

*Research Article***Aquaculture expansion and its potentiality in the hilly region Bandarban, Bangladesh****Barua, U., Mustafa, M.G. Pasha, M.R. and Nahid, S.A.A.***¹ Department of Fisheries Resource Management, Chattogram Veterinary and Animal Sciences University, Chattogram-4225, Bangladesh² Department of Oceanography, Noakhali Science and Technology University, Noakhali-3814, Bangladesh**ARTICLE INFO***Article history :*

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*Keywords :*Aquaculture, Expansion,
Potentiality, Bandarban**Corresponding Author :*

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E-mail: nahid83bau@gmail.com**ABSTRACT**

The present study was conducted in five upazillas (Bandarban Sadar, Lama, Alikadam, Rowangchari and Nikhyongchori) of Bandarban hill district to explore the hill aquaculture in Bangladesh. Data was collected through secondary data, personal interview and field observation. Total area of water bodies in the study area was 1096.85 ha where aquaculture system covered 311.9 ha. River covered 45.35% of total water bodies that was the highest whereas pond occupied 36.90%, creek 11.39%, canal 7.18% and farm 1.18%. Single and multiple ownerships of ponds/creeks were equal. In Bandarban 7% of the total culture system was semi-extensive whereas 43% of total culture system was extensive. Highest percentage of both extensive (71.12%) and semi-extensive (35.22%) culture production was found in Lama upazilla of Bandarban. Poly-culture of carp species was popular in all upazillas. Total fish production of Bandarban hill district was 1203.77 ton/year and average fish production was 0.93 ton/ha. The percentage of the highest fish protein intake among local groups was 57.14% whereas the highest other protein intake was 58.33%. 90% of the total fish farmers used self-fund for fish farming activities. Unavailability of quality water was identified as the most acute problem in all the surveyed upazillas of Bandarban.

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1. INTRODUCTION

Bandarban is one of the three hill districts of Bangladesh. Bangladesh is mainly a delta plain except the Chattogram Hill Tracts (CHT) located in the south-eastern part of the country. The geographical feature of these hilly areas is considerably different from the plain land. This area is undulating, erosive and sloppy with distinctive and specific characteristics of water resources compared to the remaining part of

the country. Chattogram Hill tracts (CHT), the hilly region of Bangladesh located in South-Eastern part of the country. The total area of the CHT is about 13,184 km² (9% area of the country) of which 92% is highland, 2% medium highland, 1% medium lowland and 5% homestead and water bodies (Ahmed *et al.*, 2010). There is rainwater potential in the hilly areas to harvest for irrigation purposes because of its high annual average rainfall and availability of suitable

landscape. 'Aquaculture' is not so popular here as it is tough to practice aquaculture in hilly areas. Establishment of artificial water bodies mainly creek may gear up aquaculture extension here. During the mid of 1990s the Government of Bangladesh encouraged aquaculture in creeks, ponds and lakes of the hill districts. Under the project named "Fish Culture Development (in hills) and Extension" 11.5 ha of nursery ponds and 92 ha of other water bodies were created by modifications of creek flows and construction of small dams, and these were brought under fish culture (Arthur *et al.*, 2015). The Department of Fisheries of Bangladesh is trying to modernize fish culture activities in hill districts and provides extension. Numbers of fish farms here are a

little compared with the rest parts of Bangladesh. A mini hatchery was established a couple of years ago, but its production have been shut down. So, fish farms here are completely dependent for fry on hatcheries in Chattogram and Cox's Bazar. No aquaculture expansion related research work has been done before in Chattogram Hill Tracts. The main goal of this research is to explore the hill aquaculture and its problems and potentials in seven (7) upazillas (Bandarban Sadar, Lama, Alikdam, Rowangchari and Nikhyongchori, Ruma and Thanchi) of Bandarban Hill District.

2. MATERIALS AND METHODS

Research Design

The total framework of the study of the survey for the present study was arranged with some mandatory steps (Figure 1).

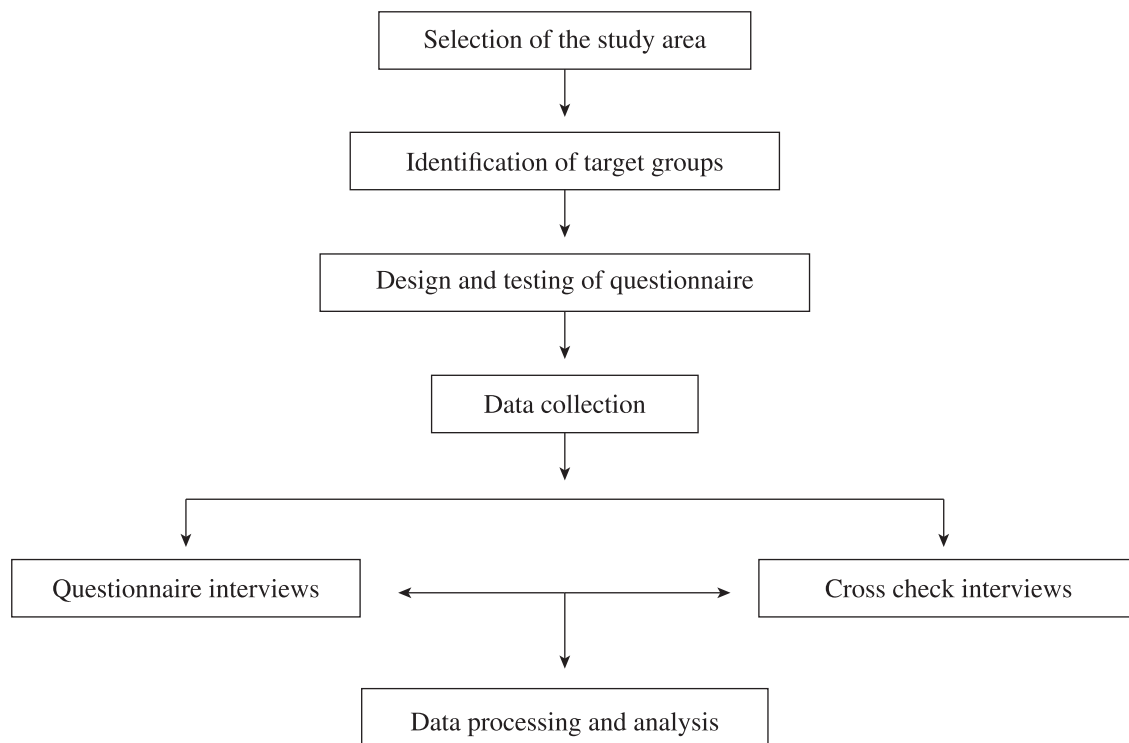


Fig 1: Flowchart of the research design

Selection of the study area

The study was conducted in Bandarban Hill District (21°48'N 92°24'E) from July 2016 to January 2017. The total area of Bandarban is 4,479 square km. Total

volume of total water bodies is 1096.85 ha. The area was selected considering the aquaculture status of the area and potentiality of aquaculture in that area.

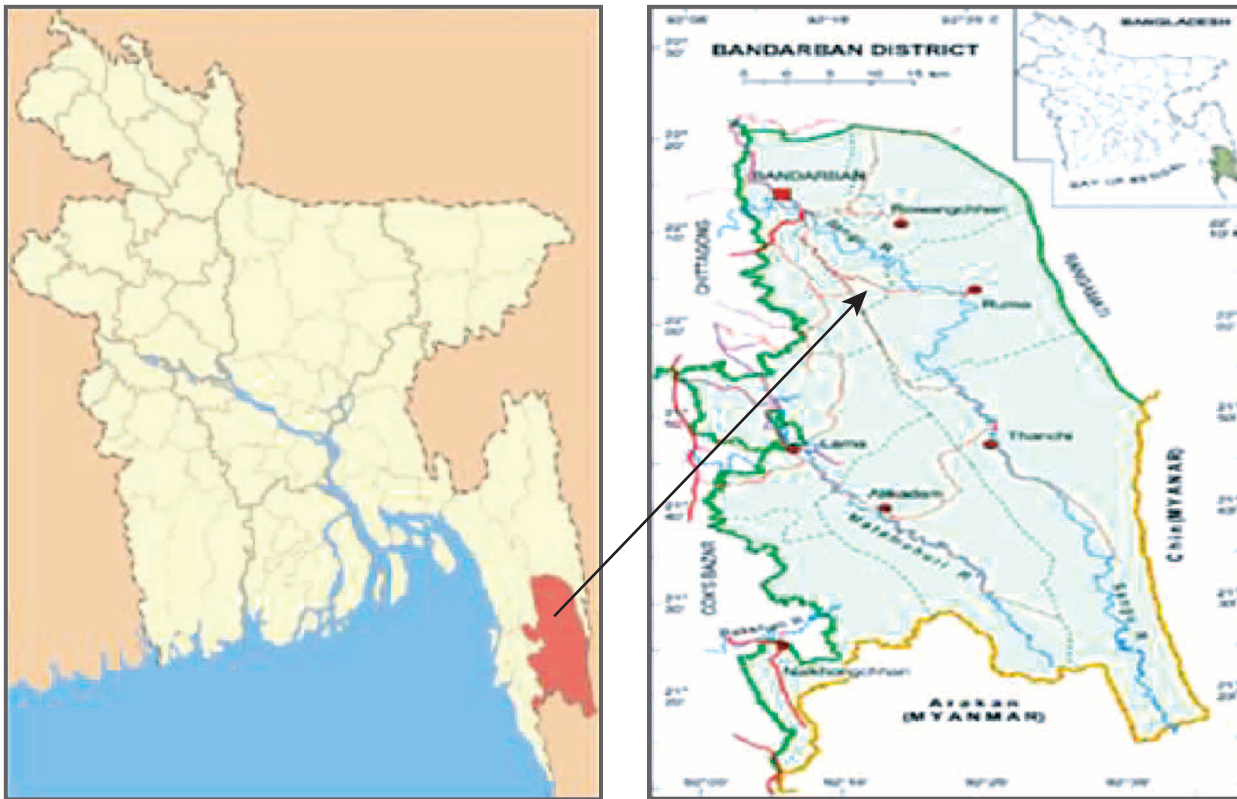


Fig 2: Study area

Sources of data and collection of data

For data collection, a set of interview schedule was designed for this study. The questionnaire was designed both in closed and open form. The data were collected on aquaculture expansion through questionnaire based on Aquaculture practice, aquaculture management, service provided by govt. and NGO's along with economical and nutritional status based on monthly income, types of fish easily consumed, amount of fish consumed per week. For questionnaire interviews, simple random sampling method was followed for local communities, UFO's (Upazilla fisheries officers) and DFO (District fisheries officer). It was not possible to study all upazillas because in two upazillas (Ruma and Thanchi) there was no govt. set up.

Data processing and analysis

All the Collected data obtained from the survey were accumulated, edited and finalized carefully and recorded. Finally, the processed data were analyzed by MS-Excel and relevant tables and graphs were prepared according to the objective of the present study for understanding the data.

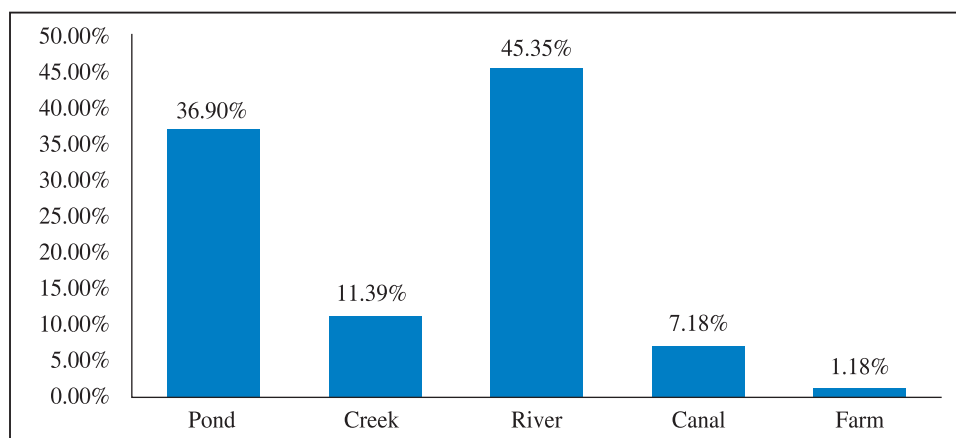
3. RESULTS AND DISCUSSIONS

Types and areas of Water-bodies

Mainly four types of water-body were found in Bandarban hill district. These are- a) Pond, b) Farm, c) Creek, d) River. Average area of water-bodies in Bandarban Hill District is 261.54 ha (Table 1). There were two types of water-bodies under the study area- 1) seasonal, 2) perennial. Most of the water-body is perennial. River covered 45.35% of total water-bodies that was the highest whereas pond occupied 36.90%. Hossain *et al.*,(2010) observed that 17% ponds were seasonal and 83% ponds were perennial in Dinajpur sadar upazilla. Huda *et al.*,(2010) found that 42% ponds were seasonal and 58% ponds were perennial in Kurigram district. It was found that the average pond size of the study area was 0.11 ha. Belton *et al.*,(2012) found that the average pond size was 0.21 ha, in Dinajpur Sadar Upazilla. Huda *et al.*,(2010) found that average pond size was 0.13 ha in Bagmara Upazilla under Rajshahi district.

Table 1: Types and areas of water-bodies

Name of the Upazilla	Types of Water-bodies	Number	Area(ha)	Total
1) Lama	a) Pond	446	48.32 ha	118.37 ha
	b) Farm	17	28.03 ha	
	c) Creek	184	42.32 ha	
2) Bandarban	a) Pond	380	41.47	90.90 ha
	b) Farm	09	14.84	
	c) Creek	152	34.96	
3) Alikadam	a) Pond	363	63.77 ha	586.77 ha
	b) Creek	20	18.00 ha	
	c) River	01	445.00 ha	
	d) Canal	02	60.00 ha	
4) Rowangchori	a) Pond	45	4.87 ha	300.51 ha
	b) Creek	25	5.75 ha	
	c) Farm	06	9.89 ha	
	d) River	01	280 ha	
5) Nikhyongchori				210.80 ha

**Fig 3:** Percentage of different types of water body in study area

Fish production status of the study area

In the study area, the season of fish farming was from April to January. In natural water bodies fishes were available from March to September. In creeks water level remained same all the year round. Fish farmers didn't follow any scientific combination of the species. Except only a few farms, most of the farmers did not maintain any scientifically recommended rate of feeding. Throughout the study it was found that the total annual fish production of the study area is 1203.77 M.ton/year (Table 2) where in Kaptai lake the inland production was 9982 M.ton in year 2016-17. Good

amount of fishes were caught from Chemir mukh, Bandarban Upazilla to Boro modok, Thanchi Upazilla. Larger sized fishes are often found here. Between this area most variety of fishes were found. Such as : Catla (*Labeo catla*) upto 40kg weight, Baghai (*Bagarius bagarius*) upto 140kg weight, Mahal (*Cirrhinus cirrhosus*) upto 17kg weight, Boal (Wallago attu) 40kg, Grasscarp (*Ctenopharyngodon idella*) 30kg. It indicates there remains a good number of fish varieties with good weights. In the study area it was found that in rivers fishes are available from August to May. From June to July water level turns lower.

Table 2: Fisheries Production of different upazilla's of Bandarban

Area (Upazilla)	Production (M.ton/year)
a. Bandarban	258.68
b. Lama	272.75
c. Alikodom	223.50
d. Nikhyongchori	236.01
e. Rowangchori	212.83
Total	1203.77

Table 3: Production status of different culture system

Name of the Upazilla	Types	Number	Area	Production	Total	Average
Lama	1) Extensive	33	25.68 ha	35.50 M.ton	212.00 M.ton	1.78 M.ton
	2) Semi-intensive					
	a. Pond	425	40.50 ha	71.00 M.ton		
	b. Farm	05	10.17 ha	35.50 M.ton		
	c. Creek	184	42.32 ha	70.00 M.ton		
Bandarban	1) Extensive	41	4.44 ha	5.994 M.ton	159.70 M.ton	1.76 M.ton
	2) Semi-intensive					
	a. Pond	339	36.72 ha	57.37 M.ton		
	b. Farm	09	14.84 ha	40.52 M.ton		
	c. Creek	152	34.96 ha	55.82 M.ton		
Alikadam	1) Extensive	28	4.19 ha	6.87 M.ton	130.17 M.ton	1.59 M.ton
	2) Semi-intensive					
	a. Pond	335	58.85 ha	92.98 M.ton		
	b. Creek	20	18 ha	30.32 M.ton		
Rowangchori	1) Extensive	11	1.19 ha	1.55 M.ton	35.29 M.ton	1.72 M.ton
	2) Semi-intensive					
	a. Pond	34	3.67 ha	5.79 M.ton		
	b. Creek	25	5.75 ha	12.01 M.ton		
	c. Farm	06	9.89 ha	15.94 M.ton		

Culture system of the study area

Mainly two types of culture system are applied in Bandarban. These are- a) Extensive, b) Semi-intensive. Highest production percentage of extensive culture system was found in Lama upazilla (71.12%) and highest semi-extensive aquaculture production was also found in Lama upazilla (35.22%) (Figure 4). In the study area, it was observed that most of the farmers

were involved in Polyculture and Monoculture. Tilapia was seen to culture together with Indian major carps. Semi intensive aquaculture was most popular in the study area (Table 3). Ahmed *et al.*,(1995) observed that peak period of carp polyculture was from April to December where Belton *et al.*,(2012) reported it from March to December.

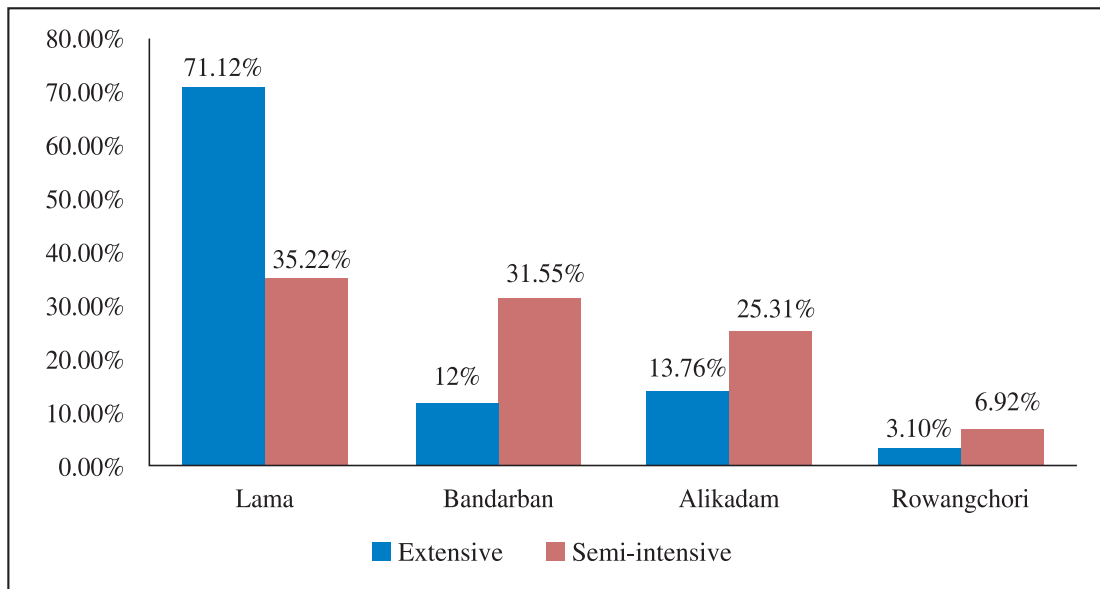


Fig 4: Percentage of production of two culture systems in different areas

Major Constraints of Fish Culture

Several constraints were identified in fish culture in the study area (Figure 5). Among these unavailability of

quality water was the most acute (30%). Among others problems of quality seed supply, land slide etc. should be solved early to promote aquaculture in Bandarban.

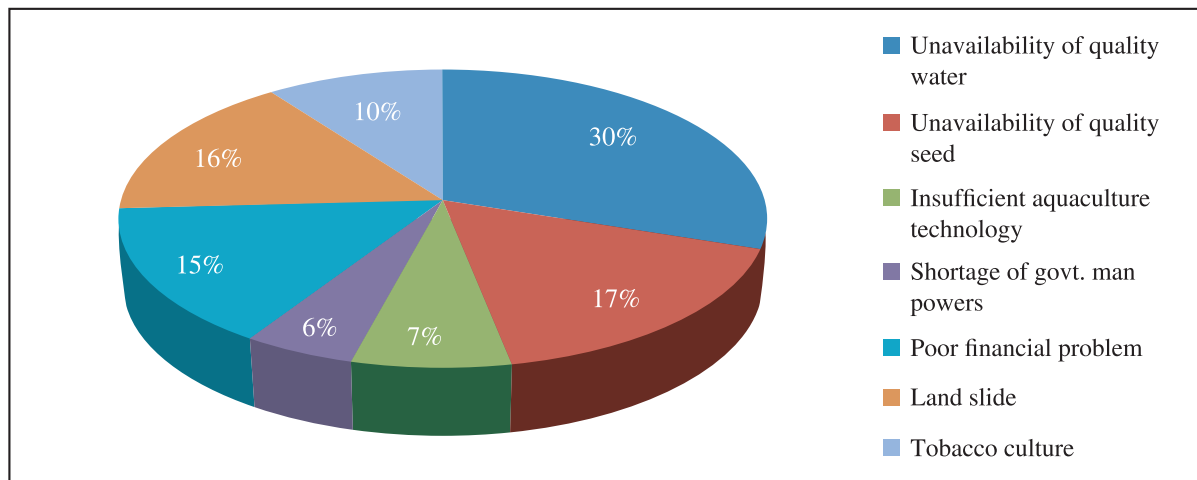


Fig 5: Percentage of major constraints in study area

Potential impacts of Aquaculture in the study area

In the study area, the target groups were brought under study to understand the potentiality of aquaculture in the study area. In the study area 50% of fish farmers had single ownership and 50% had multiple ownerships (Figure 7). Four types of population were selected to measure the rate of protein intake. The percentage of the highest fish protein intake among

local groups was 57.14% whereas the highest other protein intake was 58.33% (Figure 6). Ahmed *et al.*,(2010) showed that national average fish consumption in Bangladesh is about 37g per capita per day (13kg per year). Faruque and Golam (2007) conducted a study where the greatest effect of aquaculture on farming households had been observed in income and consumption.

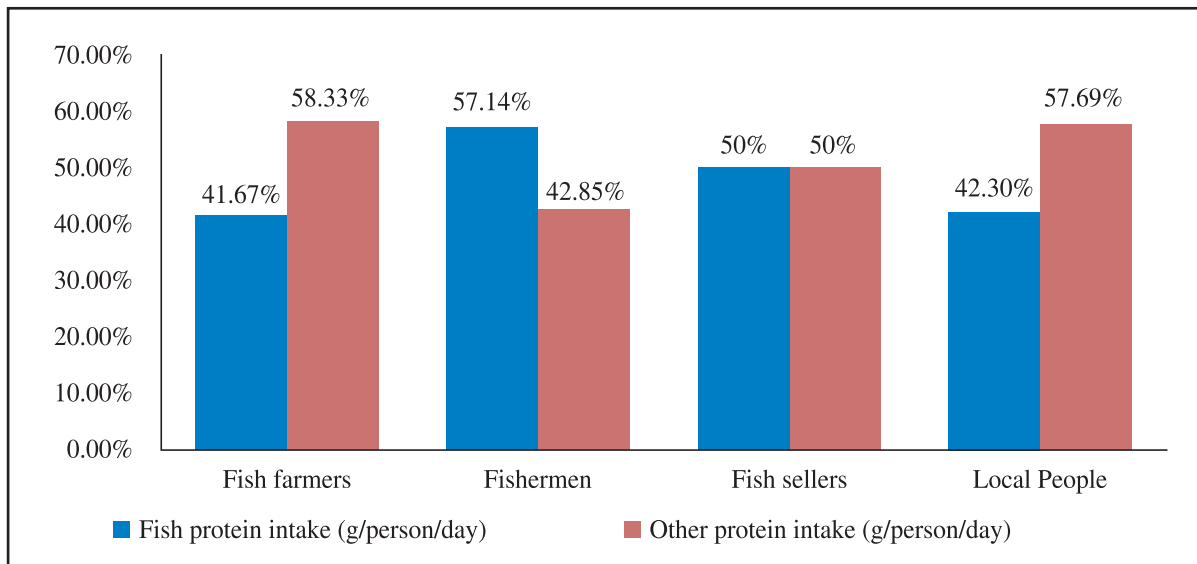


Fig 4: Percentage of production of two culture systems in different areas

Helen Keller International (2008) reported that the most available source of protein was fish, that had been

eaten by almost 9% of households at least 1 or 2 times in per week.

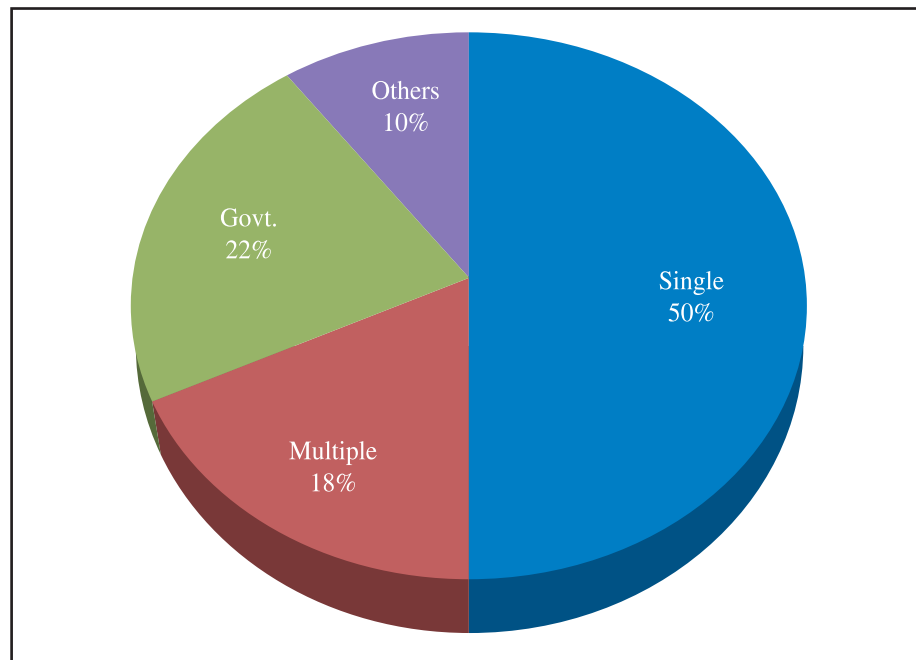


Fig 5: Percentage of major constraints in study area

It was found that 90% of the farmers used self-fund for farming activities and 10% self-fund with other sources for farming activities. Creek culture turned out very popular here. Poor physical capital affected people to pursue their livelihood strategies. Insufficient social

capital affected livelihoods of poor people in fish farming communities. In the study area fish farmers were provided with technical assistance by Department of Fisheries (DOF).

Department of Fisheries arranges several training programs for fisheries extension. The annual household net income of an average rural household CHT was around Tk. 66,000 (Bangladesh rural being Tk. 84,000). The households' annual net income of the Bangladeshi people was around Tk. 71,000 and income for tribal/ethnic people around Tk. 62,000 on average in 2009, (UNDP 2009). Agriculture-related activities are the prime sources of household income across the Communities (ranging between 49% and 72% of the net income) (HPNSDP, 2011). Kawarazuka *et al.*, (2007) identified that enhancement of the economic status of women through their involvement in aquaculture and/or fisheries-related activities is another important pathway to improve household nutritional security.

4. CONCLUSION

The result of the study indicates that Chattogram Hill Tracts occupy a larger resource. There is less risk of pollution. Fund, physical structure and technical services of fisheries offices should be increased. More hatcheries should be established so that farmers can get quality seeds easily. Through proper utilization and management of fisheries resources in Bandarban, there can be a miracle change in livelihood status of local communities.

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