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Migrating to Tackle Climate Variability and Change? Insights from Coastal Fishing Communities in Bangladesh

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Abstract

There is an on-going debate about climate-induced migration but little empirical evidence. We examine how climate-induced migration has impacted vulnerability and adaptation of a coastal fishing community in Bangladesh. We used household surveys, interviews and focus group discussions to compare fishery dependent households who migrated from Kutubdia Island to mainland with those who stayed behind. Our results suggest that the resettled households are less exposed to floods, sea-level-rise and land erosion than those who stayed behind. They also have more livelihood assets, higher incomes and better access to water supply, health and educational services, technology and markets. In our case study migration has thus been a viable strategy to respond to climate variability and change.

Key Words: Climate variability, climate change, community, fisheries, migration, livelihood, vulnerability and adaptation

1 Introduction

Environmental change is one driver of human migration because it alters the availability of ecosystem services and exposure to shocks and stresses (McLeman 2011; GOS 2011). But migration can also be considered a coping or adaptation strategy to tackle the impacts of environmental change (McLeman and Smit 2006; Tacoli 2009). Migration is thus of increasing interest to both policymakers and researchers (e.g., Action Aid 2007; Stern 2007; Warner et al. 2009).

Migration is an extreme form of adaptation – this is the undertone of the arguments which claim that millions of people will be forced to relocate by

climate change (Myers 2002; Nicholls et al. 2011). Rise in sea-level alone may displace up to 187 million people by 2100 (Nicholls et al. 2011). But the reality is that the evidence base on climate-induced migration is very limited (as argued by Black et al. 2011b; GOS 2011). Earlier studies have examined the drivers of climate-induced migration but few have assessed its outcomes for the migrants. More empirical studies on climate-induced migration have been called for to support public policy (e.g., IPCC 2007; Stern 2007; GOS 2011). Evidence on the outcomes of climate-induced migration can provide important insights for developing strategies to cope with and adapt to changing climate.

In this article, we compare livelihood vulnerability and adaptation outcomes of households who migrated from Kutubdia Island to mainland Bangladesh with those who stayed behind. The findings have important implications for other similarly situated communities for addressing climate variability and change.

2 Climate change and migration

Climatic stresses and shocks such as sea-level-rise, flooding and land erosion displace millions of people globally (IPCC 2007) and their number is predicted to increase due to climate change (Myers 2002; Nicholls et al. 2011).Climate-induced migration is more likely in drought-prone areas, flood-prone river valleys, low-lying coastal plains, deltas and small islands where livelihoods are dependent on natural resources (McLeman and Hunter 2010). Fishing communities may be subjected to climate-induced displacement and migration because they typically live on low-lying coasts and islands exposed to multiple climatic stresses and shocks (Islam et al. 2014b; Daw et al. 2009; Islam et al. 2014a).

Climate change is not the only driver of migration, it is influenced by many other economic, political, social, and demographic drivers (McLeman and Smit 2006; Black et al. 2011a; Black et al. 2011b; McLeman 2011; Piguet et al. 2011; GOS 2011). Lee (1966) suggested that drivers of migration can be grouped into 'push' and 'pull' factors. Push factors, such as adverse physical environment, operate at the point of origin and trigger emigration, whilst pull factors, such as job opportunities, operate at the destination and encourage immigration (Lee 1966). Black et al. (2011b) consider that the key reasons for migration are to improve income, join family members, escape persecution and avoid environmental and other threats. People also migrate because of limited adaptive capacity (Kates 2000; Black et al. 2011b) created by lack of access to livelihood assets (Piguet et al. 2011). On the other hand, poor people may not have sufficient resources and assets to migrate (Piguet et al. 2011; Black et al. 2013). Migration does not necessarily lead to a positive outcome: some people may migrate to destinations where they will be more vulnerable than before (Black et al. 2011b).

Slow-onset phenomena such as sea-level-rise may result in long-term migration, whereas rapid onset phenomena such as tropical cyclones may lead to temporary displacement (Piguet et al. 2011). Piguet et al. (2011) found that most studies of environmentally-induced migration have focussed on internal migration. Forced migration may happen because of conflict, development or conservation projects or environmental stress (Castles 2003).

Climate-induced migration may reduce vulnerability or enhance adaptation to climate variability and change (Black et al. 2011b; Paavola 2008; Warner et al.

2008). On the other hand, it may also lead to loss of assets, reduced opportunities and increased vulnerability (Hunter 2005). Migration outcomes are influenced by the degree to which migrants depend on the environment for their livelihood and social factors mitigating or exacerbating the impact of climatic stresses and shocks (Kniveton et al. 2008). Migration distances are also important. Risks lessen when migrants resettle nearby (Kuruppu and Liverman 2011) but increase with migration distance (Barnett and O'Neill 2012).

The sustainable livelihood approach suggests that the outcomes of migration will vary depending on the vulnerability context (trends, shocks and seasonality), migrants' livelihood assets (human, physical, social including political, financial and natural capital), and institutional structures and processes which mediate access to livelihood assets and opportunities (Scoones 1998). Migration may reduce vulnerability by reducing exposure to climatic shocks and stresses (Warner et al. 2008) or by helping to diversify livelihoods and risks and build resilience (Black et al. 2011b; Paavola 2008). Migration over shorter distances can create access to new livelihood assets and activities (Koczberski and Curry 2005). Longer distance migration can generate financial capital (remittances) for members of households who do not migrate (Paavola 2008).

Involuntary migration often leads to adverse livelihood outcomes or maladaptation (Mortreux and Barnett 2009; Barnett and O'Neill 2012). Forced migrants can face landlessness, un- or under-employment, homelessness, marginalization, food insecurity, reduced access to common-pool resources and ill health (Cernea 1997). They may also lose their lifestyle, culture and identity (Mortreux and Barnett 2009).

To conclude, climate variability and change can be important drivers of migration amongst fishing communities. Although many studies have investigated drivers of climate-induced migration, few studies have reported evidence on the outcomes of climate-induced migration which remain inconclusive. Climate-induced migration from coastal fishing communities has not been examined before and this study aims to contribute to this part of the scholarship.

3 Case study, materials and methods

3.1 Case study description

Over the past four decades both gradual environmental change and extreme events such as floods and tropical cyclones have displaced millions of Bangladeshis (Walsham 2010). People often migrate short-term to cope with extreme events (Black et al. 2011b; Paul and Routray 2010). The link between extreme events and long-term migration is less well understood (Paul 2005; Walsham 2010; Penning-Rowsell et al. 2013). Land erosion and salinity intrusion are examples of environmental stresses that induce long-term migration because they make certain locations uninhabitable (Penning-Rowsell et al. 2013).

Climate change is predicted to increase in temperature and rainfall (Met Office 2011), sea-level-rise (MoEF 2005) and create uncertain impacts on cyclones (Emanuel et al. 2008; Sugi et al. 2009; Yu et al. 2010) in Bangladesh which may result in higher storm surges. About 25 million more people could be flooded around the Indian Ocean as a result of 0.5m sea-level-rise (Nicholls et al. 2011).

Dasgupta et al. (2011) suggest that a 10% intensification of the storm surge combined with a 1m sea-level-rise could affect 23% of Bangladesh's total coastal land area. Land erosion is also likely to increase with sea-level-rise and increased flooding. These impacts of climate change have the potential to displace more people from coastal areas of Bangladesh.

We examined two fishing communities, Kutubdia Para and Kutubdia Island, in Cox's Bazar district of the southern coastal Bangladesh (Figure 1). Kutubdia Island is a sub-district of 50 km^2 with 119,899 inhabitants (22,403 households). This island is separated from the mainland by 3km wide Kutubdia Channel. Fishery-related activities facilitated by a sand bar (used as fish drying field) and creeks (used as fishing boat landing) are central to livelihoods on the island. Households in Kutubdia Island are exposed to multiple climatic shocks and stresses, which led to migration of many of its households. The history of this migration will be described below based on information from key informant interviews and focus group discussions (see section 3.2 for details).

<Please inset Fig. 1 around here>

Kutubdia Island is less than 1 metre above the mean sea level. Land erosion has increased substantially in the south-western part of the island known as Kuzier Tek since the 1960s. Locals consider sea-level-rise, floods and changes in the direction of currents as the main reasons for accelerating land erosion.

A traditional earth dike was built by the government to protect settlement in Kuzier Tek. It proved unsuccessful: about 3000 households were displaced by land erosion, sea-level-rise and cyclone-induced flooding between 1960 and 1997. The displaced households first resettled nearby on land they or their relatives owned. Over time the number of displaced households increased and most resettled 4-5 times. Around 1970 there was no land left. Some households moved behind a nearby government-owned dike with the hope of returning after accretion. Accretion did not take place and further erosion displaced more households. With the assistance of relatives some of the households moved to other parts of the island.

In 1984 the government relocated 80 households 60km south-east to the mainland. In 1986 a locally elected government representative (Chairman of Union Parishad) allocated a forested government-owned empty plot about 100km south-east of the island on the mainland for settlement. It was 6km from Cox's Bazar town and 3km from the Cox's Bazar airport. Heads of 15-25 households moved to the area the same year as it was well suited for fishery-related livelihoods. Within a year 500-600 households migrated to the new settlement which was named Kutubdia Para. Another wave of migration took place in 1991 when Kuzier Tek was hit by cyclone Gorki and over 6m high storm-surges associated with it. Most migration to Kutubdia Para took place between 1986 and 1994. The households that migrated and those that did not migrate had comparable assets (except a few wealthier households that could move to safer areas within the island).The relocation cost (consisting of transport and food) was low enough so that they could meet it by selling assets or borrowing money from relatives and friends. In 1997 Kuzier Tek was hit by another cyclone, which resulted in further migration

to Kutubdia Para. After 1997, relocation cost increased as the local musclemen in Kutubdia Para started charging for land access and poorer households were not anymore able to migrate even if they wished to.

Two thirds of the households displaced from Kuzier Tek migrated to Kutubdia Para between 1986 and 1997. There has been little migration to Kutubdia Para after 1997. More recently displaced households from Kuzier Tek have migrated elsewhere. Of the original 3500 households in Kuzier Tek only 11 remain there, 78 reside nearby on the island, 2000 reside in Kutubdia Para, and the rest have resettled elsewhere. Almost all the current households of Kutubdia Para (divided into middle, north and west) are migrants from Kutubdia Island. They live as a clustered community.

3.2 Data collection and analysis

We gathered qualitative and quantitative material on 'migrant' and 'non-migrant' households during October 2010, between February and July 2011, and May 2013. The 'non-migrant community' included 11 households from Kuzier Tek and 78 households from elsewhere on Kutubdia Island. The 'migrant community' included households from Middle and North Kutubdia Para (total population 1193 households). In both communities we approached fishery-dependent households (i.e., those depend on fishing, fish processing, fish trading, boat renting, boat making and repairing, gear making and mending, shrimp and mollusc shell post-larvae collecting and aquaculture). We conducted 150 household surveys to collect quantitative data on livelihood capital assets, activities and distance from public services. We also carried out 30 oral history interviews, 13 key informant

interviews and 8 focus group discussions (FGDs) to gather qualitative material on migration, vulnerability, coping and adaptation across the two communities.

A sampling frame for fishery-dependent households was prepared for each community and a given number of households were randomly selected using a web-based random number generator tool (Random.org 2011). Household survey sample size was calculated using a methodology consistent with UN (2005) and adjusted to take population size into account. The sample size was 100 households in Kutubdia Para and 50 on Kutubdia Island.

Heads of households were interviewed because they were considered to be knowledgeable of household security, livelihoods and vulnerability to threats (Jansen et al. 2006). Three and ten percent of household heads were female in Kutubdia Para and Kutubdia Island, respectively. To ensure representative sampling in oral history interviews and FGDs, cluster analysis of household livelihood characteristics data was conducted in each community (see Islam 2013).It produced four clusters for Kutubdia Para and three for Kutubdia Island. The number of oral history interviews in each cluster was determined by the number of households in the cluster, with a minimum of 3 interviewees from each cluster. A single FGD was conducted with representation from each cluster in each community. An additional FGD was conducted with female household heads on Kutubdia Island. A group of 6-10 household heads participated in each FGD. Within each cluster, the persons found cooperative and enthusiastic during household surveys and by whom the key concept could be explored were selected for oral history interviews and FGDs.

To determine difference in climatic exposure and livelihood characteristics, quantitative community scale data were analysed using descriptive statistics, while quantitative household scale data were analysed using z-tests. Qualitative data were transcribed in Bengali and analysed by using coding techniques of content analysis of Miles and Huberman (1994) before translation.

4 Livelihoods, vulnerability and adaptation of non-migrants and migrants

4.1 Livelihood activities

Both non-migrant and migrant households are involved in a range of livelihood activities, some related to fisheries and others not (Table 1). The household surveys and oral history interviews indicate that fishing and fish drying are two key livelihood activities. Over the years the proportion of fishing households has decreased, more among migrants than among non-migrants. FGDs and oral history interviews indicate that fishermen in both communities catch fish with boats and gear within 4-8 hours drive by motorised boat from the shore. The first fishing season runs from July to October and the second from December to June. Most fishermen catch fish during the second season in order to sell the fish to fish drying plants. Between 3and 30 people work on each boat during a fishing operation that lasts between 6hours and 15days.

<Please inset Table 1 around here>

The number of households drying fish has increased among migrants but has decreased among non-migrants since 1980s (Table 1). Available fish drying

places and better transportation, storage and marketing facilities facilitate the increase of fish drying dependent households among migrants. Fish is dried in open air and is affected by rainfall, temperature and humidity. Today about 80% of fish is dried between November and February. In the past 15 years an extended drying period has emerged – the remaining 20% of fish is dried in September, October, March, April and May.

In both non-migrant and migrant communities households are also involved in other fishery-related activities such as boat renting, boat making and repairing, fish trading, and net making and mending. Three new activities – shrimp post-larvae collecting, mollusc shell collecting and aquaculture have emerged among the non-migrants since 1990s.A considerable proportion of non-migrant households are involved in non-fishery livelihood activities such as salt production, agriculture, wage labour and livestock rearing (Table 1).

4.2 Vulnerability, adaptation and livelihoods

This section first compares the exposure to climatic impacts between the two communities, and then compares their vulnerability and adaptive capacity. The migrants' and non-migrants' exposure to cyclones and variations in temperature and rainfall are comparable and has not changed much over the past few decades (Table 2). Cyclones impact livelihoods by damaging fishing activities and assets, threatening fisherfolk life in the sea, and by damaging land-based assets, activities and services. Interviews and FGDs suggest that cyclones impact on fishing activities of non-migrant and migrant fisherfolk similarly, as both catch fish from the same source in the same way.

<Please inset Table 2 around here>

Interviews and FGDs also indicate that temperature and rainfall changes have had little impact on fish drying during the normal drying period. During the extended drying period (e.g., in May 2011) the weather is more variable. During rainfall, hot temperature and humid weather, raw or semi-dried fish attracts blowfly and can be degraded by its larvae.

Non-migrants have been considerably more exposed to floods, land erosion and sea-level-rise than migrants in the past decades (Table 2). Non-migrants have experienced 4 major floods while migrants have experienced only 2 floods (Table 2). The tidal surges brought by cyclones did more damage to livelihoods among the non-migrants: key informants reported that Gorki caused 667 (in Kuzier Tek area only) and 9 deaths among the non-migrants and migrants, respectively. Oral history interviewees suggested that almost all non-migrants' houses were destroyed or severely damaged by Gorki while only a half of the migrants had similar experience.

Non-migrants have been more exposed to land erosion than migrants (Table 2). Land erosion has displaced non-migrant households and destroyed land used for fish drying, agriculture, salt production and community infrastructure. One oral history interviewee told: *"I had to move my house 6 times due to land erosion.* It has destroyed all – *my trees, my fish drying business, my children's school".* Non-migrants have also been exposed to higher sea-level-rise than the 20th century global trend of 1.7 to 1.8 mm/year (IPCC 2007). Sea-level-rise means higher tidal

and surge waters, which are associated with higher rates of land erosion in non-migrant settlements.

Thus the migrants are less exposed to floods, sea-level-rise and land erosion, and their exposure to cyclones and variations in temperature and rainfall is no worse than that of non-migrants. Our results resonate with Warner et al. (2008) argument that migration can reduce exposure to climate change impacts.

Vulnerability to climatic shocks and stresses depends not only on the level of exposure but also on how a community or household can tackle them given their livelihood characteristics (IPCC 2007). Interviews and FGDs indicate that the livelihood characteristics of migrants and non-migrants were at first quite similar. Oral history interviews indicate that at first lack of livelihood assets and access to assets restricted livelihood activities and strategies in both communities. For the non-migrants this is because of damage to houses and land used for fish drying, fish landing, salt production and agriculture. The migrants experienced several hardships from food insecurity to violence in the first year after settlement. One FGD participant told: *"*in the early days we had to eat wild fruits and musclemen from nearby town disturbed *us".* This resonates with the arguments of Reuveny (2007) that migration may bring about conflicts. Key informants and FGD participants explained that when the community became established, the government, donor agencies and NGOs built roads and a school, which improved their access to markets, education and other public services. The migrant households started commercial fishing and fish drying and some of them became involved in net making and mending, shop keeping, tailoring and selling labour in the nearby town. These factors increased income generation potential among the

migrants (Koczberski and Curry 2005). The migrants considered that their livelihoods had improved year after year.

<Please inset Table 3 around here>

Today the migrants have more livelihood assets and enjoy better access to them (Table 3). Their per capita income is over twice that of non-migrants. If own consumption of fish was accounted for, the income difference would be even greater as migrants consume three times more fish (2.89kg/month) than the non-migrants (0.94kg/month). The migrants are healthier and fitter because of their access to safe drinking water and better nutrition. For example, heads of migrant households are able to work 342days/year compared to 324 days/year of heads of non-migrant households. Migrants need only 5 minutes to access safe drinking water while non-migrants need 15 minutes to do the same. Better housing gives more protection for the migrants against climatic shocks (see Table 3).They have better access to phones, sanitary toilets and electricity and are closer to markets and public services. This improved access again increases their capacity to cope with and adapt to climatic shocks and stresses. For instance, oral history interviewees told that greater use of phone and electricity increases the productivity and profitability of fish drying. They also suggested that better communication and proximity to government and disaster offices helps cope before, during and after extreme weather events.

Non-migrants use radio and television more (Table 3) than migrants, which offers the former better access to information such as weather forecasts. But migrants use phones more as an alternative access to information. Interviews and FGDs

indicate that more cyclone shelters have been built after the island was hit by cyclone Gorki in 1991. Non-migrants live closer to cyclone shelters (Table 3) but interviews and FGDs indicate that the island's cyclone shelters suffer from lack of capacity and maintenance and cannot be used to store food, clothes and water, or assets such as livestock, fishing gear and fish. Although the migrants need more time to reach a cyclone shelter, they are better placed to save their lives and assets. For instance, according to oral history interviewees, they could take shelter in and move most of their assets to nearby town during cyclone Gorki.

Migrant households are more dependent on marine fisheries for their income, employment and nutrition than non-migrant households (Table 3). Whilst improving livelihood outcomes in the short-term, greater dependency on climate-sensitive fisheries may not be sustainable longer-term (Allison et al. 2009).But migrants have more income they can invest in diversifying their livelihoods. Oral history interviews show that the wealthier migrants are already investing more in their children's education and others are keen to do so, with the hope that their children will obtain more secure livelihoods in the future.

Natural resource dependent rural households often spread risk and reduce vulnerability by diversifying livelihoods and income sources (Chambers et al. 1989; Ellis 2000; Allison and Ellis 2001). In our study, whilst non-migrants have a larger number of livelihood activities than migrants it has not resulted in higher incomes (Table 3): interviews and FGDs suggest that most livelihood activities on the island offer only part-time or occasional involvement. As one FGD participant noted: *"we* have low income jobs here. We do not have any work about half of the year*"*. Thus their livelihood diversification responded to lack of better

opportunities. For example, FGDs revealed that land erosion destroyed fish drying fields, curtailing this activity and pushing people to part-time and low-income activities such as shrimp post-larvae collection (started in 1997, providing income for 2-3 months per year for about one fifth of a household daily financial needs) and mollusc-shell collecting (started in 2004, generating less income than shrimp post-larvae collecting). Thus, while diversified livelihoods may help managing risks, they may not improve incomes: diverse livelihood activities like those on Kutubdia Island may only provide part-time or occasional involvement and modest economic returns (see Paavola 2008). Low level of education (Table 3) also restricts livelihood opportunities.

Non-migrants face a difficulty in continuing their livelihoods and most of them are desperate to migrate away from the island. But they cannot do so due to lack of assets and outside support, and the uncertainty of livelihoods at the destination. Household survey indicates that they have little or no savings or assets that they could sell to cover the costs of migration. FGDs also suggest that there are no buyers for their land because of erosion risk. Although banks and micro-credit providers exist, most households do not have access to credit because they do not have collateral. Micro-credit is also insufficient to cover the costs of migration and oral history interviews indicate that there is distrust between the households and microcredit lenders. Non-migrants also have covariate risks which make networks less useful. They have substantial amount of social capital and extensive networks (see Table 3) but oral history interviews indicate that relatives and contacts are also poor, and therefore cannot provide sufficient support or assistance needed to meet the costs of migration. Moreover, about a third of non-

migrant households are indebted to neighbours and relatives: repaying the loans has greater priority than migration to maintain their social status.

A third of non-migrant households consider that their old age restricts their income, livelihood activities and is a barrier to migration. Household survey indicates that heads of non-migrant households are older (43.46±14.74 years) than heads of migrant households (37.37±10.09 years): 22% of heads of non-migrant households are 60 years or older while this is true of only 4% heads of migrant households. About 10 % of heads of non-migrant households are female, which also restricts their migration. Oral history interviews and a FGD suggested that women have less income earning opportunities in the community. On Kutubdia Island, adult women, apart from widowers and divorcees, are not allowed to work outside their home. Female-headed households would also face greater livelihood uncertainty in the destination of migration.

To conclude, our results highlight that although the migrants and non-migrants originally had similar vulnerabilities and adaptive capacities before the relocation, migration has yielded several positive outcomes for the migrants including reduced exposure to climatic shocks and stress as well as better level of and access to livelihood assets and strategies. Our findings corroborate with the literature suggesting that climate induced migration may bring considerable positive outcomes for migrants (Black et al. 2011b).We conclude that migration has been a viable strategy to cope with climate variability and to adapt to climate change for those households that migrated from Kutubdia Island to Kutubdia Para

in mainland Bangladesh. Sea-level-rise, land erosion, cyclones and flooding will be the most important climate change impacts facing the migrants and non-migrants in the future. The migrants are likely to be less impacted than non-migrants if they can reduce dependency on fishery-related activities. Fish drying may be negatively impacted by climate change impacts particularly during the extended period. However, the vast majority of fish is dried in the normal period which limits the potential impact. Moreover, new technologies such as solar driers are becoming available to avoid adverse climate change impacts. In addition, the migrants in Kutubdia Para suffer less from land erosion and are on mainland close to a town, which offers better access to livelihood assets and services.

5 Conclusion

In this paper we have assessed the outcomes of migration by comparing a climate-induced resettled coastal fishing community with its original one in Bangladesh. The migrant community is composed of households who migrated to a previously undeveloped area.We collected data using surveys, interviews and focus group discussions, as well as used secondary sources.

The migrants and non-migrants were equally vulnerable and had similar adaptive capacities before the relocation in 1990s. But at the moment the migrant households are less exposed to climate shocks and stresses than their non-migrant counterparts. They also have more livelihood assets and have better access to them. They enjoy higher incomes, better health and better access to water supply, health and educational services, technology and markets than the households who did not migrate. We conclude that climate induced migration can result in positive

livelihood outcomes, reduced vulnerability and increased capacity to cope with climate variability and to adapt to climate change.

The non-migrants have not been able to reduce their vulnerability nor to increase their ability to cope with climate variability and to adapt to climate change: they have become trapped in a vulnerable position. Protecting them would require a dike around the island, which is unlikely to be built given the limited resources of Bangladesh. Migration to a mainland location remains an alternative. However, non-migrants are unlikely to be able to migrate on their own due to their limited assets. In light of the experience of the migrants, government could foster resettlement to carefully chosen destinations that reduce exposure to the impacts of climate variability and change, and provide access to livelihood activities and assets. Any initiatives for migration as a coping or adaptation strategy would need to carefully assess the potential destinations, resulting exposures, and needed support to ensure re-settlers are better off over the shorter and longer term.

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Figure Legend

Fig.1 Map of study areas in Bangladesh (modified from Banglapedia 2006)