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Multi-dimensional coping and adaptation strategies of small-scale fishing communities of Bangladesh to climate change induced stressors

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Abstract

Purpose – Coastal and floodplain areas are on the frontline of climate change in Bangladesh. Small-scale coastal and floodplain fishing communities of the country face a host of cross-scale stressors continually, some induced by climate change, and they have developed coping and adaption strategies based on customary social and experiential learnings. This paper aims to examine the coping and adaptation strategies that small-scale fishing communities undertake in the face of stresses including climate change and variability.

Design/methodology/approach – This research takes a nuanced ethnographic-oriented approach based on around two-year-long field study in two coastal and floodplain fishing villages, represented by two distinct ethnic groups. The study adopts direct observational methods to denote the ways small-scale fishing communities address the arrays of stressors to construct and reconstruct their survival and livelihood needs.

Findings – It was observed that fishers' coping and adaptation strategies comprise a fluid combination of complex overlapping sets of actions that the households undertake based on their capitals and capabilities, perceptions, socio-cultural embeddedness and experiential learnings from earlier adverse situations. Broadly, these are survival, economic, physiological, social, institutional and religiosity-psychological in nature. Adaptation mechanisms involve some implicit principles or self-provisioning actions that households are compelled to do or choose under given sets of abnormal stresses to reach certain levels of livelihood functions.

Originality/value – Based on empirical field research, this paper recognizes small-scale fishers' capability and adaptability in addressing climate change-induced stresses. Policymakers, international development planners, climate scientists and social workers can learn from these grassroots-level coping and adaptation strategies of fishing communities to minimize the adverse effects of climate change and variations.

Keywords Bangladesh, Adaptation, Climate change, Coping, Livelihood, Small-scale fishers

Paper type Research paper



1. Introduction

The location of the coast itself is dangerous. You never know how the sea will behave next hour. In the event of any cyclone, we are the first to die, and the last in terms of recovery and relief support from the government. Now “things around” (climate and local environment) are changing quickly. We have seen the angry face of nature (cyclone), we survived and learned what to do – Key Informant (KI)-1, age 51, Moheskhali, Cox’s bazar.

Some years we see long lasting flood; some years we see flash floods; some years we see drought around the “haor” (wetland). From my long observations, I can say that changes in the surrounding haor are dramatic in the last two decades – KI-2, age 70, Volarkandi, Moulavibazar.

1.1 *Climate change, Bangladesh and fishing communities*

Climate change is a global reality (IPCC, 2014). Its local-level impacts are dynamically evidenced along Bangladesh’s coasts and floodplains. Based on very high confidence and available evidences around, experts infer that climate change and variability interact with non-climate stressors and structural inequalities, worsen existing poverty and trigger new vulnerabilities, as well as opportunities, for individuals and communities (IPCC, 2014, Huq *et al.*, 2015). Bangladesh is one of the most vulnerable countries to climate change and variations because of its low-lying elevation (two-thirds less than 5 m above the sea level), higher population density (1,252 persons/km²), poverty, fragile ecosystems, climate variation-sensitive subsistence economy, relatively low levels of technological amenities and massive reliance on dwindling natural resources (Haque, 1997, Ahmed, 2008, Alam and Collins, 2010, Paul and Rashid, 2016). IPCC (2014) projected a sea level rise of 14 cm by 2030, 32 cm by 2050 and 88 cm by 2100, compared with its 2000 level; by 2050, about 27 million will be at risk to the adverse effects of the sea level rise.

Maplecroft (2015) ranked Bangladesh as the most vulnerable country to climate change based on a multitude of indicators such as food security, population density, exposure, adaptive capacity, heat stress, environmental pressure, biodiversity, deforestation and water stress. As per “Mortality Risk Index”, put forward by the UN International Strategy for Disaster Reduction, Bangladesh is placed in the “extreme” category in terms of citizens’ susceptibility to the risks of tropical cyclones, earthquakes, floods and landslides. Based on the contexts of the combined effects of predicted climate change-induced warming, importance of fisheries in the national well-being and economy and limited social adaptive capacity to these changes, Bangladesh ranks 12th among the highly vulnerable countries (Allison *et al.*, 2009). Based on extreme weather events and economic losses incurred during 1995–2014, Bangladesh ranked 6th with a record of 222 climatic change-related extreme events, a total loss of US\$2438.33m purchasing pair parity and a loss per unit GDP of 0.86 per cent (Kreft *et al.*, 2016).

Meteorological and geographical conditions ideal for the formation of tropical cyclones prevail in the Bay of Bengal along the coast of Bangladesh. From 1877 to May 2017, 168 cyclones including 52 severe cyclonic storms and 68 tropical depressions hit Bangladesh, leaving unbearable impacts on the lives and resources in the coastal areas. Tropical cyclones killed 900,000 people in coastal areas in the last 35 years, especially the southeastern coast that received around 27 per cent of the total cyclone landfalls (Paul, 2009). Rural women, children and old people with limited mobility are the most vulnerable (Alston, 2015). Mirza (1992) estimated that the frequency of cyclones in Bangladesh escalated from 0.51 events/year in 1877–1964 to 1.12 events/year during 1965–1980. Notably, the death tolls from cyclone reduced drastically in the past three decades (note: 500,000 in 1970; 140,000 in 1991; 3,406 in 2007; 25 in 2016 and only 6 in 2017 cyclone events), owing to an enhanced level of public awareness along with policies and macro-institutional supports.

Temperature regime, monsoon and regional water flow patterns immensely influence the country. During 1948-2007, the mean annual temperature in the country increased at the rate of 2.34°F/100 years, and most significantly at the rate of 3.85°F/100 years over the period of 1980-2007 (Climate Change Cell 2008, *cited in Paul and Rashid, 2016*). Heavy and prolonged monsoons with 1,270-6,000 mm of rainfall, coupled with a huge influx of rainwater from upstream Indian territories, generate around 1.37 million cubic meters of rainwater with a silt load of 1.5-2.5 billion tonnes that flow through the Bangladeshi territory, thus recurrently causing floods of different intensities and rapidly transforming the Ganges–Brahmaputra–Meghna delta both vertically and seaward (Paul and Rashid, 2016). The mean annual rainfall increased by 4.4 per cent (+4 inches) during the 1900-2012 period (Paul and Rashid, 2016). Monsoon rainfall is predicted to increase by 11 per cent by 2030 and 27 per cent by 2070, with a general rise in the average surface temperature of 1.3°C by 2030 and of 2.6°C by 2070 (GoB, 2006). Between 2003-2009, an accelerated climate change-induced melt of upstream Himalayan glaciers caused a subsequent loss of about 21 per cent area and 174 gigatons of water which eventually ran toward downstream areas, causing catastrophic floods in Bangladesh's floodplains (Laghari, 2013). Out of 2.85 million hectares of coastal and offshore areas, about 1.2 million hectares of arable land are already impacted by varying degrees of salinization (World Bank, 2011). Increased temperature and dry season setting heavily impact crop yields, land use suitability, cropping cycle, livestock, source of potable water, biodiversity and public health.

Small-scale fisheries in Bangladesh present a classic illustration of the dynamic setting of ecosystems, vulnerabilities, adaptation, livelihood insecurity, resilience and uncertainties emanating from both anthropogenic and climate-induced changes. Presumably, any climate-induced change in the production ecology and the productivity and distribution of fishery resources can fundamentally affect the well-being of the millions of small-scale fishers. Most of the fishers are extremely poor and are the first victims of catastrophic climatic events like cyclones and floods.

Through coping with and adapting to extreme events for generations, fishers developed distinct understandings of extreme hazards and collective experience of ecological adaptiveness more realistically than any other rural communities, thus representing the most appropriate scale for institutional learning. Using a fluid combination, this article holistically examines fishers' coping and adaptation measures in the face of climate change and variations at the micro level. It focuses on indigenous non-structural solutions and avoids discussing macro-level structural adaptation efforts and environmental changes in the coasts and floodplains on a temporal or spatial scale, as most of the fishers.

2. Conceptual considerations: coping, adaptation, vulnerability and livelihood

Evidences suggest that, in Bangladesh, climate change and variability singly or synergistically put forth irreversible and disproportionate pressure, and exacerbate already existing inequality across societal intersections of class, power and wealth structures. Adaptation is viewed as "adjustments in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities" (IPCC-TAR, 2001). It has focus on long-term responses and actions of individuals and communities to climate change (Burton *et al.*, 2002). We consider adaptive actions as locally appropriate place-based measures that are reflective of the perceptions, human capitals, endowment sets and socio-cultural traits of fishers. Coping is defined as "the actions of ordinary people or disrupted remains of institutions, in contrast to official and planned response" (Hewitt, 1997). It is considered as "the manner in which people act within the limits of existing resources and range of expectations to achieve various ends" (Wisner *et al.*, 2004). Coping actions, developed at a

smaller spatial scale like households, might overlap across the temporal scale which might transform into adaptive strategies over time in a socio-culturally appropriate way (Badjeck *et al.*, 2009; FAO, 2009). On practical grounds, it is difficult to isolate coping and adaptation measures on a temporal scale, as most of the fishers' actions are responsive and spontaneous, not much planned *per se*.

Vulnerability, a widely used concept, is considered as "the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes" (IPCC, 2014). Vulnerability of fishing communities to climate variability and changes intricately relate to the distribution, productivity, availability of aquatic resources and degree of adaptive capabilities of aquatic resource itself to climate dynamics. Livelihood is an effective conceptual lens in understanding the likely impacts of climate variability and changes on the small-scale fisheries and fishing communities. A livelihood comprises the assets (natural, physical, human, financial and social capital), capabilities and activities for the means of living; it is considered sustainable when people "can cope with and recover from shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation" (Chambers and Conway, 1992; Deb and Haque, 2011 for an *emic* view of livelihoods). Poverty and gender are analyzed as cross-cutting issues as and where appropriate in this article.

In the face of climate change variations, psycho-social coping strategies involving both positive attributes (hope, strong determination, a doing-related motivation, cognitive restructuring, wishful thinking, self-criticism, etc.) and negative attributes (fatalism, blame-game, fear, cognitive avoidance, helplessness, hopelessness, social withdrawal, resignation, etc.) put on demands that tend to exceed the individual's capacity and resources for coping (Lazarus and Folkman, 1984).

3. Study area and methodology

This research was carried out with small-scale fishers of Bangladesh in two fishing villages from January 2005 to September 2006 followed by another spell of group discussions with key informants during December 2009-February 2010 and November-December 2015. Initially, we examined the dynamics of livelihoods in the study villages, and at later stage, we learned about local perceptions of and responses to climate change and variations. These two study villages represent micro-level "ground zero" climate change hotspots of two distinct ecosystems – coastal ecosystem under the south-eastern climatic sub-region being prone to horrendous tropical cyclone, and floodplain ecosystem under the north-east climatic sub-region being subject to annual normal flood (*Borsha*) and abnormal long-retaining flood (*Bonnya*) [Plate 1(a), (b), (c), (d), (e), and (f)].

Thakurtala (literally, beneath the footstep of Lord *Shiva*, a sacred place for the Hindu pilgrimage), a coastal fishing village, is located in the Moheshkhali Island, Cox's bazar district, along the Bay of Bengal. The village with a population of 650 and an overcrowded slum appearance represents caste-based Hindu fishers *Jaladas* (literally, slaves of the water). Coastal fishers are very poor, highly disadvantaged, uneducated, indebted, radically exploited by moneylenders and highly prone to cyclones. *Volarkandi* (literally, upland along the rivulet *Vola*), a floodplain fishing village with a population of 1240, is located in Sujanagar union, Moulavibazar district of the north-eastern region of Bangladesh. It represents relatively new-entrant Muslim fishers (locally known as *Maimal*). It is situated within the *Hakaluki haor* – an ecologically critical area, a major source of subsistence and commercial fishing, and the largest natural wetland system of Bangladesh.

Field works in this study demanded a more nuanced ethnographic engagement with fishers to understand the dynamic aspects of their multi-dimensional coping and adaptive strategies.

Baseline survey was conducted among 78 coastal and 60 floodplain fishing households. In total, 53 coastal and 31 floodplain key informants were interviewed; 17 case studies were conducted; and 45 focus group discussions (coastal village: 25 events, floodplain village: 20 events) were carried out. Direct observations and participation with the fishers on the fishing boats were the most useful and straightforward way to learn about people's experience.

We talked with women in a culturally appropriate way. Respondents' age was calculated on the basis of some historic markers like "liberation war of 1971", "cyclone of 1991" and "flood of 1998". Names of the respondents have been anonymized and human faces blurred for the protection of privacy in compliance with the policy of the publisher.

4. Results and discussions

4.1 Common people's perceptions

Many fishers think that the greatest vulnerability for them is persistent poverty, and climate change issues added an extra layer of vulnerability to that. Irrespective of religious faith and ecosystem differences, fishers have some perceptions in common: "we the humans crossed the limits"; "when Almighty is angry, HE hurls strong cyclone"; "mild cyclones are warning signs"; "floods are opportunities for correction"; "Goddess Ganga is unhappy"; "all these events are wrath/gojob of Allah"; "may be this is our last day and meet you in heaven", and so on. Fishing communities in both coastal and floodplain ecosystems agreed that the patterns of Bengali seasons are changing noticeably. Out of six seasons as per Bengali almanac, which were distinct to local people even two decades back, only summer and monsoons are now dominantly felt, and rest four mild seasons in between are gradually fading. Here is a comment from a curious observer:

Last 10-15 years, I observed that the timing of rain and intra-seasonal rainfall patterns changed quite dramatically. You know there are six seasons in our almanac- "grishma" (summer), "borsha" (monsoon), "shorot" (autumn), "hemanta" (late autumn), "sheet" (winter), and "boshonto" (spring).

Plate 1.

- (a) Small fishing boats taking refuge in mangrove forests prior to cyclone;
- (b) house dilapidated by cyclone;
- (c) skeleton of a cyclone-damaged fishing boat;
- (d) coastal children who are often the first victims of calamities;
- (e) a fish pond washed away by a tidal surge; and
- (f) cyclone-affected fishers eating cooked rice-lentils slurry (*Khichury*) served on banana leaves



(a)



(b)



(c)



(d)



(e)



(f)

There are two months for each season. In our boyhood, we could ascertain the differences when season changed from one to another. We could see new season's indicators in the nature- flowers, insects, fish, birds (cuckoo for spring, peacock for monsoon, "loitta" fish in winter) [...] we celebrated our rituals as per almanac. Now it is difficult to guess [...] you will see only "grishma" (summer), "borsha" (monsoon) and "sheet" (winter). The "beauty" (to mean rhythm) of the monsoonal rain is lost. Mild seasons like "shorot" (autumn), "hemanta" (late autumn) and "boshonto" (spring) almost died out or reduced to one-fourth of what these seasons were a few decades back. Temperature is increasing for sure; we can feel the "fire". What is ahead-I don't know, only God knows – KI-3, age 69, Thakurtala.

Old fishers, from their long and comparative observations in between decades, generally agreed that "things" in mother nature are changing rapidly. Such observations on increasing trend of temperature regime, rainfall extremes, subtle shifts in rainfall patterns and, importantly, the divergent rate of change of extreme hot and cold days/nights are supported by some scientific inputs (Jennings and Magrath, 2009; IPCC, 2014). Table I reveals concerns of fishers. Floodplain fishers observed that waterbodies became shallower in the past two decades:

Look, the bottom is rising up (hint to sedimentation); water born fruit-yielding plants are decaying; big fish are hardly seen [...] these are all signals of changes in the weather and local ecosystem [...] things around are somewhat wrong – opines KI-4, age 55, Volarkandi.

Floodplain fishers have a common mental map of annual flood (*Borsha*) being a normal phenomenon. Only long-lasting abnormal floods (*Bonnya*) that inundate homesteads and rural roads up to knee heights are considered as disaster, warranting extra efforts for coping. Cyclones with higher intensity (highest signal 10 as per government-approved cyclone signalling system) are considered something serious by coastal fishers, and tidal/storm surges or cyclones with lower intensities are a natural part of their lives. Climatic events and variability are so deeply embedded in fishers' lives and socio-cultural constructions that we found it difficult to specifically segregate the perceived impacts of climate change patterns from many other anthropogenic and natural stressors. In total, 73 per cent coastal and 45 per cent floodplain agreed that there is a decline in catch per unit effort and availability of big fish, and for that they blame both anthropogenic and natural disturbances.

4.2 Fishers' coping and adaptation strategies

Each fishing household has its own mental frame of livelihood struggle and disaster preparedness, well-communicated with members who singly or collectively take coping actions, deliberate or not, to address stress-provoking or dissatisfying conditions. Based on empirical evidences, we follow a comprehensive course of adaptive measures tuned to the local socio-cultural landscape of the fishing villages. The broad six categories of strategies discussed in this article are dynamic, interactive and overlapping in nature and some adaptive actions can be viewed from more than one angle, and equally judged as short- to mid-term coping measures.

4.2.1 Survival strategy. Fishing communities have different sets of immediate preparations and some long-term responses [Plate 2(a), (b), (c), (d), (e), (f), (g), (h) and (i)] in different climatic sub-regions based on the type and intensity of the climatic hazards. Some adaptive first-order actions prior to hazards are:

- psychological preparation and planning for the worst time exercised within the family (coastal areas, floodplain areas);
- storage of dry foods (puffed rice, flattened rice, fried peas, molasses, biscuits, dates, etc.), and essential items (dry clothes, blankets, drinking water, fuel, matches, portable clay-stoves, dry wood, water purification tablets/alum, oral saline packages, medicine, etc.), (coastal areas, floodplain areas);

Table I.
Seasonal calendar of
natural hazards in
Bangladesh and
associated impacts

Major natural hazards and associated impacts	Grishma (summer) 14 April-15 June <i>Boishak Joisto</i>	Borsha (monsoon) 16 June-17 August <i>Ashar Shrabon</i>	Shorot (autumn) 18 August-17 October <i>Bhadro Ashwin</i>	Hemanta (late autumn) 18 October-16 December <i>Kartik Agrahayan</i>	Sheet (winter) 17 December-12 February <i>Poush Magh</i>	Bosonto (spring) 13 February-13 April <i>Falgun Choitra</i>	Perceived impact
Cyclone (C)	↔					↔	++++
Tidal surge (C)		↔					+++
Flood (F)			↔				+++
Water logging (F)			↔		↔		++
Drought (C, F)	↔					↔	++

Impacted sectors:

Cyclone: Human lives, houses, aquaculture, livestock, poultry, job availability, safety, farming, fishing equipment, income flow, fishing operations, food security, fodder, crop yield, water scarcity, gardening, education, well-being

Flood: Livestock, poultry, food security, safety, waterborne diseases, fodder, communication, drinking water, food preparation, sleeping, women, children, sanitation, job scarcity, crop inundation, education, loss of wealth *Tidal surge:* Crop failure, salinization, fish disease, poultry, house structure

Drought: Water availability and quality, livestock, poultry, skin disease, heat wave, food scarcity, crop failure, backyard gardening, seed storage, fodder

Water logging: Food scarcity, communication, fodder, crop yield, sanitation

Notes: C = coastal zone; F = floodplain areas; +++++ = highest impact; ++ = moderate impact

- storage of fodder and productive assets (nets, traps, ropes, hooks, ploughs, engines, valuables, etc.), (coastal areas, floodplain areas);
- reinforcing houses with extra supports (coastal areas, floodplain areas);
- repair bamboo-made thatched houses with ropes (coastal areas, floodplain areas);
- send old people and children to upland safe areas (floodplain areas);
- build temporary bamboo-made or wooden platforms (*macha*) for humans/livestock/poultry birds (floodplain areas);
- move to safe areas like cyclone shelters (coastal areas);
- lease livestock during the disaster seasons to upland areas (floodplain areas);
- protect the tube-well from floodwater and tidal surge by sealing the openings (coastal and floodplain areas);
- save some cash for emergency use (coastal areas, floodplain areas);
- strengthen huts with diagonally set bamboos (*theka*) (coastal areas, floodplain areas);
- untie domestic animals prior to landfall of cyclone (coastal areas) and lift them to raised land or raft during abnormal floods (floodplain areas);
- make earthen stoves for cooking (floodplain areas);
- repair small boat or make rafts with banana plants or bamboo for communication (F);
- tighten long hair of women and keep a buoy ready (coastal areas);



(a)



(b)



(c)



(d)



(e)



(f)



(g)



(h)



(i)

Plate 2.
 (a) Raising the homestead land to combat flood;
 (b) adapting to Ferrocement life boats that provide better maneuverability and safety; (c) clay pots for storing food/drinking water prior to cyclone;
 (d) improving drainage canal;
 (e) women prepare nursery bed after flood; (f) floating gardening (hydroponic) in flood zone; (g) fish nursery in flood proof pond; (h) rice seedling nursery; and (i) shelter on coastal embankment

- store seeds for farming and gardening (coastal areas, floodplain areas);
- store dry fish as crisis time food (coastal areas);
- burn hot chilly or turmeric to keep poisonous snakes away (floodplain areas);
- raise the height of wooden sleeping bed *khatia* with bricks or wooden poles;
- preparing early meals prior to cyclone landfall (coastal areas); and.
- saying a final prayer prior to leaving homestead and putting off light/fire (coastal areas) (Focus group discussions, 2010, 2015).

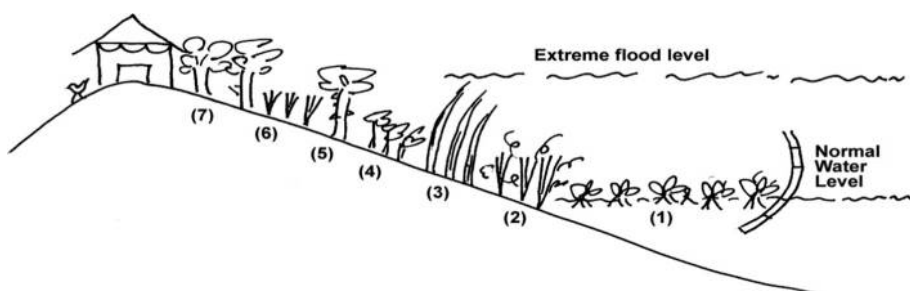
Some long-term second-order adaptive measures [Plate 2(a), (b), (c), (d), (e), (f), (g), (h) and (i)] in the wider coastal and floodplain areas (within and outside the ambit of the study villages) are:

- practicing floating agriculture/hydroponics (floodplain);
- cropping rotation (coastal areas, floodplain);
- adopting Ferro-Cement boat instead of heavy wooden boat (coastal areas);
- mechanization of fishing boats (coastal areas);
- shift in species composition with emphasis on polyculture instead of monoculture (coastal areas);
- trial on salinity tolerant rice and crop varieties in the island (coastal areas);
- planting water-resistant trees to form a canopy around the house (floodplain);
- building a temporary dyke around the house (floodplain);
- more backyard gardening and nurseries for fruit trees (coastal areas, floodplain);
- increasing efforts for duck rearing (floodplain); and
- raising plinth of homestead land (coastal areas, floodplain) (Focus group discussion 2015).

Based on the intensity of flood, floodplain fishers stay on roof top or the platform *macha* for few days to weeks, while coastal fishers take shelter on the top of *Adinath* hill or in nearby cyclone shelter for 10-15 h during a cyclone. As per social norm, washed-away domestic animals are returned to the owner; however, this does not apply to fruits. These indigenous knowledge and practices pass on from generation to generation through practical observations and learning-by-doing.

Hakaluki wetland dwellers evolved a unique indigenous practice of maintaining a “plant canopy” to save their houses from the disastrous waves during the monsoons. At the outer end of the household areas, a circle of free-floating water hyacinth (*Eichornia crassipes*) is maintained, followed by “Nol Khagra” (*Phragmites karka*), “Hogla” (*Typha angustata*), “Pati pata/Mutha” (*Cyperus* sps.), “Hijol” (*Barringtonia acutangula*), “Koroch” (*Pongamia pinnata*) and cane in the lower elevations, and popular fruit-yielding trees in the upper elevations (Figure 1). We exclude the importance of long-term adaptation hardware like building embankments, cyclone shelters, green belting, developing salinity-resistant and floodwater-resistant crop varieties, etc. from discussion.

Our field observations allude to the uncomfortable fact that climate change-induced natural calamities impact women more heavily in terms of mortality, susceptibility to accidents and sufferings – a dilemma of the prevailing gender inequalities of various kinds and magnitude. A few gender-focused studies following climatic disasters in April 1991 showed that among women of age group 20-44, the mortality rate was 71/1,000, while it was 15/1000 for men (UNEP, 2005). Women, especially pregnant and lactating mothers, and adolescent girls are further susceptible to declining health condition, as there is hardly any



Source: Deb (2009)

Notes: 1: Water hyacinth confined by bamboo shoots; 2: Cane plants and “Khagra” (*Phragmites karka*); 3: “Hogla” (*Typha angustata*); 4. “Mutha” (*Cyperus sps.*); 5. Swamps like “Hijol” (*Barringtonia acutangula*), “Koroch” (*Pongamia pinnata*), “Barun” (*Cratogeomys muriei*); 6. Terrestrial vegetables; and 7. Fruit and wood plants

Figure 1.
Plant succession
adopted by floodplain
fishers to prevent soil
erosion and save
household properties
from waves of flood
waters

safe isolated place for them to carry on reproductive roles and healthcare needs during cyclones and floods.

The time cyclone hits the land, the environment within the cyclone shelter becomes chaotic, unsafe, congested and scary for all categories of people. Fishing communities are victims of social seclusion – they are allowed in the shelter only after the local high-caste people are accommodated. Floodplain fisherwomen narrated their sufferings from the lack of latrine facilities during abnormal long-retaining floods. Fisherwomen work for prolonged periods (14-20 h) for carrying out their productive and reproductive roles in pre-and-post-disaster situations compared to normal period. Though the rural societies are strongly influenced by patriarchal values, socio-culturally embedded issues of women’s veil and isolation get relaxed during disasters.

4.2.2 Economic strategy[1]. An added income from more than one source has profound impacts on a family’s world and livelihood sustenance, insulating households against multiple shocks, spreading over the risks of absolute dependence on a seasonal profession, adaptive capability, moral strength, social dignity, and the ability to challenge or change institutional aspects [Plate 3(a), (b), (c), (d), (e), and (f)]. Access to fisheries’ resources still remains critical, sometimes even more so because of vulnerability. Fishing families undertake multiple activities (*rural pluriactivity*), comprising “complex *bricolage*” or portfolio of activities in the face of climate change vulnerability, and the causes and consequences of diversification may be differentiated in practice by geographical locations, assets, family income, opportunities available and social networks (Salmi, 2005; Scoones, 2009).

Fishing families use their asset base, networks and experience accumulated over time to develop workable livelihood strategies. Considering the ancillary activities along with active fishing, around 84 and 55 per cent of male-headed households make their livelihoods directly from fisheries in the coastal and floodplain villages, respectively. Family members ranging from two to four individuals were engaged in earning activities whatever the amount is, and members earned from one to three activities with an average of two in most cases. Other than active fishing, trades we identified in the coastal (C) and floodplain (F) fishing villages are: fish retailing/processing (C, F), sub-leasing small wetlands (F), net weaving and repairing (C, F), boat repairing (C, F), terrestrial agriculture (C, F), daily labor (C, F), carpentry (C), rural

transportation (C, F), foreign remittance (F), tailoring (C), hair dressing (C), ranching milking cows (*bathan*) (F), homestead poultry and livestock (C, F), gathering natural resource (C, F), lending boats and gear (C, F) and low category services (C, F). Around 59 per cent fishers depend on gathering natural resources as their main income source.

Table II synthesizes the subsistence-oriented diversification efforts within the fisheries sector. Small-scale fisheries, already overpopulated and overexploited, offer a limited scope for extensification and intensification. Income earned through foraging (US\$7-19/month/individual), although insignificant, plays an important role in ameliorating a grim situation of food scarcity, especially in those families where adult male fishers fail to cling to fishing due to disease or accidents. Terrestrial agriculture ensures earnings for around 23 and 29 per cent of the male-headed and female-headed households, respectively, in the floodplain village which is more than double that of the coastal village.

In the face of an increased level of temperature and consequent crop failure, income from upland terrestrial land in the floodplains will be threatened. Interestingly, female-headed households in the coastal and floodplain villages are in a better position of earnings through multi-tasking and compromising with a low wage rate compared to that offered to men for similar manual jobs. Coastal fisherwomen are actively involved in post-harvest activities like fish drying, selling of products from home-based livestock, poultry, producing fermented fish, shrimp smoking and crab fattening. As earners, they play fundamental roles in supplementing family incomes; when male economy is at stake, the female economy plays significant roles for livelihoods and reviving after disasters (Deb *et al.*, 2015).

We observed that poor households rely more on income sources which are physically demanding, whereas the higher medium and rich classes use their networks for maximizing earnings. Large-scale disasters, like cyclone, impose a process of defisherization and subsistence crisis; fishers cannot go out for fishing if their fishing crafts and gears are damaged or lost. Roles and efficient functions of macro-institutions are critical in such contexts.

4.2.3 *Physiological strategy (self-deprivation)*. Households characterized by low endowments, female-heads, higher number of children, old/injured/sick persons and victims of shocks from natural calamities are usually forced to undertake this strategy frequently.

Plate 3.

(a) Illegal bird poaching in wetlands; (b) cow ranching in upland areas during dry months; (c) raising ducks in the open wetland; (d) crab hunting using traps in the coast; (e) migration to different wetlands for 5-6 months; and (f) sun drying of surplus low-quality fish in the coast



(a)



(b)



(c)



(d)



(e)



(f)

Actions	Actions undertaken for more income	
	Coastal areas	Floodplain areas
Vertical integration or intensification	Use of dense-mesh mosquito nets for catching shrimp fry Use of low-mesh “tunnel” in estuarine and marine set bag nets Catching of juvenile <i>Hilsa</i> fish Foraging for mud crabs Shift in species composition in pond aquaculture and crab fattening Catch unconventional foods like squids, eels, mollusks, etc. Desperate inshore fishing ignoring bad weather and danger signals More fishing hours and child labor	Use of synthetic “current nets” Use of illegal large encircling gears (<i>ber</i> , <i>jagat</i> , <i>dharma</i>) and lift nets Fishing using illegal obstructions “Total fishing” by removing water from small ditches More fishing hours and use of child labor Use of multiple gears from same craft
Horizontal expansion or extensification	Fishing beyond customary territory Foraging fish Targeting fish migration routes Product diversification like fish drying, salting, fermentation (<i>Nappi</i>), smoking Fish camping in the Sundarbans mangrove forest areas in the south-west	Poaching migratory birds Gathering earthworm and frog (baits) Clandestine fishing in the leased waterbodies or sanctuaries Night fishing Angling by women Product diversification through drying and fermentation

Table II.
Intensification and
extensification
efforts for enhancing
income

Source: Deb and Haque (2016, p. 362)

Primarily through an adjustment in the frequency and quality of meals compared to “normal days”, this strategy implies one of the last-resort actions for survival. Here are a few quotes:

Tufan (cyclone) kicks us multiple times. It takes our lives; it hits on the source of income, and finally on our bellies. We can survive a few days with whatever dry food we stored and relief support we get from different agencies; after that we keep starving for long time – KI-5, age 45, Thakurtala.

Even if I have something to cook, where shall I cook? There is no dry land where I can put on fire, and there is hardly any potable water source [...] you see dead animals everywhere [...] water is colored and polluted. How long can one survive on slurry of cooked rice? – KI-6, age 51, Volarkandi.

Food stock analysis and meal statistics in the study villages revealed that the incidence of “zero food stock” is higher in Thakurtala (47 per cent) compared to Volarkandi (29 per cent). Meal statistics would provide us a scenario of the severity of food crises and the resultant physiological coping actions. Using two meals per day for basic survival needs, we see that 44 per cent of the coastal and 32 per cent of the floodplain fishing families are forced into a state of seasonal hunger during the crises seasons. Using three meals per day pattern as culturally determined for manual works of fishers, we see that around 80 per cent coastal families are victims of food insecurity irrespective of the season. For most of the fishing families, it is important to adapt and get used to *monga* or pseudo-famine situation – a “below extreme poverty-level equilibrium trap” in which fishers do not die out from a famine-like situation, rather they gradually diminish physiologically from severe scarcity of adequate healthy meals. Rice consumption declines from 200-300 g/person (normal period) to 100-150 g/person during crises periods. Food insecurity is strongly prevalent during mid-April to mid-September in coastal areas and mid-September to mid-November in floodplain areas when demand for manual labor utility declines.

Members of the poor fishing families can signal well about the advent of “bad days”, and a psychological preparation surfaces among them in the advent of any natural disaster. Here are some comments from fishers (Focus group discussions, 2015):

- “Eating less and remaining half-fed is our destiny; we are born to suffer from hunger”.
- “I drink a lot of water and raw unusual fruits”.
- “Sniffing for wild foods in a group is our ritual”.
- “Just one meal in the evening serves both lunch and dinner; we get used to rice slurry”.
- “I sleep keeping my belly downside, so that I don’t feel the pain of hunger”.
- “It is not important what I eat, rather if I have something to eat”.
- “Our bellies are squeezed; there is no obesity problem in fishing villages”.
- “There is a month-long fasting for Muslims [...] for the poor, it is always more months”.

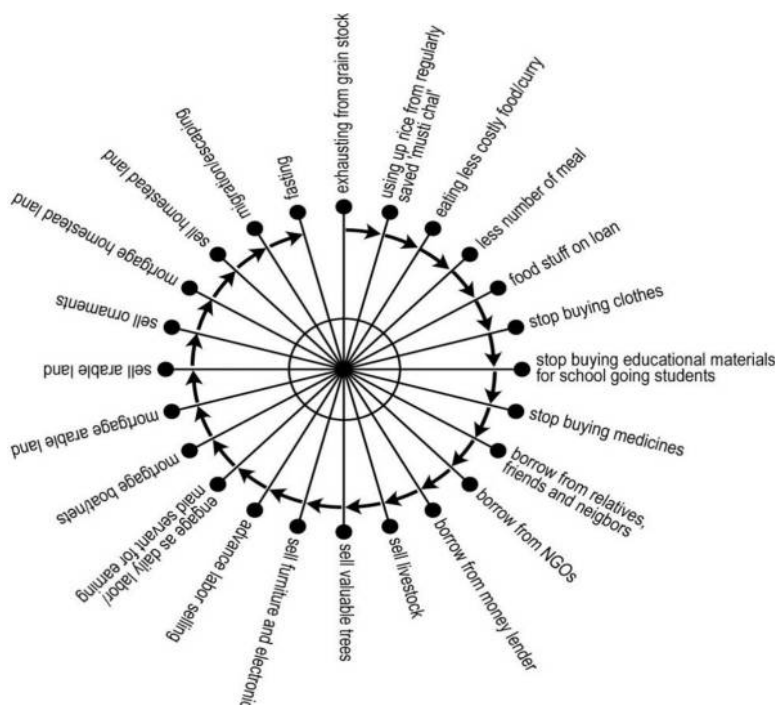
For >45 and 60 per cent families of Volarkandi and Thakurtala villages, respectively, income/day/family goes down to as low as US\$0.7-0.9 and 0.4-0.6 during the lean periods (meaning an allocation of about 10 cents per person per day), and fishers spend 55-83 per cent of that tiny income for buying rice. Using current endowment sets to maximize long-term entitlements, food-insecure households make strategic decisions to bridge their consumption deficit, and draw a balance between its longer-term economic and social costs (Sen, 1981; Devereux, 2001; Deb and Haque, 2011). Following two cases mirror the contexts of food crises situations in two coastal and floodplain families.

4.2.3.1 Case analysis of KI-7 (part one), revealing immediate and long-term impacts of cyclone. KI-7’s husband (age 45 years) disappeared as the fishing boat was capsized by a cyclone on 3 July 1997 near the *Sundarbans* mangroves forest in the Bay of Bengal. As the dead body could not be recovered, as per social custom, she had to wait one *Juga* (12 years) to be declared a widow:

The news of boat capsize fell on my head like a thunder [...] can you imagine how a woman with scanty or no income can run a family of nine? I have 4 daughters and 4 sons. Think about those days. He gave me Taka 5000 (US\$62) for meeting our daily necessities which he had borrowed from his sister before he left home for six months. It was difficult for me to manage even a single meal a day for all. I prepared slurry of cooked rice and vegetables. Sometimes I had to go to sleep after drinking a glass of water. How long can one fast? Kids used to cry out at mid-night for food; I used to press on bellies to lessen nasty bite of hunger – KI-7 adds.

4.2.3.2 Case analysis of KI-8, revealing immediate and long-term impacts of flood. KI-8 was 16 years when she got married; 7 years of married life, now she has 2 daughters and 1 son. Her husband was a fisherman cum farmer. During last flood, family members took shelter on roof-top. “Imagine how difficult it is for a pregnant woman to stay on roof top of a fragile house for weeks” – she adds. In the middle of a night, her husband felt that he had a snake bite on left leg; he started feeling numbness, and in just a few minutes, he died. Later, KI-8 took shelter in her parent’s house. Her brothers were annoyed as she ended up with them with kids. She had no income; she survived at the mercy of her brothers and parents. “One snake bite during the flood, and my life turned to hell” – she adds.

Intensive case studies revealed that people tend to convert endowment sets into food entitlements to avoid starvation during crises periods, but there are situations when poor people sometimes chose to starve rather than sell their productive assets (Figure 2), and this can be accommodated in the entitlement approach using a relatively long-run formulation for “future entitlements” (Sen, 1981). This means that poor people are capable of analyzing and



Source: Intensive case studies and participatory observations with key respondents

Figure 2.
Cycle of coping and
adaption measures
observed in the
fishing villages
during severe crises

predicting their endowment sets and entitlement conditions in the longer term. The sets of the most common and identifiable sequential actions that we developed based on intensive cases and validated afterwards with some other poor families of the fishing villages are shown in Figure 1. However, it is quite usual that the most vulnerable families begin and move along the physiological coping actions earlier and faster than the relatively better-off families.

Strategies that relate to self-exploitation (like austerity in consumption, starvation) are usually adopted first, whereas the actions that are difficult to reverse (selling of goods) are adopted later. Figure 2 reveals that fishing families initially depend on the grain stock, and then they depend on *musti chaf* [2] followed by eating less costly foods. After that, they reduce their number of meals, and then they borrow from multiple sources and sell/mortgage whatever they have. The final step is starvation and consuming food occasionally, what has been termed as ‘family exploitation’ for the peasantry (Chaynav, 1966). Fishing families are forced to starve intermittently to the extent physiologically bearable for them, and prolonged starvation is obvious in post-disaster periods.

Following any major climatic hazard, fishing families compromise with the quality of meals. Austerity measures involve avoiding costly foods like meat, lessening the use of cooking oil and ingredients, cooking low-quality food compared to that cooked during normal earning periods and reduction in the amount of intake per meal and/or number of meals per day. We observed that fishers took meals with only green chilies, a small piece of onion or a paste of rice and locally harvested vegetables. Poor families eat cheap jackfruit as

“complete meal and stomach filler”, and the seeds were cooked later as curry. While eating jackfruit is a matter of luxury and nutrition for the rich, eating it as “replacement of meal” is an indication of worse economy of poor families.

Intensive case studies revealed that women shift their dependence heavily on wild and backyard-grown plants during post-disaster crises periods. More dependence on the “famine or pseudo-famine foods” [3] becomes very distinct and characteristic for the poor families during crises periods. They boil stems of wild plants like arum (*kachu*), wild yam (*maitta alu*), *kalmi* vegetables, green banana, and backyard-grown vegetables like gourd, radish (*mula*), cauliflower and cabbage as replacement of rice. As the amount of rice allocation (250-400 g/day needed for hard-working adults) goes down, the amount of vegetable trashes increases. Local food culture indicates that failure to cook curry and rice separately is an indication of “bad days”. Twigs of banana and green banana paste are very useful in filling up the stomach. Rice allocation in the extremely poor families drops down to 30-70 g/meal/child which is around one-fourth of their bodily requisites (personal communication KI-7, Thakurtala). The working-class fishers have been hit hard by a price hike of essential commodities in the past ten years.

The unfortunate gender dimension to the physiological strategy is that often women consume less food or intake irregular meals. Differential inter-household power within the community usually tends to translate differential impacts during crises periods. Sen puts forward the notion of “extended entitlements” (Sen, 1987; Drèze and Sen, 1989) to cover “socially legitimated” entitlements that were not conferred by market mechanisms; these included intra-family allocation of food, or what has been labeled as “dependency entitlements” (Devereux, 2001 for details). Irrespective of ecosystems the authors studied, children and old cohorts suffer worse because of their increasing physiological demands and poor bodily resilience, respectively.

4.2.4 Social strategy.

Families, societies, communities – these are like web of synthetic nets [...] you can't break the mesh of the nets and go out easily [...] people around create illusion (Maya) that's difficult to abandon – KI-9, age 47, Thakurtala fishing village.

My relatives and neighbors are equally poor like me [...] sometimes they come forward to help whatever they can afford, but how long? Following major disaster like cyclone, people's ability to help diminish [...] disaster is a killer of morality also – says KI-10, age 49, Thakurtala.

Social strategies, from coping and sustainable livelihoods perspectives, capture the ideas that uphold the aggregated values of social bonds, cultural norms including cognitive and behavioral aspects, helping attitude, goodwill, fellowship, moral economy, a culture of reciprocity, mutual trust, sympathy and collective actions embedded in societal relations. Unlike other capitals, social capital is rather intangible and a value-oriented cementing force that many individuals use as a refuge or safety net for coping against adversities. Making the best use of brokerage opportunities is reflective of the household's capability in maintaining relationship with different actors, institutions and power sources, thus adding to household's standing inside and outside the ambit of the village.

Next to family, support from neighbors is important after any disaster, and different forms of social capitals play differential roles in enhancing or hindering climate resilience (Jordan, 2015). Indicative of kinship obligations and moral economy, Thakurtala fishing families exchange materials like curries, rice, firewood, oil and spices regularly, and such benevolent exchanges help to reduce stress of hunger during low-income periods. During food deficit periods, fishing families generally try to borrow money from near relatives and then from neighbors; then they try to get credit from NGOs and other informal sources (Table III). This is chiefly because relatives and neighbors hardly talk about interest and have a common realization about crisis. However, when major disaster like cyclone affects

Table III.
Sources of loan
critical to livelihoods
and business

Sources of loan	Range of loan (US\$)	Interest rate/year (%)	Households		Duration (months)	Uses of loans taken by households
			C (%)	F (%)		
No loan	—	—	8.9	35.0	—	—
Relatives/friends	8-110	—	24.3	21.7	1-6	Gear purchase, house and boat repair, foods, dowry, treatment, education
Neighbor	5-30	—	17.9	8.3	1-3	As above
Boat owner	30-110	—	11.5	1.7	1-5	Food, dowry, treatment
Moneylender/ companies	45-500	96-120	34.6	1.7	3	Boat repair, gear purchase, fishing operations, dowry
NGOs	30-150	32-40	37.2	25.0	12-24	Domestic consumption, house repairing, familial crises, fishing operations
Banks/other	—	—	—	—	—	—

Source: Field survey, Legend: C-coastal, F-floodplain; (multiple answer options) (1US\$ = Taka 82)

the whole community, the rural institution of moral economy among kin relations tends to break down. Labor reciprocity, especially during overburdening post-harvest works and post-disaster periods, helps in building and sustaining social relations and saving money.

Fishing families tend to simplify social events during the post-disaster crises periods. Respondents (27 per cent male and 4 per cent female from coastal areas; 14 per cent male and 1 per cent female from floodplain areas) mentioned that they preferred to defer social celebrations like wedding events through negotiating with bridegroom sides. Fishing families (23 per cent male and 60 per cent female from coastal areas; 14 per cent male and 32 per cent female from floodplain areas) simplify occasions and rituals, and celebrate only unavoidable rituals with simple arrangements and entertainments. Fishing families (63 per cent male and 32 per cent female from coastal areas, 28 per cent male and 5 per cent female from floodplain areas) stop spending on buying new clothes and repairing houses. Table III reveals that around 35 per cent inhabitants of Volarkandi did not require borrowing, which is reflective of a better economic position compared to those of Thakurtala. In the “no loan” group of Thakurtala, there are ultra-poor families, including beggars, and a few rich families.

Maintenance of social capital is an important adaptive strategy for those who are excluded from formal or state-run means of subsistence support. Other than taking a philosophically and morally just position, “Compromise (*Samajota*), Ignore (*Upekkha*) and Adjust (*Mene chola*) (CIA)” strategy works well for the voiceless and powerless poor. The perception of “something is better than nothing” in negotiating for formal help worked well for a destitute fisherwoman. In her words:

Getting support from the government is not easy; the administrators enlist their own relatives and political cadres in lieu of genuine destitute. I have nothing; so I could not bribe cash to enlist my name. Through verbal agreement, I managed to get little share of rice from the local member. He keeps his share (illegal, 40 per cent) and gives me the rest (60 per cent). Happy with whatever little is left for me [...] people like us can't bargain'—KI-11, destitute, age 65+, Thakurtala village.

Small-scale fishing families work and survive in a narrow orbit of patron–client relationship. As poor fishers face day-to-day struggle for basic needs, boat owners and moneylenders pay advance to tie them for the upcoming fishing seasons at rates around 25-

40 per cent lower than the existing market values of skilled labor. In the Hakaluki floodplain areas, fishers can fish anywhere during floods (demarcation of the leased property of the powerful leaseholders is difficult), but as water level goes down slowly, fishers get into some forms of conditional arrangements with the leaseholders. In recent decades, fishers in the Hakaluki haor started paving marital relationships with upland-dwelling families, and this social strategy would allow the lowland-dwellers to get shelter during extended flooding.

While social capital is an important asset for fishers, social exclusion eventually culminates in economic exclusion, as they fail to exercise their *de facto* right over common property resources. There are cases of caste- and ethnicity-based social marginalization in the country. Individuals use social capital as a means of survival within the gamut of both friendly and exploitative structures in and around the community. Intensive case study of KI-7 (Thakurtala village) shows how important it is to maintain close relationships with villagers as well as outside well-wishers.

Part two of Case analysis of KI-7. Consciously knowing that her husband will never be back, KI-7 strategized to “live on” relatives, neighbors and wider institutions. She worked as a daily-basis laborer in a filthy fish drying yard; later she took the job of repairing muddy roads under the management of CARE Bangladesh. Relatively better payment [...] around US\$1-1.5/day. Partly depending on supports from relatives and neighbors, and with what she could save in the last three years, she arranged social marriages for three daughters with very little offerings and dowry to the bridegrooms. Now she has a debt of around US\$195 with the women’s group, shopkeeper and moneylenders. One moneylender grabbed her homestead land. NGOs did not give her loan, as she was considered incapable of paying weekly installments. In the past nine years, she did not buy any clothes. Last year, she got 16 kg rice and US\$1.2 from the local government. As of February 2015, KI-7, now socially declared as widow, could send one of her sons to college and two others ended up as crews in fishing boats.

Notably, KI-7 took reality-driven decisions and made complex negotiations with many outside forces. With differing degrees of dependence, each fishing family has both positive and negative social relationship categories. That way, fishing households have different defensive mechanisms with sets of social relationships and networks that are subject to continuous renewal, acceptance and rejection based on the services, reciprocities and conflicts of interest.

4.2.5 Institutional strategy.

All the villagers work cooperatively in the event of climatic hazards spontaneously. This attitude to work in a group is fundamental. Alone we can’t survive in a calamity-prone area; we must hold each other – KI-1, age 51, Moheshkhali Island.

Institutions, formal or informal, are the rules prevalent in a society that shape the activities of the people. Their roles are critical in the sense that fishing households and communities, despite their access to and control over natural, social and human capitals, might not be able to successfully elevate their coping actions to higher level of sustainable adaptive capacity-building process unless supported by multi-institutional-level networks and good governance. “Adaptation to climate change is inevitably local”, and hence, local institutions, are critical leverage points in mediating between individual and collective responses, and also as means of delivery of outside resources to facilitate climate change adaptation and govern access to external resources (Agrawal, 2008). Fishing families undertake a host of local actions to build resilient mechanisms. Functional institutional interplay within informal and formal institutions, both vertically and horizontally, can add positively to coping actions and adaptive process in the face of climate change and variability (Osborne *et al.*, 2010).

Coastal fishers exhibited unique leadership in the face of natural calamities. With prediction of severe cyclone, youth groups along with Red Crescent volunteers alert all the households for quick evacuation and restoration of dry foods. As the village gets dilapidated,

the households depend on their own efforts to erect the shanties with whatever is left after cyclone. Afterwards, village leaders (*sarder* and his associates *mannyabar*) organize collective actions (involving at least one youth per household) for the following priorities:

- collection and burial of dead bodies;
- arrangement of treatment for the wounded;
- arranging “quick food” (usually hotchpotch/*khichuri* made of rice, potatoes and lentils);
- repairing community tube wells and latrines; and
- erecting damaged houses and clearing fallen trees.

In the floodplain, village *panchayet* leaders assist in preparing platforms for shelter, arranging fodder for livestock, harvesting paddy prior to inundation, sending patients to far-off district hospital, lending boats and fetching potable water. Meanwhile, households adapt individual coping actions based on their capital and capabilities. These post-hazard actions are well-founded in the social memories of the elders which they revitalize following every major disaster.

Table IV summarizes the level of participation of fishers in different socio-political institutions. Activities of development projects have certain impetus in the fishing villages [Plate 4(a), (b), and (c)]. In Thakurtala, village organizations, catalytically persuaded by UNDP-funded “Empowerment of Coastal Fishing Communities for Livelihood Security project, 2001-2006”, helped in building cohesion among fishers, establishing networks with the power sources of local governments and regaining confidence. These grassroots-level organizations can still serve as primary vehicles for implementing and mainstreaming climate change action plans locally (Table IV).

Making the best use of institutional networks, a few poor fishers had access to programs initiated by the government that had positive impacts for survival in crises periods. Some of these programs are: rural maintenance program, old age allowance, test relief, food for work, vulnerable group feeding, post-event gratuitous relief, etc. The existing institutional setup for climate change adaptation and mitigation is active in developing action plans and mainstreaming climate change into sectoral planning process and a range of development

Thakurtala		Volarkandi		Remarks
Types	No. of persons and level of response*	Types	No. of persons and level of response	
ECFC-Village Organization	117, active 71, medium 33, inert 13, female dominated	Mosque committee (<i>Panchayet</i>)	11 (active), absolutely male	Participation level is affected by off-village labor engagement for livelihoods. Fishers of Thakurtala village usually set meeting dates with respect to lunar tides and lean fishing periods in the month. Participation at district or national level institution is insignificant
NGO groups	52 (active 18, medium 27, inert 7), female dominated	Primary school committee	1 (active), male	
Project and disaster management committees	23 (active 14, medium 9); around 60% women	Community Based Fisheries Mgt. committee	23 (active 5, medium 7, inert 11); ornamental inclusion of 2 women	
Hamlet-based committee	3 (active 3), all male	UP member	1	
–	–	NGO groups	65 (women dominated)	

Notes: *Response level is calculated from the attendance register maintained in the fortnightly meetings of the village organization (active = 80-100%, medium = 50-80%, inert = <50%)

Table IV.
Level of participation
of fishers in socio-
political institutions

activities. Vision 2021 outlines efforts of the government in mitigating adverse impacts of climate change with emphasis on capacity building and good governance.

The more households relate to formal and informal institutions, the more resilient are their livelihoods (Osbahe *et al.*, 2010). Specially, the informal networks within the fishing villages were central to the everyday system of livelihood dependence, and supports from cross-scale institutions become critical during and after hazards. Increased dependence of female-headed households on institutional supports reminds us of the gender inequalities and vulnerabilities in the rural area.

While NGOs as microfinance organizations are active in the rural areas, there are serious criticisms about their modes of operations. Considering the gravity of livelihood situation during drought, flood and cyclones, NGOs need to show flexibility in their payment collection approach. Otherwise, fishers would end up in the trap of moneylenders who charge exorbitantly higher interest.

4.2.6 Religiosity-psychological strategy. Hope – a belief system in self-power, a will-force for revival, a doing-related motivation, a theological virtue – is something particularly important for fishers who are largely characterized by a sense of helplessness and hopelessness. The role of religiosity in the healing process is widely known (Bjarnason, 2007; Plakas *et al.*, 2011). Hope and psychological stress share some commonalities: both are contextual, meaning-based and dynamic with profound impacts on one's well-being in stressful conditions (Folkman, 2010). Hope helps people cope with serious and prolonged psychological stress, and it “is not a perpetually self-renewing resource; it has peaks and valleys and is at times absent altogether” (Folkman, 2010). Given the cultural and religious diversity and gender construction within the study villages, it is difficult to examine religiosity as a general or singular frame of hope for coping against and adaptation to distress. Poverty and climate-induced stressors not only lead directly to sickness and incapacities in numerous ways, they also generate frustrations and hopelessness culminating to poor livelihood resilience and ill-being.

From selective longitudinal case studies, we observed that in desperate situations, especially prior to and after any climatic disaster, religiosity provides hope to victims, and hope and coping actions are reciprocal in nature. Some fishers are psychologically stronger than others. Here is a comment:

If the water level is beyond half-knee on the homestead level, then we suffer more; below that level, we can adjust somehow. As dwellers in the haor area, we are pretty used to flash floods since childhood age; [. . .] not a big deal for us – adds KI-12, age 45, Volarkandi.

With insignificant capital endowments and other asset bases for dealing with recurrent calamities, and almost independent of any significant government support, such a coping

Plate 4.

(a) Donor-supported cyclone shelter cum primary school in the coast; (b) grassroots-level school run by community leaders in remote locations; and (c) fishers pledge to protect fisheries



(a)



(b)



(c)

psychology of the poor fishing families deserves compliments. We found each villager to be a believer in God irrespective of their faith system, and remarkably, the frequency of religious practices tends to be higher during distress periods. With the negative signals (e.g. serious decline in catch, bad weather cycle, cyclone warning, torrential rain, accidents, etc.), members can guess the gravity, duration and nature of sufferings. Some actions pertain to seeking blessing as preventive strategy. Here are a few comments from fishers:

When God's Act washes out everything, I feel so helpless to the Power [...] then comes another ordeal test of survival [...] starvation [...] hunger [...] I pray to God to ease my sufferings - KI-13, age 57, Thakurtala, Moheskhal Island.

The day he (son) goes to sea for around seven months, my only job is to say prayer to numerous Goddesses for his safe arrival and good health. With no safety tools on boat, who else can save my son in a vast sea waterscape - KI-14, age 60, Thakurtala.

Society changed; Allah will impose more punishments for us" - KI-15, age 51, Volarkandi.

Any event of extreme natural hazard affects the psychosocial aspects of the survivors and fishing communities inevitably suffer from depression and post-traumatic stress disorder. Religiosity, with a sense of surrender for the grace of God, helps fishing families in relieving their pains, whether it is out of hunger (case of KI-13's family) or uncertainty/fear (cases of KI-7, KI-8, KI-13, KI-14, KI-15). Religious coping actions involve both public and private religious practices. Hindu caste-based sea-faring fishers worship the deity *Ganga* and Goddesses in Adinath temple with utmost devotion to get rid of storm surges, cyclones and accidents while fishing in the sea. Additionally, fisherwomen, whose family members are in the sea, say special prayer every night inside their homes to satisfy the Goddesses *Bipodnashini*, *Shoni*, *Mongolchondi* (rescuer from danger), *Shitola* (rescuer from disease) and *Laxmi* (Goddess of wealth).

Helplessness and frustration in the face of frequent cyclones is so socio-culturally instilled that coastal fishers are reluctant to rebuild their houses with better materials, as they know that another cyclone next year or soon would wipe out everything they build. The fact is that Muslim fishers of the study village live in wetland areas that are relatively less vulnerable compared to life-threatening cyclones and storm surges in the coast. Floodplain fishers can better cope with flash floods but the whole coastal village may be wiped out in hours during cyclones.

5. Conclusions

Bangladesh is already experiencing the impacts of climate change and variability. Our research revealed that fishing households cope with climatic adversities by applying a host of strategies based on the opportunities and capabilities they have, constraints they face and the changing social relations dictated by external and internal forces. We observed that the seasonal nature of income from fishing along with a prolonged underemployment and unemployment, lack of low-skill jobs in the informal sectors and failure of macro-institutions in providing support services result in fishers' poor resilience to climate-induced stressors. Fishing households' ability to cope with stresses over time is an outcome of a complex nexus of factors such as family composition, number of earners/dependents, endowment sets, socio-political linkages, biophysical settings, macrolevel economic processes and political forces (Huq *et al.*, 2015). As the coping thresholds are crossed-over by multiple stressors, households become extremely vulnerable and continue to experience serious existential crises.

Each extreme climatic hazard results in almost irreversible negative effects on the livelihood well-being of the fishing communities. The "always poor" families are pushed to the starkest state of food insecurity in the post-disaster period. Extreme climatic events, especially cyclone,

and the associated consequences (loss of boats, nets, death of earning member, etc.), might render the medium-rich fishers to “tomorrow’s poor” as they eventually fail to transform the endowment sets and capability into productive sources of income and food security. Coping and adapting in the face of adversities require classic skills to manage relationships and transactions in different spheres, making the best use of what can be achieved through one sphere, and then undertaking together more well-orchestrated actions in the other spheres (Bebbington, 1999). As endowments and coping capabilities rapidly deplete and institutions fail to adapt to change, available coping strategies become brittle, resulting in reduced resilience.

One must not overemphasize that fishers’ local-level coping actions can consequentially sustain adaptive capacity in the face of climate change and variability. Government planners should develop macro-, meso- and micro-scale adaptive strategies for different biomes to help build ecosystem resilience and social adaptive capacity of fishing communities, ensuring that macroeconomic drives in one sector do not become counterproductive for another important sector. Some recent initiatives from the government are indicative of boosting the aquaculture industry and better management of *Hilsa* fishery; however, there are negligible efforts for mitigating multiple challenges small-scale fishing communities face.

Taking neoliberal directives, some policy and management interventions suggested by the fishers (synthesized from Deb and Haque, 2016) for disaster risk reduction and adaptation are:

- special recognition of the fishing villages as “disaster prone” and “seasonally food deficit” zones;
- introducing food aid program for the most vulnerable section (widows, deserted women, physically weak persons, etc.);
- providing microcredit support with zero interest;
- providing government support in marketing fish products in overseas markets;
- taking special initiatives for accommodating unemployed and underemployed persons in labor-intensive industries (e.g. garments and shrimp processing industries);
- constructing more cyclone shelters to accommodate all members during disasters;
- regular maintenance of cemented infrastructures so that fishing families can take shelter during catastrophic disasters;
- special support services and safety measures from emergency management organizations during disasters; and
- providing well-orchestrated program support for socio-political and economic empowerment, livelihood security, disaster risk reduction and strengthening of gender-inclusive community-based self-help groups of fishers by the Department of Fisheries, other government institutions and regional/international development agencies.

Notes

1. For a detailed version, please see Chapter 21 titled “Livelihood Diversification as a Climate Change Coping Strategy Adopted by Small-Scale Fishers of Bangladesh” by Deb and Haque (2016) in the book *Climate Change Adaptation, Resilience and Hazards*.
2. It is an age-old practice that many poor rural women pick up one handful of rice (*musti chal*) from the budget of rice for each meal; accumulated rice serves as emergency stock during crises periods.
3. Characteristics of famine foods in fishers’ interpretations: *foods usually not preferred during normal period and often culturally not appropriate for the majority in the community; usually gathered from wild sources with little or no use of spices and oil; same food taken repeatedly without choice and little amount provisioned compared to need.*

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