allowed a thorough and comprehensive scrutiny of the research.

Study Village selection for the Empirical research

For the study four coastal fishing communities (North Salimpur, Dakshin Kalbortopara of Chittagong, Kutubdia para and Ahmadia para of Cox's Bazar) were chosen in Chittagong and Cox's Bazar. The communities were

selected based on a number of considerations with well-focused to possible research outcomes. The main characteristics on the basis of which the study area has been selected were the location of the settlement, community people's dependency on small-scale fisheries, their livelihood opportunities and previous record of climatic shocks. Finally, selected village is Delipara of North Salimpur.

4.2 Primary Data

The primary data were accumulated after a field study in designated village by consuming a well-designed questionnaire. Data were composed both by direct surveillance and meeting with fishermen at household, working ground, fishing place and marketplace.

Physical survey and observation of houses and settlement

Field survey in Delipara has been accomplished for accumulating data on numerous features of socio-economic condition of fishermen. Participatory Rural Appraisal (PRA) and physical survey of livelihood opportunities, observation of work place, houses and settlement were done meticulously.

Structured household questionnaires and Focus group Discussion (FGD)

Structured questionnaires and FGD were done to gather data on family features including configuration of families, access to open resources, issues distressing capital possessions, domestic activities and family history.

4.3 Secondary Data

An extensive level literature review was accessed through published and unpublished documents for accumulating evidence relevant to the study. These included publications of different organizations, books, thesis paper, and journal.

5. Fish and Marine Fishers of Bangladesh

In the Bangladesh over two hundred rivers form a network of 24,000 km of riverways before ending into the Bay of Bengal hosts a vast number of rich fisheries and make scope of a livelihood opportunity for millions of

native communities. The country also has 9,060 km² of Marine water (territorial), 118,813 km² Maritime boundary and a coastline of 714 km along the Bay of Bengal (BBS, 2007), which supports a large artisanal and coastal fishery. Small-scale fisheries offer occupation for millions of people, source of a vital and inexpensive source of protein for the poor and produce cash from transactions of fish. Small-scale fishing is an extremely hereditary profession and an integral part of the culture and tradition in Bangladesh. But, the vast popular small-scale fishing societies of Bangladesh are facing more or less alike restraints which obstruct their sustainable livelihoods. (Sengupta, K. et al 2006)

5.1 Marine Fisheries

The coastal area of Bangladesh is enriched with a warm-humid tropical climate and regular monsoon, supplemented by organic materials and minerals from the land, generating one of the diversified ecosystems in the world with high yield of fish. The current judgement of the International Tribunal for Law of the Sea (ITLOS) concerning the Bangladesh-Myanmar sea border and the judgement of the Arbitral Hearing of the UNCLOS on India-Bangladesh sea borderline, recognized independent constitutional rights on more than 118,813 km² area of regional sea and 200 nautical miles (NM) of Exclusive Economic Zone (EEZ) and all varieties of possessions under the continental shelf up to 354 nautical miles from the Chittagong coast (MoFA, 2014). Presently, 32,440 km², from the shoreline to 40 m distance, in the Bay, are exposed to about 67,669 unregistered boats, of which around 51% are manual fishing boats (Action Aid, 2010).

In the study of FAO, it is stated that previously 706 oceanic fishing villages in Bangladesh were tallied in 1967-68 and among those villages 51 percent were located in the south eastern coastal district of Chittagong. 72 percent of those 28,754 fishing households were live in this district (Alam, K. et al 2006). Later the Community Development Centre (CODEC), a national NGO working with fishing communities made a rough estimate of the number of villages in coastal and riverine areas of Bangladesh. The survey report was prepared in October, 1991 and there 1350 fishing villages were identified. The result of the CODEC survey is shown below:

Table 01- Distribution of Fishing Village Surveyed by CODEC (Source: CODEC)

Name of the District	Estimated No. of Villages	Corresponding Old District	Estimate No. of Villages				%
Chittagong	100	Chittagong	350				26
Cox's Bazar	250						
Noakhali	50	Noakhali	250				19
Laxsmipur	200						
Bhola	300						
Barishal	50	Barisal	350				26
Patuakhali	200	Patuakhali	300				22
Barguna	100						
Khulna	100	Khulna	100				7
Total =	1350		1350				100

5.2 Coastal Small-scale fishery and fisher's livelihoods

Small-scale fisheries have enormous significant influence in respect to income generating activities and nutrition for a huge inhabitant. Small-scale fishing is considered to be more ecological than industrial fishing. And it is more admissible in provision of socio-economic welfares resulting from the marine resources; this small-scale fishery also needs to be prioritized for exceptional contemplation to encourage a rich tradition, culture and heritage of the fishers. (Walmsley, S. et al 2006)

The small-scale fisheries in Bangladesh are struced by frequent pressures originating from multi-dimensional causes and therefore trapped in a severe poverty cycle. The fisher folk also suffer from a number of additional magnitudes of scarcity (like lack of schooling, lack of medical facilities, lack of provision of pure drinking water and unhygienic sanitary system, etc.). Living in vulnerable situations these artisanal fishers of coastal areas in Bangladesh have to admit unpredictable shocks that are manifold and widespread. The major shocks come from: repeated poor catch or harvest failure over a long period of time, cyclone damages to houses and/or productive assets, an illness of family members, and in the worst case, death of income earners. The exposure to different shocks often drains out the earned income of fishers and this shock exposure is one of the profound causes of poverty. (Islam, M. M. 2012)

6. Study Area Delipara, Sitakundu

Among the 24 *Jaladas* villages (previously it was 22, CODEC) in Sitakundu Upazilla of Chittagong Delipara is

selected as a study village. Delipara, a small village of inherited Hindu 'Jaladas' along the coast of Sitakundu. The '*Jaladas*' ('slaves of water') are the caste-based fishers, an isolated small-scale fishing community of Sitakundu are living along the shore of Bay of Bengal for generations and passing their life with destitute facilities and within a disregarded conditions which is additionally deteriorated by their susceptibilities to recurrent natural calamities. (Habib, A. 2010)

6.1 Coastal small-scale fishing village, "Delipara"

Delipara is a very small fishing village in North Salimpur, under Sitakundu Upazilla, just adjacent to Chittagong Metropolitan Area. The village is only 17 km away from the town, just adjacent to the Chittagong City Corporation area. According to administrative location the village is situated under ward no 3 and 10 no Salimpur Union Parishad. Delipara is a very small fishing village of Hindu jaladas, where the fishermen (Jaladas) practice traditional marine fishing for generations. The people of the village are mostly employed or self-employed in small-scale fishing at sea; and these artisanal fishing community is a little bit isolated from the rest of the society because of their religion, culture and heritage.

Geographically, on the west of the village there is Bay of Bengal, to the east there is Dhaka-Chittagong highway, mid Salimpur village is situated to the south of Delipara and Tulatoli village is to the north. Because of proximity to the sea the village is very much exposed to the coast. The waves of Bay of Bengal wash the embankment along the border of the village.



Figure 01- Location Map of Delipara

General condition

The fishing sector of Delipara is mostly controlled by the private fishing industries, mechanized fishing boats, Aratdar (intermediaries who traditionally handle the catch), moneylenders for fishing activities



Figure 02- Coastal Fishing Village Delipara

The condition of the fishing community of the fishermen’s village Delipara are just the same as those of other fishing community of Bangladesh. Although the role of the seaside fishing folk in collecting fish is very important, no one thought of the improvement of those fishermen seriously before. The sea side fisher of Delipara did not get enough advantages of modern technologies of catching fish and this is for lack of capital, organization and united effort. Even so, these fishermen playing an important character as a contributor in the national economy by providing fishes in local, national and international market.

Demography

Population density of Delipara is relatively higher than the other villages of the country, because of the scarcity of land. Most of the people in the village are illiterate and related to small-scale marine fishing. Total number of inhabitants in Delipara is 1745 (According to the Statistics of Union Parishad), among which 908 are male and 837 are female. The percentage of man and woman in the village is 52.03% and 47.97% respectively. According to Statistical Year Book of Bangladesh, 2012, the ratio of male and female is almost 50:50. During the survey it is found that average household size is 6.64, whereas national household size is 5.44.

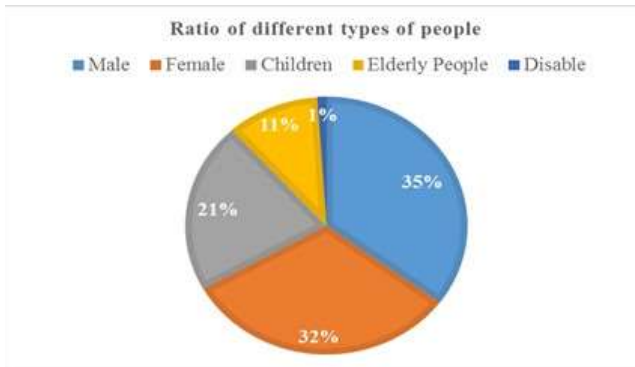


Figure 3- Ratio of different type people in Delipara among Surveyed Households

Education

There is one primary school in Delipara run by CODEC in the cyclone shelter situated at the north end of the village. Fouzdarhat K. M. High School is around one and half kilometres from the village. A BRAC primary school and a school of SHANGU gas field are also located within a very close distance to the village. In Delipara major percentage of school going children leave education permanently, especially after completion of primary education and engaged themselves in income generating activities.

Health facilities

In the study area, the members of the fishing families lose their physical strength and become older at their early age because of constant physical and psychological pressure of work. They also fall victim to the germs of different disease, ill health and malnutrition, thus they become physically weak. Frequent pregnancy, increase in birth rate and similar other things are the common pictures of the fisher folk in the study area of Delipara. There is no physician in Delipara. Half kilometre away at Fauzderhat, there are M.B.B.S. physicians who are the nearest accessible treatment facilities for the fishermen of the study area. They take medicine just describing illness from the charitable dispensary. This is because they do not have to pay for it.

Livelihood and Economic Condition

The people of the fishing village Delipara in course of time have accepted fishing as their only source of livelihood. They have fallen victim to the mal-distribution of wealth and the social inequality and consequently they are steeped in poverty and misery. Even so, they think that by the grace of the sea-mother their condition may change some day. There is no arable land in this village. All the villagers are concerned with catching fish as well as with buying and selling fish. They are out and out

fishermen and they have been fishermen generation after generation. The fishermen of this area are known as “Jaladas” (small-scale fishermen) and usually catch fish with the help of country boats and nets.

Table 2- Income Distribution in the Village

Monthly Income of Households in Study Area.	
Household income in Taka	Study Area %
Less than Tk. 5,000	9
Tk. 5,001 to 10,000	43
Tk. 10,001 to Tk. 15,000	26
Tk. 15,001 to Tk. 20,000	18
Tk. 20,000 +	4
Total	100

Housing and Settlement

The village Delipara stands just beside the sea, Bay of Bengal. So that the settlement is affected by tidal surge and storm very frequently. There is an embankment along the coast line adjacent to the village. To the east of embankment there lies the neighborhood of the fisherfolk, this is a densely populated rural settlement. The houses of this locality of the fishermen stand huddling together, like a single block. At first glance, it appears to be the outcome of the unnecessary narrow-mindedness of the inhabitants. It seems that these poor people are deceiving themselves on the vast generous earth. But the real situation is not like these, it is their inability which bound them to live in this manner. Because of land scarcity, the extent of fishermen’s settlement and livelihood cannot spread out according to their need.





Figure 4- Scattered pattern and 2. Linear Pattern in settlement, Delipara

The embankment in Delipara has nearly been levelled to the ground, which is nearly 1.5m to 2m high from Sea Level. Water gets into the village driven by the wind as the embankment is not enough to protect it. Not only this, the embankment has been ruptured in a number of places, through which the lower portion of the village is being inundated during high tide. The coast of Delipara is supposed to be covered with coastal mangrove forest. But part of these mangrove forest has been smashed by shipbreaking industries which is situated adjacent to the study area.



Figure 5-Fragile condition of Embankment

The settlement of the study area is anything but slum. The houses are built very close to one another without considering any kind of natural lighting and ventilation,

which is very much contradictory to the rural settlement. Some of the houses constructed around a courtyard, with a very narrow lane. The settlement is developed on



Figure 6- Brick soaling and Kancha road in the site

the both side of a narrow herring bond road (average width of the road is 2m). At the centre of the study area, there is temple known as 'Kali Mandir'. At the north-west end of the study area, there is Cyclone shelter constructed by CODEC which is used as a school named 'CODEC Shishu Shikkha Kendra' (centre for child education).



Figure 7-Squeezed house layout in the study area

In Delipara, only a few houses of some solvent

fishermen and the temple are brick-built. All other houses are seemed tube huts. The condition of the head of the village (Sarder) and a few families are a bit well-off. The wealth of other families is very limited and scanty, which are reflected by the state of the houses. The houses are made of bamboo, straw, hemp, CI sheet and wood on a very small scale.



Figure 8- Materials of houses Mud, CI Sheet, and Bamboo

Water and sanitation

33% of surveyed households in the village have their own tube-well. Other people of the community collect water from community tube-well. There are severe difficulties of water in village because all the tube-wells in the village are shallow tube-well. Most of the tube-well water is contaminated by arsenic and iron. At present there are total 32 tube-well in the study area, on an average 08 to 12 families share a tube-well. There are two ponds in the study area, which is used for bathing and other household work accept drinking. CODEC provided drainage system along the herring bond road of the study area throughout the village. 78% of total families use hygienic latrine and rest of 22% use unhygienic latrine.

Table 3- House and Number of Rooms

House	Yes (%)	No (%)	Number of Rooms	%
Have own House	86	14	One room	20
			Two rooms	50
			Three rooms	13
			Four rooms	12
			Five rooms	2
Total	100		Total	100

7. Key Aspects of Vulnerability of the fishing community, Delipara

Delipara as a coastal area is a zone of multiple hazards as well as opportunities. Morphologically, the area is characterized as shallow basin with rugged coastline separated by a breached embankment from the sea. So that the area is exposed to cyclone, coastal erosion and tidal flood. The people of the study area are mostly depending on artisanal or small-scale fishing which are in danger

from the very beginning because of natural hazard, excessive fishing, loss of habitation, water pollution and many other reasons. Dependency on only one profession is an added burden to their livelihood system and is expected to influence on most of the fishermen’s income level. Consequently, increased poverty level and thus increased vulnerability of the fishermen of the study area are perceived. Lower level of income influenced the poverty level of the fishermen and reflects by their housing conditions (Alam, K. et al 2003 & Habib, A. 2010). Housing condition in this area is fragile and primarily built with perishable material, most of the house type are

jupri or kancha. Therefore, it is necessary to assess the key aspects of vulnerability of fishery-based livelihoods in the fishing communities in Delipara as a means to find a probable illumination to get rid of the situation and built a resilient community. The key aspects of vulnerability are discussed below.

7.1. Natural and Environmental Aspects of Vulnerability

Through historical analysis, field observations and FGDs, it is found that there are a number of natural and environmental phenomenon exist in Delipara which have great impact on the life and livelihood of the fishermen. It is also observed that separately all these catastrophic events are multi-faceted in source and consequence, and most of the events produce outside the domain of the villages and are out of the control of fishing community. Some of those natural and environmental problems or stresses which make the fishermen of Delipara poorer and vulnerable argued below.

Declining Stocks:

Extensive escalations of sea fish catches have occurred between 1975 and the early 1990s. Subsequently a steady declination of catches fish has been perceived by the fisher folk at Delipara. Nevertheless, it needs to be identified that the declination is not linear and it is found that some fishing seasons are better than others. Anyway, the risk of deteriorating fish reserves in the sea is highly present in Delipara. This fish reserves are probable to have most important magnitudes upon the livelihoods of those concerned.

Seasonality:

In Delipara, and along the Chittagong coast, the main period of fishing is mid of July to mid of November and the fishing is comparatively low at the starting and near the finishing of this period. Again, Bangladesh Government banned fishing at sea for 65 days in each year for the enhancement of fish stocks. The ban last from 20 May until 23 July. Again, the fishermen may not go for fishing when dipression formed at sea.

Natural Shocks:

Natural disaster like Cyclone, tidal flooding, coastal erosion and salinity intrusion is the main reason which increase the vulnerability of the fishing community of Delipara. Among all of these events, Cyclone is the most hostile natural shock that utterly ruined the fishermen again and again. The impact of cyclone is very severe in the study area. Even a moderate cyclone like Nargis or Mohasen disrupt the life and livelihood of Delipara.

Decreasing land because of Erosion:

Different part of Chittagong coastal belt has been affected by the sea erosion for a long time. A properly designed and constructed embankment and afforestation to protect erosion are essential for the fisher community of Delipara to save the community from becoming refugee and for saving their belongings.

Environmental degradation:

Delipara is situated very close to a number of industrial areas like Fauzderhat and Kumira. There is also a ship breaking industry just adjacent to the village at its North West corner. All these industries especially the ship breaking industries make the study area vulnerable to environmental degradation.



Figure 9-Shipbreaking yard in study area and destruction of Mangrove Forest

Destruction of Mangrove Forest

Mangrove forest acts like a protection shield during the cyclone and reduce the damages due to storm surges in the coastal settlements. There was a series of mangrove forest along the coastal belt of Sitakundu. Part of the coastal zone near the study area of Delipara are covered with Mangrove Forest. But most of the Mangrove forests bordering the Bay of Bengal in Delipara coasts are at a

point of severe depletion due to overpopulation and many other reasons.

7.2. Vulnerability due to Physical setup

The vulnerability of coastal community is not only depending on the proximity of natural hazards but also depends on the existing settlement pattern of the community, lack of emergency services and shelter and absence of proper protective measure from the hazard (Kabir, S. 2012). Vulnerability of coastal community due to its physical setup can be explained as follows:

Vulnerability because of position and configuration of settlement

The settlement of Delipara is linear and at the same time scattered in pattern where the houses are close to each other and work as an obstruction during the cyclone to flow surge water and heavy wind. And because of these the community experiences greater damage than the inner rows of houses and due to fragile construction of the house and shortage of vegetation around the settlement the damage become more significant. This settlement confronted additional wind pressure and the first attack of sea during a cyclone of any level. Damaged and bricked earthen embankment due to poor construction of semi hard embankment and improper mangrove afforestation in the shore line increase the vulnerability in coastal area.

Vulnerability because of infrastructure

Shortage or improper cyclone resistant infrastructure also make the settlement vulnerable to cyclone induced disasters. It is obvious that cyclone is accompanying with heavy wind pressure and rain. An amalgamation of rain and wind may disrupt the earthen roads and other infrastructures in the village. Lack of *Killa or* shelter for livestock within the community, community people are generally anxious of their means of livelihood and often do not want to move to the shelters easily.

Vulnerability due to weak structure of the house

Fragile construction and uses of poor construction materials in houses is another reason of vulnerability of coastal community. In addition, local building materials like bamboo, thatch are not durable against early destruction due to decay, fungi, termites and high humidity. When this kind of materials come into the contact with ground may cause of early damage of houses in coastal area.

7.3. Vulnerability due to Socio-economic condition

From the study it is found that the people in the coastal fishing community commonly are poor than the

rest of the people in the country. And it is obvious that poor people suffer more because of their poor financial ability to build durable house or reconstruct the house after each hazard incident (Kabir, S. 2012). Of them, main socio-economic features that effect the vulnerability of coastal fishing community are given bellow:

Vulnerability because of unemployment and dependency on single earner

Households in study area are mostly depend on only fishing as their income generating activities and they don't have that much capacity and skills for proper jobs or informal economic activities. As a result, any disruption in fishing activity due to seasonality and natural hazard may causes the economic disruption of the households.

Piracy:

When the fishermen of Delipara managed the struggle of life with their unfading smile, local goons and pirates impede their way. After being robbed of their all belongings by the cyclone, the fishermen try to find out a way out by procuring fish materials like net, boat, and other equipment with the borrowed money. But the never-ending tyranny of the goons and pirates make all their efforts failure. The fishermen of Delipara suffer from a sense of insecurity by the tyranny of the pirates in the Bay of Bengal.

Poor marketing system:

Market of the product of the fishermen in the study area is controlled by others. So, they do not have any option to fix their desired price level and will not be able to do this until they get the freedom to establish their control over the market.

Lack of Credit Access and Insurance Policy:

In Delipara, there is no formal arrangement of savings and credit facilities to ensure capital when the fishermen are in scarcity. After the destruction by a cyclone or after a dull fishing season, the fishermen of the village need capital not only for re-establish their livelihood but also for their day-to-day need. But the fishermen do not have access to any formal financial institute to get credit at a low interest rate.

Lack of Provision for Alternative or Supplementary Livelihood:

The people of Delipara have to pass idle time without any income generating activities, especially in the off season. Most of the fishermen in the study area do not have any significant alternative livelihood which can be a source of income during the off season. The people of the

study area are not much aware about any supporting or alternative livelihood activities.

Governance Issues:

The fisher village Delipara is far behind in the development of fisheries because of the absence of planning, active work plan consciousness. Even there is no programme of supplying the fishermen all equipment including the net for catching fish with fair price. Because of high price of commodities and imposition of VAT (Value Added Tax), the prices of different fishing equipment have gone beyond the buying capacity of the fishermen. But there is no proper policy which support the small-scale fishermen in creating better opportunity that support their livelihood and thus can catch fish in the sea, preserve and market them.

8. Sustainable Approaches to make the fishing community Resilient

For creating a better future of small-scale fishermen, it is necessary to reduce the natural and socio-economic vulnerability and thus we will find a resilient fishing community. It is also essential to consider about how we can move small-scale fisheries from the present vulnerable position to the desired resilient position. Government well intention for the welfare of small-scale fisher is required to be linked with their socio-economic condition. And to reduce the vulnerability, the following issues need to be considered to take any initiative regarding the welfare of the fisherman:

- Freedom to Attain Prosperity of the Fishermen
- Diminish Resource Exploitation
- Priority should be given for fisher's well-being
- Rights of Fishermen needs to be ensured
- Learning from indigenous fishers and involves them in decision making
- Enhancing women's contribution

Reducing poverty through the improvement of socio-economies condition of fishermen is essential for building a resilient fishing community against any catastrophic natural or manmade events. And for the development of socio-economic condition, attention should be given on the following issues **a.** Improvement of traditional fishing through technology and accessibility to natural resources, **b.** provision for alternative and supplemental income generating activities which are suitable for the fishermen, **c.** building a disaster resilient habitat, and **d.** integrating income generating activities with disaster resilient housing and settlement for better livelihood opportunities

of small-scale fishers.

8.1. Building a Disaster Resilient Habitat (DRH)

This segment will deliver some approaches for cyclone resilient settlement which are largely created on the exercising and analyzing physical survey in different locations in coastal areas and additionally authors' input from architectural and engineered knowledge.

Settlement and land use planning to resist cyclone hazard

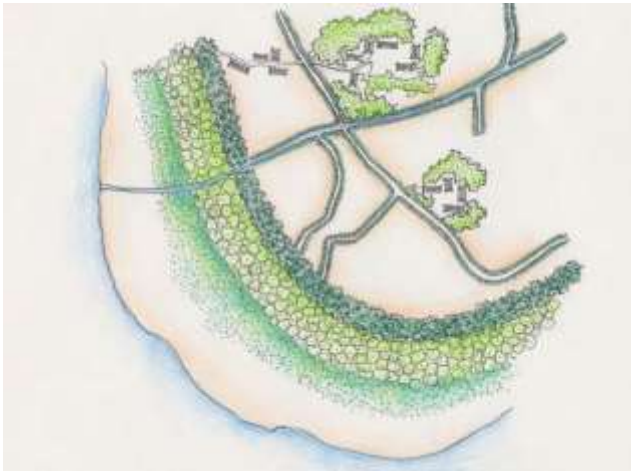
In the study area the houses and settlements are mostly secured from the cyclonic hazard and tidal floods by the coastal mangrove forest and the earthen embankment. Safe location for housing inside the embankment, proper and efficient internal road network, proper drainage and inclusion of plantation in the settlement should be considered during the determination of settlement pattern. Land use designs of an area needs to be analysed considering safe habitations. Hazardous location must be evaded specially for the placement of lifeline structures like cyclone shelter, Mosque, power station, school and hospital etc. Areas with basic amenities may be selected as evacuation points to act as nodal points in the community. (Islam, S. M. et al, 2014 and 16. Rashid, M. 2020)

Coastal mangrove afforestation

Bangladesh Government continuously executing mangrove afforestation alongside the coastline of Sitakundu. From the previous experiences it is found that the mangrove forest along the shore is playing a significant part in decreasing the effect of cyclones and associated tidal floods. It was assessed that a 100 - 200 m wide plantation belt along the coastline decreases surge elevations significantly.

Semi-hard embankment

Primary objective of constructing road cum embankment is to prevent salinity intrusion and to protect the life, livelihood and assets of the community during cyclones or tidal surges (BWDB). But the embankment along the coast of Delipara is almost damaged. These earthen embankments work as primary defence system to disperse the severity of cyclonic wave and prevent surge water to get inside.



and section. (Source: Islam, S. M. et al 2019)

Public building will be used as a cyclone shelter and should be placed in most accessible location

All public building like school, mosque, health center, etc. should be considered as a cyclone shelter during emergency period and those building should design considering as an emergency shelter.

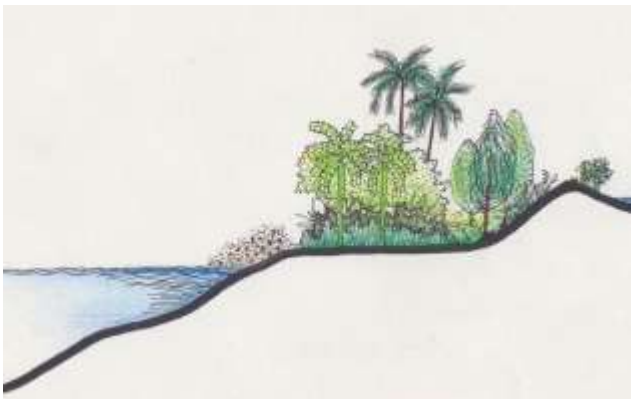


Figure 10-Implementation of Mangrove Forest helps to build a safer settlement. Figure showing Mangrove with plan



Figure 11- Section of a safer settlement showing Mangrove Forest, embankment and plantation. (Source: Islam, S. M. et al 2019)

8.2. Hazard Resilient Houses and Safe Refuges

Any structure in the coastal areas should be disaster resilient so that the houses may face least damage during the tropical cyclone. Weak buildings, particularly the

older and worsened one is the most vulnerable to cyclones. Indigenous and locally available materials and improvisation of modern technology along with well ties and joints in the components should be used for the construction of good quality houses. Different aspects to build resilient houses are described below:

Physical Planning:

When design the house with complete backdrops it is important to consider the environmental issues related to housing. Setting of the house in a safe position is main concern at the beginning of design a house and its surroundings.

Plantation practice

As plants are the very good wind backer, it is necessary to plant trees in the windward direction to decrease the wind pressure of storm towards the house. Additionally, choice of tree types and positioning of plants require special consideration depending on their size and height because tumbled plants and moving rubbish may demolish or damage the nearby houses. A system of layering in plantation should be considered in front of the homestead which can work as a wind and wave barrier and can work as a shield of the settlement during the cyclone.

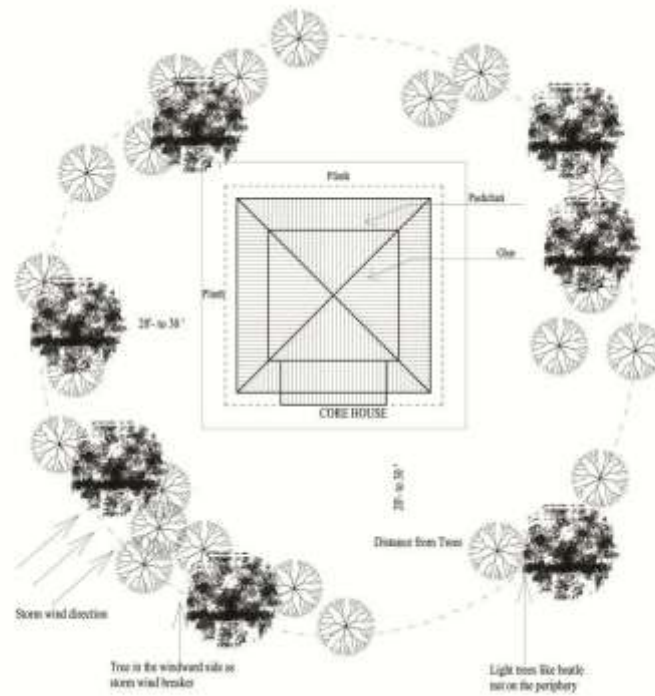


Figure 12- House layout considering wind direction, plantation distance, orientation (Source: Islam, S. M. et al, 2014)

Two storied nucleus houses:



Figure 13- Different layer plantation of trees may help to protect from the heavy wind low during cyclone. But very close placement of trees has the risk of house damage by fallen trees during cyclone.

Because of concern for house belonging and afraid of losing the staffs during their absence, people are unwilling to leave their house even the cyclone warning. In this circumstance, two-storied house might be an alternative to protect belongings during cyclone with tidal surge. Creating higher floor over ‘ghar’ will be able to offer accommodation when water comes with cyclone. Cautious construction of adjoining ‘pashchati’ will reduce the wind force towards hip roof over ‘ghar’.



Figure 14–Two story traditional houses as protection against tidal surge (Source: Islam, S. M. et al 2019)

8.3. Integrating livelihood diversification and DRH

Modified and diversified income generating activities is a method by which rural community may develop a dynamic financial portfolio and gain enormous capabilities to make them resilient and thus the community may recover their living standard (Masud, 2013). Community People go for diversified livelihood to develop their revenue absorbing both farm activities and non-farm informal income generating events to increase their financial capacity to protect themselves from a threat, when principal livelihood miscarry to meet their survival essentials. Enlarging the concept in the perspective of Bangladesh it can be said that: *“One of the most efficient ways to build a disaster resilient coastal community is divergence of income generating activities. Rather than depending on one profession the coastal people need to spread their economic activities in different ways and also in different location if possible. All the members including women, elderly people and even children may contribute in such kind of livelihood approaches. Ensuring this kind of income generating activities, problem in one sector of livelihood will have less impact on overall income source.”*

Along with the main profession local community may be introduced the alternative and supplemental livelihoods within the houses as well as in the settlement. So that

integrating livelihood and the disaster resilient habitat is very essential for this kind of income generating initiative. (Rashid, M. 2013)

A. Diversification of livelihood within fishery activities

When we think about the livelihood diversification for this community, it will be better to think about the scope of diversification related to their main livelihood fishing. Below some diversified livelihood has been described which can be accommodated within the homestead as well as in the settlement.

Adaptive saline tolerant fish culture

To adjust with recent climate trends, and variations to the surroundings, the main emphasis should be given on choosing appropriate types and culture procedures. Freshwater tilapia are more saline tolerant species and silver carp may tolerate a fair salinity range.



Figure 15– 1. Tilapia hatchery at Noakhali (Source: World Fish) 2. Caging fish culture (Source: Practical Action)

Explore the potential of Dry Fishing

An amount of captured sea fishes is preserved through dried in sun for either domestic consumption as human food or animal food. A number of fish species are processed in numerous places of coastal areas for export

from Bangladesh to overseas.



Figure 16- Dry fish yard at Nazirartek, Cox's Bazar and Modern dry fishing technology. (Source: Practical Action)

Crab and Cuchia fattening at homestead level

Recently, it has been identified that there are excellent facilities available for mud crab and cuchia farming in the seaside zones of Bangladesh, which have great economic value that can be a source of additional income for the fishermen.

Parallel Crab and Shrimp farming along the embankment

Shrimp aquaculture has increased substantially in coastal environment of Bangladesh. At the same time crab farming is receiving acceptance amid the coastal farmer which is also a prospective export-oriented sector. The coastal areas crab and shrimp farming can be promoted simultaneously in two parallel caging which do not occupy enough space and the cages may be place along the embankment.



Figure 17-1. Crab fattening box 2. Parallel Crab and Shrimp farming (Source: PKSf, 2014)

Integrated fish-vegetable or fish-vegetable-poultry farming

Dyke production system plays a key role in providing household food, nutrition security, family income and women empowerment. Farmers also cultivate creeper vegetables (bitter gourd, cucumber, bottle gourd, sweet gourd, etc) by extending a trellis over the water and quick growing white fish and sweet water shrimp in water of the land. Duck and chicken farming may also be possible above the pond, in addition to the vegetable cultivation through extending a trellis over the water.

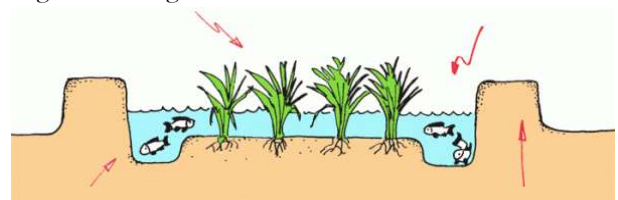


Figure 18-Rice and Fish culture (Source: PKSf, 2014)

B. Livestock and Poultry farming

Poultry, goat, sheep and cattle rearing is a traditional household farming in the rural and sub-urban areas of Bangladesh, are usually grown in the household or in the adjacent surroundings of the house. So that homestead farming provides an occasion for women to vigorously contribute to an income generating activity that is also simply manageable and does not require extreme effort.

The homestead farming also provide food on daily basis, such as eggs, fresh meats and pure milk for example.



Figure 19-Poultry Farming by the women (Source: PKSf, 2014)

C. Saline tolerance Agriculture

Different institute in Bangladesh have innovated a verity of modern technologies that are being adapted and accomplished at the farmers level in the coastal area of Bangladesh. Bangladesh Rice Research Institute (BRRI) and Bangladesh Institute of Nuclear Agriculture (BINA) innovated a number of variations of rice which are well accepted in the coastal region of Bangladesh for its production quality and quantity. Bangladesh Agricultural Research Institute (BARI) also invented a verity of fruits and vegetable which are appropriate to nurture in the coastal areas of Bangladesh. (Source: BARI, BINA)

Saline tolerance Rice cultivation

BRRI and BINA have invented some diversities of rice

which accomplish well in the coastal area. Some of these rice varieties are: BRRI-47, BINA-8, BRRI-55, BRRI-53, BRRI-54, BR-23, BRRI-40, 41, 44, and BRRI-51 and 52 etc. (Source: BARI, BINA)

Homestead vegetable gardening

Homestead vegetable production can help fishermen to generate income. Around the homestead in the kitchen yard or back yard or at the corner of the courtyard various types of vegetable can be cultivated. The main benefit of this kind of gardening is that it can be managed by the women and the elderly people of the family.

Large scale community-based vegetable cultivation

Community based vegetable and other crops can be cultivated in the unused govt. khas land adjacent to the village and may be managed by community people, even by the women.

D. Rural non-farm home-based income generating actactivities

Some fishermen who are forced to leave their hereditary profession fishing may start business and trading, homemade food production and handicrafts, agro based product processing, small industrial production and service activities can play a vital role to increase their income and thus make them more sustainable. Rural people can change their socio-economic condition through adaptation of these kind of home-based livelihood activities. (Rashid, M. 2013)

E. integrated Homestead Farming (IHF): Year-round income generating activities with in the home.

Through an integrated homestead farming an individual household can cultivate different kind of home based agriculture in the kitchen yard or back yard of the houses like vegetable and fruits, can get egg, milk and meat by poultry and livestock farming within house and can involve themselves in small scale pisciculture for fish within the homestead area which improves not only the food security and nutrition but also can be used as an opportunity of income generating activities of the household members. IHF engenders employment for women and encourages women's empowerment.



Figure 20-Integrating DRH with SLA (Source: Islam, S. M. et al 2019)

Homestead productivity system of the activity:

1. Micro-sites of homestead:

- Trellis over home yard: Cucurbit vegetables like white gourd, ribbed gourd, snake gourd and cucumber

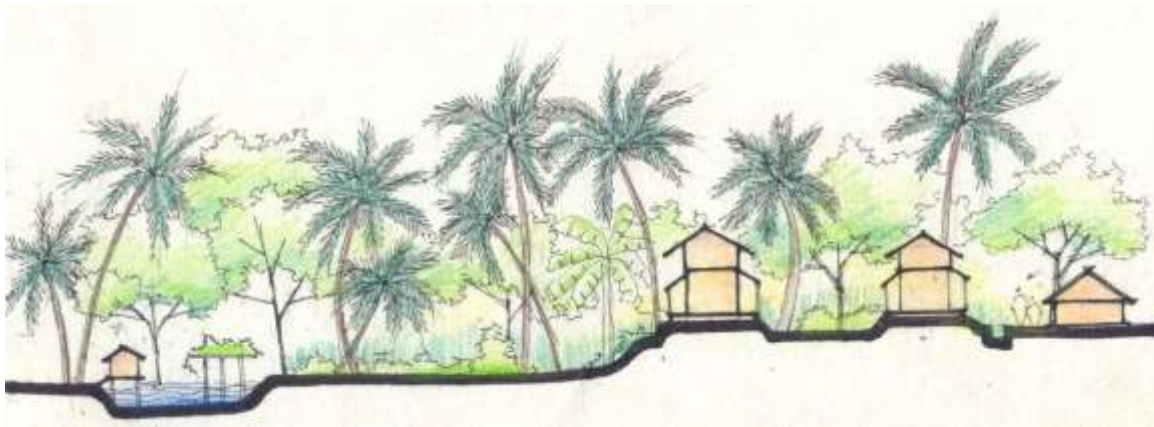


Figure 21- DRH with Integrated Homestead Farming (Source: Islam, S. M. et al 2019)

8 Conclusion

The small-scale fishermen are the poverty-stricken members of this stratified society and have fallen victim to it. Although affluence is necessary for the growth and maintenance of a civilized society, this affluence have not yet found its way into the fishing society. The benefit of many modern technology has not been reaped in this society still now, as a result, constant living in financial difficulties has rendered them mentally barren. All of these constrain make the small-scale fishermen vulnerable to

- Open land: Seasonal vegetable like- leafy, fruity and cucurbit vegetables
- Adjacent crop land: Seasonal vegetable and rice cultivation
- Hedge of entry road: Country bean and YLB
- Backyard and fallow land: Region based fruit species of farmer choice

2. Micro-sites of fish pond:

- Dyke of pond: Leafy and fruity vegetables like Indian spinach, spinach, okra and brinjal
- Trellis over fish pond: Cucurbit vegetables like bottle gourd, bittergourd and sweet gourd
- Hedge of pondside: Country bean and YLB
- Quik growing fruit species: Banana, jujube (apel kool/BAU kool) and papaya
- Quik growing fish: Nilotika, china fry, salmon and trout

any kind of natural or man-made shocks. In order to advance this retrograde community on way to prosperity and keeping pace with the speedy development of civilization, all kind of scope of economic relief are essential. It is also open to question - how much help and co-operation this fishing community can get from this intransigent society.

To build a resilient fishing community, it is important to enhance fishers' capacities by providing diversified livelihoods, which will help to increase their income, or employment opportunities to escape from poverty. In addition to development of household income, protection

of household or broadly protection of habitat are also required to create buffers to sustain a descent socio-economic condition into poverty, by reducing the exposure to risks and uncertainties. The integrated development of both livelihood and habitat as agreed in this study are tangled and support each other. A disaster resilient habitat can be utilized or planned for a sustainable livelihood to generate additional income and on the other hand an improved level of income of a fishing family can increase the ability of small-scale fishermen to build a resilient habitat. So that, when we think about a resilient fishing community, we have to think both the issues simultaneously.

References:

- Alam, K. and Habib, A. 2006, Coastal Communities: A Study on Economic Development. Community Development Center (CODEC) Publication, Chittagong, Bangladesh, April 2006.
- Alam, K., Kleih, U., Dastider, R., Dutta, U., Oudwater, N. and Ward, A. 2003, Livelihoods in Coastal Fishing Communities, and the Marine Fish Marketing System of Bangladesh. NRI Report No 2712 Project A1004, NRI, DFID, CODEC, January 2003.
- Action aid, 'Base Line Survey of the Fishing Community Villages in Chittagong', 2010.
- BBS (2007) Statistical yearbook of Bangladesh. Bangladesh Bureau of Statistics, Statistics Division, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka
- Bene, C. 2004, Poverty in small-scale fisheries: A review and some further thoughts. In E. Neiland & C. Bene (Eds.), Poverty and small-scale fisheries in West Africa (pp. 61- 82). Dordrecht: Food and Agricultural Organization of the United Nations and Kluwer Academic Publishers.
- Bene, C. 2009, Are fishers poor or vulnerable? Assessing economic vulnerability in small-scale fishing communities. *Journal of Development Studies*, 45(6), 911-933.
- Disaster risk reduction and climate change', Practical Action's Programme in Bangladesh, Source: <https://practicalaction.org/drr-climate-change-bangladesh>.
- Habib, A. 2010, Upokuler Najibpur- Jibon Jekhane Uthe Daranor Poth Khoje. CODEC-Community Development Center, Chittagong, Bangladesh, February, 2010.
- Islam, M. M. 2012, Poverty in small-scale fishing communities in Bangladesh: Contexts and responses. Phd Thesis, University of Bremen, Germany.
- Islam, S. M. and Siddiqua, A. 2014, Using Indigenous Building Patterns to Cope with Natural Disasters: The Case of Cyclones in Bangladesh. *International Journal of Architecture, Engineering and Construction*, Vol 3, No 1, March 2014, 27-43.
- Islam, S. M. and Niger, M. 2019. Community Based Approaches to Resilience: Response to Vulnerability of Coastal Habitat in Changing Climate. Proceedings, International Conference on Disaster Risk Management, Dhaka, Bangladesh.
- Jentoft, S. and Eide, A., 2011, Poverty Mosaics: Realities and Prospects in Small-Scale Fisheries. Springer, 2011.
- Palli Karma-Sahayak Foundation (PKSF), 2014, PRIME and LIFT- Intervention in the Climate Resilient Coastal Area. Nowabanki Gonomukhi Foundation, December 2014.
- Palli Karma-Sahayak Foundation (PKSF), 'Shopno – Gagar Upokule', Upokulio Anchole Krishi, Mostho o Pranisompoder Tekshoi Unnoyon and Somproshoron. PKSF.
- Rashid, M. 2013, The Role of Rural Home-Based Enterprises on the Housing Transformation in Sirajganj. Master's Thesis, Department of Architecture, Bangladesh University of Engineering and Technology, Dhaka, Bangladesh, January, 2013
- Rashid, M. 2020, Factors Affecting Location and Siting of Settlements. *Southeast University Journal of Science and Engineering*, Southeast University. Vol. 14, No. 1, June 2020, pp. 44-53. DOI: 10.13140/RG.2.2.31512.32009
- Rashid, M. 2020, In Search of a Settlement Pattern for Bengal Delta Through Theoretical Re-Interpretations. *Journal of Creative Space*, Chitkara University, India, Vol. 8, No. 1, November 2020, pp. 21-34. DOI: <https://doi.org/10.15415/cs.2020.81003>,
- Kabir, S. 2012, A study of geo-climatic vulnerability and its response in the settlement pattern in coastal Bangladesh. M. Arch thesis, Department of Architecture, Bangladesh University of Science and Technology.
- Sengupta, K. and Giasuddin, S. M., 2006, Socio-Political Empowerment of Chittagong Coastal Fisherfolk Communities under CODEC Intervention. Community Development Center (CODEC) Publication, Chittagong, Bangladesh, April 2006.
- Walmsley, S., Purvis, J. and Nines, C. 2006. The role of small-scale fisheries management in the poverty reduction strategies in the Western Indian Ocean region. *Elsivier: Ocean & Coastal Management*, 49(11), 812-833.