



Livelihood, Climate Change and Fisheries: A Case Study of Three Fishing Communities of Northwestern Bangladesh

Shams Muhammad Galib^{1*}, Md Nazmul Hoque², Sumana Akter³, Nipa Chaki^{1,4}, ABM Mohsin¹

¹Department of Fisheries, University of Rajshahi, Rajshahi 6205, Bangladesh

²Department of Sociology, University of Rajshahi, Rajshahi 6205, Bangladesh

³Department of Sociology, Varendra University, Rajshahi 6204, Bangladesh

⁴Geography and Planning, University of New England, Armidale, NSW, Australia
thegalib@gmail.com

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Abstract

This paper describes the livelihood status of three riverine fishing communities, i.e. the Brahmaputra, the Fakirni, and the Mahananda; in relation to climate change issues and fisheries in the northwestern Bangladesh based on a detailed survey, questionnaire based interview and focus group discussion carried out from January 2013 to December 2014. The highest mean age (44.68±14.37 years) was recorded for the fishermen of the Brahmaputra River. Over one-third (76-92%) of the members were Muslim and the remaining were Hindu. Experience of fishing in the river was positively correlated with age but negatively with the level of education ($p<0.01$). Poor level of education was found for majority of the respondents and it was negatively correlated with the age of the respondents ($p<0.01$). Though small amount of household and agricultural lands were found to be owned and operated by the fishers but there was no one owned a water body. Access to non-government organizations by the respondents was more common than that of government organizations— mostly for receiving loans and rarely for training. Fishes, both small and large, represented the prime source of protein in the household diets. Habitat degradation and fragmentation, restricted access to water body, and reduction in fish catch were the prime vulnerabilities and problems of the respondents resulted in involvement in some other income generating activities, primarily crop production and to some extent, as daily laborer. This study concludes that fishing communities of small rivers are particularly vulnerable in Bangladesh.

Keywords: Fishing community, Livelihood, Climate change, Socio-economic aspects, Fisheries, Vulnerability, Brahmaputra, Fakirni, Mahananda.

Introduction

Both the fishing communities and fisheries are playing a key role in Bangladesh. Fishing communities are particularly important in harvesting and supplying fishes from water bodies to the country people. There are 1.316 million people in Bangladesh engaged in fishing in both inland and marine waters¹. In Bangladesh, fishing has traditionally been an occupation of members of several lower castes of Hindu² but a change in this type of involvement has also been noticed. Members of the fishing communities in Bangladesh are generally an isolated group and are deprived of many amenities of life³.

In addition, in recent time, activities of fishing cannot be carried out throughout the year because of various climatic and anthropogenic reasons leading members of fishing communities to a more vulnerable position^{2,4}. Impacts of climate-induced changes on fishers took them to a more vulnerable position by affecting their only resource, fish⁵. Being one of the most vulnerable group, no major initiative has been taken to improve the livelihood of members of fishing communities in the

country, but, emphasis on all groups of people should be given in order to ensure proper development². Adequate baseline information is a must to implement any developmental plan which is the major problem in Bangladesh regarding livelihood of fisherman².

The climate change issue is very important as it can seriously affect aquatic ecosystems resulting in declination of fisheries production and food insecurity⁶, ultimately the fishing communities. There are very few researches have been carried out on fishing communities in Bangladesh; majority of them focused mainly on socio-economic conditions^{3,7,9}. In all these researches, livelihood status of fishermen in relation to climatic change and fisheries were not studied which must be addressed in order to understand the present scenario.

Moreover, no statistical relationships were established among different variables in all these researches. Thus this study was conducted to reveal the status of fishing communities in terms of their basic information, land assets, access to different organizations, climate change issues, problems and vulnerabilities, and changing pattern of occupation.

Methodology

Location of fishing communities and research duration:

Three different riverine fishing communities were surveyed under this research for a period of two years, from January 2013 to December 2014. The fishing communities were engaged in fishing in the Brahmaputra River in Gaibandha district, the Fakirni River in Rajshahi district, and the Mahananda River in Chapai Nawabganj district of Bangladesh (Figure-1).

Data collection: Primary data were collected through questionnaire based interview of the fisherman and focus group discussion (FGD). However, direct observation was employed to cross-check and collect data.

The questionnaire was developed, pre-tested in fields and updated based on pre-test results and feedback before final use. Data from a total of 150 members of the fishing communities, 50 respondents from each community, were collected through interview during this study. Only members of the fishing community who directly involved in fishing in the river were considered for interview.

Data analysis: Collected data were tabulated and subjected to different analyses using statistical software SPSS (Statistical Package for Social Sciences, version 15.00).

Results and Discussion

Basic profile of the respondents:

Age and sex: All the respondents were male as there was no female member in any of the fishing community engaged in direct fishing in the rivers. It is a common trend in Bangladesh that male member will carry on jobs outside home and present findings are no exception. Similar results were also revealed by several researchers^{2,8}.

The highest mean age (44.68 ± 14.37 years) was recorded for the fishermen of the Brahmaputra River. The overall age of the respondents varied from 15 to 77 years (Table-1). Pearson correlation results revealed that average age of respondents belonging to Fakirni and Mahananda fishing communities was highly significant ($p < 0.01$). People of almost all ages take part in fishing activities in Bangladesh but lowest portion of participants are the children in majority of the cases^{8,9} which was also revealed from the present findings (Figure-2).

Over one-third (76-92%) of the members of each fishing community were Muslim and the remaining were Hindu by religion (Table-1). However, Abdullah-Bin-Farid⁷ and Islam *et al.*² have reported that all the fishermen were Hindus in Jessore district of southwestern part of Bangladesh. This variation may be due to the geographical differences of study areas as more Hindu people, about 12% of the total district population, are living in Jessore district than that of three districts (about 5-7%) covered under this study¹⁰.

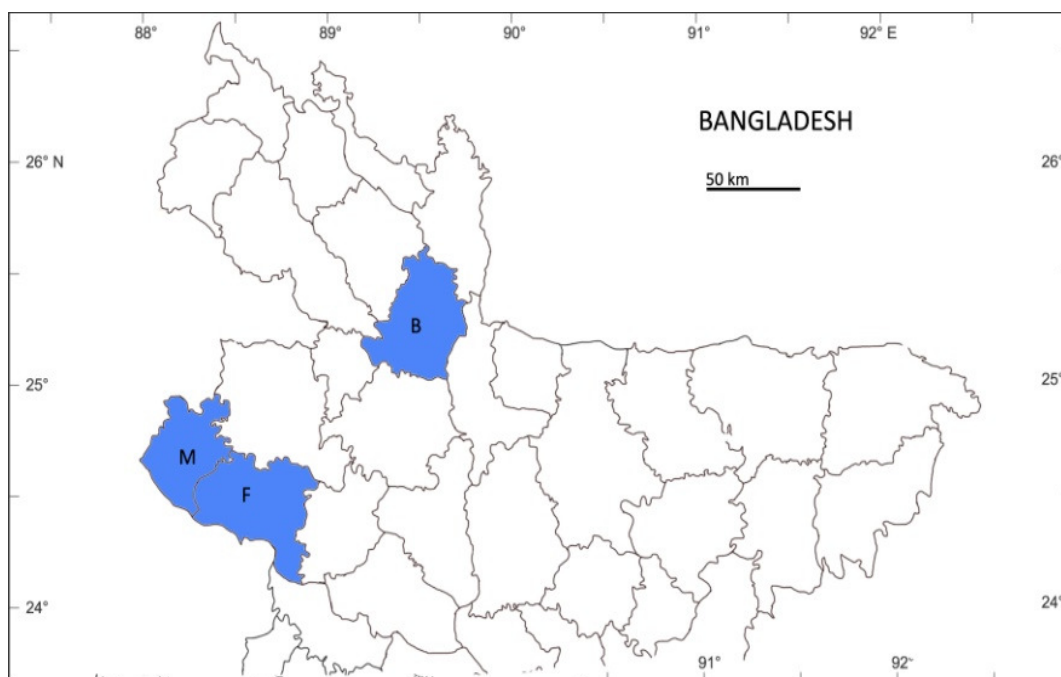


Figure-1

Map of the northern part of Bangladesh showing location of studied fishing communities in Gaibandha, Rajshahi and Chapai Nawabganj districts. B, Brahmaputra; F, Fakirni; and M, Mahananda

Table-1
Age, sex and religion of the respondents (N=150)

Fishing community	Age (years)		Sex (%)		Religion (%)	
	Mean±SD	Range	Male	Female	Islam	Hindu
Brahmaputra	44.68±14.37 ^a	16-68	100	0	82	18
Fakirni	38.60±09.89 ^b	22-60	100	0	92	08
Mahananda	39.32±14.81 ^b	15-77	100	0	76	24

Values bearing the same superscript have a strong correlation ($p < 0.01$)

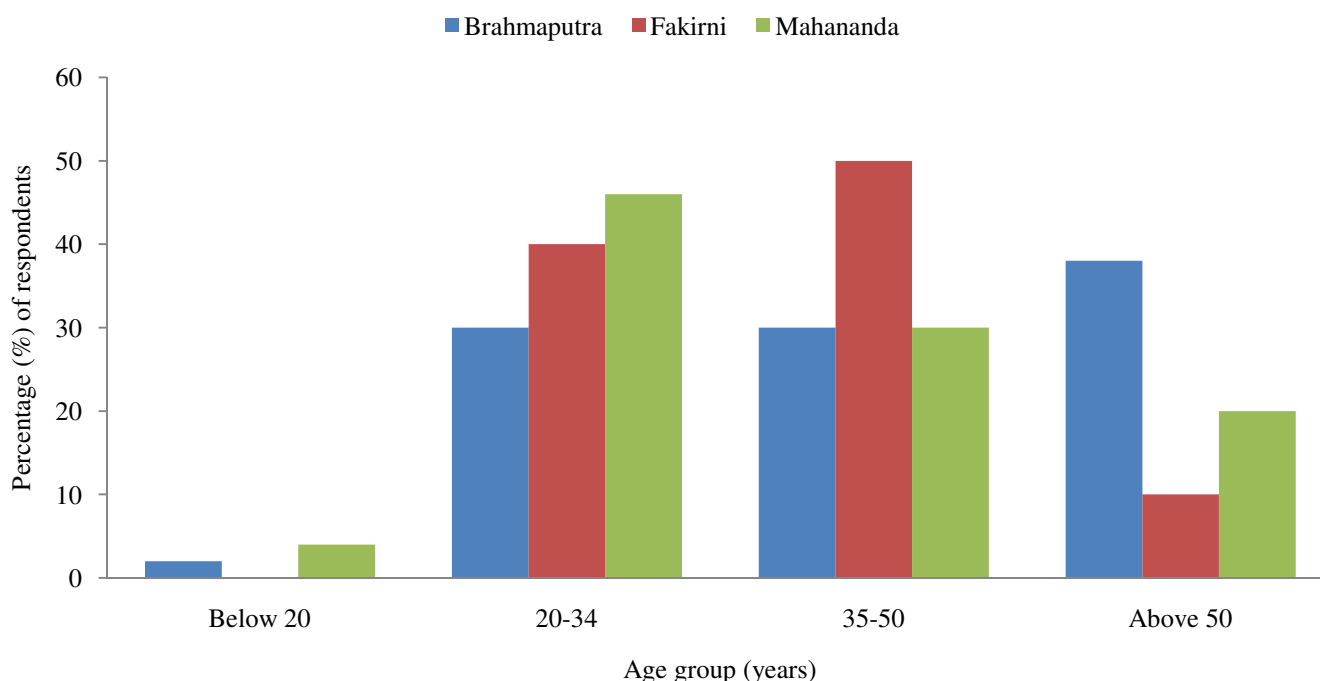


Figure-2
Age distribution of the respondents (N=150)

The highest mean experience in fishing (25.02±15.66 years) in the rivers was found for fishing community of the Brahmaputra River followed by Mahananda and Fakirni fishing communities (Table-2). Fishing experience in the river of the respondents varied from 2 to 56 years. Significant correlation was found between fishing experience of Fakirni and Mahananda fishing communities ($r=0.415$; $p < 0.01$). Strong positive correlation was also recorded between age and fishing experience in all the fishing communities ($r=0.897$ to 0.949 ; $p < 0.01$).

However, the highest mean number of household members was recorded in Brahmaputra fishing community (6.34±2.42). Family size varied from 2 to 12 members among the respondent's households (Table-2). Of the total household population, 53.23% were male and remaining 46.77% were female – represented by 67.25% adults and 32.75% children (below 18 years of age). The figure was much higher than that

of findings of Galib *et al.*¹¹ who have found mean household size of 3.90±1.66 (2 to 9) members for rural people of Bangladesh.

Monthly income of the households: Individual Income plays probably the most vital role in every sector of life. The highest income generating members were found in the households of Brahmaputra River fishing community (2.10±0.76; Table-3). Though the maximum monthly household income (BDT 7092.00±2748.57) was found for the same community but it formed the lowest value among studied fishing communities (BDT 1155.36±304.07) when per capita income was considered. Nevertheless, monthly household income of the Fakirni River fishing community was the lowest but came first when per capita income was considered (Table-3). After performing bivariate Pearson correlation test, highly positive correlation was found between total number of members and number of

earning person in a household in every fishing community ($r=0.469$ to $0.0.861$; $p<0.01$). The same test also revealed a negative correlation among total household members and per capita income in the Brahmaputra ($r=-0.323$; $p<0.05$) and Fakirni ($r=-0.501$; $p<0.01$) fishing communities. However, no such correlation was found for Mahananda fishing community.

Level of education: Poor level of education was found for majority of the respondents (Figure-3). In case of Brahmaputra and Mahananda fishing communities more than half of the respondents were illiterate. Education beyond secondary level was found only for some 8% of the fishermen in Fakirni River fishing community (Figure-3). Strong negative correlation was also recorded between age and level of education in all the fishing communities ($r=-0.802$ to -0.566 ; $p<0.01$).

Land holding status: Three categories of land ownerships were studied under the present research: household area, agricultural land, and water area (Table-4). The highest mean household area (8.12 ± 1.02 decimal) was found for Mahananda fishing community. Whereas, 88% of the total respondents in the Brahmaputra fishing community had some sort of household land represented by 2.10 ± 0.82 decimal (Table-4). Majority of the respondents were involved in agricultural farming; they have grown crops in their owned and leased in lands. However, no single respondent was found to have water body (Table-4).

Access to government organizations (GOs) and non-government organizations (NGOs)

Training of the respondents: All most all the respondents had no previous training on any subject (Table-5). Only a very small part (4-6%) of the fishermen in the Brahmaputra and Mahananda fishing communities received training on fish culture, crop production and vegetable production from NGOs. Strong positive correlation was also recorded between level of education and receipt of training in all the fishing communities ($r=0.81$ to 0.95 ; $p<0.01$).

Status of loan or credit and savings: More than half of the respondents in each fishing community have received loan from NGOs. On the other hand, more than one third of members in Fakirni River fishing community had no savings. This figure of no savings was recorded ever higher in two other fishing communities where more than three fourth of the fishermen had zero savings. However, a small portion of the respondents (6-22%) had some savings in NGOs (Table-5) and statistical results have revealed that level of education had positive impact ($r=0.71$) on the tendency of savings of the respondents while negatively ($r=-0.53$) affected receiving loan ($p<0.01$). No previous study was found regarding savings of fishermen in Bangladesh and thus it is impossible to compare the present findings with previous results. However, Galib *et al.*¹¹ have recorded that 63.41% of the total respondents in their studied rural area of Bangladesh had some sort of savings which clearly indicating that members of the fishing communities are far beyond then general people of the country regarding savings issue.

Table-2
 Mean (\pm SD) experience in fishing and household member details (N=150)

Fishing community	Fishing experience (years)		HH members					
			All		Adults		Children	
	Mean \pm SD	Range	Mean \pm SD	Range	Male	Female	Male	Female
Brahmaputra	25.02 \pm 15.66 ^a	2-56	6.34 \pm 2.42	2-12	2.30 \pm 0.91	2.36 \pm 1.12	1.10 \pm 0.93	0.58 \pm 0.81
Fakirni	17.92 \pm 09.79 ^b	3-45	3.60 \pm 0.97	2-5	1.18 \pm 0.39	1.16 \pm 0.42	0.72 \pm 0.70	0.54 \pm 0.65
Mahananda	21.58 \pm 13.11 ^b	2-52	6.14 \pm 2.79	2-11	1.92 \pm 1.16	1.88 \pm 1.10	1.34 \pm 0.92	1.00 \pm 0.99

Values bearing the same superscript have a strong correlation ($p<0.01$)

Table-3
 Earning members and monthly income of respondent's households (N=150)

Fishing community	Earning members		HH income (BDT/month)		Per capita income (BDT/month)
	Mean \pm SD	Range	Mean \pm SD	Range	
Brahmaputra	2.10 \pm 0.76	1-4	7092.00 \pm 2748.57	3000-14000	1155.36 \pm 304.07
Fakirni	1.14 \pm 0.35	1-2	4548.00 \pm 1462.07	3000-10000	1320.87 \pm 435.03
Mahananda	1.86 \pm 1.01	1-5	7414.00 \pm 4229.10	3000-20000	1200.72 \pm 332.27

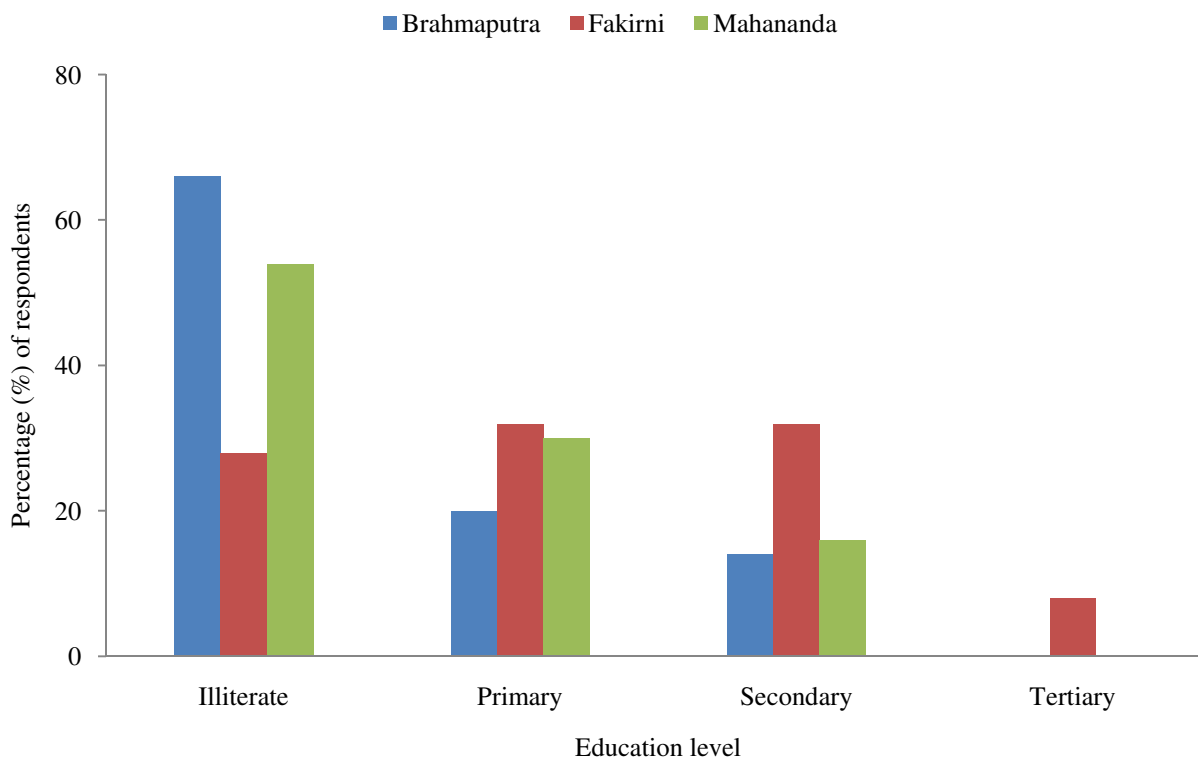


Figure-3
 Level of education of the respondents (N=150)

Table-4
 Land holding status of the respondents (N=150)

Fishing community	Land types and area (in decimal)					
	Household area		Agricultural land		Water body	
	%	area	%	area	%	area
Brahmaputra	88	2.10±0.82	46	11.43±2.43	0	0
Fakirni	100	6.07±1.23	84	89.04±63.63	0	0
Mahananda	100	8.12±1.02	96	18.66±3.47	0	0

Table-5
 Training, loan/credit and savings status of respondents (N=150)

Fishing community	Training categories (%)				Loan (%)			Savings (%)		
	No training	Fishing or fish culture	Crop production	Vegetable production	No	GO	NGO	No	GO	NGO
Brahmaputra	96	0	2	2	34	0	66	94	0	6
Fakirni	100	0	0	0	48	0	52	78	0	22
Mahananda	94	2	4	0	38	0	62	84	0	16

Household nutrition (protein): Small indigenous species (SIS, small fishes that grow not more than 25 cm) play a key role in food and nutritional security in Bangladesh¹². Common protein sources in households of the respondents and monthly consumption rate are shown in Table-6 which reveals that fishes, both small and large, was the most common protein supplementing diet in all the respondent’s families. Though SIS consisted a considerable portion of animal protein supply to the diet of fishing communities but increasing trend to have large fishes was noticed from the present study. Less availability and uprising price of SIS were the key factors behind this change which was also mentioned previously¹². Introduction of farmed chicken greatly enhanced the meat consumption by the people of Bangladesh; but, fishes still are playing the most vital role in household nutrition. Similar findings were also reported by Galib *et al.*¹¹ for rural people of the country.

Climate change, vulnerability contexts and problems: The level of the impacts due to climate-induced changes depends on the vulnerability of each community, combination of potential impacts and adaptive capacity of the communities⁶. Fishery-dependent communities may face increased vulnerability in terms of less stable livelihoods, declination in availability or quality of fish for food, and safety risks due to harsher weather conditions¹³. During the last couple of decades the negative impacts of climate change have been very conspicuous in different sectors of Bangladesh including fisheries. A range of vulnerabilities and problems relevant to climatic factors have been revealed from this study (Figure-4). Lack of sufficient water in the rivers; particularly in Fakirni and Mahananda Rivers, reported by all and 96% of the respondents of the concerned communities respectively, was the most serious issue resulted from less rain and supply of less water from upstream.

High siltration was also reported by all the respondents from all three fishing communities which is the prime cause of flooding. Due to absence of regular seasonal circulation and adequate water, and loss or fragmentation of water bodies, the breeding of fishes in the rivers was at stake resulted in less catch in fishing gears. In addition, catch of large sized fishes has reduced to a great extent– as reported by all the respondents. In two rivers, the Fakirni and Mahananda, catch of large fishes was seldom found, mentioned by the fishers. Because of less large fishes in the harvest, the fishermen also changed their mood of fishing and fishing gears, sometimes to illegal fishing gears to harvest fishes of any size, particularly fish seeds.

Over one third of the fishermen in the Fakirni and Mahananda Rivers fishing communities were using illegal or destructive fishing gears in the rivers which, in turn, became another major cause of loss of fish diversity as well as its abundance. Introduction of community based fisheries management (CBFM) system also led members of fishing communities to a more vulnerable position. Due to CBFM their open access to water bodies other than rivers, e.g. floodplains and *beels*, has already been restricted or blocked forcing them to find alternative source of income.

Problems like limited access to water body, use of illegal fishing gears and declination in fish catch have previously been reported in Bangladesh including the Brahmaputra and the Mahananda rivers^{3,14-18} which indicates that this scenario is common for all over the country. During this research, it was found that almost all of the respondents (97%) did not know about fisheries rules and regulation of the government except for few scattered information.

Table-6
Common sources of protein in households of the respondents (N=150)

Source of protein		Fishing communities		
		Brahmaputra	Fakirni	Mahananda
SIS* fish	% consumed	100	100	100
	Consumption rate**	6.46±1.21	4.27±2.18	6.32±0.93
Large fish	% consumed	100	100	100
	Consumption rate**	7.76±2.14	6.93±4.18	7.10±2.12
Meat	% consumed	96	100	100
	Consumption rate**	0.42±0.21	1.47±0.64	0.54±0.13
Eggs	% consumed	100	100	100
	Consumption rate***	14.32±3.10	16.4±6.24	12.32±4.56
Milk	% consumed	8	20	12
	Consumption rate****	2.11±0.33	7.73±3.78	5.33±0.43

*SIS, Small Indigenous Species; small fishes those do not grow more than 25 cm or 9 inches; **, in kg per month; ***, in number per month; and ****, in liter per month

Changing pattern of occupation: Due to a number of problems and vulnerability issues, all the members of the studied fishing communities were being involved in several alternative income generating activities (Figure-5). This type of involvement was higher among respondents with comparatively higher level of education and financial capability.

Production of agricultural crops was found as the most common means in such case, particularly among members of Fakirni and Mahananda fishing communities where almost all the respondents were being involved in this venture. More than half of the respondents (54%) of the Brahmaputra River fishing

community were being served as a daily laborer to earn for their livelihood.

Production of agricultural crops is the most common occupation whereas, people with no or small land and capital tend to serve as daily laborer in Bangladesh. Unfortunately, all the respondents had no water area which could enable them to begin more profitable fish. A more advanced thinking would be culture of native ornamental fish at a low investment as Galib and Mohsin¹⁹ mentioned that breeding and seed production of ornamental fish is very much possible in Bangladesh.

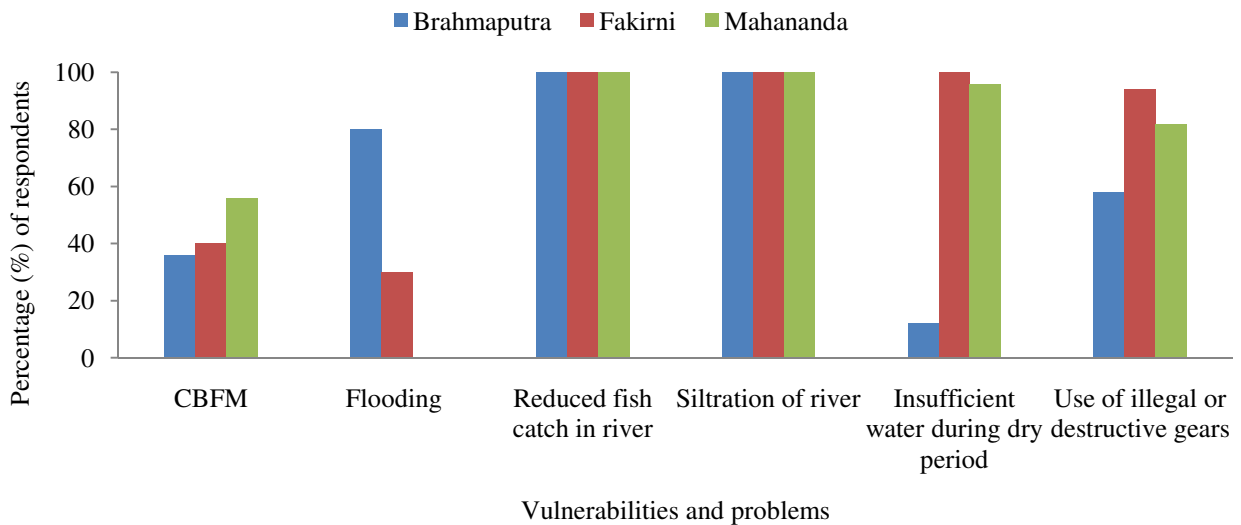


Figure-4
 Existing problems and vulnerability issues of the respondents (N=150)

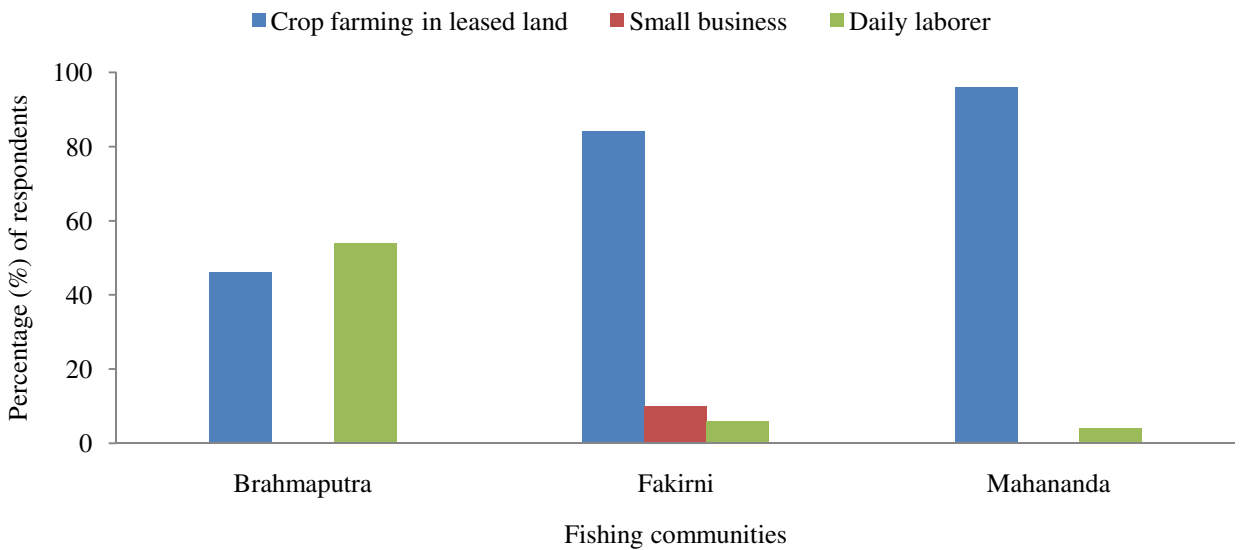


Figure-5
 Involvement in alternate income generating occupation of the respondents (N=150)

Conclusion

In Bangladesh, fishing communities are one of the most vulnerable groups in terms of livelihood opportunities and also under the serious threat of climate change. Degradation and fragmentation habitats, reduced catch, and restricted access to natural waters- all led members of traditional fishing community to shift their by-born occupation of fishing to some other low income generating occupations. Fishing communities of small rivers; for example, Fakirni, are particularly vulnerable to this situation. However, level of education can play a vital role in continuing the livelihood of members of fishing communities as this had a significant impact on different factors of their life.

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