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Sketching Livelihoods and Coping Strategies of Climate Vulnerable Fishers

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ABSTRACT

This study identifies how climate change-induced events affect the livelihoods of haor fishers and what coping strategies are adopted by the fishing community to tackle the ongoing climate change. A number of qualitative tools such as interviews, focus group discussions and oral history were employed to collect empirical data. The vulnerabilities related to climate change included fluctuation of temperature and rainfall, frequent occurrences of natural calamities, and outbreaks of damning diseases. Fishers were found to survive initially on income through illegal fishing while enjoying relief from the government by taking an immediate loan from NGOs for any calamity. In the case of long-term strategies, improvement of physical capital, harvesting rainwater, and tree plantation around houses are found as common strategies. A number of suggestions were elicited from fishers' perceptions to confront the vulnerabilities of environmental changes effectively.

INTRODUCTION

Bangladesh is situated in South Asia between 20°34'- 26°38' N latitude and 88°01' to 92°42' E longitude, with a national territory of 148460km^2 **(Sunny, 2020a)**. Dekhar Haor is considered one of the momentous and ecologically sensorial wetlands of Bangladesh, which stands on the Sunamganj Sadar, Daskhin Sunamganj, Chatak and Dawrabazar Upazila of Sunamganj district. Basically, the haor is inundated in monsoon and almost arid six months of the year **(Sunny *et al.*, 2020b)**. People of these areas maintain their livelihood by cultivating paddy on haor land during the dry season and become engaged in fishing during monsoon **(Kuddus *et al.* 2021)**. In addition, the haor plays a vital role in the country's economic, ecological, socio-economic, cultural and industrial context **(Ali *et al.*, 2010; FRSS, 2017; DoF, 2018)**. Dekhar Haor supports a diversified assemblage of aquatic

biodiversity and contributes to building a sustainable socio-economic life for thousands of people of north-eastern Bangladesh by providing employment opportunities, irrigation, food and nutrition, fuel, fodder and transportation **(Kuddus *et al*., 2020)**. Haor fisheries contribute a lot to the GDP and economic development of Bangladesh **(Shamsuzzaman *et al*., 2017)**. However, the exploitation rate of fisheries increases tremendously in haor areas based on economic, social, political and cultural exploitation which is a very common affair for haor-dependent people **(Pandit, *et al*., 2015; Kamruzzaman & Hakim, 2016)**. They suffer greatly from lack of health facilities and credit problems **(Alok *et al*., 2018)**. On the other hand, they are the most tragic vulnerable group of climate change. Obviously, the haor-dependent community is the frontal group facing several natural calamities and disasters **(Brander, 2010)**.

The climate in Bangladesh has changed over the last few decades, showing its considerable adverse impact, particularly on coastal and north- eastern Bangladesh **(Milton, 2010; Kuddus *et al*., 2022)**. The climate crisis and flash floods in the north- eastern region of Bangladesh have become a crucial reality for the haor- dependent fishing community **(Islam *et al*., 2016a; Sunny *et al*., 2021a)**. The increasing intensity of floods, storms and droughts turned them more vulnerable and disrupted their fishing operation, crops, houses and livelihoods **(Islam *et al*., 2018a; Sunny *et al*., 2018)**. Fishers of the country are directly and indirectly engaged with climate change **(Drinkwater *et al*., 2010; Kabir *et al*., 2012; Hasan &Ahsan, 2014)**. Dekhar Haor is considered one of the vital disaster-prone areas of the country. Identifying the climate-induced shocks and stresses that make the fishers vulnerable and their surviving coping strategies could help to take necessary actions to ameliorate the adverse impact **(Minar *et al*., 2012; Mohammed *et al*., 2016)**. Successful coping strategies should be adopted to minimize the adverse effects **(Islam *et al*., 2018b; Sunny *et al*., 2019)**. However, due to the high vulnerability of fishing communities and mode of dependency on the fishing profession, some obstacles are hindering the elimination of the negative impact of climate change **(Cheung *et al*., 2009; Chakma *et al*., 2022)**. Moreover, the sudden environmental change could alter the physical environment, which might hamper the coping capacity of the community **(Islam *et al*., 2018c; Sunny *et al*., 2021b)**. Thus, the present study was conducted to identify the existing scenario of climate change on Dekhar Haor, its trend, threats, coping strategies and how the community's coping strategies hamper aquatic biodiversity conservation by increasing fishing pressure. Dekhar Haor was selected because of having global consideration as a climate hotspot and densely vulnerable fishing community **(Pandit *et al*., 2015; Sultana *et al*., 2022)**.

It is essential to conduct more in-depth research on climate variability and change in fishing communities as the vulnerability of these communities is not well studied. However, a number of studies were conducted to assess the impact of climate change on agriculture-based livelihood systems. Therefore, this study aimed to fill this gap by representing the scenario of this highly vulnerable fishing community.

MATERIALS AND METHODS

1. Location of the study and data collection

The study was operated in two fishing communities of Sylhet division. The communities were identified based on the sufficiency of the natural resources and livelihood structure. The communities were Abadipur and Thandargaon of Dekhar Haor of Sunamganj District (Fig. 1). Various qualitative and quantitative tools, such as focus group discussions (**FGD**) with different groups of stakeholders, individual interviews (II) and key informant

interviews (KII) with expert persons and oral stories were employed for primary data collection. Several local and international articles and different reports and newspapers were used to formulate the secondary data.

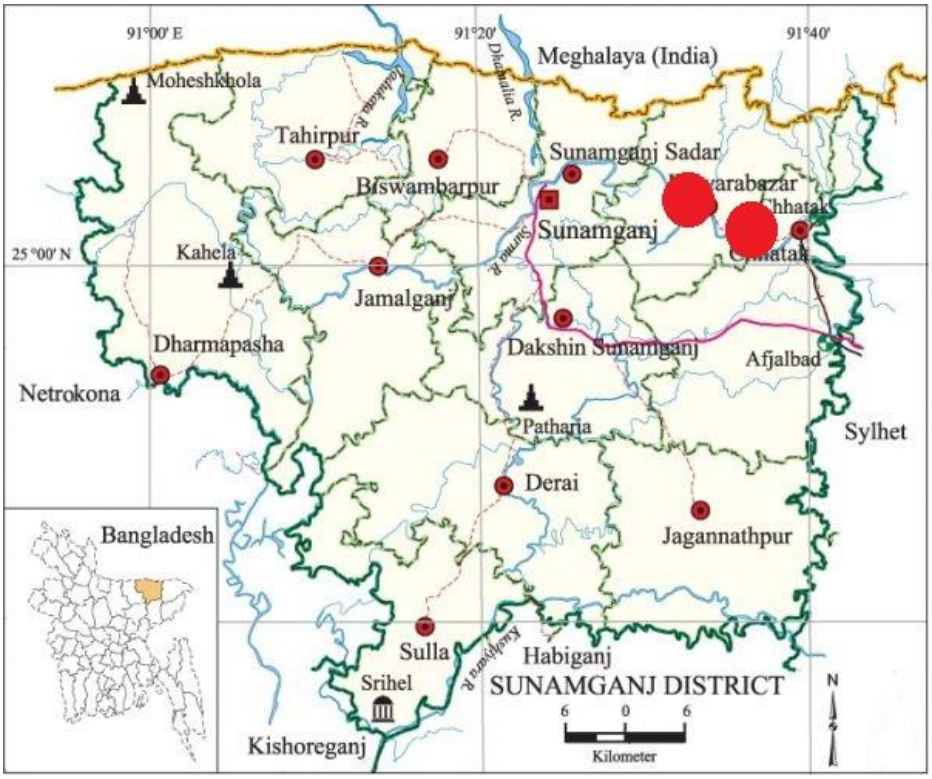

Fig. 1. Map of the study area (modified form **Sunny *et al.*, 2020b**)

2. Questionnaire setting and field observation

Based on the communities and field observation, a semi-structured questionnaire with exploratory interviews (total= 100) was conducted in two locations to collect particular community information. Along with 75 individual interviews, 10 FGD meetings with resource beneficiary groups consisting of almost 7-10 persons and finally 15 KII or cross-check interviews were taken from haor issues and fisheries official experts, NGO personnel and local entrepreneurs to evaluate the authenticity of the data. To manage the data, the interviews were conducted in different places such as boats, bank of the haor, paddy field, local market, fisher's houses and their yard, whereas approximately 40-50 minutes were taken to draw a summary.

3. Data processing, analysis and presentation

MS Excel (Version 2016) was applied to analyze the data. The sustainable Livelihoods Approach, commonly known as the SLA framework (**Sunny *et al.*, 2020a**), was adopted to formulate the qualitative and quantitative data, providing sufficient detail to allow the work to be reproduced.

RESULTS AND DISCUSSION

1. Socio-demographic profile of the fishers

The socio-demographic position of the fishers was diversified from any other profession in haor areas of Bangladesh. There were almost 1400 people who lived in an average of 180 households (HH) in the studied areas (Table 1). Among the households,

70.2% lived in a nuclear family and 29.8% in a joint family, where the family size varied from 5 to 7 in nuclear family and 10 to 12 in joint family. A large portion of 180 HH: 97±2 (mean ± standard deviation) of them were profoundly engaged in fishing, and 83±3.3 were also embroiled in fishing as well as a small business. Basically, a considerable number of fishers (82%±2%) got no self-fishing gears or boats, and they joined as hired labor for others. On the field experienced, it was identified that they lived below the marginal poverty line, and the percentage of highly poor (land size 0 decimal), poor (land size <5 decimal) and modest poor (land size >5 decimal) was 27%±3%, 49%±4% and 20%±1%, respectively, in some respects. Literacy status was not satisfactory including 45% illiterate, 30% signed, 15% primary and 10% secondary level. Women in the fishing communities were largely dependent on men and had minimal opportunities for decision-making on different issues. A large number of people (72%) have access to credit with high interest from local NGOs. Natural calamities jeopardize people of that community in addition to low earnings and limited employment options, which greatly affect livelihood sustainability; whereas, livelihood stand for assets, resources and capable operations related to making a living **(Mohammad & Wahab, 2013; Islam *et al*., 2017)**.

Table 1. Socio- economic profile of fishers in the study areas

Variable	Status	Mean ± SD
Family type (%)	Nuclear	70.2± SD
	Joint	29.8± SD
Family size (in number)	Nuclear 5 to 7	6 ±1.4
	Joint 10 to 12	11 ± 2.3
Poverty status (%)	Highly poor	27±3
	Poor	49±4
	Modest poor	20±1
Education (%)	Illiterate	45±SD
	Signed	30± SD
	0 to 5	15± SD
	5 to 10	10± SD
Occupation (%)	Only Fishing	97 ± 2
	Fishing and other	83 ± 3.3
Public/private assistance (%)	Yes	38± SD
	No	62± SD
Access to credit (%)	Yes	72± SD
	No	28± SD

2. Livelihood assets of the small-scale fishers (Fig. 2)

To provide fruitful socio-economic status of extreme marginalized climate vulnerable fishers lifestyle, specifically livelihood assets based on Sustainable Livelihood Approach (SLA) should be classified, such as human capital, natural capital, social capital, physical capital and financial capital as recorded in the studies of **Khan *et al*. (2018)** and **Rana *et al*. (2018)**.

Human capital of the studied area was identified as their literacy rate, age structure, marital status and poverty ratio. Highly poor socio- economic condition and early stage fishing engagement was the prone cause of extreme poverty. For the marital status of the communities, it was found that, 60% were married; 5% were divorced, and 35% were unmarried. With respect to the age composition of people investigated, it was recorded that, 35% of fishers were between 41 &50 years old, while 26%, 23%, 9%, and 7% of fishers represented the age composition of 21-30, 31-40, 51-60, and 61-70 years, respectively. A

huge number of fishers lived in the nuclear family (80%), and a small amount of them lived in a joint family (20%).

Physical capital of the fishers indicated their accessories such as various types of gear, including kunijal, dubajal, teta, koach, current jal, patijal berjal, chai, tuna jal, koiajal, thelajal, chip/borshi and moiyajal, as identified in the area under study. On the other hand, two types of houses were detected for fishers' communities, such as kutcha houses (85%) and semi-pucca houses (15%). The sanitary status of the community was quite satisfactory, and the majority of the fishers (82.2%) drank tube-well water for drinking, whereas 17.8% used pond water for other purposes (**Islam *et al*., 2016b; Rahman *et al*., 2017)**.

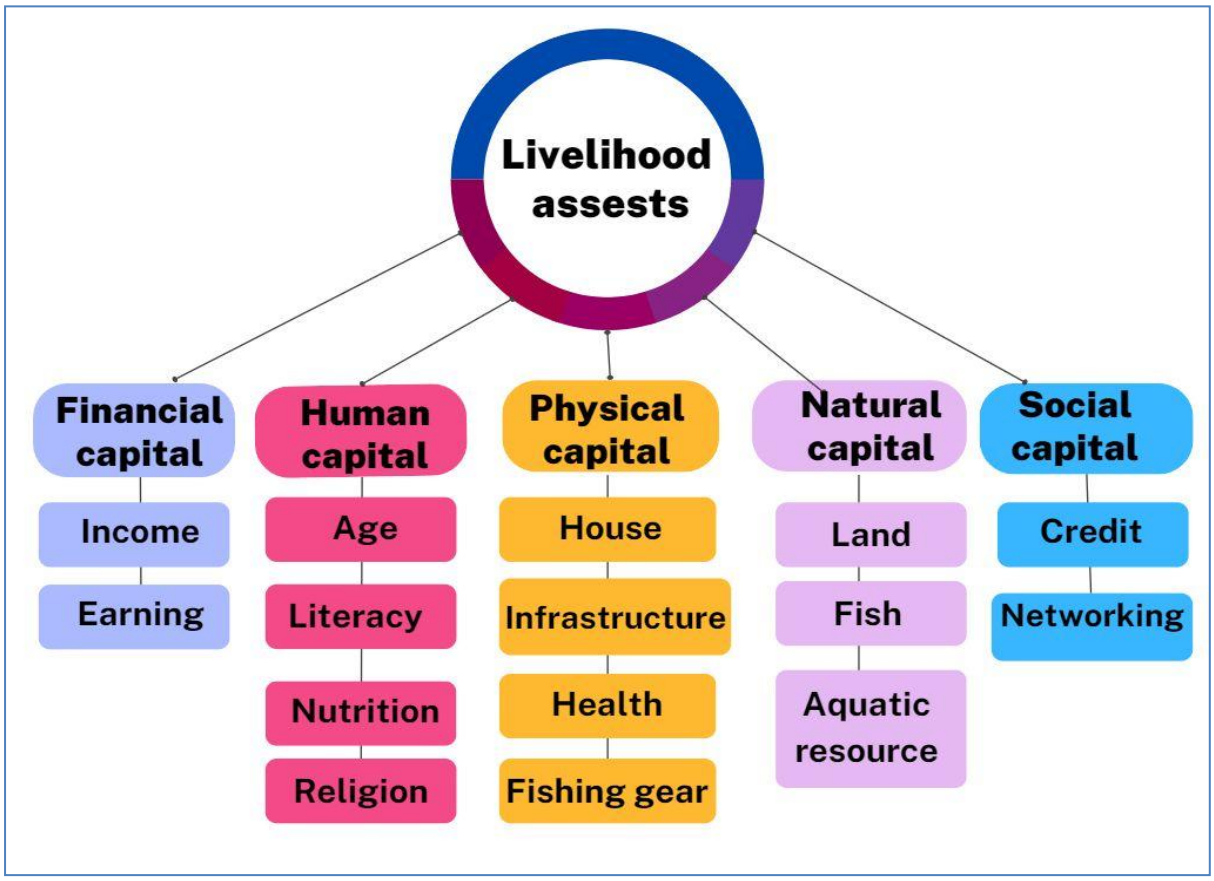

Fig. 2. Livelihood assets of the small-scale fishers

Natural capital explains the land properties and fish resources of the communities. It was deduced that, the fishers had few land properties, and they were mostly landless poor, with <5 decimal land, and the modest poor had >5 decimal land. The salinity of the haor was <0.5ppt. For fish species, **Sunny *et al*. (2020b)** listed 75 species from Dekhar Haor and Tanguar Haor, whereas 53% were Cypriniformes, 4% Clupeiformes, 7% Channiformes, 15% Siluriformes and 14% Perciformes. While, a number of 71 fish and prawn species belonging to 11 orders and 25 households were enlisted from the wetlands of Chatak in the study of **Pandit *et al*. (2015)**.

Financial capital demonstrates the income and earning opportunity of the fishers. The fishers under investigation were marked as the poorest communitity, and their earnings **(Islam *et al*., 2017)** explained their insolvency and low socio-economic position in existing society. Their average income fluctuated from 4000 to 8000 BDT which was the lowest among the South and Southeast Asian fishers **(Alok *et al*., 2018)**. Yet, fishing people did not prefer to change their proffesion, which is regarded as a deficiency; they were

forcefully engaged in other professions relative to fishing and selling **(Sunny *et al.*, 2020a)**. Recently, fishers were involved in agriculture as agricultural laborers, and more interestingly, women started fostering ducks and chickens in particular areas.

The social capital of the fishers' community indicated networking, credit operation and relationship with various stakeholders. The study produced an observation that fishers tremendously face complexities upon taking an institutional loan or loan from the bank since they were unable to mortgage resources which were mostly mandatory **(Sunny *et al.*, 2018)**. Thus, they were obliged to go to a Mahajan (local money lender) to help them manage loans while taking a high interest, and even sometimes they were forced to sell their fish catches to the Mahajan. Besides, during the field data collection, fishers said that almost 48% of fishers were obligated to work for the Mahajan at a cheap labor rate, and they did it year after year.

3. Factors making fishers vulnerable (Fig. 3)

3.1 Rainfall

Rainfall pattern has drastically changed day after day, and scarcities of rainfall in one year is turned to an abundance in the following year. This episodic norm of rainfall is the reason behind excessive floods and drought, which ultimately backpedal the normal pattern of the way of fishing.

One of the fishermen narrated that "Extreme rainfall in fortuitous time hindered them from fishing, and growing water flows damaged their net and other utensils, which forced them to use illegal cost- effective jal (monofilament gill net)."

3.2 Temperature

Global climate variation changed rapidly, and this is directly connected to the temperature with its gradual ups and downs at any moment, and this phenomenon is growing every day. During the summer period, the temperature becomes excessively hot and the coldest in the winter season, which eventually demolishes working ability and leads to the loss of potency and reduction of earnings in addition to various out breaking diseases. Besides, the fisher uses detrimental fishing gears like *current jal* (monofilament gill net) to catch more fish within the earliest time to avoid hitting the hot sun. At the time of the field group discussion, some fishers explained "Temperature drastic cold in winter which unable to complete fishing trip and due to foggy weather they sometimes could not manage fishing trip properly and affects in their profit."

3.3 Flash Floods

The livelihoods of the fishers became more vulnerable last June 2022 due to the excessive flash floods in the north-eastern region of Bangladesh. It did a severe catastrophe to the fisher's community by ruining their fish in the pond, causing health and sanitation hazards, losing fishing gear, communication and overall situation kickback to the debt cycle of local money lenders. The gradual happening of flash floods and all sorts of current and tidal surges, cyclones and extreme hits of the wind and waves, unfavorable weather increases thunders which makes the fishers community also vulnerable **(Islam *et al.*, 2017).** Besides, fishers couldn't go fishing during the flash floods occurred and were unable to earn on the other hand family expenses increased which ultimately pressured of debt to return to the lenders.

The devastating flash floods and some natural disasters occurred in Bangladesh recently which is mentioned above. The consequences of these natural calamities affected extremely vulnerable fishing communities in Bangladesh, especially in the northeastern region **(Kuddus *et al.*, 2022)**.

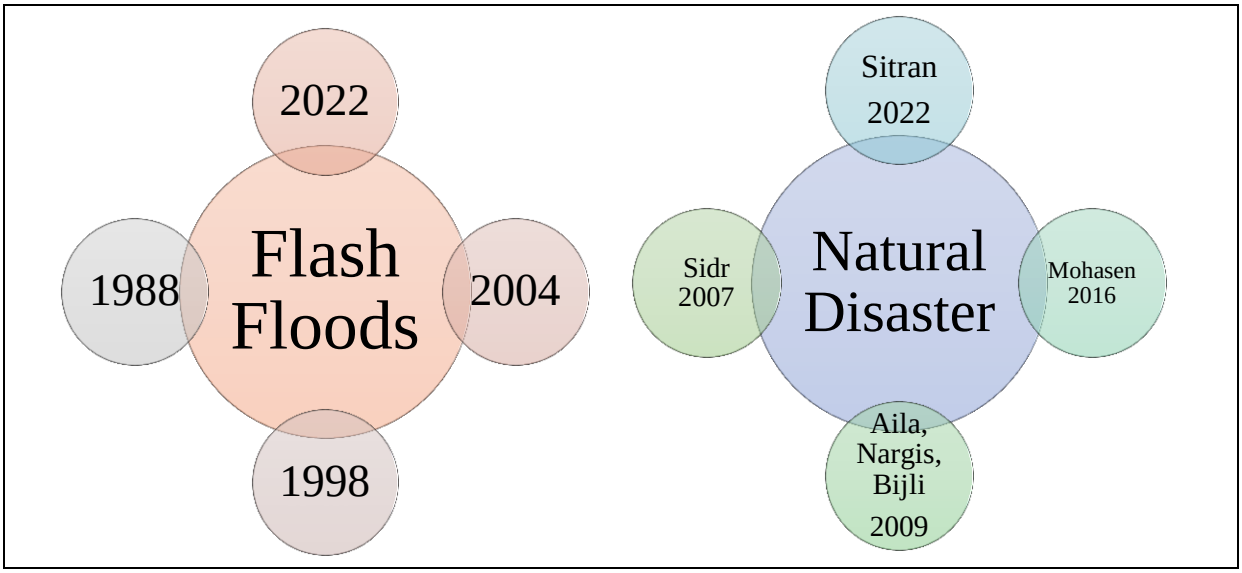

Fig. (3) Flash floods and Natural disaster in Bangladesh

3.4 Fishing oriented factors

Fishers and fishing oriented reasons make less contribution to change in climatic affairs **(Islam *et al*., 2018b)**. There are some key factors, such as the extreme rate of catching fish, prohibited fishing utensils, low fuel efficiency and the growing power of the engine and also climate change behind the fishing factors. So, such kinds of work directly affect the resources and decrease the ability of fishers to cope with the situation (**Islam *et al*., 2018c**).

3.5 Non fish oriented factors

Non-fish-oriented causes, suppose environmental degradation, destruction of fish ecology and huge human pressure, have great impacts on the coping strategy of the fishers. They generate from different sources and it is almost quite difficult to determine the exact factors which ultimately necessary to realize the proper causes behind the livelihood and coping strategies of fishers.

3.5.1 Pollution

Pollution makes the environment worst. Several types of pollution such as human waste, sewage, burn oil from engine boats and agricultural waste are directly released into haor and wetlands. Every day a huge amount of waste pollutes the water and gradually reduces fish sufficiency from haor (**Sunny *et al*., 2020a**). These all manmade causes pollute the natural water as well as fish availability and hampers fisher livelihood.

3.5.2 Unplanned development activities

Unplanned development activities such as road construction, building culverts, filling up haor areas without knowing river rules and other manmade barriers impede the movement of fish and fisher's livelihood (**Pandit *et al*., 2015**). These illegal activities affect the normal flow of haor water and are liable for moving various traditional fishes from our haor areas.

4. Coping strategies to tackle the changes (Fig. 4):

4.1 Proactive strategies

Proactive strategies basically explain the resistant activities that are taken before unfavorable climatic conditions to reduce or decrease the damage **(Sunny *et al*., 2018)**. Such strategies are:

4.1.1 Development of physical capital

These resistant actions are making sure that all the fishing gear and boats are in a secure place after confirming early warning for the betterment of the fishers building pucca or semi-pucca houses, elevating the plinth of the houses, warehousing food and arrangement of the fresh water in case avoiding the possibility of drowning tube-well.

4.1.2 Restorative natural capital

Generally, fisher's plant trees around the houses to keep their home safe during the natural calamity and strong winds and on the contrary, homestead vegetables provide emergency support and obviously timber woods to refit houses also.

Fig. (5). Coping strategies of the fishers

4.2 Reactive coping strategy

Reactive coping strategies of the haor dependent fishing community could be explained by taking action against minimizing or diminishing the damages of unfavorable climatic situations. It includes:

4.2.1 Deposits and Credits

Fishers were facing more vulnerability when there occurred calamities then soon after they tried to recover from the situation through their deposits, taking government relief and other compensations as well as taking a loan from mohajon (money lenders) and NGOs with such a high-interest rate **(Islam *et al.*, 2017)**. Besides, they engaged in other's professions to earn more and used the credits to refit the net and others fishing gear to cope with the situation and try to deposit increased income.

4.2.2 Changing Fishing Duration and System

Haor-dependent fishers' community usually going to catch fish at night to avoid the excessive heat from the sun and also both in the morning and night to go fishing after any natural disaster occurs which ultimately changes their fish-catching time and affects

devastatingly their health, family ties and bonding. To minimize the loss after natural calamities fishers change their net into small meshed ones (0.5cm to 1cm) in order to catch more fishers and overpass fishing rules.

4.2.3 Adopting Climate Resilient Culture Technique

The adverse effects of climate change have posed significant impacts on the food production system of the haor region. Here the highly acidic soil also hampers productivity **(Kuddus *et al*., 2020)**. Vegetable production is mostly threatened by heavy rainfall and floods. People are trying to cultivate vegetables in tower gardens to tackle these challenges. The diameter of the tower structure was 4.5 ft with a 5 ft height. The vegetable tower is cylindrical like structure that is made with bamboo, brick chips, water hyacinth, soil, compost or organic fertilizer and a special exhibition of the vertical garden to produce vegetables around the year **(Kuddus *et al*.,2021**). They prepared a common media mixing with soil (50%), rotten water hyacinth (10%) and cow dung/compost (40%) for uniform growth of vegetables. Climber's vegetables (i.e., bottle gourd and bitter gourd) and herbaceous vegetables (i.e., kangkong, Indian spinach, red amaranth and okra) were found to grow in the studied communities. So, tower gardening technology could be an effective option for producing vegetables in inundated areas. Farmers were also found to practice integrated culture of fish, vegetables and duck by enclosing a part of a canal or haor by a net. The cage culture system of fish appeared as an innovative climate resilience technology as well. Community people expected that the cage culture system would be more popular if the construction cost could be reduced **(Sunny *et al*., 2019)**.

4.2.4 Migration

Capable fishers and farmers were shifting their houses to the secure place of that community. 35% of fishers were found to leave the fishing profession and migrate to less vulnerable areas to involve in off-farm activities like rickshaw pulling, day labor, etc. 25% of people wanted to educate their children and migrate to another region to ensure a secured future for their next generation.

CONCLUSION

The repugnant outcome of climatic vulnerability will be discrepant in fishers' community life. People of the haor region, especially fishers are one of the most vulnerable communities who are basically dependent on natural resources and have comparatively less resilience, exposes ultimately facing destructive environmental hazards. In order to develop haor dependent fisheries scenario, some recommendations and suggestions could be followed. Some demonstration and training activities need to be addressed for the improvement of networking and institutional weaknesses. Public and private branches of the country could play a sound role in promoting livelihoods and increasing dam and embankment activities for the betterment of the vulnerable fishing community. Beyond it, Public Private Partnerships PPP could take the initiative to introduce Alternative Income Generating Activities AIGA. The clinic cum cyclone center strategy also provided huge support to the climate-vulnerable people but more cyclone center is needed to build up to avoid insufficiency in the emergency period. Whenever there occurred any natural or climatic disasters then economic solvency is a must to minimize the losses but they find it difficult to take a loan from the bank and other financial institutions. Fishers must have easy accessibility to credit; otherwise, they are bound to go to NGOs or mohajon (money lenders) for credit with high-interest rates and ultimately affecting their coping strategy and livelihoods.

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