

**AUGMENTING FISHERS' WELFARE AND LIVELIHOOD ASSETS THROUGH
COMMUNITY BASED MANAGEMENT IN BANGLADESH***

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Abstract

This study investigates the impact of Community Based Fisheries Management (CBFM) on fishing households' welfare in Bangladesh by examining how the various types of livelihood assets contribute to household incomes. The CBFM projects have been implemented in Bangladesh since 1995, through the partnership of Department of Fisheries (government organization), 9 NGOs and the WorldFish Center, with about 113 waterbodies and more than 23,000 households living around the project sites. The major objective of CBFM is to establish local fishery community organizations by providing credit facilities, training and by promoting social awareness with an aim to enhance poor fishers' capability of greater access to their livelihood assets. A survey of 240 households in Bangladesh was conducted to obtain information from fishers at CBFM and non CBFM sites (control sites). A livelihood assets framework is utilized and a regression model is used to analyze the factors that contribute to household income of poor fishers. The study found that fishers in CBFM areas have improved their access to different assets including social, human, physical, financial and natural capitals. The regression results show that the contribution of social capital is significant to household income, indicating that social factors play very important roles in poverty alleviation in Bangladesh. Future poverty alleviation policy options need to give priority to investments in human, physical and natural capital assets.

Keywords-Community-Based Management, institutions, access, equity, livelihood assets, inland fisheries.

1. INTRODUCTION

Bangladesh is a densely populated country (850 people per sq. km) of 140 million people, together with widespread poverty. Approximately 45 percent of the country's population is living in extreme poverty and a large proportion of them are fishers. Fish and fisheries play an immensely important role for employment, nutrition and foreign exchange earning. Majority of rural people depends on inland capture fisheries as their source of livelihoods. More than 70% of households fish in the floodplains either for income or food (Minkin et al., 1997; Thompson et al., 1999).

In Bangladesh poverty is understood to be multidimensional and has many roots. A household is considered welfare-poor if its assets do not allow the generation of adequate income (in money or in kind) to satisfy food needs. On the other hand, a household is investment-poor if its assets fail to generate an adequate flow of money or services to support investments (Bahamondes, 2003). Fishers possess a very limited capital assets, most of them are landless, have poor fishing assets and lack other productive capitals. Fisheries resources are state property and the management control very often falls into the hands of rich and influential leaseholders. The leaseholder exploits the poor fishers by appropriating maximum share of benefits from fisheries. The poor fishers are denied to participate in making fisheries management decisions. Their income from fishing has been declining over the years due to inequitable distribution and declining production. It is argued that inequality in livelihood assets among the user groups might be associated with different degrees of control and access of the fisheries resources.

Access to different types of capital such as natural, physical, human, financial and social makes livelihood strategies possible for the households. Increase access to resources depends on which assets are more relevant to the types of livelihood.

Current fisheries management approaches based on centralized government intervention have proven inadequate to address the present problems of fishing communities. Community based fisheries management approach has gained increasing acceptance among governments, development agencies and researchers as an important option to address these issues on future management systems. CBFM is a partnership arrangement where management responsibility is shared between the government and fishing communities. A range of institutional arrangements is evident with varying degrees of community participation. Under this approach, the users can participate to the management of fisheries to ensure its sustainable use and equitable distribution of benefits.

In Bangladesh, various forms of co-management arrangements have been experienced more than a decade. These are: (1) NGO led strategies; (2) Government led strategies, and (3) Government and NGO partnerships (Ahmed *et al.* 1997). Community Based Fisheries Management approaches has been implemented since 1996 to develop alternative fisheries management that will ensure equitable distribution and sustainable management of the fisheries resources. The responsibilities of CBFM arrangements are shared by the government (DOF), NGOs and the fishers. The WorldFish Center is responsible for providing technical support including monitoring and research. This project is working with about 113 waterbodies and more than 23,000 households living around the project sites. The waterbodies under the project are diverse, comprising mostly of rivers, closed *beels*, and open *beels*, but also significant areas of floodplains (largely private land) and small *beels* (under 8 ha).

The main thrust of CBFM management is to build community based institutions to ensure access to the resources and to improve livelihood of poor fishers. The partner NGOs based on their previous experience in fisheries management and community development has taken responsibilities for the project¹. CBFM institutions have made their effort to reverse declining production trend from inland capture fisheries over the last eight years in Bangladesh. The NGO effort has largely focused on institution-building: organizing fishers into groups, getting access to resources, providing credit, enabling them to design and carry out their own management measures (e.g., stocking, closed season, fish sanctuaries, gear restriction), and helping to make and enforce their own regulation for resource management. The WorldFish Center has focused on providing back-up for institution building, in line with common property resource management and reducing poverty. Our findings confirm that the organized fishers under CBFM project have got more access to their livelihood assets. It is found that social capital factors such as empowerment, participation in decision making and influence over resources use has significantly improved in the project areas.

¹ The partner NGOs are mixed in size and characteristics. They include large national NGOs such as BRAC, PROSHIKA and, international NGO such as Caritas. The national NGO focused on resource management. They were involved in community level fisheries management in several projects. They have developed experience and skills across a diversity of approaches and gradually involved in natural resources management projects.

Institutional arrangements for better fishery management and for stakeholder participation have received limited attention in the past. This paper will provide information on whether poor fishers are benefited in terms of increasing income by efficient and equitable access to different livelihood assets. Section 2 reports the methodology; Section 3 reports the results and discussions, the paper concludes with policy recommendations for future inland fisheries management.

2. METHODOLOGY

2.1 Sampling and Data Collection

Two types of waterbodies have been selected for this study: semi-closed *beel* and open *beel*. The semi-closed beels under the project are perennial and fishers involved in fish culture practices. The executive members of *Beel* Management Committee have been elected by the participants. On the other hand, the open beels are seasonal and remain dry for about six months in a year. They are extensively used as capture fisheries for the purpose of subsistence fishing by a wide range of stakeholders. Property rights are not clearly defined in open beels, as people use the beels and floodplains for crop cultivation and fishing. The CBFM fishing communities have established fish sanctuaries in these beels, introduced voluntary closed season (3 months), restrictions on destructive gears in order to enhance natural fish stocks.

The study was undertaken in four project waterbodies and four control waterbodies in two selected regions of CBFM project activities (Table 1). Random samples of 30 fisher households were chosen from each of the 8 selected waterbodies, giving total sample households of 240. The primary data were collected through memory recall of respondents using structured questionnaire.

Table 1: Sample of Waterbodies and Households

Waterbody	Project /control	Area (ha.) min-max	Total household	Beneficiary households(no)	Sample households
Ashurar OB	project	100-350	2466	527	30
Chapandaha CB	project	26-100	578	57	30
Hamil CB	project	16-20	956	139	30
Dubail OB	project	21-45	1211	176	30
Shal nodi OB	control	35-84	1320	na	30
Doriar CB	control	32-80	535	na	30
Shampur CB	control	35-40	480	na	30
Nabagia OB	control	16-40	1973	na	30
Total sample households					240

OB=open beel; CB=closed beel

2.2 Principal Component Analysis

The livelihood assets which include the social, physical, human, financial and natural assets are measured by a set of variables. These variables as shown in Table 2 are combined by using the Principal Component Analysis to form an index for each capital asset in this study. In the Principal Component analysis, the important principal components are found as unrotated factors based on the criteria of eigenvalues greater than one. PCA extracts maximum amount of variance from highly loaded factors in computing the factor scores. The factor scores are weighted

according to the factor loadings. To ensure the correlations between the factors, the Bartlett's test of sphericity (Bartlett, 1954) and Kaiser-Meyer-Olkin (KMO) test were used. For the Bartlett's test, a variable is included in the factor scores if it is significant ($p < .05$). For the KMO test, the KMO index of 0.6 is suggested as the minimum value for a good factor analysis (Tabachnick and Fidell, 1996).

Table 2: Definition of Variables

<p><i>Social Capital Variable</i> Membership = membership in organizations (5=most important; 1=less important) Influence = influence over access to resource (5=strong influence; 1=no influence) Participation = participation in decision making (number of times) Knowledge = fisheries management knowledge (5=full knowledge; 1=no knowledge) Trust = level of trust (5=strongly agree; 1= disagree)</p> <p><i>Physical Capital Variable</i> Housing = value of house structure (Taka) Latrine = value of water sealed latrine(Taka) Capital assets = Value of a set of household assets (Taka) Homestead land = area of homestead land (ha) Fishing equipment = value of equipment (Taka) Fishing area = measure of fishing area (ha)</p> <p><i>Human Capital variable</i> Education = education of household head (years of schooling) Age = age of household head (year) Employment = total employment days</p> <p><i>Other assets</i> Credit = amount of credit received by household (Taka) Cultivable land = cultivable land owned by household (ha) Household size = number of household members</p>
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2.3 Regression Analysis

The factors that contribute to household income are analyzed using a regression model. As shown in Equation (1) the explanatory variables included in the model consist of those measuring various asset endowments and demographic characteristics of the households. The dependent variable is the welfare of the household measured as annual household gross income from different sources.

Equation (1) is estimated separately using the survey data from households in the sampled CBFM (project) and non-CBFM (control) areas:

$$Y = \alpha + \beta_1 SC + \beta_2 PC + \beta_3 EDN + \beta_4 CRT + \beta_5 CUL + \beta_6 EMP + \beta_7 AGE + \beta_8 HS + \beta_9 FISA + \beta_{10} ATCM + \text{Error}, \quad (1)$$

Where

Y = household annual income (taka)

α = constant

β_1 to β_{10} = coefficient of variables for household asset endowments and household characteristics

SC = household endowment of social capital (index)

PC = household endowment of physical capital (index)

EDN = household education (years)

CRT = credit received by households (taka)

CUL = area of household cultivable land (ha)

EMP = employment days of households (days)

AGE = age of household head (years)

HS = household size (number)

FISA= area fished by households (ha)

ATCM= household head attended in community meeting (number)

Error

3. RESULTS AND DISCUSSIONS

3.1 Livelihood Assets Indices Measurement

Descriptive statistics shows that about 60% of the household members in both project and control sites have no formal education. Table 3 show their principal occupations are farming (44%), wage labourer (11%) and fishing (15%). Women do not work outside, but they assist in household productive activities such as cow and poultry rearing and other non-paying self employment activities.

Table 3: Percentage of Households by Sources of Income

Sources of income	Project			Control		
	Closed Beel (%)	Open Beel (%)	Total (%)	Closed Beel (%)	Open Beel (%)	Total (%)
Agricultural Labour	5.9	7.6	6.7	7.6	8.4	8.1
Non-Agricultural Labour	4.4	4.4	4.4	4.1	2.4	3.2
Agriculture Farming	47.0	40.6	44.0	47.8	37.5	42.2
Livestock and poultry	3.6	1.7	2.7	4.0	2.5	3.2
Fishing	15.9	14.1	15.0	7.8	14.6	11.5
Petty trade, business	7.6	9.0	8.3	15.4	18.6	17.1
Rickshaw/van pulling	4.6	4.3	4.5	1.7	3.3	2.5
Service/profession	3.6	5.2	4.3	3.2	3.5	3.3
Skilled labour/tailoring	2.5	2.7	2.6	1.8	1.5	1.6
Remittance, gift, govt. support	3.0	5.5	4.1	1.4	5.7	3.8
Rent out (animal, van, boat)	2.0	5.0	3.4	5.3	2.1	3.5
All	100.0	100.0	100.0	100.0	100.0	100.0

Fishing is an important income source to the households in close *beel* (project) compared to those in the open beels. The organized fishers have got more fishing access compare to the fishers in the control area. Average fishing area in the project was larger (12 ha.) compare to the area in non-project sites (8 ha.). The fishers in the project area have higher income level compare

to the households in the control sites. There are smaller percentages of fisher households (18%) in the lowest income group in the project sites than in the control sites (30%). One third of the households belong to the higher income category in both project and control sites (Table 4).

Table 4: Percentage of Households by Annual Income Categories

Income category Tk	Project		Total (%)	Control		Total (%)
	Closed beel (%)	Open Beel (%)		Closed beel (%)	Open Beel (%)	
<20,000 Tk	20	17	18	30	30	30
20,000-29,999 Tk	20	30	25	22	20	21
30,000-39,999 Tk	32	17	24	17	22	19
40,000 Tk and above	28	37	33	32	28	30
All	100	100	100	100	100	100

The NGOs are capable of identifying and organizing poor fishers to build community based organizations. Community based institutions were strong and capable in semi closed *beels* in the project sites. Out of the two CBFM open *beels*, community fisheries management is strong in *Ashurar beel* and the BMC introduced fishing rules such as establishing and maintaining fish sanctuary, imposing restriction of destructive gear used (gill net made of monofilament), and closed fishing season for three months. These rules have been strictly followed by the fishers in this *beel*. Fish production has increased and the fishers are using more gears than before. Fishing for food is allowed and a growing number of new comers are recently engaged in fishing in *Ashurar beel*. Local people are very happy to see the results of fish sanctuary. Fish from *Ashurar Beel* is said to be tastier than other sources according to the view of the local fish consumers. The consumers said that the price of fish from this *beel* is always higher in their local markets than fish from other sources.

The government has transferred the use rights of waterbodies and provides administrative support to the fishers. The NGOs have full time staffs at the village level that facilitate coordination between the government and the fishers. In this study, social capital was measured by how the fishers interact with other people in the community and get access to different assets for improving their livelihoods. Fishers are organized and their activities are endorsed by the partner organizations. They have established relationship with local government and other agencies through DOF and obtain government support such as rice, wheat and fishing equipment at crisis times.

Social Capital Index

To measure the social capital variable, an index was constructed using the PCA method. The most important factors of social capital are: membership in organizations, participation in decision making, level of knowledge and influence on access to resources. These four variables load highly on a single common factor (Table 5).

Table 5: Social Capital: Factor Pattern

Performance Indicator	Factor Loading
Membership in organization	.693
Participation in decision making	.685
Level of knowledge	.622
Influence over decision making	.610

Extraction Method: Principal Component Analysis.

The scores of four separate items were aggregated to form the Social Capital Index. The most dominating factor found in social capital is household's membership in organizations (0.693). The majority of the poorer households have affiliation with production oriented organizations such as NGOs, various cooperative societies and local credit management societies. The reason why the poor fishers are not involved in the social, religious and cultural organization is mainly due to their poverty. Their primary concern is to look for work for their daily food and other necessities. Good leadership exists among the community in three project sites. In both *Chapandaha* and *Hamil beel*, the CBFM participants elected their executives for *Beel* Management Committee through voting. The organized fishers have participated in stocking and other production related activities such as protecting and harvesting fish. Poaching is a common threat for stocked waterbodies. This has been controlled through surveillance provided by the fishers in the project sites. It has been observed that there is improvement in fishers' confidence in using fish culture technologies. The second social capital factor is found that the participants have actively participated in the decision making on fisheries management rules (0.685). Fisheries management rules introduced by the management committee aim to enhance fish production. These rules are fishing restriction in the fish sanctuary, restriction on destructive gear used and three months closed season. The fishers strictly obeyed the first rule but the other two rules were sometimes violated when they could not find any income-earning work. The level of knowledge is important in social capital variable (0.622). Low level of formal education is observed among the fishing communities. Partner NGOs conducted awareness campaigns and training programs on leadership, accounting management, productive activities and fisheries management to improve fishers' level of knowledge. The last social capital variable is the fishers' influence on resource use (0.610). The fishers have exclusive access to use the fisheries resources and can resist outside threat. They can decide who, when and where to fish, and thus they are able to control overfishing on their own.

Physical Capital Index

Generally poor fishers are landless or functional landless. They have small amount of productive assets. Physical assets endowments are a good indicator of income, welfare and livelihood. The study has found that the organized fishers have improved their assets over the last couple of years such as using better construction materials for their houses and fitted with flush latrines. The level of income has increased and they have got some other productive assets to be used in creating additional income such as rickshaw pulling, petty trade (grocery, tea stall and fish), and crop cultivation. Women are now engaged in cattle and poultry rearing using credits from the NGOs.

In constructing the Physical Capital Index using the Principal Component Analysis, the significant variables are house materials, area of homestead land, sanitary latrine and productive assets. These four variables load highly on a single common factor (Table 6).

Table 6: Physical Capital: Factor Pattern

Performance Indicator	Factor Loading
Value of house	.748
Area of homestead land	.744
Value of sanitary latrine	.697
Value of durable assets	.684

Extraction Method: Principal Component Analysis.

The scores of four separate items were aggregated to form the Physical Capital Index. Land is a very scarce resource in Bangladesh. The average area of homestead is 0.05 hectare in the study area. Most fisher households do not own any cultivable land. However they cultivate land owned by others either through sharecropping or mortgage arrangements. More and more poor fishers in all survey areas are engaged in high-yielding variety (HYV) *boro* rice cultivation. This indicates that poorest fisher could be employed in the agriculture and non agriculture sectors. Improvement of housing is found to be an important factor for the rural households. The first important variable is the value of house (0.748). The area of homestead land is the second dominating variable (0.744), followed by sanitation condition (0.697). The CBFM participants have greater awareness in health and sanitation. NGOs have provided with sanitary latrines at low cost to their group members. The last important variable is the productive and household assets (0.684) such as livestock, rickshaw/vans, shallow tube well, bi-cycle, watch, radio and television sets. These assets play an important role as safety nets during unemployment and occurrence of natural crises such as floods, or cyclones which results in loss of fish and other crops.

Human, Financial and Natural capital Assets

The poor fishers are generally illiterate; access to formal education is very limited. Human capital includes age of household head, attendance in community meetings, participate in trainings and access to information. Only the level of formal education variable is significant in the principle component analysis. The role of financial capital is very important to explain livelihood of poor fishers. Fishers have very limited access to credit; they are not able to pay lease money for fisheries resources and can not invest in productive sector to generate income. Financial capital includes the variables: amount of credit received, value of household assets, value of fishing equipment and income from asset sales. Only the amount of credit received variable was significant. The land and fishing ground are considered as natural assets for the fishers. Fishers are generally landless, but they have traditional access to fishing in the floodplains owned by the private landowner or open access common property. Access to fishing to such fishing grounds depends on the extent of social linkages among the community in that particular location.

One variable in each of the three types of assets was found significant in the PCA method: level of formal education for human capital, amount of credit received for financial capital and area of fishing for natural capital (Table 7).

Table 7: Human, Financial and Natural Capital: Factor Pattern

Performance Indicator	Factor Loading
Education level of household head	.704
Amount (Tk) of credit received by household	.690
Area of fishing by household	.615

Extraction Method: Principal Component Analysis.

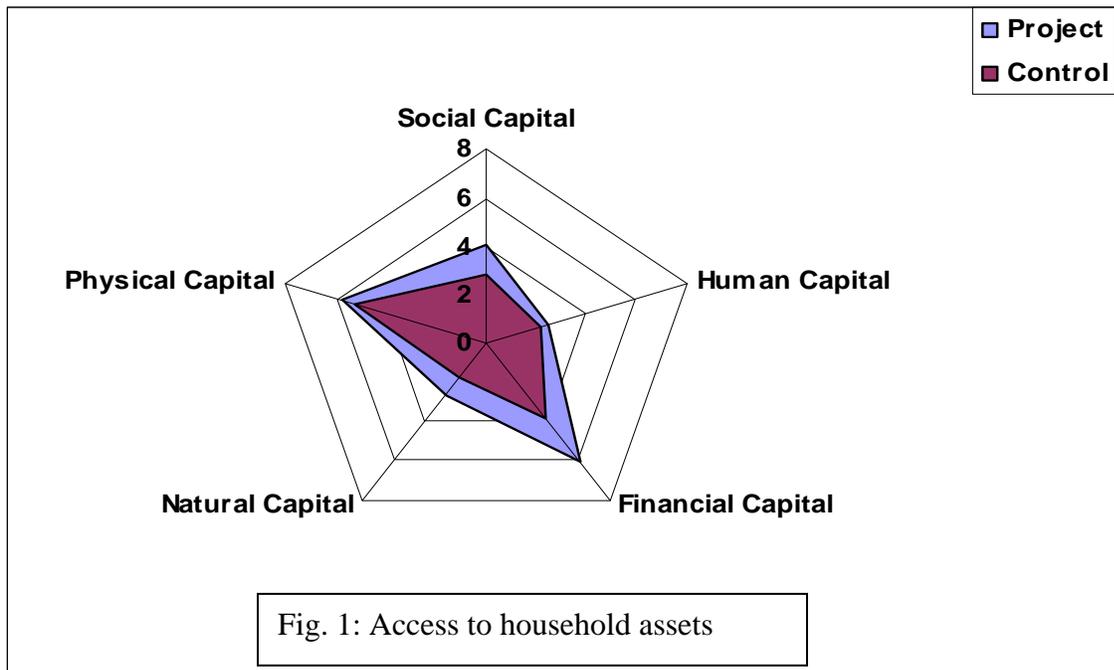
Impact of CBFM on Livelihood Assets

The results indicate that the CBFM project approach has contributed to improve participant's livelihood assets endowments. Figure 1 shows that the gap between project and control areas in

terms of social capital and financial capital is significantly wider; however, the difference in the mean score of each of the livelihood asset is positive.

Impact of social capital

Under the CBFM project the government has transferred the use rights of waterbodies and provides administrative support to the fishers. The NGOs have full time staffs at the village level that facilitate coordination between the government and the fishers. The organized fisher’s participation in making decisions has increased that contributed to better management of fisheries and improved access to livelihood assets. The CBFM participants elect their executives for Beel Management Committee through voting. The fishers have improved social linkages that enhance their ability to gain economic power and livelihood security in the project areas.



Impact of Financial Capital

The participants have received higher amount of credit (financial assets) as shown in Figure 1. The credit was utilized for different productive purposes. The participants received interest free loans to pay lease fees for the *jalmahal* and to meet other fisheries related costs. The fishers could reduce their dependency on the moneylenders for credit. However, almost all the households who received credit used a part for crisis mitigation such as buying food, medical treatment and repair houses. The participants have received higher amount of credit (financial assets) as shown in Figure 1. Higher number of households (85%) in the project area received credit compared to the control area (75%). The amount of credit received per household was also higher in the project areas (Tk 7,456) compared to the control area (Tk 5,058).

The fishers of the floodplains are engaged in fishing as well as other activities. Households derived their income from a wide range of sources. Day labouring is still an important livelihood option for both the project and control households. Substantial increases in self employment such as rickshaw pulling and petty trade have been reported by households in project area. Higher

percentage of project households in both the open and close *beels* are in the high income categories in comparison to those in the control sites. These results indicate that the project has contributed positive benefits to the participants.

Impact of Physical Assets

Level of physical assets endowments are the important indicator of household income and welfare. Generally poor fishers are landless or functional landless. They have small amount of productive assets. The fishers sell their assets during the period of crisis since they do not have savings to fall back to during this period.

The households in the project areas have increased slightly their ownership of productive assets such as livestock, rickshaw/vans, pump machine and other assets such as bi-cycle, watch, radio and TV compared to the control areas. These assets contribute to generate income during the crises period in the CBFM areas. The participants are now able to invest in their house repairs, health and sanitation showing their quality of life has improved compared to the control areas.

Impact of Human Assets

There was no significant difference in formal education attainment of household head observed between the project and control areas (Fig. 1). The participants were provided with human and skill development training by the project. The government has taken various programmes recently such as “Education for All” and “Food for Education” to enhance education. The study has considered the level of education of household head, but the impact of these recent programmes has not fully reflected in this study.

Impact of Natural Assets

Land is the important but scarce natural capital for the poor fishers. Poor fishers primarily rely on the vast floodplain wetlands for their livelihood. Access to the fishing area is also determined by the extent of social interactions and relationships with local elites. In rural areas of Bangladesh, majority of households are engaged in fishing for both income as well as subsistence. During the monsoon season all lands (government and private) are treated as fisheries. Although various property rights exist in wetlands in Bangladesh, the poor fishers are allowed to fish in the private lands during the monsoon season. The fishers in the project areas have established trust in the rural community and they are able to negotiate with the landowner for fishing. The fishers have increased modestly their access to the fisheries in the project sites compared to the control sites (Fig.1).

3.2 Regression Analysis

Multiple regression analysis is used to examine the link between the household income and various livelihood asset variables. The equation as specified in Section 2.3 is estimated separately for the project and control sites by the Ordinary Least Squares technique. The results of regression are presented in Table 8.

The results indicate that the social capital, employment and area of fishing are important predictors of household income in the project area. In the control areas education, household size and age variables are significant. The contribution of social capital factor is an important variable

in determining household income. Thus social factor plays a very important role in poverty alleviation in Bangladesh.

Table 8: Relationships between livelihood assets and Household income

Variables	Model 1: Project		Model 2: Control	
	Estimated Coefficient	<i>t</i> Statistic	Estimated Coefficient	<i>t</i> Statistic
INTERCEPT	6449.7	.580	20906.6	1.848*
SC	2619.4	2.225**	995.2	.568
PC	-.206	-.416	-.517	-.980
EDN	413.0	.549	1693.2	2.146**
CRT	.576	1.288	.693	1.273
CUL	-19.4	-.793	-3.8	-.129
EMP	50.6	3.005***	12.9	.865
AGE	123.9	.641	717.9	3.375***
HSZ	-759.9	-.513	-5432.9	-3.914***
FISA	-167.8	-1.720*	62.0	.698
ATCM	1002.4	1.191	-385.7	-.387
<i>N</i>	120		120	
<i>R</i> ²	0.22		0.21	
<i>Adj-R</i> ²	0.15		0.13	
<i>F-ratio</i>	3.07		2.78	
<i>F-probability</i>	0.002		0.004	

Note: * Statistically significant at the 10% level.

** Statistically significant at the 5% level.

*** Statistically significant at the 1% level.

The impact of human development training conducted by CBFM partner NGOs helped the organized fishermen in gaining socio-political knowledge. Associational involvement encouraged them to participate actively in decision making on livelihood issues. There is also evidence that they have capability to influence their access to livelihood assets.

The coefficient for the social capital factor is significant for the project area, as expected from community based management. The regression model in Table 5 reports positive coefficient for social capital (2619) and its associated *t*-statistic is significant at the 5% level. The fishers in the project area have got easier access to credit due to their institutional identity. Access to financial capital is not only from CBFM project NGOs, other organizations are also providing credits. Grootaert and Narayan (2004) found that greater access to credit is a spillover effect due to high social capital than human capital in Bolivia.

The coefficient of fishing area is negatively (-167.8) linked but is a moderately significant (at 10% level). The implication of negative relationship of fishing area is that capture fisheries has been restricted by land owners. The land owners have introduced either fish farms called *gher* or cultivate rice crops. The organized community established fish conservation strategies such as setting up fish sanctuaries and imposed closed season ban on fishing for 2-3 months during fish breeding periods. In the control sites the fishing area coefficient is positive (62.0) but is not a significant determinant of income.

Land is a scarce resource in Bangladesh. The coefficients are negative and not significant in the project (-19.4) as well as in the control sites (-3.8). The poor fishermen in the project areas are involved in farming mainly in share cropped land but their crops are subject to natural calamities. Poor people have limited access to financial assets due to their lack of ownership of other assets. The very poor people are not eligible for formal credit from banks and NGOs. The coefficient for credit in both project and control areas are positive (0.576 and 0.693 respectively) but are not significant predictor for household income. Although credit is very important for the participants, it is not a significant contributor to household income. The possible reason is that the poor participants used their credit for non-productive activities such as household consumption, health care and festivals.

The physical asset coefficient of both project and control areas are negative and are not significant predictors of household income. The important implication of this relationship is that the poor people cannot retain their assets during crisis periods. Flooding and other natural hazards occur almost every year, causing people to sell or mortgage their assets to meet their basic needs such as, food, house repair and health care. Bird and Shepherd (2003) reported a similar scenario in Zimbabwe. A severe natural shock could wipe out productive assets which results in increased livelihood vulnerability and reduced productivity.

4. CONCLUSIONS AND POLICY IMPLICATIONS

In this paper the impact of CBFM on household's welfare is examined by investigating how the various types of assets contribute to household income. Comparisons were made between the sample households from project and control areas.

The study shows that poor people are dependent on fishing for income and subsistence. They have multiple sources of income, although fishing is the important earning activities for project participants. Project participants have exclusive use rights to the fisheries due to strong local community based organizations facilitated by NGOs and government (DOF). Employment in alternative activities has increased to a greater extent particularly in low paid labouring sectors. The low educational attainment of household head in both project and control sites is the reason why they are not employed in highly paid or non-farm employment. Ownership of capital assets is poor to support their livelihood.

The project households received higher amount of credit from multiple sources compare to the control households, and they could utilize the credit for productive activities. The CBFM provided training to the participants on awareness building and leadership development which are important for empowering the fishers. Participation in decision making on fisheries management has increased in the project sites indicates that they have more incentive to work in community based fisheries activities.

Principal Component analysis was used to examine the important factors contributed to household wellbeing due to CBFM project intervention. Social capital and financial capital has contributed significantly to household livelihood assets in the project area compare to control area. Natural capital (area of fishing) has contributed moderately to households in project area.

However, there was only a slight improvement observed in physical and human capital due to the CBFM project implementation.

The regression results indicate that the social capital, employment and area of fishing are important predictors of household income in the project area. In the control areas, education, household size and age variables are significant. The contribution of social capital factor is important to household income which indicates that this variable play a very important role in poverty alleviation in Bangladesh.

The important policy implications of this study is that the user groups of community based organizations who primarily depend on fisheries for their livelihood need strong facilitation by NGOs and government to establish access to the fisheries. Posting of experienced staff of DOF and NGOs is vital for the success of CBFM. Fisher households require assets for their security during crisis periods. There would be a strong need for establishing a social safety net so that poor fishers feel secure to use their physical assets as investments. Provision of public works at critical times may be a good option for creating employment opportunities.

Health services are extremely poor in Bangladesh and the poor people spend a good portion of income for health care. The provision of free and effective primary health care facilities at the village level should be given priority. Since the poorest fishers rely on fishing for income and their nutritional needs, the security of access to the fisheries resources need to be taken as a priority in future policy formulation in natural resources management.

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