Chapter 21
Livelihood Diversification as a Climate Change Coping Strategy Adopted by Small-Scale Fishers of Bangladesh

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Abstract Coastal areas and wetlands are on the frontline of climate change and variability in Bangladesh. Small-scale coastal and floodplain fishers continually face a host of cross-scale stressors, some induced by climate change. This research is based on 21-month long field study carried out in two coastal and floodplain fishing villages represented by two distinct ethnic groups. Adopting nuanced people-centered ethnographic approach of field research, this study examines the ways small-scale fishers address the arrays of stressors in order to construct and reconstruct their livelihoods. Findings of our study highlight fishers' capability to plan and construct creative livelihood strategies and their adaptability in the face of stresses. We observed that fisher's coping strategies comprise a fluid combination of complex overlapping set of actions that they undertake based on their capabilities, socio-cultural embeddedness, and experiential learning under different adverse situations. Broadly, the coping strategies embody under economic, physiological, social, survival, institutional and religiosity-psychological factors. In this article, considering its predominant roles, only economic dimensions of coping actions that fishers undertake under unusual and abnormal stresses for survival and well-being are analyzed.

Keywords Bangladesh • Climate change • Coping • Small-scale fishers • Poverty • Livelihood diversification

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Introduction

'That you see I am still alive, means that I have gone through series of adversities, some happening on a day-to-day basis, and the others happening on a seasonal or annual basis. I have perfected my inner-self, my attitude and my body to the extent that I can survive any situation. Look, during calamities, the elephants die, little cockroach can survive somehow. We, the fishers, are like cockroaches.'- Anar Koli Jaladas, 45, fisherwoman and community leader, Cox'sbazar.

'I don't know about the climate change issues, but from my experience and observations in the last five decades in the sea, I can tell you that something goes wrong with the whole system. Things like species abundance, catch per trip, size and combination of species, etc. look extremely unusual. Probably the golden days of coastal and marine fisheries are gone. Who are to be blamed? We all are responsible- our lifestyle, deforestation, growth overfishing, population bloom, pollution, and so on. Who suffers most from this uncertainty and paucity in catch? It is us-the poor fishers.'- Ananda Jaladas, 70, Cox'sbazar.

Bangladesh and Climate Change

Climate change and variability is no more an issue of scientific thoughts, it is a reality. The low-lying deltaic physical characteristics, combined with the demographic and economic conditions make Bangladesh as one of the most vulnerable countries to climate change and variability (Government of Bangladesh 2009). It is one of the largest low-lying deltas on earth with a population of around 160 million living in an area of around 148,000 Km^2 with a GDP/capita of around US$ 2000 and life expectancy of around 65 years. Two-thirds of the country are below 5 m above the sea level, and get inundated by massive monsoonal floods at an interval of every 3–5 years- causing substantial damage to economy, crop production, lives and livelihoods.

The country is at the receiving end of about 40 % of the impact of total storm surges in the world. Between 1877 and 1995, Bangladesh was hit by 154 cyclones including 43 severe cyclonic storms and 68 tropical depressions, meaning an average of one horrendous cyclone every 3 years, at pre-or-post-monsoon periods creating storm surges that are sometimes >10 m. Even a median prediction from the General Circulation Models for Bangladesh would be 1.5 °C warmer and 4 % wetter by the 2050s, while a relatively warmer and wetter pattern of future climate that goes beyond historical variations will worsen existing climatic risks. These would cause increasing susceptibility by accelerating the severity and frequency of flooding, cyclones, storm surges, droughts, salinity intrusion, water-logging, and production failure. Notably, the impacts of existing climate variability and change are concentrated in geographical areas that are demographically characterised with higher concentrations of poor and socially vulnerable populations (World Bank Group 2010).

Climate Change, Small-Scale Fisheries and Fishers

Climate change can impact small-scale fisheries and fishers through multiple pathways. Its direct and indirect impacts on the lives and livelihoods of the majority of small-scale fishers in the tropical regions who comprise >90 % of worlds' fishers and fish traders are not well-researched and well-understood (Badjeck et al. 2010; Barbier 2015). The issue of climate change is alarming because of its direct and indirect linkages to food security, poverty, economies, well-being and sustainable fish production. Bangladesh is one of the most vulnerable countries to the impacts of climate variability and change on the fisheries, which is the source of economic livelihoods for millions of poor fishers, and around 80 % of all animal protein supply to the nation. Building fishers' resilience to adapt to short-term climate variability and long-term climatic changes through livelihood diversification and other development efforts are yet to be undertaken.

The real impacts of climate changes on fisheries are yet to be fully understood; it is assumed that climate change might amplify a boom-and-bust cycle of fish catches. But certainly, any change in production cycle is likely to negatively impact the marginalized fishers who are almost solely dependent on the profession. While a prolonged wet season flooding may be helpful in enhanced inland fisheries production, higher temperature regime might threaten the production, growth and distribution of both culture and capture fisheries. In the coastal areas, extreme weather events like cyclones usually hit the fishing communities, aquaculture operations, and fisheries infrastructures first. However, ascertaining precisely climate-induced changes from those of anthropogenic disturbances remain as a challenge to climate change researchers and development scholars (Brander 2010; Grafton 2010; Holbrook and Johnson 2014; Barbier 2015; Rita et al. 2015).

Poverty is a fundamental feature of the livelihoods of fishers- a harsh reality that thousands of small-scale fishers with so little economic endowments are forced to cope with, day-in and day-out. Such an unwanted situation continue to impede their capabilities, self-esteem, hope, happiness, dignity, level of tolerance, and other positive attributes for human well-being. Supported by the wide biodiversity and deltaic ecology, fishing is an age-old profession, especially for the birth-ascribed Hindu fishers. They are prone to multiple sets of natural and socio-culturally induced vulnerabilities that singly or synergistically impact the family well-being and livelihood resilience (Deb and Haque 2011). Given their dependence on fisheries resources, fishers live close to the shorelines, and hence, become first victims in the event of catastrophic hazards like cyclones and storm surges. We observed that alongside death and physical injuries, extreme climatic hazards like cyclones and floods damage their craft and gear- the basic economic capital they need for fishing and transportation on a daily basis, local fish landing facilities, houses, roads, and many other physical infrastructures.

By and large, fishers' economic livelihoods centre on the subsistence mode of income and employment. The corollary is that fishers falling below the minimum economic equilibrium with an extremely low level of income do critically risk, not

only nutritional deprivation, but also their familial and social standing. In the face of shocks and stresses emanating from multiple sources, fishers as permitted by one's adoption of new skills and social networks, are more inclined towards adopting a multiplicity of livelihood strategies to sustain basic livelihood functions. Once used to be self-reliant, fishing villages have now turned to poverty catchment areas, especially in the last two decades. Struggling almost on a diurnal basis, the rural poor of the floodplain and coastal areas have proven their considerable capacities to adapt with layers of adversities including natural hazards and environmental degradation, primarily through mitigating impacts of stressors on fragile livelihoods.

Broadly speaking, fishers can reduce vulnerabilities in two ways. First, fishers as a whole can collectively resist the pressures. Second, they can define mechanisms at the individual or household level through actions like lessening consumption, employing more family labor, diversifying income sources, and seeking loans. While there are commonalities in nature and gravity, there are still remarkable variations in crises between families and among the fishing villages in different agro-ecological zones. Our knowledge is limited about how poor small-scale fishers cope with multiple stressing situations. Examining the ways how fishers try to cope with climate variability and change would help government policy makers and NGOs in designing and implementing development actions and strategies for ameliorating negative impacts.

The objective of this research is to examine the household level livelihood diversification efforts as coping actions of the small-scale fishers that they employ to sustain livelihood functions. This research excludes focus on long-term adaptation measures; rather we focused on the day-to-day coping actions. Our plea is simple: we simultaneously intend to reveal that although coping strategies and livelihood struggles of the poor fishers are primarily individual and familial issues, they are simultaneously telling of appalling social facts for this occupational class, coupled with irresponsiveness of the cross-scale political governance institutions. We explored these dimensions.

Conceptual Considerations: Climate Change, Coping and Livelihood of Fishers

The detailed effects of climate change on the physical and biological processes that singly or synergistically impact different biomes (freshwater, coastal and marine waters) and bio-agrological provinces are yet to be fully understood. Based on climate change vulnerability analysis of 132 countries including Bangladesh from the contexts of combined effects of predicted warming, the importance of fisheries in the national well-being and economies, and limited social adaptive capacity to these changes, Bangladesh has been categorized as the top 12th of the highly vulnerable countries (Allison et al. 2009). Historically, fishers coped with

environmental challenges through developing, exercising and devolving their own socio-culturally appropriate strategies against the vagaries of nature. A comprehensive understanding and valuation of these adaptive strategies, and removing obstacles to further building adaptive capacity of fishers would obviously make them prepared to better cope with climate change vulnerabilities (FAO 2009). In simple interpretation, fisheries-based livelihoods of small-scale fishers, a climate-sensitive profession, become vulnerable when fishers fail to ensure livelihood functions, and cope with negative changes in catch availability supposedly induced by climate change variability and extreme events. Fisheries-resource based livelihoods become increasingly defenseless as the character and magnitude of climate-induced changes operate rapidly at a pace beyond the adaptive capacity of the fishers.

Livelihood at the household and community level as a concept is a good conceptual lens in understanding the likely impacts of climate variability and changes on the small-scale fisheries, and the fishers. Presumably, any climate-induced change in the production ecology and the productivity and distribution of fisheries resources can fundamentally affect the well-being of the small-scale fishers. 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) (See Deb and Haque 2011 for details on *emic* views of livelihood and poverty in the fishing villages). A sustainable and vibrant livelihood system enables people to pursue robust livelihood strategies that provide, in effect, 'layers of resilience' to overcome 'waves of adversity', consequently enabling people to deal with and adapt to changes, and even transform multiple adversities into opportunities (Glavovic et al. 2002).

The notions of 'well-being' (Chambers 1995) and 'capabilities' (Sen 1981, 1987) provide a wider philosophical dimension along with other concurrent development issues. Simply, the more one manifests capabilities, the more secure is livelihood well-being, and individuals or households with higher levels of entitlements are anticipated to hold higher levels of livelihood resilience. Capability is viewed as *'what people can do or be with their entitlements'*, a concept surpassing material concerns of food intake or income that allows people to do things (Sen 1990). The concept of entitlement holds the fact that food insecurity and persistent hunger is an indicator of very low livelihood resilience of the poor who lack the requisite capacity either to produce sufficient food themselves or the financial ability needed to purchase food in a sustained manner, although food might be available in the market (Sen 1981, 1987; Devereux 2001).

From climate change point of view, vulnerability of fishers to climate variability and changes intricately relates to the extent of the distribution, productivity and availability of aquatic resources, and also the degree of the adaptive capabilities of aquatic resource itself to climate dynamics. From livelihood resilience and coping point of view, vulnerability also relates to the holding of assets; *'the more assets people have, the less vulnerable they are, and the greater the erosion of people's assets, the greater their insecurity'* (Moser 1998). Vulnerability is *'exposure to*

contingencies and stress, and difficulty in coping with them. Vulnerability has thus two sides: an external side of risks, shocks, and stress to which an individual is subject; and an internal side which is defencelessness, meaning a lack of means to cope without damaging loss' (Chambers 1989). Adaptation as a concept is synonymous with 'downstream coping' (Downing et al. 1997), and usually refers to all those responses and actions of individuals and communities to climate change that may be used to reduce adverse effects on their health and well-being, and take advantage of opportunities that their climatic environment provides (Burton et al. 2002).

We consider the concept of coping both as process/strategies and sets of composite actions undertaken by people through experiential learnings in the face of adversities. Coping as a process or strategy comprises sets of active-behavioural actions or instrumental means that people decide to undertake based on their economic endowments and capabilities, and such actions gradually evolve, and the knowledge is transmitted. Under adverse situations, people undertake coping actions, deliberate or not. 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). Some coping actions might be embedded to emotion, spirituality, and religiosity based on individuals' perceptions, human capital and the socio-cultural trend within the community.

Stability in livelihood functions can be considered as the *'coping dimension of response to climate change and variability and demonstrates the ability of people to retain basic livelihood functions while absorbing shocks, especially unpredictable climatic events'* (Osbahr et al. 2010). The concept of coping strategy is also connected to livelihood resilience; households with a higher level of livelihood resilience are expected to enjoy livelihood well-being and sustainability (Chambers 1995). Coping strategies involve people's cognitive or behavioral efforts, mostly situationally determined, or some long-term planned measures, that they apply when faced with stressors. At the family level, coping actions might be persuaded by experiential learning; such actions usually bring into play an image of collective behavior where members of households, as part of their parental or marital obligations and emotional attachments for providing necessary amenities, contribute differentially in their complex and multi-faceted areas of income, expenditure, power, influence and decision-making processes, as culturally appropriate for their age and gender. For different categories of people, numerous shocks in turn may result in different types of responses which include 'avoidance, repartitioning, resistance or tolerance mechanisms' (Payne et al. 1994).

Study Area and Methodology

This research was carried out in two fishing villages of Bangladesh, one coastal and the other floodplain, from January 2005 to September 2006 followed by another spell of group discussions with key informants during December 2009-February 2010 and November-December 2014. Small-scale fisheries in Bangladesh provide a poignant example of the dynamic setting of ecosystems, seasonality, geomorphologic process, productivity, poverty, and uncertainties to understand the impact of both anthropogenic and climate-induced impacts on fishers who understood and adapted to such changes for generations (Fig. 21.1a–d). The two villages selected for this study also represents 'climate change hotspots', each representing a primary hazard- the coastal village is most vulnerable to tropical cyclone, and the floodplain village is vulnerable to flooding. But never the less, both are again exposed to sets of stressors that reinforce the negative shocks of the aforementioned primary hazards.

The coastal fishing village *'Thakurtala'* is located in the Moheskhali Island of Cox'sbazar district along the Bay of Bengal of the Indian Ocean, and represents caste-based Hindu fishers *'Jaladas'* (literally, slaves of the water; one of the lowest in the caste-based social hierarchy). It has a population of 650 (male 300, female

Fig. 21.1 (**a**) Coastal erosion making fishing villages vulnerable to destruction, (**b**) water logging and tidal surge in the coast (**c**). house dilapidated by cyclone, and (**d**) women and children mostly become victims of cyclones

350, 78 households; approximately 45 % minor). The village is impacted by the semi-diurnal tidal pattern, especially during new moon and full moon phases; the periphery of the village is surrounded by a narrow strip of mangrove forests (a mix of *Avicennia* spp., *Sonneratia* spp., and *Rhizophora* spp.) and the terrain of the '*Adinath* temple hill', a sacred area for the Hindu pilgrims.

The floodplain fishing village *'Volarkandi'* is located in the Sujanagar union, Baralekha sub-district, Moulavibazar district of the north-eastern region of the country, and represents relatively new-entrant Muslim fishers (locally called '*Maimal*', bearing low-status in social hierarchy). It has a population of 1240 (male 640, female 600, total 184 households; approximately 40 % minor). The village is located within the '*Hakaluki haor'*- an ecologically critical area and the largest natural wetland system of Bangladesh. These low-lying fragile landscapes with interacting dynamic waterbodies render insightful historical and cultural geography of lower-Bengal delta, occupational niches of the inhabitants, their relentless struggle over territorial uses, and their access rights to the aquatic resources on which they primarily depend on for making simple livelihoods.

Both qualitative and quantitative methods were used with heavy emphasis on participatory techniques because they are more responsive to exploring complex phenomena that are situated and embedded locally. However, philosophically, field works in this study demanded a more nuanced ethnographic engagement with fishing families to get fine-grained understanding of their day-to-day livelihood constructions and coping actions for survival. Among the participatory tools, focus group discussions, key informant interviews, case studies, and participant observations were extensively used. Baseline survey was conducted among 78 coastal and 60 floodplain fishing households; 45 coastal and 27 floodplain key informants were interviewed, and 42 Focus Group Discussions (FGD) (coastal village: 23 events, floodplain village: 19 events) were carried out. Initially, prior to in-depth field research, around 3 months were spent with the respondents to develop a sense of intimacy and trust, and to learn more specifically about local cultures and fishers' sentiments.

The unit of analysis in this research spanned from individual to households to community. Direct observations and participation with the fishers on the fishing boats during day-and-night time fishing in the floodplains and sea were the most useful and straightforward way to learn about people's experience about livelihood dynamics, vulnerabilities, and coping strategies. To talk with women in a culturally appropriate manner, their time of cooking, weaving, chasing head-lice in a group, and other household activities in the open backyard areas of the homesteads was chosen. Given the fact that there is no authentic document on one's age in fishing villages, we used some historical markers (e.g., how old a respondent was during the 'liberation war' of 1971, 'big cyclone' of 1991, 'mega-flood' of 1998), followed by validation with parents or grandparents, as appropriate. This technique of 'back calculation' of age proved useful in building intimacy with the respondents.

Results and Discussions

Small-scale fishers in Bangladesh, specially the coastal/marine fishers, are prone to a host of cross-scale stressors or vulnerabilities (See Deb and Haque 2011 for details) including those emanating from climate changes, that impact differentially on different groups. We found it both flawed and difficult to precisely isolate the perceived impacts of climate change patterns from many other anthropogenic and natural resource management issues. However, based on their observations and experiential learnings, the older generation fishers agree that 'things' in mother nature are changing swiftly. Fishers from both the fishing villages agreed that climate change fetch poor catch, unpredictability in weather conditions, illness and other health-related problems (e.g., skin diseases), scarcity of potable water, threat to life, loss in income, and low livelihood status. Specifically, coastal fishers mentioned about the intrusion of salinity in both surface water and groundwater (tube well), increased frequency of cyclones and storm surges, change in species structure and size of fish, poor growth of mangrove forest, outbreak of disease in fish and shrimp culture farms, erosion along island edges, and accretion in shallow sea area. Floodplain fishers mentioned about increased flooding, drought, hot weather, worse infestation, poor fruit yields, and hence, increased dependence on insecticide, poor fruit yields, short retention of water in swamp areas, arsenic in ground water, prolonged fog, and deteriorating health status of livestock.

Common to both the fishing villages, some of the adaptation practices prior to ant hazard are: storage of essential items (like dry clothes, food, drinking water along with water purification tablets), building temporary platforms for livestock, raising the homestead land, making houses flood proof with bamboo as a base, protecting tubewell from contamination of floodwater, moving to safe areas like cyclone shelters, sending old people and children to upland areas, leasing livestock for disaster seasons to upland areas, protecting the tube well by sealing the openings, saving some cash for emergency uses, storage of essential medicine, etc. (Focus Group Discussion 2014) (Fig. 21.2a–d.). 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 here. For most of the fishers, climate change issue is not a direct concern, rather they are heavily concerned with their daily needs.

A total of 73 % coastal and 45 % floodplain fishers have elicited their food insecure condition (*'pete bhat nai'*, literally no rice in the belly), followed by their worry about decline in natural resource base- the very basis of their livelihood making, and an increasing trend in climatic uncertainties and shocks (see Deb and Haque 2011 for details). Fishers' coping strategies against stressors may vary based on a host of factors: one's physical condition, age/experience, attitude, gender, literacy, frequency/repetition of stressors, social capital, and economic endowments (Table 21.1). For example, a food-insecure person with an acute disease will have to apply more coping strategies compared to an only food-insecure able-bodied person.

Fig. 21.2 (**a**) Making temporary shelter after cyclone, (**b**) raising the homestead land to combat flood, (**c**) tubewell base is raised high for protection from floodwater, (**d**) houses erected to make flood proof

Table 21.1 Categorization and prioritization of coping strategies by small-scale fishers

Coping strategy	What does it mean for individuals and households?	Fisher's priority
Reliogiosity-psychological	Making one-self and the collective behavior of the family members tuned to crises by signaling and informing in a culturally appropriate manner. Also includes some emotion-focused issues including extended prayer and more sacrificial actions to please the Almighty.	**
Physiological	Making one-self physically ready to cope with adverse situations through reduced food intake, taking little food or famine food, situation, and bear the pain out of persistent hunger.	***
Economic	Includes reduction in family expenses, employing more adult and minor's familial labors, intensification and extensification within natural resource sector, migration, use of assets and multi-tasking.	*****
Social	Communicating with the social networks involving neighbors, relatives, friends, well-wishers, and seeking beneficial or symbiotic actions (for example, exchange or lending of foods).	***
Institutional	Making best uses of the beneficial local level institutions and attempting to link with higher institutions.	*
Survival	Includes some immediate measures for survival of family members, community members, and domestic animals.	*****

Source: Based on FGDs with fishers, 2010, 2014. Number of stars reveals emphasis

Most of the climate change and livelihood related coping literature put emphasis on economic activities. It is difficult to isolate and judge coping actions using a single lens of analysis and often, such actions change within days or even hours. Based on empirical evidence, unlike academic and western constructions of coping, we follow a comprehensive course of coping following the socio-cultural landscape of the fishing villages. The broad groups mentioned here are dynamic, interactive, overlapping or intermingling in nature and some coping actions can be considered from more than one angle (See Table 21.1).

Each family has a different epic of struggle for addressing poverty correlates and traps, and socio-economic transitions and tensions. Each rural household has its own mental 'frame of living standard' or a benchmark for subsistence living, well-communicated within members of households. Responsible members singly or collectively take coping actions, deliberate or not, to address stress-provoking or dissatisfying conditions compared to that particular frame of living standard. How do the poor families figure out their coping actions? Salmi (2005) succinctly conceptualizes that *'for each life-mode, there is a corresponding specific conceptual universe which is quite distinct from that of other life-modes'*. Coping strategies of households may include defense mechanisms, active ways of solving problems, and techniques for overcoming stresses (Murphy and Moriarty 1976).

This study focuses on the aspects of livelihood diversification which fishers undertake as a mechanism to spread the risks and uncertainty inherent in small-scale fishery. First of all, we attempt to provide a theoretical discussion based on works of Shanin (1972), followed by a general picture of diversification, and then we look closely at what fishers do within and outside fisheries sector for livelihood diversification, one of the most important coping actions in addressing climate change. Small-scale fishing being a seasonal activity, livelihood diversification is extremely important for the fishers who are often considered not suitable for jobs other than manual and fishing-related activities. Diversification supports households to insulate themselves from multiple environmental and economic shocks, and access to the fisheries resources remains critical for such communities, sometimes even more so as a result of vulnerability (Baumann 2002). In the rural context, access to multiple sources of capitals not only helps people to make a living commendably, but also adds importance to the person's world, encompassing one's capability, moral strength, dignity, sustainability of living, empowerment process, and the ability to change institutional aspects.

Based on economic endowments, familial choices in actions, composition of families and overall condition of the food deficit situations, different households calculate their own sets of priorities with considerations to pros and cons of each action during a food deficit period. For all categories of families in the study areas, the most common economic strategy is to save and build up endowments, at whatever amount possible, to offset the sufferings of food deficit period. Typical of fishing families, there are both male economy and female economy, usually complementary and supportive to each other. When the male economy collapses, the female economy plays a distinct and cautious role. When both the economies

collapse, families face serious crises. Female economy is usually based on rigorous savings through austerity and selling of products from home-based livestock, poultry, dry fish, smoked shrimps and vegetable products.

Theoretically, rural livelihood diversification is viewed as the 'process by which rural households construct an increasingly diverse portfolio of activities and assets in order to survive and improve their standard of living' (Ellis 2000). For ensuring food security, households in their livelihood pathways undertake multiple activities, comprised of 'complex *bricolage* or portfolio of activities' (Scoones 2009). Diversification of livelihood opportunities is extremely important for the 'persistence of subsistence', as familial incomes are seasonally affected by a host of factors. Livelihood diversification (What) involves activities undertaken by (Who) adult individuals and/or minor family members to (Why) augment individual or familial income from more sectors or activities than considered usual, (When) in the face of crises or as preparations for coping with adversities, (Where) centering one's own professions or involving some other sectors in which one can apply some acquired skills. It is the process by which 'rural households construct an increasingly diverse portfolio of activities and assets in order to survive and improve their standard of living'; such a process may comprise of 'reactive strategy' for family subsistence of small-scale farmers, and a relatively stable voluntary course of 'choice and adaptation' for 'big farmers' in the face of shocks and crises (Ellis 2000). The equilibrium thinking of 'fading away' and back to normalcy is often limited for a proper understanding of livelihood strategies (de Haan 2000), as household's coping strategies are now increasingly impacted by cross-scale issues like climate change, global market and politics.

Livelihood diversification, as a key to successful adaptation in the face of climate change vulnerability, is not only about acquiring new skills, but also about accumulating asset to capitalize the acquired skills. Diversification may be deliberately thought out by households as part of their survival strategies, or as a spontaneous reaction to offset crises during declining periods of livelihood well-being. The causes and consequences of diversification may be differentiated in practice by geographical locations, assets, family income, opportunities available and social networks (Davies 1996; Ellis 1998; Barrett et al. 2001), and thus, diversification may bridge over gaps or even accentuate economic and social inequality. The concept *'rural pluriactivity'*, an attempt to 'gaining an income from more than one economic activity' is popularized by Eikeland (cited from Salmi 2005). Such diversification activities are intended as mechanisms for coping, adaptation and accumulation, meaning there are differences between livelihood diversification of poor who are struggling to survive, and those of better-off households that diversify to mount up more capital for future (Salmi 2005).

Fishers' livelihood diversification can be hypothesized from a temporal and experiential point of view. For peasants, Shanin in 'Awkward Class' (Shanin 1972) put forward that *'a complex multi-dimensional mobility, involving both 'centripetal and centrifugal' tendencies simultaneously operating among peasant households is, therefore, at work and underlies the gross differentiation process in*

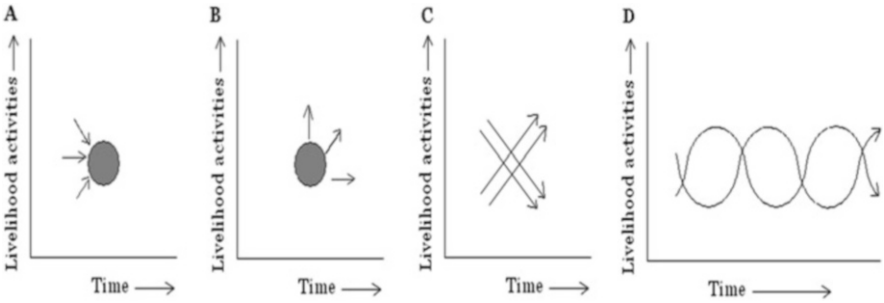

Fig. 21.3 Proposition (**a**): 'Birth-Ascribed profession and occupation of the last resort' (**b**) as opportunities surround, fishers diversify their incomes from multiple sources, (**c**) multi-directional professional mobility to maximize earnings, and (**d**) trade-off between fishing and non-fishing activities as cyclical mobility of livelihood activities (*modified from* Shanin 1972)

peasant society'. This hypothesis is used as a basis of our explanation of the livelihood diversity (Fig. 21.3) of fishers.

a. *Notion of centripetality:* Historically, caste-based Hindu fishers revealed *'centripetality'* towards their profession. Because of the lack of skill in other similar professions and a birth-ascribed occupational affinity, caste-based fishers tend to remain in fishing-related professions. This notion of 'centripetality' is also true for many fishers for whom small-scale fishing is literally a mouse-trap from which the exit is difficult though the entry is relatively easier (Fig. 21.3a).
b. *Notion of centrifugality:* The Muslim floodplain fishers revealed *'centrifugality'* in their professions (Fig. 21.3b). Being privileged by the availability of farming land in the vicinity of the fishing village (both upland and seasonally inundated drawdown areas), a relatively higher level of socio-political freedom and networks, subsistence fishers have the opportunity to earn from agriculture also.
c. *Notion of multi-tasking:* A section of the fishers in all the villages behaves smartly to pool more resources through multi-directional mobility adopting strategies like seasonal migration and migration for remittance earning. Up to a certain level of age and physical condition, multi-tasking is bearable. Such multi-tasking is physically demanding and stressful for some fishers (Fig. 21.3c).
d. *Notion of cyclical mobility:* Through the experience gained from multiple livelihood activities and based on the opportunities, fishers would make a trade-off between major livelihood activities in the form of cyclical mobility (Fig. 21.3d). The cyclical mobility model tends to conceal class differences that exists among small-scale fishers, but in real life conditions, some biases like the number of active earning members, number of women and old persons, inheritance of wealth, family partition, fisheries resource availability and price, political power, desire for social dignity and macro-economic issues would impact the proposed picture of professional diversity.

Efforts for livelihood diversification 'obeys a continuum of causes and motivations that vary across families at a particular point in time, and for the same families

at different points in time' (Ellis 1998). It is more important for a marginalized section of the communities who are victims of the processes of deagrianization and defisherization. Diversification, in our opinion, under certain context is a rational for building economic endowments and minimization of risks, which simultaneously points out to their capabilities and access to other capitals. The following two cases reveal the adaptive capability of fishers given the seasonal nature of their profession. Interestingly, though the first case sounds reflective of seasonal migration or 'transhumance' (Keesing 1981), it is more a form of 'transcattle', where cattle, pastoralist and cattle-owners get mutual benefits from the change in physical environment. Cattle farming/numbers are central to the economy of not only agricultural families, but also for many rural households as a means of a safety net.

Case 1 His name is Nurul Islam; his life orients with seasonality; he is a fisher in the monsoons and a cow rancher (*bathanee)* in the dry seasons. "*During winter, there are hardly any grass covers left in the hilly area. There is a serious scarcity of fodder; the owners have no alternative left than to send the cattle at the downstream areas. As the uplands ('Kandis') wake up following the receding water, there is plenty of new grass. This new grass is very useful for the health of milking cows.'* says Nurul. Cows are from plain land, semi-hilly, and hilly areas. He charges Taka100 (US$ 1 = Taka 82)/month for oxen and pregnant cows for their maintenance. There is no charge for the milking cows as he earns money through selling milk. Animals are brought for 4 months- *Poush, Magh, Falgun and Chaitra* (mid-December to mid-April); number varies from 70 to 700 in the ranching areas of the *haor*. Nurul doesn't have any notebook or diary for keeping accounts of the cows and associated financial transactions. *'Everything is in head, there is no document'*- he adds proudly. There is a small shed for the milking cows and calves; Nurul lives in one corner of the cow-shed. Both Nurul and his cows drink polluted channel water. Around 20 % of the animals are milking cows (1–1.5 L/cow/day); milk is sold at US$ 0.25–0.30/L. His income ranges between US$ 350–850 (Taka 25,000 to 65,000 for the dry season) based on the number of cows. He notices unusual nature of floods in recent years. As water starts entering the *haor*, he returns cows and gets ready for subsistence fishing with a small lift net for rest of the year and deals with different sets of clients.

This case demonstrated that some households with enhanced social networks and different sets of knowledge can interplay with changing sets of ecological characteristics.[1] It shows that seasonal adaptations in the

[1]From literature, we get a similar picture of cow ranching known as *habbanae* in rural Cameroon which is based on social reciprocity. The *habbanae* is the loan of an animal (e.g., a heifer) from a herdsman to another. The receiver keeps the animal for a given period of time throughout which he can hold it in usufruct (e.g., a heifer's milk and calves). Afterward, the animal is returned to the provider, who may then enjoy a new *habbanae* in return. This system of gift giving—based on *habbanae* as a common norm of reciprocity—is a device for herdsmen to build and maintain social

haor shape the interrelations between social groups and their economic lives.

Case 2 'Sabbir is an influential young leader. With 235 ducks, he does duck ranching on a small piece of upland; he encloses the land with torn fishing nets and constructs a small house (L-7 m, W-7 m, H-2 m) with bamboo fence to protect the ducks against attacks of foxes and wild cats. He does not buy small ducks; he purchases juveniles to rear them quickly in a limited time. He provides some supplementary feed during *'Ashar-Srabhan-Bhadra'* (mid-June to mid-September). Around 20 kg of unhusked rice and 10 kg of rice bran are given everyday. Sabbir keeps a proportion of 5 % male (*haoa*) and 95 % female (*aai*). He gets 160–180 eggs each day. His wife and little sons take care of the duck when he goes outside. Sabbir earns around Taka 8000–15,000/month (US$ 100–190) for a period of 4 months. He knows that duck litter is very important in maintaining a higher productivity of the *beel* water. Once the business of ducks is over, Sabbir starts growing vegetables, thus making best use of his upland area.

Case 3 Her name is Urmila Jaladas. Her husband became injured during fishing at sea. He came back home, and could not do anything economically productive for months. Eventually Urmila had to come forward to sustain the family. She started vending fish and crabs from door to door. The cyclone of April 29, 1991 washed out whatever physical assets she had. This climatic hazard worsened her already precarious livelihood. She relied a lot on social support to sustain the family. She ended up working as a laborer in fish drying yard. To her, everyday is a different reality. She is desperate and employs host of manual works and *'dhaandha'* to feed the family.

Bengali word '*dhaandha*' indicates desperate efforts of poor for enhancing income from whatever sources possible. For fishers, sniffing around for earning from more than one source during the period of unemployment or disguised unemployment is critical for reducing stresses of food insecurity. There are scholars who believe that if income sources from the wider economy increase, individuals would leave fishing profession (Allison and Ellis 2001). We observed that such a generalization might not be applicable for all groups of fishers. There are caste-based fishers who adhere to fishing largely due to socio-religious obligations, typical psychological attitudes, a gambling nature with the seasonality of fishery, lack of skill for alternative activities, geographical remoteness, political powerlessness and lack of endowments that repeatedly tend to keep them dependent on a single profession. A fisher elicited such beliefs in the following words:

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relationships and, incidentally, to protect themselves from exposure to natural disasters (dryness, epizootics, etc.) by dispersing part of their herds and asking members of their network for help as needed (synthesized from Ballet et al. 2007).

'I am a caste-based fisherman; fish curse on us before death; fish can reach heaven if/when touched by 'Jaladas' fishers. I have to wait for resurrection for obtaining purity for changing caste and profession'. Sunil Jaladas, 48, A Hindu fisherman, Thakurtala.

Sunil will wait for resurrection to change his birth-ascribed profession. While the caste-based affiliation is still strong in the Hindu fishing village, it is mainly the relatively higher income from low cost fishing operations that keeps Muslim fishers attached to fishing in the floodplain areas. For both these categories of fishers, centripetality of the fishing profession holds true.

Fishers employ their asset base, networks and experience accumulated over time to develop workable livelihood strategies. Results presented in Table 21.2 provide a perspective of the distribution of households' efforts for enhancing incomes from multiple sources. Considering the ancillary activities along with active fishing, around 84 % and 55 % of male-headed households in the coastal and floodplain villages respectively make their livelihoods directly from fisheries. Family members ranging from 2 to 4 individuals were engaged in earning activities whatever the amount is, and member earned from 1 to 3 activities with an average of two in most cases. However, the cases of multi-tasking and gear specialization[2] was found extremely limited in both fishing villages.

Access to and availability of natural resources from the ecosystem plays a significant role for the women-headed households, especially in the floodplains. Small groups of fishermen are found to take up some other jobs like terrestrial farming, daily labor, hair dressing, rural transportation, etc. on temporary or permanent bases. Women in both the villages did not exhibit any participation in some activities like rural transportation, carpentry, hair dressing and remittance earning. Begging was taken up as a means of survival by a few destitute fishers in the coastal village. For all these categories of people, our propositions of centrifugality and multi-tasking hold true.

Among the alternative sources of income other than fishing, there are professions which require substantial time for getting a full return (like terrestrial farming, cow and duck ranching). A small section of fishers remained engaged usually in a combination of two professions like- fishing and cow ranching, fishing and duck rearing, and fishing and farming. The nature of the secondary profession is such that engagement in the third category of activities is usually difficult. For these fishers, the notion of cyclical mobility holds true. They acquire substantial expertise in the alternative profession also. Only 56 % of the male-headed coastal households managed to gather secondary jobs while others are left with unemployment or unemployment eventually leading to the debt trap; the scope of earnings from secondary occupations is higher in floodplain areas (Table 21.2). The overall health of the ecosystem and catch directly or indirectly affects the earning of the female-

[2]Floodplain fishers adapted well to the banned mono-filament 'current nets' given their low price, poor regulatory measures and easy availability in the market. Similarly owners of larger marine set bag nets convert their nets to suit in the shallow coastal waters during bad weather periods through further reducing mesh sizes at the cod end.

Table 21.2 Combination of livelihood sources for male and female-headed households (expressed in %) as part of livelihood earnings *(multiple responses allowed)*

	Primary earning source				Secondary earning source			
	Coastal		Floodplain		Coastal		Floodplain	
Types of profession	M	F	M	F	M	F	M	F
Active fishing	68.44	–	49.08	–	6.77	–	9.43	–
Fish retailing/processing	5.27	29.42	1.88	–	3.76	7.53	–	–
Shrimp fry catching /selling	3.76	5.88	–	–	4.51	9.76	–	–
Lending boats and gear/ *beel* subleasing (floodplain)	3.76	–	3.77	–	–	–	–	–
Net weaving & repairing	5.27	29.42	–	14.28	9.54	5.41	3.77	2.50
Boat repairing/painting	1.5	–	–	–	4.50	–	3.77	–
Terrestrial agriculture	0.75	5.88	5.67	14.28	3.0	3.76	12.64	2.50
Daily labor	2.25	17.64	11.30	14.28	12.78	17.53	15.85	12.86
Carpenter	1.50	–	3.77	–	–	–	–	–
Rural transportation	1.50	–	5.67	–	3.76	–	3.77	–
Foreign remittance	–	–	1.88	–	–	–	–	–
Small business/tea stall	–	–	3.77	–	–	–	–	–
Tailoring	–	1.50	–	–	–	–	–	–
Barber	0.75	–	–	–	–	–	–	–
Seasonal ranching		–	3.77	–	–	–	–	–
Homestead poultry/livestock	0.75	5.88	–	14.28	2.83	9.76	7.55	37.14
Natural resource gathering	–	1.50	5.67	28.58	2.83	3.76	9.43	22.85
Service	0.75	–	1.88	–	–	–	–	–
Begging	1.50	3.00	–	–	–	–	–	–
Other	2.25	–	1.88	14.28	3.76	13.65	7.55	4.28

Source: Field survey

headed households; around 59 % of them depend on gathering natural resources as their main source of income.

Terrestrial agriculture ensures earnings for around 23 % and 29 % of the male- and female-headed households in the floodplain village which is more than double that of the coastal village (Table 21.2). This is reflective of the importance of the availability of arable land, which is extremely limited in the coast. Interestingly, female-headed households in the coast and floodplain village 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. However, this situation also reveals an entry of unskilled labor force in the farm/non-farm activities. Recent trend of fishing in leased *beels* is a big concern both in terms of labor utility and sustainability. A 50 acre *beel* with multiple sets of *'katha'* (fish aggregation devices) and medium water level usually require a man-power size of 40 fishers for around 3 days; while the same *beel* can be dried up and totally harvested with one-fourth labor requirement using pump machines in the same duration. The former process is ecosystem-friendly while the latter is deadly for the wetlands.

A glimpse of subsistence-oriented diversification efforts within the fisheries sector can be seen in the results presented in Table 21.3. Small-scale fisheries, already overpopulated and overexploited, offer a limited scope for extensification and intensification. Only the wealthy owners of mechanized fishing vessels can take advantage of mechanization and intense fishing in the inshore and off-shore areas. For some fishers, foraging fish becomes a seasonal coping action. Serious food scarcity is a prime mover for children and women's active involvement in foraging for small discarded fish in fish landing areas. Socially accepted custom allows for small fish fallen from the baskets in course of handling and transportation of fish from mechanized vessels becoming the property of the poor foragers. Fish assembled from beach thus not only play a significant role in family nutrition and gourmandizing, but also in earning a small amount from sale of the surplus to low-income customers. Income earned through foraging (US$ 5–13/month/person), though insignificant, yet plays an important role in ameliorating grim situation of food scarcity. Also, such a scanty amount of income from foraging plays an invaluable role in those families where adult male fishers fail to cling to fishing due to disease or accidents. The immediate consequence of decline in catch level on the livelihood is that scope of foraging on beach for remnants becomes sharply limited.

Here, we would like to analyze the impacts of intensification on the overall fisheries resource (Fig. 21.4a–f). For the purpose, we consider shrimp fry (species: *Peneaus monodon*; harvested for semi-intensive shrimp farming) catching (coastal areas) and use of dense-meshed synthetic nets in the inland areas. *'Not bad; just 4-6*

Table 21.3 Intensification and extensification efforts for subsistence

	Actions undertaken for enhanced income	
Strategy	Coastal areas	Floodplain areas
Vertical integration or intensification	– Use of 'mosquito nets' for shrimp fry catching – Use of low-mesh 'tunnel' in E/MSBN – Catching of juvenile *Hilsha* fish – Forage for mud crabs – Catch unconventional foods like squids, eels, mollusks, etc. – Desperate inshore fishing ignoring bad weather signals – More fishing hours and child labor	– Use of synthetic 'current nets' – Use of illegal large encircling gears (*ber, jagat, dharma*) an lift nets – Fishing through obstruction – 'total fishing' by removing water from small ditches – More fishing hours and child labor – Use of multiple gears from same craft
Horizontal expansion or extensification	– Fishing beyond one's customary territory – Foraging fish – Targeting fish migration routes – Product diversification like fish drying, salting, fermentation (*Nappi*), smoking – Fish camping in the Sunderban mangroves areas in the south-west	– Poaching migratory birds – Gathering earthworm and frog for use as baits – Clandestine fishing in the leased waterbodies or sanctuaries – Night fishing – Angling by women – Product diversification through drying and fermentation

Fig. 21.4 (**a**) Ferrocement boats gradually replace traditional wooden boats, (**b**) front side of boat redesigned to face turbulent tide, (**c**). use of monofilament nets to catch small shrimp fry in the coast, (**d**) destructive low-mesh nets used in floodplain, (**e**). children seen engaged in shrimp fry segregation, and (**f**). duck farming in the backyard of house in the floodplain

hours/day at the advent of two high tides during full-moon and new-moon phases; if luck favors, we get good catch and good price': says Sazzad Islam, 35, a 'Rohinga refugee' from Myanmar. In catching one shrimp-fry, the catcher ultimately destroys around 100 other small creatures that include commercially valued shellfish and finfish larvae. In a similar vein, inland fishers evolved large-sized encircling gears, made of highly dense synthetic materials, which can filter everything from water including smallest plankton (See Deb and Haque 2011 for details). The former and

later cases involved around US$ 3–5 and $2000–5000/gear respectively. These two cases demonstrate that intensification efforts within the unregulated small-scale fisheries sector would be unsustainable and negative for the resource base.

Members of about 2 % of floodplain fishing families managed to migrate as laborers to the Middle East earlier this decade. However, their remittances cover a much larger percentage of household income among the migrant families. There were demand of south-Asian fishers for work on fishing trawlers in Middle Eastern countries (Divakarannair 2007), but the process of emigration has become increasingly difficult for the poor and less educated members of fishing communities. Resultantly, none from the coastal village could afford to immigrate. We observed that remittance money did not succeed in uplifting the rural agricultural and fisheries enterprises. Rather it created a dependency syndrome among family members, started challenging the existing social and cultural institutions, and in some instances proved counterproductive to sustainable uses of the wetland resources. '*We struggle for earning little money from the haor, whereas he (Nurul Chairman, leaseholder of the highly productive 'Padma beel') fights with fishers for displaying power and earning more using his remittance money'*- comments Mamtaj Ali, 56, Volarkandi. Most of the leaseholders of productive waterbodies have remittance earners in their families, and once they manage lease order from the government through scrupulous process, their activities become subversive of the interests of common fishers and values for sustainable management of wetlands.

There is a difference in the trend of diversification among different wealth category groups. Our observation is that poor households rely more on income sources which are physically demanding, while the higher medium and rich classes use their networks for maximizing earnings. Remittance earning is almost impossible without strong financial backup and networks at home or abroad. Diversification of livelihood activities is closely connected to the growth of agriculture or non-agriculture-based labor-absorptive small and medium enterprises in the rural areas. Due to lack of macro-level support and inputs needed (like electricity, security, political stability, good governance, loan on easy terms, market outlets), labor-absorbing small and medium enterprises are yet to flourish in rural Bangladesh. Large-scale disasters impose a process of defisherization and subsistence crisis; fishers cannot go out for fishing if they lose boats and gear. Roles and efficient functions of macro-institutions are critical in such contexts.

Conclusions

This paper progressed with an implicit understanding that climate variability and change have begun to impact the small-scale fisheries, with the inherent recognition that fishers' livelihoods are at stake in the face of such effects. The Government of Bangladesh should be engaged to put more thoughts and actions towards making fisheries and fishers more resilient towards climate change vulnerabilities. It is critical that the Government seriously considers fisheries into its countrywide

adaptation planning ensuring that macroeconomic drives in one sector do not become counterproductive for other important sectors. Creation of more income generation activities is a much-needed option. Policy interventions targeted at creating sustainable livelihoods for fishery-depended communities need to focus more on gender roles in the development process. Very nominal macro-meso-micro-scale adaptive strategies have been planned to build ecosystem resilience and social adaptive capacity of fishers under the national climate change adaptation program.

For the small-scale fishers at any point of time, livelihood functions are directly or indirectly impacted by the available opportunities, households' endowments and entitlements, macro-and-meso-institutional issues, and the stresses and hazards they face. The impact of climate change and variability is not homogenous across communities. Sustaining livelihood well-being requires classic skill to manage relationships and transactions in different spheres, making the best use of what can be achieved through one sphere, and then going together with more well-orchestrated actions in the other spheres (Bebbington 1999). This means that graduation from poverty requires not only enough income to move to a better economic status, but also the means to defend against negative forces of downward mobility so households can remain at that improved level (Rahman 2002).

Livelihood coping responses are strongly influenced by circumstances of individuals and households as there are strong inequalities and vulnerabilities accentuated at individual, household and community levels. Even in a fishing community where fishers are apparently equally exposed to climatic shocks, higher sensitivity and lower adaptive capacity combine to generate elevated level of vulnerability (Islam et al. 2014). One must not overemphasize that local level coping actions taken by small-scale fishers to deal with livelihood disturbances can consequentially sustain adaptive capacity in the face of climate change and variability. Research in Southern Africa revealed that *'local coping as a form of resilience to uncertain future climate change must not be overemphasized since the process at both the individual and household level is competitive, subtly differentiated by climate context, household adaptive capacity and individual perception of risk'* (Osbahr et al. 2010).

This research revealed that fishing households cope with adversities by adopting multiple livelihoods, in compliance to opportunities and capabilities they have, constraints they face, and the changing social relations dictated by external and internal forces. However, opportunity of multi-tasking is very limited in the study areas. Households' ability to ensure livelihood security over time is an outcome of a complex nexus of factors such as composition of the families, sex ratio and number of earners/dependents, endowment sets, socio-political linkages, biophysical settings, macro-level economic processes and political forces (Hesselberg and Yaro 2006). Based on Oshaug's classification of food security situation (Oshaug 1985), we conclude that majority of the fishers of Thakurtala village are fragile households, and there are limited numbers of enduring and resilient households. In both the villages, many households are forced to dwindle between their resilient status in the good fishing seasons and fragile status in the bad seasons. Around six and a half

decade after Sen's (1981) observations of vulnerable groups like landless laborers, rural artisans and fishers on their entitlement failure over food and adequate alternative access, there has not been a significant change in the food security condition of these poor classes. Meanwhile, we notice added pressures on these vulnerable groups from climatic variability and change. Acute food deficits and a kind of hidden hunger or pseudo-famine is persistently prevalent for a sheer majority of small-scale fishers.

Poor people's livelihood systems are continuously buffeted by shocks and stresses, and hence, gravitate around some 'basins of attractions' as they fail to find equilibrium using a certain form of coping strategy, and they keep shifting or intermingling coping strategies until and unless their livelihood capabilities attain some resilience and transform to a new desirable stability landscape (Walker et al. 2004). Taking neoliberal precepts, some policy and management interventions suggested by the fishers are: (a) special recognition of the fishing villages as 'disaster prone' and 'seasonally food deficit' zones, (b) introducing food aid program for the most vulnerable section (widows, deserted women, physically weak persons, etc.), (c) providing microcredit support with zero interest, (d) financial support during no-fishing time, (e) providing government support in marketing fish products in overseas markets, and (f) taking special initiatives for accommodating unemployed and underemployed groups in labor-intensive industries (e.g., garments and shrimp processing).

Policy-makers of the country need to pay due attention to fishers' endogenous strategies for developing locally appropriate crisis management interventions. Each household, based on its capitals and capabilities, has an intangible line of coping threshold. As the coping threshold limits of households are crossed-over by multiple sets of stresses, households become extremely vulnerable and continue to experience serious livelihood struggles. When assets of a livelihood system are depleted and institutions are unable to adapt to change, available livelihood strategies become 'brittle'- resulting in reduced resilience- and vulnerability to disturbance increases (Glavovic et al. 2002). In the background of a worldwide signal of fisheries resource decline, crises of existence of poor people (FAO 2009), and recent trends in climatic and human-induced stresses, we consider that the situation of poverty in the small-scale fishing villages might be aggravated if appropriate types of resource governance are not adopted.

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