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Research Article

Analyzing Livelihood Sustainability of Climate Vulnerable Fishers: Insight from Bangladesh

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ABSTRACT

Fish and fishery resources play an important role in improving socio-economic status of the fishing communities. Sylhet, the haor (bowl or saucer shape shallow depression) dominated administrative divisions (encompassing RAMSAR site and Ecological Critical Wetland Area) of Bangladesh is very promising for freshwater capture fisheries. But very few studies focused on the overall status on livelihood sustainability of fishing communities in this region. This study identified the demography, livelihood strategy, constraints of fishing and their coping strategies, strength, weakness and opportunity of fishing communities using household questionnaires, oral history interviews, and focus group discussions in Sylhet division (north eastern region of Bangladesh). The study identified physical strength and intention to work all the year round as the key strengths and acute poverty, poor economy, lack of alternative income generating opportunity and reduced fish availability as common weakness of fishers. Major threats facing by the fishers were natural calamities, overexploitation, dependency on natural resources and improper policy implication. Scope of alternative income generating opportunities, training and motivational program among the resource users and community based fisheries management could improve the situation. Findings of this study would provide important guideline for wetland management, planning and development of livelihood sustainability of the fishing communities.

Keywords: Fishing community; Livelihood Sustainability; Vulnerability; Biodiversity; Bangladesh

INTRODUCTION

Bangladesh is located on the world's largest river deltas, created by the Ganges, the Brahmaputra, the Meghna and their tributaries. This is a riverine country of Southeast Asian region [1,2] having a total area of 147,570 km^2 and a population of about 140 million [3]. The whole country is criss-crossed by 230 rivers and their tributaries and vast floodplain; thus ten percent of the total area of Bangladesh is always covered with water [4,5]. Bangladesh is the 4th largest producer of inland fisheries and has a huge water resource all over the country in the form of ponds, ditches, lakes, canals, small and large rivers and estuaries covering about 4.34 million hectares [6]. The favorable geographic position has blessed Bangladesh with a large number of aquatic species and provides plenty of resources to support fisheries potential [7]. It is enriched with freshwater fish species comprising 260 indigenous, 12 exotic, 24 freshwater prawn species [8,9].

Fish is the second most important agricultural crop in Bangladesh and its production contributes to the livelihoods and employment of millions of people [10,11]. The production and consumption of fish therefore has important implications for national income and food security. Bangladeshi people are also popularly referred to as "Mache BhateBangali" or "fish and rice makes a Bengali" [6]. Among all the division north eastern region (Sylhet division) is very promising for freshwater fishing due to abundance of wetlands of international importance [2,6]. Haor is a mosaic of wetlands including rivers, streams, irrigation canals and large area of seasonally flooded cultivated plains. There are 411 haors in Bangladesh comprising an area of about 8000 km^2 [12]. Sylhet

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basin cover the most ecologically and economically important wetlands of Hakalukihaor (country's largest haor), Tanguarhaor (RAMSAR site since 2000, country's ecologically critical area 1999), Dekharhaor, Hail haor and Sanirhaor associated with Eralibeel and Jamaikatabeel. These haor occupies a land area of 40,000 ha area of three big districts (Sunamgonj, Moulvibazar, Sylhet) of Sylhet division. These Wetlands play vital role in the country's economic, industrial, ecological, socio-economic, and cultural context [13-15]. It support the biodiversity of flora and fauna and contribute to build a sustainable socioeconomic life of millions of people of rural Bangladesh [14,16] by providing employment opportunities, irrigation, food and nutrition, fuel, fodder and transportation.

But the fish production from the fresh waters has declined to less than 40% [17] which gave a significant impact on the fishing community, their income, basic needs and overall socio-economic status. Fishermen community is deemed to be one of the most vulnerable communities in terms of their livelihood opportunities due to the deprivation of many amenities that considered them as the poorest of the poor [1,18-20]. It is important to understand the livelihood characteristics for sustainable development of Fish and fishery resources play an important role in improving socio-economic conditions of the fishing community. Several studies were conducted on the socioeconomic condition of fishers of different districts in traditional method but very few systematic studies were conducted on the fishing community of north eastern region [1,16,18-20]. Thus the study was conducted using Sustainable Livelihood Approach (SLA) framework to gain knowledge about the livelihood strategy, strength, weakness, opportunity and threats of fishing communities of this region.

Sustainable Livelihoods Approach (SLA)

Livelihood means the capabilities, assets, resources and activities those are needed for living [21]. Livelihood become sustainable when it can be able to cope with and overcome stresses, shocks, and maintains capabilities and assets for present and future generation [22]. The Sustainable Livelihood Approach (SLA) provides an understanding of the lives of marginalized people by offering a way of poverty reduction [23]. There are five important key indicators for assessing sustainable livelihoods, these are natural (timber and non-timber forest resources, water, wildlife), physical (shelter, infrastructure, equipment), and financial capital as well as intangible human (education, skills, health) and social (institutions, relationships, trust) resources [24-28].

Sustainable Livelihoods Approach (SLA) is important for development programs that aim to reduce poverty and vulnerability in communities who are engaged in small-scale fisheries and aquaculture [29,30]. The sustainable livelihoods framework helps to think and identify that poor might be very vulnerable to the assets and resources that assist them to survive, and the policies and institutions that put impact on their livelihoods [22]. Figure 1 shows the sustainable livelihoods framework and its various factors, which reduce or enhance livelihood opportunities and show their interrelation. Livelihood strategies include fisheries and agricultural intensification and expansion, livelihood diversification, and migration [24]. Institution and vulnerability are integral components of the SLA, and provide the crucial context where resources and strategies can be deployed and implemented.

MATERIALS AND METHODS

Study sites

The study was conducted in five fishing communities of Sylhet division. The communities were selected considering the dependency on natural resources and socioeconomic structure. The communities were Dakkhinsreepur, Uttorsreepur of Tanguar Haor (ecologically critical area since 1999 and Ramsar site since, 2000) of Tahirpur Upazilla, and Uttorgaon, Dakkhingaon of Dekhar Haor of Sunamaganj Sadar Upazilla under Sunamganj District. For primary data collection, a number of qualitative tools such as individual interviews (II), focus group discussions (FGD) with

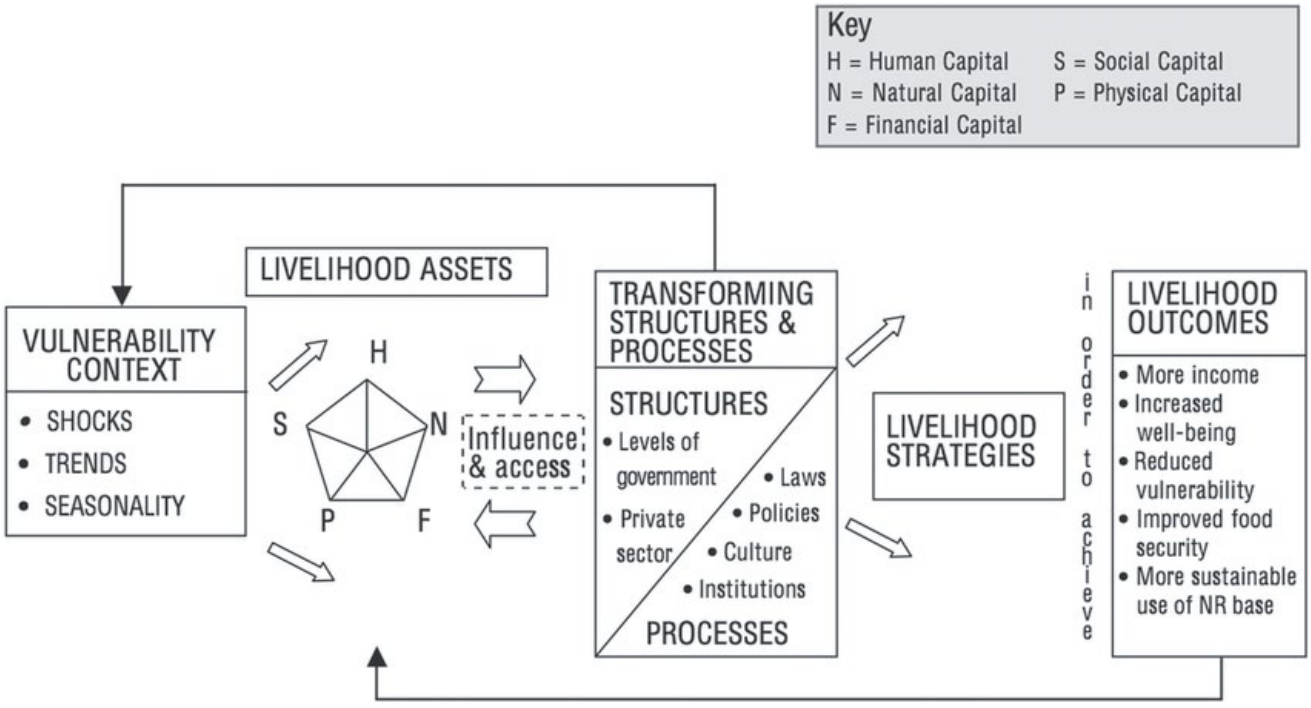

Figure 1: The sustainable livelihoods framework [22].

various groups of stakeholders, key informant interview (KII) with knowledgeable persons and oral history were employed (Figure 2).

Data collection

To collect empirical data, 'household survey' and 'survey during fishing' was conducted and a number of qualitative tools such as interviews, focus group discussions, and oral history were employed. Secondary data was collected from several sources including different articles, reports of freshwater wetlands, local and International newspapers. For analysis of qualitative data, content analysis method was employed; themes were identified and classified into manageable categories of different variables, such as natural capital, social capital, strength, opportunities, weakness, threats etc.

Questionnaire interviews

Using a semi-structured questionnaire exploratory interviews (total= 125) were conducted in five areas to collect necessary information. Each interview took approximately 50 minutes to complete. In addition to the 90 interviews above, ten FGD sessions with resource users (where each group consisted of 8–10 persons) were conducted. Finally, fifteen KII or cross-check interviews with local entrepreneurs, NGO personnel working on mangrove issues and forest officials were conducted to collect and verify or necessary information. Fishermen and community people were interviewed on boat, bank of the beel and haor, fishers' houses, fish markets, paddy field and where participants could sit and feel comfortable.

RESULTS

Socioeconomic status of fishers

Nuclear (72.9%) and joint families (27.1%) were present in the study areas. Size of the family was 4-7 persons in nuclear families and 8-12 persons in joint families and main profession was fishing. Among all the fishers 32% people were found engaged in fishing at the age group of 31-40 years, 22% people were in 41-50 years,

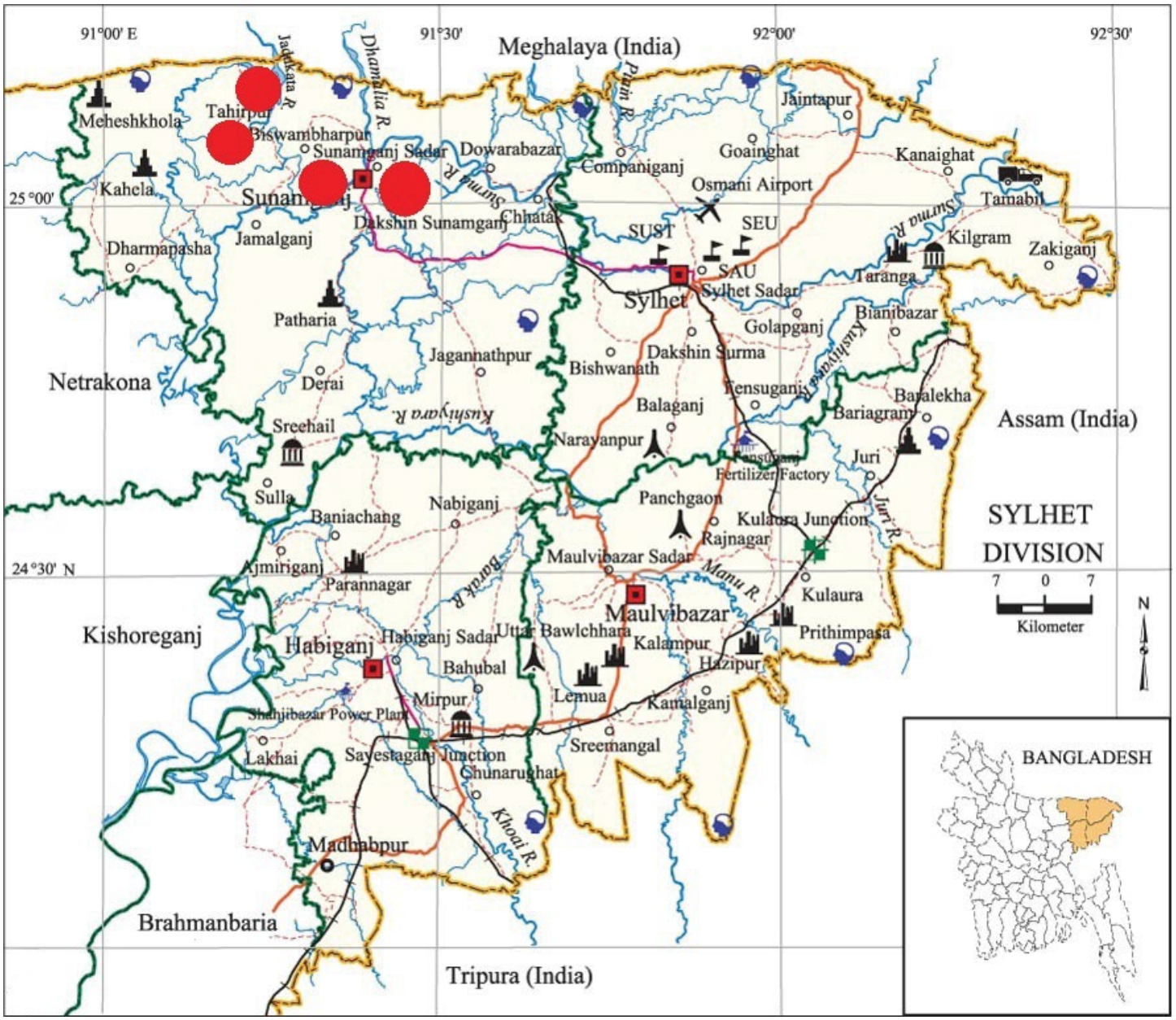

Figure 2: Location of the study areas.

24% people were below 20 years, 22% people were between 21 to 30 years. Education is very important in socioeconomic aspects. Among the respondents of fishing communities 45% were illiterate, 30% can only sign their name, 15% got primary level education, 10% went to secondary level and no one went to higher secondary level. The income of the fishers was very poor. The only source of income of fishermen was selling fish in the market and other place. There were very limited options for non-fishery activities such as day labor activities in Agricultural field. Fishers got wages from 100 BDT (1.3 US$) to 180 BDT (2.3 US$) daily depending on their capability in Sylhet region. Alternative income generating activities are must for living standard improvement of the community people. Moreover, every year many people are leaving fishing profession getting involved in other profession due to increasing fishing pressure and climate change. Among the respondents 38% got assistance from the government and different private voluntary organizations during natural calamities especially flood. Most of the respondents (72%) had credit facility from NGOs. They didn't have access to take bank loan as they didn't have enough wealth to morgue in the bank (Table 1).

People of this community become poorer and poorer due to debt cycle and intensive pressure of NGO's credit. As natural calamities like flood, storm etc. is now a common phenomenon that badly hampers the income of the fishers especially who is dependent on only fishing profession. So, alternative income generating activities should be created and ensured. Income source should be diversified and engagement of women in income generating activities by maintaining the norms of their own society. Following suggested AIGAs (Alternative Income Generating Activities) could be helpful in this regards (Table 2).

Livelihood assets of fishing communities

Sustainable livelihoods approach (SLA) discuss with five types of capital upon which fishermen's livelihood depend, categorized as human, natural, financial, social and physical capital.

Human capital

Human capital includes the knowledge, skills, working ability and good health of fishers. Fishing was done by using indigenous technology and fishers built up skills through their own knowledge. People were engaged in income generating activities like fishing, fish marketing, agriculture, homestead gardening and poultry rearing. Risk of contagious disease like diarrhea, typhoid and jaundice was found a common phenomenon due to inundation and flood when the locality suffers from lack/no sanitation facility. Decreased in fish catch due to seasonality, unavailability and overexploitation is responsible for malnutrition of this community. Fluctuation of temperature and rainfall and frequent occurrences of natural calamities reduce working capacity.

Natural capital

Natural capital of this region includes land, water, wild fry, fish and minerals. Environmental goods are critical in fish production. Fishers relied on rainfall, and sometimes canal water for fish availability and fishing. List of available fish species collected from local community is given below (Table 3).

Financial capital

Financial capital includes fishers' incomes, savings and credit. Fishers spent their income mostly for payment of loan, dowry payments and buying of fishing utensils like fishing net, boat etc. Farmers had very little scope to collect loan from Bank due to their ignorance and complex banking system. NGO activities were rampant in these areas. Due to lack of education, fishers went to money lenders and pay high interest rate of 10% monthly.

Table 1: Socioeconomic profile of fishers in the study area.

Variables	Status	Mean (± SD)
Family type	Nuclear	72.9%
	Joint	27.1%
Family size (in number)	Nuclear 4 to 7	5 (1.4)
	Joint 8 to 12	10 (2.3)
Age of fishers	<30	24% (5.9)
	21 to 30	22% (2.6)
	30 to 40	32% (4.9)
	40 to 50	22% (4.5)
Education	Illiterate	45%
	Signed	30%
	0 to 5	15%
	5 to 10	10%
Occupation	Fishing	94.9%
	Other	5.1%
Income	Net annual income	52,280 (1510) BDT
Access of alternative income	Yes	51%
	No	49%
Public/private assistance	Yes	38%
	No	62%
Access to credit	Yes	72%
	No	28%

Table 2: Potential AIGAs for men and women of fishing households.

Name of potential AIGA	Rank	Target group	Justification	Challenges
Mobile Mechanic	1	Men	Who completed primary education	• Lack of skill
Auto mobile mechanic	1	Men	Part time/full time (Age 15 to 40)	• Lack of skill • Lack of capital
Tea stall	2	Men	Part time/during less availability (Age>40)	• Lack of skill • Lack of capital
Cage culture in open water	2	Men	Part time/during less availability (Age>40)	• Lack of skill • Value chain complexity
Agriculture (Crop cultivation in land)	1	Men	Part time/during less availability (Age>40)	• Lack of skill • Lack of capital
Aquaponics (Integrated culture of fish and vegetables in homestead area)	1	Men	Part time/during less availability (Age>40)	• Lack of skill • Lack of capital
Poultry farm	1	Men	Part time/during less availability (Age>40)	• Lack of skill • Lack of capital
Small business	2	Men	Part time/during less availability (Age>40)	• Lack of capital
Rickshaw pulling	1	Men	Part time/during less availability (Age>40)	• Lack of capital
Sewing (Nakshikatha)	1	Women	Age 15 to 40	• Lack of matured value chain
Baby toys (made by cloth, clay, paper etc.)	1	Women	Age 15 to 40	• Lack of skill • Lack of capital
Handy craft (made by bamboo, cloth etc.)	1	Women	Age 15 to 40	• Lack of skill • Lack of capital
Hen/duck rearing (indigenous)	1	Women	Age>40	• Lack of skill • Lack of capital
Vegetable cultivation in yard	1	Women	Age>40	• Unconsciousness
Fish pot mending	2	Women	Age>40	• Lack of skill • Lack of capital
Net mending	2`	Women	House wife and children	• Lack of skill • Lack of capital

Table 3: List of different fish species with their order name, local name, and scientific name.

S. No.	Order	Scientific identity of the taxon with author	Vernacular or local Bengaliname	Common English name
1.	Anguilliformes	*Anguilla bengalensis* (Gray, 1831)	Bamos	Indian mottled eel
2.	Cypriniformes	*Salmostomaphulo*(Hamilton, 1822)	Fulchela	Flying barb
3.	Cypriniformes	*Esomusdanrica* (Hamilton, 1822)	Darkina	Flying barb
4.	Cypriniformes	*Rasborarasbora* (Hamilton, 1822)	Darkina	Flying barb
5.	Cypriniformes	*Chela labuca* (Hamilton, 1822)	Labuca	Hatchet fish
6.	Cypriniformes	*Psilorhynchussucatio* (Hamilton, 1822)	Titari	River stone carp
7.	Cypriniformes	*Bengalaelanga* (Hamilton, 1822)	Sephatia	Bengala barb
8.	Cypriniformes	*Bariliusbendelisis* (Hamilton, 1807)	Joia	Hamilton's barila
9.	Cypriniformes	*Danio rerio* (Hamilton, 1822)	Anju	Zebra danio
10.	Cypriniformes	*Osteobramacotio* (Hamilton, 1822)	Dhela	Cotio
11.	Cypriniformes	*Systomussarana* (Hamilton, 1822)	Sarpunti	Olive barb
12.	Cypriniformes	*Puntius chola* (Hamilton, 1822)	Chalapunti	Chola barb
13.	Cypriniformes	*Pethiaguganio* (Hamilton, 1822)	Molapunti	Glass-barb
14.	Cypriniformes	*Puntius conchonius* (Hamilton, 1822)	Kanchanpunti	Rosy barb
15.	Cypriniformes	*Puntius ticto* (Hamilton, 1822)	Tit punti	Ticto barb
16.	Cypriniformes	*Puntius sophore* (Hamilton, 1822)	Jatpunti	Pool barb
17.	Cypriniformes	*Puntius terio* (Hamilton, 1822)	Teri punti	One spot barb
18.	Cypriniformes	*Oreichthyscosuatis* (Hamilton, 1822)	Kosuati	Sortfinner barb
19.	Cypriniformes	*Garra* gotyla (Gray, 1830)	Gharpoia	Sucker head, Gotyla

20.	Cypriniformes	*Acanthocobitiszonalternans* (Blyth, 1860)	Bilturi	River loaches
21.	Cypriniformes	*Schisturacorica* (Hamilton, 1822)	Koikra	Stone loach
22.	Cypriniformes	*Schisturascaturigina* (McClelland, 1839)	Dari	Stone loach
23.	Cypriniformes	*Schisturabeavani* (Gunther, 1868)	Shavonkhokra	Greek loach
24.	Cypriniformes	*Somileptesgongota* (Hamilton, 1822)	Poia	Gongota loach
25.	Cypriniformes	*Botiadario* (Hamilton, 1822)	Rani	Stripped loach
26.	Cypriniformes	*Lepidocephalusguntea* (Hamilton, 1822)	Gutum	Guntea loach
27.	Cypriniformes	*Labeorohita* (Hamilton, 1822)	Rui	Rohu
28.	Cypriniformes	*Catlacatla* (Hamilton, 1822)	Catla	Catla
29.	Cypriniformes	*Cirrhinuscirrhosus* (Bloch, 1795)	Mrigal	Mrigal carp
30.	Cypriniformes	*Labeocalbasu* (Hamilton, 1822)	Kala Baush	Karnataka labeo
31.	Cypriniformes	*Labeobata* (Hamilton, 1822)	Bata	Bata labeo
32.	Cypriniformes	*Chaguniuschagunio* (Hamilton, 1822)	Jarua	Minor carp
33.	Cypriniformes	*Labeoangra* (Hamilton, 1822)	Angrot/kharas	Angralabeo
34.	Cypriniformes	*Labeogonius* (Hamilton, 1822)	Ghainna	Kuria labeo
35.	Cypriniformes	*Labeonandina* (Hamilton, 1822)	Nandina	Nandi labeo
36.	Cypriniformes	*Labeopangusia* (Hamilton, 1822)	Ghoramach	Pangusialabeo
37.	Cypriniformes	*Cirrhinusreba* (Hamilton, 1822)	Bhagna	Reba carp
38.	Cypriniformes	*Amblypharyngodonmola* (Hamilton, 1822)	Mola	Molacarplet
39.	Cypriniformes	*Danio devario* (Hamilton, 1822)	Debari	Bengal danio
40.	Cypriniformes	*Raiamas bola* (Hamilton, 1822)	Bhol	Trout barb, Indian trout
41.	Siluriformes	*Eutropiichthysvacha*(Hamilton, 1822)	Bacha, Bhacha	Schilbi
42.	Siluriformes	*Clariasbatrachus* (Linnaeus, 1758)	Magur	Walking catfish
43.	Siluriformes	*Wallago attu* (Bloch & Schneider, 1801)	Boal	Freshwater shark
44.	Siluriformes	*Heteropneustesfossilis* (Bloch, 1794)	Shing	Stinging catfish
45.	Siluriformes	*Pangasiuspangasius* (Hamilton, 1822)	Pangus	Pangas catfish
46.	Siluriformes	*Ailiacoila* (Hamilton, 1822)	Kajuli	Gangetic catfish
47.	Siluriformes	*Rita rita* (Hamilton, 1822)	Rita	Rita, Striped catfish
48.	Siluriformes	*Sperataaor* (Hamilton, 1822)	Ayre	Long-whiskered catfish
49.	Siluriformes	*Mystuscavasius* (Hamilton, 1822)	GolshaTengra	Gangetic mystus
50.	Siluriformes	*Mystusbleekeri* (Day, 1877)	Tengra	Catfish
51.	Siluriformes	*Mystustengara*(Hamilton, 1822)	BazariTengra	Stripped dwarf catfish
52.	Siluriformes	*Clupisomagarua* (Hamilton, 1822)	Garua	River catfish
53.	Tetraodontifomes	*Tetraodon cutcutia* (Hamilton, 1822)	Potka	Ocellated pufferfish
54.	Beloniformes	*Xenentodoncancila* (Hamilton, 1822)	Kakila	Freshwater garfish
55.	Beloniformes	*Hyporhamphuslimbatus* (Valenciennes, 1847)	Ekthota	Congaturi Halfbeak
56.	Cyprinodontiformes	*Aplocheiluspanchax* (Hamilton, 1822)	Kanpona	Blue Panchax
57.	Channiformes	*Channastriatus* (Bloch, 1793)	Shol	Snakehead murrel
58.	Channiformes	*Channamarulius* (Hamilton, 1822)	Gajar	Giant snakehead
59.	Channiformes	*Channabarca* (Hamilton, 1822)	Piplashol	Barca snakehead
60.	Channiformes	*Channa punctatus* (Bloch, 1793)	Taki	Spotted snakehead
61.	Channiformes	*Channaorientalis*(Bloch & Schneider, 1801)	Raga/Cheng	Walking snakehead
62.	Clupiformes	*Chitalachitala* (Hamilton, 1822)	Chital	Clown knifefish
63.	Clupiformes	*Notopterusnotopterus* (Pallas, 1769)	Foli	Bronze featherback
64.	Clupiformes	*Coricasoborna* (Hamilton, 1822)	Kachki	The Ganges River Sprat
65.	Perciformes	*Macrognathusaculeatus* (Bloch, 1786)	Tara baim	Lesser spiny eel
66.	Perciformes	*Mastacembelusarmatus* (Lacepede, 1800)	Baim	Spiny eel
67.	Perciformes	*Mastacembeluspancalus* (Hamilton, 1822)	Guchibaim	Spiny eel
68.	Perciformes	*Colisafasciatu*(Bloch & Schneider, 1801)	Khalisha	Banded gourami
69.	Perciformes	*Colisalalia*(Hamilton, 1822)	Lalkholisha	Dwarf gourami
70.	Perciformes	*Anabas testudineus* (Bloch, 1792)	Koi	Climbing perch
71.	Perciformes	*Chanda nama* Hamilton, 1822	NamaChanda	Elongate Glass Perchlet
72.	Perciformes	*Parambassislala* (Hamilton, 1822)	LalChanda	Highfin Glassy Perchlet

73.	Perciformes	*Parambassisranga* (Hamilton, 1822)	Rangachanda	Indian glassy fish
74.	Perciformes	*Chanda beculis* (Hamilton, 1822)	Chanda	Himalayan glassy perchlet
75.	Perciformes	*Glossogobiusgiuris* (Hamilton, 1822)	Bele	Freshwater goby

Physical capital

House, fishing gear, boat Vehicle, road, communication system, market, electricity, water supply, sanitary and health facilities were the physical capital of the fishing community. A totalof 14 types of fishing gear belonging 7 categories like koiajal, current jai, patijal, berjal, moiyajal, dubajal, tuna jal, kunijal, thelajal, chip/borshi, teta, koach, anta, chai were found in this region (Table 4).

Road and transportation service was very poor with severe health and sanitary problems. People got poor medical facilities due to long distance of the upazila hospital, scarcity of necessary pathological test and inactiveness of the community clinic system and people often suffered from diarrhea, cholera and malnutrition. Almost all households used tube-wells for drinking water. Electricity status of the communities was very poor and only 15% of farmers had electricity.

Social capital

Social capital includes relationship, cultural norms and other social factors that significantly help in exchanging experiences, sharing of knowledge and cooperation among rural communities. Fishers and their neighbors didn't get any training so they contribute to the livelihood of each other by their own ideas of indigenous knowledge.

Vulnerabilities

Vulnerability deals with different strategies like shocks (unexpected events), trends (factors influence financially), seasonality (seasonal fluctuation of available resources), (Table 5) institutional structure and process that were composed of a range of activities and could vary from individual to individual or from household to household.

Institutional processes and livelihood outcomes

Understanding institutional processes help to identify the opportunities and barriers to sustainable livelihoods. Livelihood strategies and livelihood outcomes are influenced by transforming structures and institutional processes. The study found several transforming structures and processes that could be helpful for desirable outcomes from the fish production, harvesting and other economic activities of the fishing community. It was found livelihood outcome of the fishers depended simultaneously on livelihood assets, vulnerabilities and performance of institutions and organizations (Figure 3). Poor fishers had limited resources to maintain their livelihood. Government agencies, NGOs and the private sector could play significant role in this regards to improve the livelihood of the fishing communities. Introduction of public private partnership system for creating employment opportunities can improve the situation which will also encourage some entrepreneurs to small business as well as open the door of alternative income generating activities (AIGA).

Strength, weakness, opportunity and threat

This study identified the Strength, weakness, opportunity and threat of the fishers from their livelihood approach and represents these by SWOT analysis (Figure 4). Intrinsic brave, physical strength, hardworking capacity, simple life style, protein availability and women involvement in economic activities were strengths of the fishing community. Weaknesses included acute poverty, illiteracy, unemployment, poor infrastructure and linkage with public and private organization, lack of capital and lower participation in the decision making. Vast water resources, Scope of AIGAs, ecotourism, awareness rising through co-management practice were the opportunities for the fishing communities to develop their livelihood in sustainable way. Fishers are facing some threats that included frequent occurrence of natural calamities, over exploitation, high dependency on natural resources, poor income, political pressure and improper policy implication. A summary of the key strengths, weaknesses, opportunities and threats with respect to the sustainable livelihood framework is given below (Figure 4).

DISCUSSION

Fishers are the key protein supplier to the consumer though they are still deprived of basic needs and other professional facilities [1]. Sustainable livelihoods approach (SLA) can be helpful to find out the existing status of fishers and fisheries resource [31]. Fishers require various assets to achieve positive livelihood outcomes [24]. Capitals like knowledge, skills, working ability and good health enable fishers to pursue their livelihood strategies and achieve their livelihood objectives [22]. Changes in food availability and affordability due to natural calamities and seasonality add an additional burden to the health and income of the community [31]. Rapid population growth in fishing communities accelerated natural capital depletion that affected fish production and fishing. Changes in the availability of fish (natural capital) could affect total profit and harvesting costs, resulting in greater costs in managing and accessing natural capital [31]. Income of the wetland's fishers in Bangladesh is not up to the mark. Low income hampers the savings and induces the credit taking tendency. Informal source of credit is only easily available to fishers with unfavorable interest, terms and condition [10,32-34]. Mahmud (2007) indicated fishers of Chalan beel (largest beel of north region) area had the highest income of 8000 BDT (196,000 BDT yearly) and Lowest 3000 BDT (36, 000 BDT yearly) [19] that support the finding of this study (yearly average income 52, 280 BDT). Reduction in income causes decreased in catches due to overexploitation, seasonality and climate change that induce malnutrition and under nutrition [35]. Climate change is also responsible for reduction of fish abundance and catches [36-38]. Income diversification could be the best option to increase the income of the fishers [20,39] and reduce over exploitation as well as high dependency on natural resources. Women could also contribute in family income [40]. Alternative income generating option could vary from place to place according to local demand, age, education, gender and capacity of the fishers.

Frequent occurrences of natural calamities destroy and hamper the productive assets and infrastructures [33,38,41-43]. This increased exposure to the hazard could also be attributed to inadequate structural protection, health facility, potable water, and sewage and drainage facility. Vulnerabilities of fishing community could

Table 4: Different types of fishing gears used by the fishers.

S. No.	Category	Type	Length (m)	Width (m)	Mesh size (cm)	Operating manpower
1	Gill net	Koiajal (Specialized net for *Anabas testudineus*	50-65	1-1.5	0.5-1	1-2
2	Gill net	Current jal (monofilament gill net)	105-110	1.2-1.5	1-1.5	1-3
3	Gill net	Patijal	80-90	1.5-2	2.5-4	1-3
4	Seine net	Tunajal	7-8	3.5-5	0.5-1.2	5-10
5	Seine net	Dubajal	100-150	25-35	0.5-0.8	4-10
6	Seine net	Moiajal	5-7.5	4-4.5	0.3-0.4	4-10
7	Seine net	Berjal	100-220	2-3	0-0.5	5-10
8	Cast net	Kunijal	-	-	-	1
9	Push net	Thelajal	-	-	-	1
10	Hook and line	Borshi	-	-	-	1
11	Spears	Teta	-	-	-	1
12	Traps	Chai	-	-	-	1-2

Table 5: Vulnerabilities of fishing communities.

Shocks	Trends	Seasonality
• Illness of fishers	• Increasing number of fishers reduce access to natural resources	• Seasonal shift of fish availability
• Damage due to natural calamity		• Natural resource based livelihood are subjected to seasonal stress
• Reduced income	• Increasing population rate, political crisis and environmental change affect income	
• Death of family member, especially earning member		• Seasonal unemployment due to lack of AIGAs

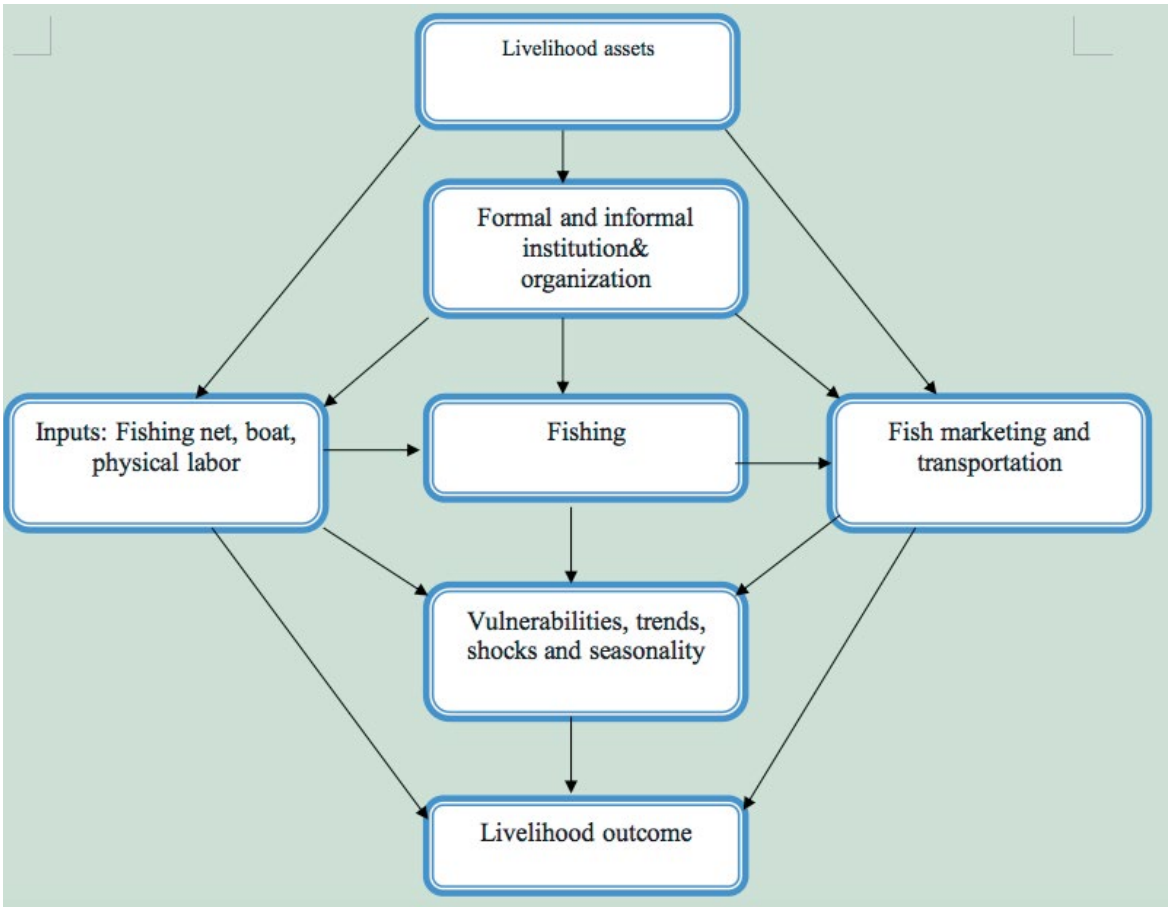

Figure 3: Schematic diagram of livelihood outcomes of fishers.

also be influenced by different factors like shocks (diseases, floods and drought), trends (economic trends) and seasonality (seasonal fluctuation of fisheries resources) as well as social factors such as policies, institutions and process [2,44,45]. Existing livelihood status of a community could be understood easily by analyzing the strength, weakness, opportunities and threats of a community.

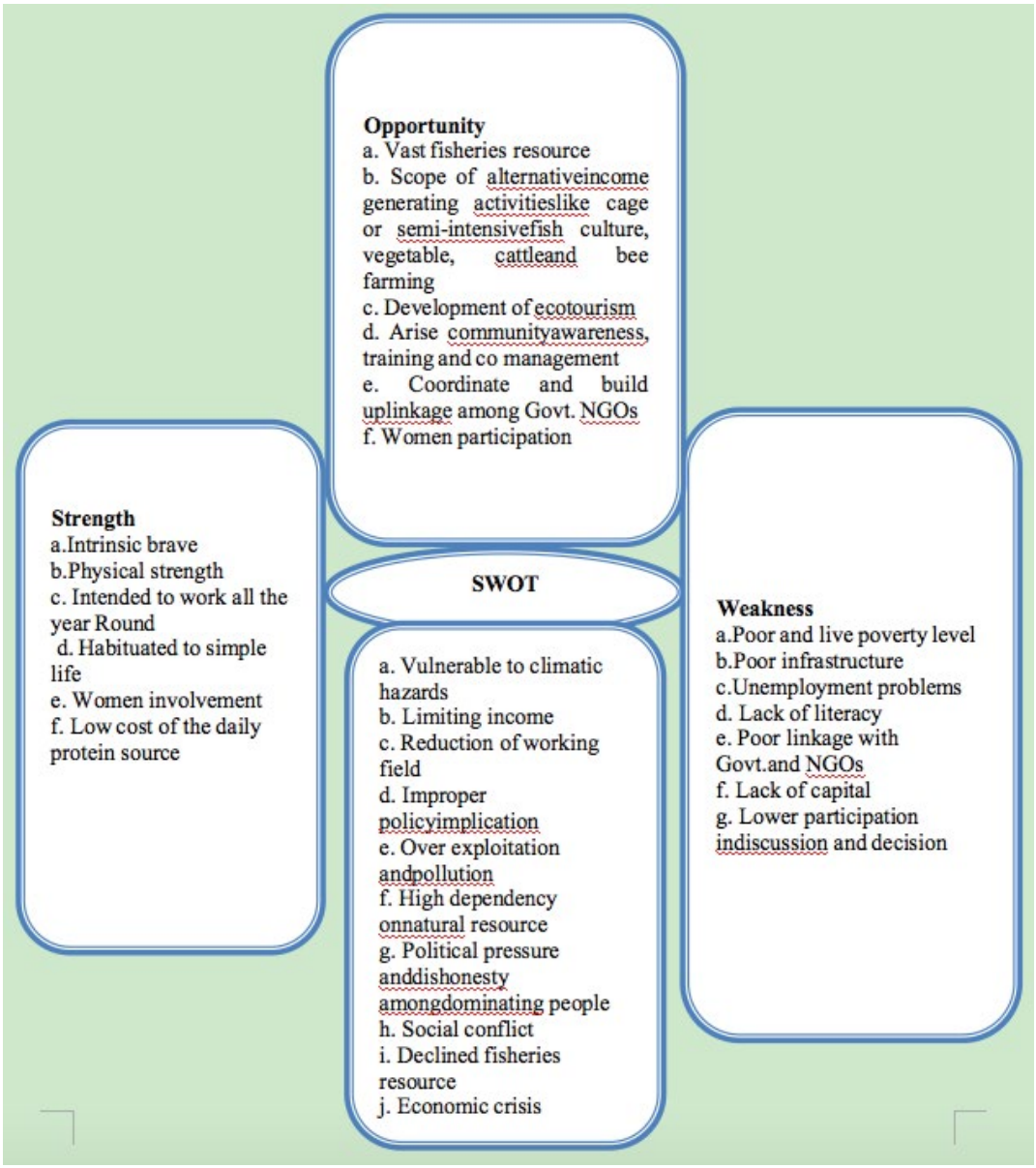

Figure 4: SWOT analysis of the fishing communities.

Internal factors are discussed via strengths and weakness, while threats and opportunities focus on external factors that affect the communities [18,46]. The process is a simple, qualitative analysis that encourages the development of opportunities to build strengths of the communities and overcome weaknesses while at the same time utilizing community's strengths to minimize vulnerability to external threats [32,46]. The view that emerges from this SWOT analysis suggests training and motivational program should arrange to increase awareness among the resource users and improve their skill for sustainable use of natural resource that will ultimately change their living status. It is also helpful for the organizations who are involved in the development of such communities to carry out the activities of the organizations and for the consideration of their effective options.

CONCLUSION

Creation of alternative livelihood opportunity for fishers of north eastern region is vital for the current situation. Most of the families of this area are directly involved in fishing to maintain their livelihood throughout the year though the socioeconomic status of the fishers is not satisfactory due to social, economic and technical constraint. There is also lack sufficient baseline information to initiate proper developmental steps and to improve the livelihood of fishermen. Resource base data bank should be established for future research and development. Implementation of appropriate policies, legal instruments and introduction of co-management strategies for wetland management could improve the situation of the fishing communities and fish production of the wetland. Community based fisheries management could also improve the situation with the help of different government organizations, NGOs, donor organization, research organization and other national and international organizations. The findings of the present study could become a guideline for planning and management of the wetlands and development of the livelihood of fishing communities.

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