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Research Article

Understanding Livelihood Characteristics and Vulnerabilities of Small-scale Fishers in Coastal Bangladesh

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ABSTRACT

Small-scale fishers are considered one of the most vulnerable communities in Bangladesh but very few studies focused on the livelihood sustainability and vulnerabilities of this professional-group. Fieldwork in lower Padma and upper Meghna hilsa sanctuaries identifies different livelihood characters and the fishers' vulnerabilities. A conceptual framework known as Sustainable Livelihood Approaches (SLA) has been introduced to analyses the qualitative and quantitative data. The insights of the livelihood strategies provide on small-scale fishers and fisheries management have been explained and explored. Fishers are found solely dependent on fishing, economically insolvent, and neglected. Besides, some socio-economic abstractions such as low income, credit insolvency, lack of substitute earning flexibility make them more vulnerable. Several effective suggestions are elicited from fishers' perceptions, the implementation of which is crucial to ensure livelihood sustainability of the small-scale fishers.

Keywords: Livelihoods; Sustainability; Vulnerability; Small-scale fishers; Bangladesh

INTRODUCTION

Bangladesh is a Riverine country and located in South Asia between 20°34' to 26°38' N latitude and 88°01' to 92°42' E longitude with an area of 147570 sq. km and a population of about 140 million [1]. Inland open water capture fisheries production Bangladesh ranks third and fifth in aquaculture production in the world [2]. At present, Bangladesh ranks 4th globally in tilapia production and 3rd in Asia [3]. 60% of the total Hilsa (*Tenualosa ilisha*) in the world also comes from Bangladesh [4,5]. Hilsa supports 11% of total national production (394, 951 MT) and contributes 1% of the Gross Domestic Product (GDP) of Bangladesh [4-6]. Hilsa fishery also supports livelihood of a large number (3 million) of small-scale fishers of Bangladesh [7,8]. Fluctuations in hilsa catch adversely affect small-scale fishers' livelihoods, particularly in coastal Bangladesh [9]. Small-scale fishers are considered one of the most vulnerable communities in Bangladesh, although they support about 12 million people directly and indirectly [10]. They live from hand to mouth and are recognized as the poorest of the poor [11,12]. Most of the fishers are landless, poor and fully dependent on fishing for their livelihoods. Some socioeconomic constraints like increasing fishers number, low income, lack of alternative income-generating activities, loan complexity, piracy and price hike make their life miserable [13,14]. The annual per capital income (BDT 2,442) of the fishers, is almost 70% lower than the country's per capital income as a whole [4,11]. Hilsa fishers suffer most among the small-scale fishers due to restriction on catching hilsa during ban period, frequent natural calamities, and seasonality [15-17].

Vulnerability in both disaster and development literature both disaster and development literature, a widely used term, has linked to poverty, both as a causal factor and a direct product. It can be defined as the universal level of exposure to risks, shocks, stresses, and food insecurity [18,19]. All these factors affect the sustainability of livelihood. A livelihood will be sustainable if it can cope with and recover from stress, shocks, maintain or enhance its capabilities and assets for the present and next generation. Livelihood assets could be categorized as natural, physical, human, financial, and social

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capital [20,21]. Human capital of the small-scale fishers includes skills, working ability, knowledge, and good health. Natural capital includes land, water, wild fry, fish, mollusks and all the fisheries products. Fishers' incomes and savings are considered as financial capital. Physical capital includes house, fishing gear, boat, road and communication system, electricity, water supply, sanitary and existing health facilities. Social capital includes credit, relationship and cooperation, cultural norms, and sharing of knowledge [1,4].

Shariatpur is a gathering place for small-scale fishers due to the presence of both the mighty Padma and Meghna River. The Padma covers Naria and Bhedargaj upazila and the Meghna covers only Bhedarganj. Bhedarganj is blessed with Riverine fisheries resources and the major catches are hilsa, poa, icha, taposhi, bata, pangas etc. For a long time, different types of fishing gears have been used in the sanctuaries of the Padma and Meghna. The intensity of use any type of gear in the sanctuaries depends on the intensity of the target fish population found in the River. Some gears are selected for specific species, whereas other use for several species during operation. The choice of nets also depends on operation and varies in the different places of the same River [22,23]. People of Riverside particularly depend on hilsa fishing to support their livelihood.

Sustainable livelihood is a pre-requisite to achieve the Millennium Development Goals (MDGs) [24,25]. Adequate and precise information on the target community's livelihood characteristics is essential and decisive for decision-making. Still, the lack of required information of economically backward small-scale fishers is the major obstacle to the successful development of their livelihoods [1,4]. Considering the above facts, the present study is carried out to assess livelihood sustainability by analyzing different livelihood assets and associated vulnerabilities of the small-scale fishers of the hilsa sanctuary in the Padma and Meghna River.

MATERIALS AND METHODS

Study sites

The study was conducted in the Char Bhaga union's fishing communities in Bhedarganj upazila under Shariatpur district (Figure 1). The upazila was located in between 23°08' and 23°24' north latitudes and in between 90°23' and 90°36' east longitudes. Reasons behind selecting the communities were presented below-

- The suitability of the area to meet the study objectives
- Location on the bank of the lower Padma River and access to Meghna River
- Presence of fish landing center (Mach ghat) to fishing community.
- Availability of very poor, ladless fishing communities.
- Involvement of large number people in fishing.
- Indiscriminate use illegal fishing gear.

Formulation of Questionnaire

To identify the fishers' socio-economic condition, a scheduled interview as conducted to gather information about fishers' demography, health, sanitation, household, income, credit, savings, literacy and land ownership, etc. A structured questionnaire was designed by following De Vaus [26] that also included socio-economic parameters the living and survival strategies to understand fisher's condition.

Questionnaire Interviews (QI)

Random sampling method was adopted for questionnaire

Figure 1: Map of the study area.

interviews. There were almost 90 fishermen randomly selected for interviews from the study area. They were interviewed by their houses and Riversides only when they were available and each fisher took per interview almost half an hour.

Focus Group Discussion (FGD)

Participatory Rural Appraisal (PRA) tool as FGD was used in this study. A focused group discussion was conducted towards the fishers to find out socio-economic conditions and existing fishing systems.

Cross-cheek Interviews

Upazila Fisheries Officers (UFO) and other associated personnel were selected for cross-check interview

Secondary data collection method

The data was collected from various secondary sources to complete the study. Various scholarly articles and relevant literature were quoted from relevant technical and newspaper reports. All of these aggregated data were comprehensively reviewed; synthesized and relevant data were used in this study.

Data processing, analysis, and presentation

Interviews and data from FGD were coded and inserted MS Excel (Version 2016) to process and analyze tables, figures, etc. for results presentation. The Department for International Development (DFID) sustainable livelihoods framework [1,20] was applied to shape the qualitative and quantitative data.

Sustainable Livelihoods Approach (SLA)

Livelihood becomes sustainable when it could cope with and overcome stresses, shocks, and maintained capabilities and assets for present and future generation [1,4]. The concept of a 'livelihood' combined together with the critical factors that affect individual or family survival strategies [27]. The fishers had more or less various type assets as defined by the DFID sustainable model which could be classified as human, natural, financial, social and physical capital [28]. The sustainable livelihoods framework can reflect the risk that the poor might be very vulnerable, the assets and resources that could help them improve and survive, and the policies and institutions that affected their livelihoods [20]. The SLA framework showed that in a different context, the constraints of different livelihood assets were achieved that were consolidated following different livelihood strategies.

RESULTS AND DISCUSSION

Social profile of the fishers

The socio-demographic status of the fishing communities was quite different from the other professional communities. There were 1500 people who lived in 185 households (HH) in the Charvaga village. Among 185 HH, 102 HH+2HH (mean ± standard deviation) were intensively involved in fishing, and 83 HH+3HH were involved both in fishing and small business. Most of the fishers (84%+2%) provided hired labor and had no fishing net and boat of their own. All the fishers lived below the poverty line. The percentage of extreme poor (land size 0 decimal), poor (land size <5 decimal) and moderately poor (land size >5 decimal) was 25%+3%, 51%+4% and 18%+1% respectively (Table 1). There were 130 nomads and 30 gypsies living in this area. The nomadic families stayed here for six to seven months a year and worked as day laborers in their own areas for the remaining five to six months. Only the locals' fishers were found fishing, but gypsy women were seen fishing in the Padma River. Women of fishing communities were not self-reliant. Women had less decision-making capacity in their family and had to depend on their male family members. Community people were at risk due to natural disasters and low income and lack of employment which hindered livelihood sustainability. Livelihood means the ability, resources, assets, and activities needed to make a living [1,4]. The fishers' livelihood assets could be categorized as human, natural, financial, social and physical as defined by the DFID that indicated the actual socioeconomic status of this marginalized, vulnerable community [29].

Livelihood assets of the small-scale fishers

Human capital

Fishers' type and fishing duration: A large number of fishers used to fishing in the Padma sanctuary and adjacent Meghna River.

Table 1: Social profile of the fishers.

Variables	Status	Mean (+ SD)
Population	Total number	1500
House hold	Total number	185
	Number of exclusive fisher	102 (2)
	Number of other	83 (3)
Gipsy	Number of HH	30
Nomad	Number of HH	130
	Temporary period (month)	6 (1.2)
Land size (decimal)	Extreme poor	0
	Poor	<5 (0.5)
	Moderately poor	>5 (0.5)
Women's decision making capacity	Yes	1%
	No	99%
Climatic hazards affect daily life	Yes	95%
	No	5%

Fishers could be classified into three groups based on their practice: professional fishers, seasonal fishers, and subsistence fishers. Professional fishers depended on fishing almost round the year for their livelihood. Seasonal fishers caught fish only a particular time of the year which kept them engaged in other income-generating activities to support their life. Subsistence fishers caught fish mainly for their home consumption to meet family demand and sold remaining (if have) to add money in family income. The study found 55.5%+2% (mean ± standard deviation) were professional following seasonal (35%+3%) and subsistence (55.5+2). Rana et al. [11] found 91% professional fishers and 9% seasonal fishers in the Meghna River. Professional and seasonal fishers were known to go fishing both day and night. Subsistence fishers were only seen fishing during the day. The average fishing time was recorded for Professional fishers 12+2 hours, 15+2 hours for seasonal fishers and 4+1 hours for subsistence fishers. The average fishing duration of the Meghna RiverMeghna River's fishers' fishers was recorded 15 hours in a day (24 hours) [11].

Marital status and family types: Marital and family background was important to assess socioeconomic status, live to sustainability and disaster susceptibility. The study identified 55%+2.2% (mean ± standard deviation) were married following unmarried (40%+1.4%) and divorced (5%+0.4%). There were no oppressed persons in the study area. Family type varied from joint to nuclear. It was found that 30%+1.5% of the people lived with joint families, and 70%+4.2% lived with nuclear families in this region. The nuclear family was very popular due to its abundance of movement and economic opportunities, better clothing, better education, and women's authority. The family size was 5+1.1 persons in nuclear families and 10+2.2 persons in joint families. 5.1 ± 2.11 members in nuclear families and 10 ± 2.05 members in joint families of the Padma River fish's in 5th hilsa sanctuary of Bangladesh was reported earlier [4]. Another study found that 78% had average 5, 14% had 3 members, while 8% had 9 members in their family among the fishers of the Padma River in Rajshahi region which also reflected the findings of this study.

Age distribution and fishing experience: The fishers' age structures were an important indicator in taking the decision and maintaining a profitable fishing operation. 40% ± 3.2% (mean ± standard deviation) of the studied areas were in the age group of 41-50 years. It was found that 20%, 20%, 10%,10% and 0% of fishermen were belong to age group in 21-30,31-40, 51-60, and 61-70 years respectively. The result showed that 41-50 years age group was considered more active due to their physical strength and the young generation was less interested in fishing. The finding of the study was merely similar to another earlier study who reported most of the fishers in 31-50 years age group in their study respectively in the Padma (in 5th hilsa sanctuary), Padma (outside the hilsa sanctuary), Meghna, and Kirtonkhola River [30]. The average fishing year was 15 ± 3 years with a minimum of 2.5 ± 1.2 and a maximum of 17 ± 3 years

Religious status: In the present study 100% of the fishers were Muslim as the entire population of this village was Muslim. Religions and castes played a vital role in the fishing and trading of small-scale fishers. Currently the involvement of Hindus in fishing in the Padma sanctuary was increasing [4].

Educational and literacy status: A minimal educational background was necessary for success in using natural resources of Padma sanctuary, but the state of education in the study area was not so good. The majorities of the small-scale fishers were either illiterate or only can sign. Fishers were classified into four groups based on their level of education. Among the fishers 50% ± 2.5% (mean ± standard deviation) had no education (illiterate), 30% ± 1.5% could only sign, 10% ± 0.2% had primary level (class 1 to 5), and 10% ± 0.2% had secondary level education (class 6 to 10). Poor socioeconomic status (55 ± 1.5), early fishing involvement (30 ± 1.4) and unavailability of educational institutions in the surrounding areas (15 ± 0.4) were the main responsible factors of low literacy rate. A previous report mentioned 88% fishers were illiterate [31].

Nutritional status: The nutritional status of the fishers was not satisfactory. Fisher's families did not have appropriate knowledge about the nutritional quality of food and the importance of a balanced diet [1,4]. 68.5 ± 3.3 (mean ± standard deviation) did not eat enough and nutrition-sensitive meal three times a day. They sold their fish to get more money. Their main diet is only vegetables with rice most of the times (25 ± 2) in a month that induced malnutrition and disease susceptibility. Same scenario was also found health and nutritional misery among the marginal fish farmers of Barisal region [32]. Common diseases of the small-scale fishers were headache (75 ± 5), flu (68 ± 5) and fever (54 ± 5).

Physical capital

Housing and Infrastructure: In the study area, the community houses were of two main types named as katcha-houses and semi pacca houses. Kacha-houses were made of bamboo spill and tin with mud flooring and semi pacca- made of wood and tin with cement floor. In this community, 90% ± 4.5% (mean ± standard deviation) of housing structures were kacha, and only 10% ± 0.5% were semi pacca. Road and transportation system was not developed. There was only a local road to communicate with upazila and district city. The status of other roads which were used in local communication among the communities was very poor.

Available fishing gears: Fishers used different fishing gears to catch different fishes. The use of fishing gears also varied from season to season, depending on the availability of fish. A total of 10 types of fishing gears in 3categories like gulti jai (drift gill net), current jal (drift gill net), ber jal (drift gill net), pangaissha jal (drift gill net), moia jal (seine net), mushuri jal (seine net), gachi jal (seine net), boro chai (fishing trap), dar chai (fishing trap) and gura chai (fishing trap) were found in this area (Table 2). Among the gears only gultijal and pangaissha jal were legal and others were illegal. Berjal, moiajal,mushurijal and gachijal were used round the year and the remaining were seasonal. Zafor et al. (2007) noticed nine (9) categories of fishing gears in the Pagla River of Kishoregonj that included gill net, seine net, lift net, set bag net, push net, hook and line, long line, spears and traps were noticed in a previous study [33].

Treatment facility: Medical facilities were also very limited in this area. They didn't have access to medicine and necessary treatment due to the absence of a specialized hospital at the nearest distance. Fishers took immediate treatment from quacks. The study found 60% of fishers took allopathically, 20% homeopathic, and the rest 20% take herbal and other treatments.

Drinking water facility: The study found that 80.2% ± 2.1% (mean ± standard deviation) of the fishermen used tube-well water for drinking. Among them, 9% ± 0.2% fishers used their own tube-well, 27% ± 2.2% used government tube-well, and 60%

Table 2: Fishing gears used by the fishers.

Gear	Categories	Operating man power	Specification	Status	Operating period
Gultijal	Drift gill net	04-Oct	Mesh size (4.5 cm)	Legal	August, September, January, February, March
Current jal	Drift gill net	02-May	Mesh size (3 cm)	Illegal	Round the year
Pangaissha Jal	Drift gill net	02-May	Mesh size (5 cm)	Legal	March, April, October, November, December
Berjal	Seine net	04-Oct	Mesh size (.5 cm)	Illegal	Round the year
Moiajal	Seine net	04-Oct	Mesh size (.5 cm)	Illegal	Round the year
Gachijal	Seine net	03-Jul	Mesh size (.4 cm)	Illegal	Round the year
Mushurijal	Seine net	03-Jul	Mesh size (.4 cm)	Illegal	Round the year
Boro chai	Fishing trap	01-Feb	large in size (mouth 6 ft. in length), exclusively used for large sized fish; especially pangas	Illegal	March, April, October, November, December
Dar chai	Fishing trap	01-Feb	Small in size, approximately 3 ft. in length	Illegal	March, April, October, November, December
Gura Chai	Fishing trap	01-Feb	Exclusively used for small fish with mouth size of 1 ft.	Illegal	March, April, October, November, December

± 2.5% used neighbors' tube-well. The remaining 10% ± 0.5% of fishers used well or Indira (specialized well in Bangladesh) water for drinking, 10% ± 1.1% of the fishers used ring-well water for drinking purposes. Those who used safe tube well water used it not only for drinking, but also for cooking and bathing. It was reported that 94.44% of non-migratory fishers of the Padma River used tube-wells as a drinking water source. In comparison, only 10.53% migratory fishers of the Padma River used nearby tube-well water whereas, the greater proportions (89.47%) used River water for drinking and other purposes [28].

Sanitary status: The people were aware of sanitary problems, and all the people were very keen to ensure safe, sanitary facilities and used sanitary latrine. It was observed that the majority (102) of the people had katcha (earthen) toilet and 83 respondents had semi-pacca (semi cemented) toilet. They observed in the fishers 92% fishers of the Padma River in northern Bangladesh used the unhygienic toilet, indicating poor sanitary status [25].

Electricity facility: The power situation in the fishing community was very fragile. Electricity was available to only 30% ± 3.5% (mean ± standard deviation) people. 70% ± 6.3% of the people in this community used solar power as a source to illuminate their homes. An earlier study mentioned the opposite findings and observed electricity connection in most fishers' house [10].

Natural capital

Land properties: The number of landless fishers was high in the Padma sanctuary. Extreme poor fishers were landless. Poor fishers had <5 decimal and moderately poor fishers >5 decimal land.

Biodiversity status: The sanctuary of Padma was situated in coastal region but most of the time the salinity range was close to zero. So, the fish biodiversity of this region was a combination of estuarine and freshwater fishes. The study recorded 71 fish species in the Padma sanctuary area (Table 3). Hilsa (*Tenualosa ilisha*) was the main commercial species of the Padma sanctuary. A total of 35% of recorded fishes were in cypriniformes, following siluriformes (24%), perciformes (16%), synbranchiformes (6%), channiformes (5%)and clupiformes (4%). Beloniformes, channiformes, osteoglossiformes represented 3% each andcyprinodontiformes,anguilliformes,gasterosteiformes,pleuronectiformes, tetraodontiformes represented 1% each (Figure 2).

Financial capital

Income status: The level of income of a household determined the socio-economic status in a society [34]. In most cases, the income of the fishers in Bangladesh was below poverty line [5,11,14]. The earnings of the fishers were comparatively lower than those of other marginalized communities. The average monthly income varied from 3000 ± 255BDT to 7500 ± 495BDT. Fishers in South and Southeast Asia could be considered as the poorest of the poor [10]. Fishers had very rare alternative sources of income for living other than fishing and selling [35]. They rented their labor on the agricultural land or spent time lazily, and women raised chickens and ducks on a limited scale. Lack of capital, rearing space, and skilled workers were their main problem faced by the fishers' women (Table 4). The outbreak of contagious diseases also discouraged fishing households to be involved in pet rearing. The study identified the necessity of diversified Alternative Income Generating Activities (AIGAs) to improve the fishers' living standards.

Social capital

Credit operation: The study found 93% ± 5% (mean ± standard deviation) took a loan, but the institutional credit facilities were very limited due to lack of resource or property to mortgage. Fishers took a loan to feed their families and buy fishing equipment (e.g. net, boat, fishing basket etc.) (48% ± 5%) fishers took loan from the boat owner and moneylender (dadondar) and were forced to work round the year in favor of them. The boat owners (38% ± 4%) took loans from aratdar (middle man) and had to pay repayment by selling fish to aratdar at fixed price and commission rate. Fishers also took loan (52% ± 4%) from NGOs with high interest. It was observed that fishers took loan from multiple NGOs and repaid the installments of the loans from One NGO to another. Among the NGOs Grameen bank, BRAC, ASA, NUSA, SDS were found to work in this area (Table 5).

Table 3: List of available fish species.

S. No.	Order	Scientific identity of the taxon with author	Vernacular or local (Bengali name)	Common or English name
1	Pleuronectiformes	*Brachirus pan (Hamilton, 1822)*	Kathal pata	Pan sole
2	Cypriniformes	*Salmostoma phulo (Hamilton, 1822)*	Fulchela	Flying barb
3	Cypriniformes	*Esomus danrica (Hamilton, 1822)*	Darkina	Flying barb
4	Cypriniformes	*Rasbora rasbora (Hamilton, 1822)*	Darkina	Flying barb
5	Cypriniformes	*Chela labuca (Hamilton, 1822)*	Labuca	Hatchet fish
6	Cypriniformes	*Aspidoparia morar (Hamilton, 1822)*	Morari	River stone carp
7	Cypriniformes	*Megarasbora elanga (Hamilton, 1822)*	Along	Bengala barb
8	Cypriniformes	*Barilius bendelisis (Hamilton, 1807)*	Joia	Hamilton's barila
9	Cypriniformes	*Osteobrama cotio (Hamilton, 1822)*	Dhela	Cotio
10	Cypriniformes	*Puntius sarana (Hamilton, 1822)*	Sar punti	Olive barb
11	Cypriniformes	*Puntius chola (Hamilton, 1822)*	Chala punti	Chola barb
12	Cypriniformes	*Puntius guganio (Hamilton, 1822)*	Mola punti	Glass-barb
13	Cypriniformes	*Puntius conchonius (Hamilton, 1822)*	Kancha npunti	Rosy barb
14	Cypriniformes	*Puntius ticto (Hamilton, 1822)*	Tit punti	Ticto barb
15	Cypriniformes	*Puntius sophore (Hamilton, 1822)*	Jat punti	Pool barb
16	Cypriniformes	*Puntius terio (Hamilton, 1822)*	Teri punti	One spot barb
17	Cypriniformes	*Cirrhinus reba (Hamilton, 1822)*	Reba	Reba carp
18	Cypriniformes	*Devario devario (Hamilton, 1822)*	Baspata	Bengal danio
19	Cypriniformes	*Lepidocephalus guntea (Hamilton, 1822)*	Gutum	Guntea loach
20	Cypriniformes	*Labeo rohita (Hamilton, 1822)*	Rui	Rohu
21	Cypriniformes	*Catla catla (Hamilton, 1822)*	Catla	Catla
22	Cypriniformes	*Cirrhinu scirrhosus (Bloch, 1795)*	Mrigal	Mrigal carp
23	Cypriniformes	*Labeo calbasu (Hamilton, 1822)*	Kala Baush	Karnataka labeo
24	Cypriniformes	*Labeo bata (Hamilton, 1822)*	Bata	Bata labeo
25	Cypriniformes	*Amblypharyngodon mola (Hamilton, 1822)*	Mola	Molacarplet
26	Cypriniformes	*Raiamas bola (Hamilton, 1822)*	Bhol	Trout barb, Indian trout
27	Siluriformes	*Eutropiichthys vacha (Hamilton, 1822)*	Bacha	Schilbi
28	Siluriformes	*Eutropiichthys murius (Hamilton, 1822)*	Muri bacha	Muriusvacha
29	Siluriformes	*Ompok Pabda (Hamilton, 1822)*	Modhu Pabda	Pabda catfish
30	Siluriformes	*Ompok Pabo (Hamilton, 1822)*	Pabda	Pabo catfish
31	Siluriformes	*Wallago attu (Bloch & Schneider, 1801)*	Boal	Freshwater shark
32	Siluriformes	*Silonia silondia (Hamilton, 1822)*	Shilong	Silond catfish
33	Siluriformes	*Pangasius pangasius (Hamilton, 1822)*	Pangus	Pangas catfish
34	Siluriformes	*Ailia coila (Hamilton, 1822)*	Kajuli	Gangetic catfish
35	Siluriformes	*Rita rita (Hamilton, 1822)*	Rita	Rita, Striped catfish
36	Siluriformes	*Sperata aor (Hamilton, 1822)*	Ayre	Long-whiskered catfish
37	Siluriformes	*Sperata seenghala (Sykes, 1839)*	Guizza ayre	Giant River catfish
38	Siluriformes	*Mystus vitatus (Bloch, 1794)*	Tengra	Stripped dwarf catfish
39	Siluriformes	*Mystus cavasius (Hamilton, 1822)*	Golsha Tengra	Gangetic mystus
40	Siluriformes	*Mystus bleekeri (Day, 1877)*	Golsha Tengra	Catfish
41	Siluriformes	*Mystus tengara (Hamilton, 1822)*	Bazari Tengra	Tengaramystus
42	Siluriformes	*Clupisoma garua (Hamilton, 1822)*	Garua	River catfish
43	Siluriformes	*Chaca chaca (Hamilton, 1822)*	Chaka	Squarehead catfish
44	Siluriformes	*Pseudeutropius atherinoides (Bloch, 1794)*	Batasi	Indian potasi
45	Tetraodontifomes	*Tetraodon cutcutia (Hamilton, 1822)*	Potka	Ocellated pufferfish
46	Beloniformes	*Xenentodon cancila (Hamilton, 1822)*	Kakila	Freshwater garfish
47	Beloniformes	*Hyporhamphus limbatus (Valenciennes, 1847)*	Ekthota	Congaturi Halfbeak
48	Cyprinodontiformes	*Aplocheilus panchax (Hamilton, 1822)*	Kanpona	Blue Panchax
49	Channiformes	*Channa punctatus (Bloch, 1793)*	Taki	Spotted snakehead
50	Channiformes	*Channa orientalis (Bloch & Schneider, 1801)*	Raga/Cheng	Walking snakehead
51	Clupiformes	*Tenualosa ilisha (Hamilton, 1822)*	Ilish	Hilsa shad

52	Clupiformes	*Corica soborna (Hamilton, 1822)*	Kachki	The Ganges River Sprat
53	Clupiformes	*Setipinna phasa (Hamilton, 1822)*	Phasa	Gangetic hairfin anchovy
54	Synbranchiformes	*Macrognathus aculeatus (Bloch, 1786)*	Tara baim	Lesser spiny eel
55	Synbranchiformes	*Mastacembelus armatus (Lacepede, 1800)*	Baim	Spiny eel
56	Synbranchiformes	*Mastacembelus pancalus (Hamilton, 1822)*	Guchi baim	Spiny eel
57	Synbranchiformes	*Monopterus cuchia (Hamilton, 1822)*	Kuchia	Gangetic mud eel
58	Osteoglossiformes	*Notopterus notopterus (Pallas, 1769)*	Foli	Bronze featherback
59	Osteoglossiformes	*Chitala chitala (Hamilton, 1822)*	Chital	Clown knifefish
60	Perciformes	*Colisa fasciatu (Bloch & Schneider, 1801)*	Khalisha	Banded gourami
61	Perciformes	*Colisa lalia (Hamilton, 1822)*	Lalkholisha	Dwarf gourami
62	Perciformes	*Anabas testudineus (Bloch, 1792)*	Koi	Climbing perch
63	Perciformes	*Chanda nama Hamilton, 1822*	Nama Chanda	Elongate Glass Perchlet
64	Perciformes	*Parambassis lala (Hamilton, 1822)*	Lal Chanda	Highfin Glassy Perchlet
65	Perciformes	*Parambassis ranga (Hamilton, 1822)*	Ranga chanda	Indian glassy fish
66	Perciformes	*Chanda beculis (Hamilton, 1822)*	Chanda	Himalayan glassy perchlet
67	Perciformes	*Glossogobius giuris (Hamilton, 1822)*	Bele	Freshwater goby
68	Perciformes	*Rhinomugil corsula (Hamilton, 1822)*	Khorsula	Corsula mullet
69	Perciformes	*Nandus nandus (Hamilton, 1822)*	Bheda	Mud perch
70	Perciformes	*Brachygobius nunus (Hamilton, 1822)*	Nuna Baila	Bumblebee goby
71	Gasterosteiformes	*Microphis cuncalus (Hamilton, 1822)*	Kumirer khil	Crocodile-tooth pipefish,
72	Anguilliformes	*Pisodonophis boro (Hamilton, 1822)*	Bamosh	Rice-paddy eel,

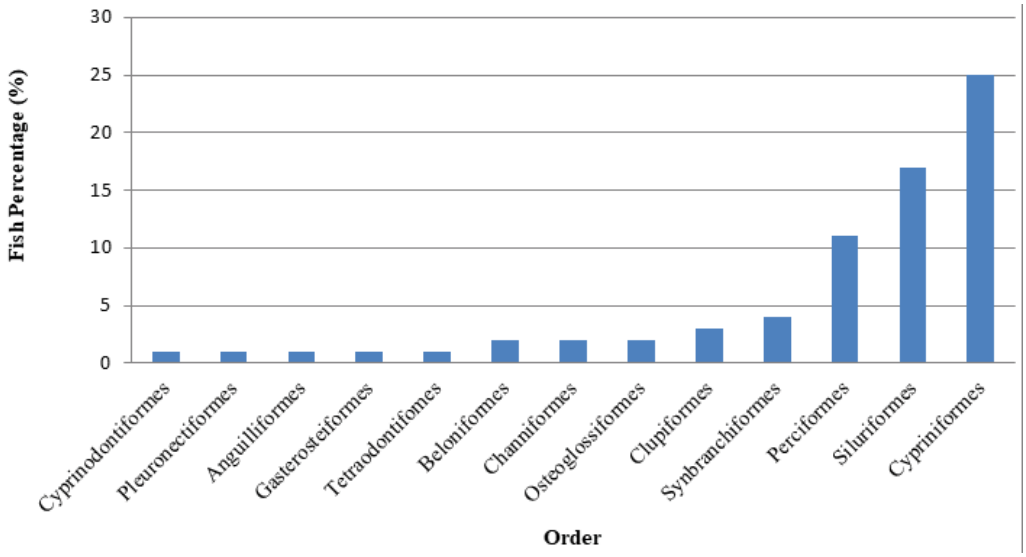

Figure 2: Percentage of different orders of recorded fishes.

Table 4: Existing AIGAs for women and men of fishing households.

Existing AIGA	Involvement	Inducing factors	Challenges
Agricultural activities	Man	· Availability of unused land · Source of food and income · Low investment · Less time consuming	Limited working scope Lack of modern technology Lack of communication with Dept. of Agriculture
Sewing	Women	· Need less investment · Women can do by maintaining family · Regular income for day to day life	Lack of money to buy or repair machine
Hen rearing	Women	· Source of income · Provide egg and meat for home consumption · Increase savings	Contagious diseases Lack of rearing place
Duck rearing	Women	· No need of artificial feed due to having vast water resources · Require less monitoring · Source of income	Contagious diseases

Table 5: Name of the loan provider NGOs.

Name of NGOs	Activities
Grameen bank	Micro-credit program
Bangladesh Rural Advancement Committee (BRAC)	Micro-credit program
Association for Social Advancement (ASA)	Micro-credit program
Naria Unnayan Samitty (NUSA)	Micro-credit program
Shariatpur Development Society (SDS)	Micro-credit program
	Child education program

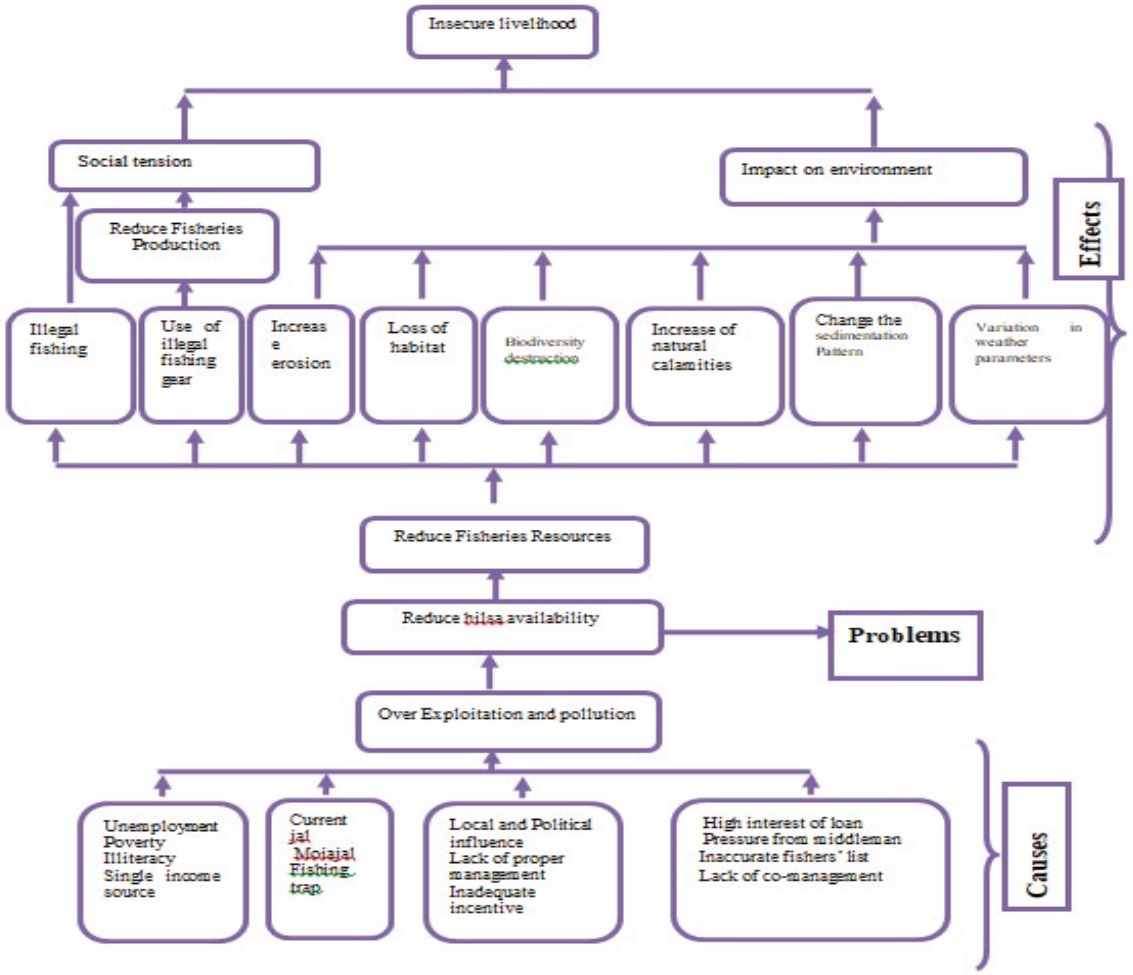

Figure 3: Vulnerabilities of small-scale fishers.

Vulnerabilities of the small-scale fishers: Livelihood of this community mainly depended on hilsa fishing. Fishers caught hilsa mainly in January, February, May, August, September, October, and December, but fishers' income varied with seasonality that hampered the normal flow of livelihood. During March and April, food scarcity and natural disasters became prominent during March, April, May and June. People of this community were very prone to natural calamities and low income and lack of employment opportunities that hampered the resilience strategy to overcome the sufferings.

The main vulnerabilities reported by the fishers were ban periods, inadequate assistance during ban period, increasing fishing pressure, reduction in fish catches, creditor's pressure, weak value chain and poor market facility, loss of fishing equipment, especially nets and boats during fishing etc. (Figure 3). Dependency on a single profession made fishers' life more vulnerable [36,37]. Existing conflicts of the stakeholders like boat owner, money lender, also affects the stability of fishers' livelihood and allured to illegal fishing [38,39].

CONCLUSION AND RECOMMENDATIONS

In Bangladesh, the small-scale fishers were among the most vulnerable communities living with extreme stratification rates, discrimination, social exclusion, and economic domination. Their livelihood and living status pattern was still below average in the adjacent Padma and Meghna River. They were fully dependent on a single profession, economically insolvent, and neglected. Some socio-economic abstractions such as low income, credit insolvency, and lack of substitute earning flexibility made them more vulnerable. To make their livelihood status better, some mandatory preamble should be taken. The government needs to ensure adequate assistance, specifically financial support during the ban period and other unavoidable crises, to continue their profession. Government and affiliated NGOs should arrange training programs and skill developing seminars with knowledgeable and resource personnel for the fishers' skill development. Sustainable co-management, development of aquatic ecosystem, livelihood, and vulnerability characteristics needs to be addressed by the policy-makers and researchers.

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