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Constraints and Perceived Scope for Practicing Small Scale Aquaculture in Thakurgaon District, Bangladesh

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Abstract

The aims of the study were to determine the extent of constraints as faced by the farmers engaged in small scale aquaculture, to explore the relationships of selected characteristics of fish farmers with their faced constraints, and to explore the perceived scope of small scale aquaculture. The study was conducted in Ranisonkail upazila under Thakurgaon district of Bangladesh. A sample of 92 fish farmers were selected from a list of 276 fish farmers using multi-stage random sampling method. Necessary data were collected by a structured interview schedule during 1st March to 30th April 2014. A constraint facing index (CFI) for each constraint was developed to compare among the constraint items. Among the total 19 constraints "unavailability of fish fries in proper time" occupied the highest (CFI= 229) score and stood top in the ranking while "disturbance from otter and predatory birds" had the lowest (CFI= 74) score. Majority (72.8 percent) of the respondents had medium constraints, 18.5 percent had low constraints and 8.7 percent had high constraints for practicing small scale aquaculture. Scored Causal Diagrams (SCDs) explored that the main root causes of 'low practicing small scale aquaculture' identified were 'unavailability of fish fries in proper time'; 'lack of training and education' and 'rigid rules for getting credit'. Among the eleven selected characteristics of the farmer's farm size, area under aquaculture, knowledge of aquaculture, training received and extension media contact showed significantly negative relationship with the constraints. On the other hand age, educational qualification, family size, annual family income, income from aquaculture and organizational participation of the respondents did not show any significant relationship with their constraints. Main scope for practicing small scale aquaculture as mentioned by the respondents 'small scale aquaculture is profitable' followed by 'nutritional requirement'.

Key words: *Constraints, scope, small scale aquaculture, scored causal diagram*

Introduction

Aquaculture is one of the fastest growing food producing sectors in Bangladesh with an average annual growth rate of over 6 percent during the last three years (DoF, 2012). Small scale aquaculture represents the backbone of many rural communities in many countries and it forms the basis that provides livelihoods of many people living in the areas. In the Bangladesh context, the small scale aquaculture is characterized by having contribution to rural income, employment, nutrition and food security (Ray *et al.*, 2004). Among the small scale aquaculture landholders, 34 percent live below the poverty line. They have access to moderate amounts of land for farming (0.5-1.0 ha), often including fishpond, they tend cattle and small livestock, and live in basic houses. They do not produce much surplus. They may have some access to financial capital and credit, but are vulnerable to crisis conditions. Farmers in small scale

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aquaculture may also be categorized as medium sized landholders, those who possess l-2 ha of pond, produce some surplus, and employ seasonal wage laborers (ADB, 2005).

Although small scale aquaculture production is profitable, concerns have arisen about its long term sustainability because of many constraints that hinder the progress of this sector. Overcoming the hindrance of small scale aquaculture will help the fish farmers in carrying out profitable fish farming which endorses the economic development of the country. So find out the constraints in small scale aquaculture is prime necessity to explore the sector. In Bangladesh only few researches are available in the area. Parvez (2009) identified important constraints faced by small scale fish farmers in Bangladesh. More location specific studies are also important. In view of the circumstances, the present study was undertaken (i) to determine the extent of constraints for practicing small scale aquaculture; (ii) to explore the relationship between the selected characteristics of the fish farmers and their constraints associated with practicing small scale aquaculture; and (iii) to identify the perceived scopes for practicing small scale aquaculture.

Methodology

Locale, population and sample: Thakurgaon district was selected as the locale of study because of the fact that it is a major area of practicing small scale aquaculture. Ranisonkail upazila was selected purposively as the specific location of the study. Ranisankail upazila consists of eight unions among which four unions, namely Nakmarad, Bachor, Hossaingaon and Lehemba were selected randomly. An up-to-date list of fish farmers was collected from the concerned Upazila Fisheries Officer (UFO). In this study, a total of 276 fish farmers constituted the population. To make a representative sample, one-third of the population was randomly selected by multi-stage random sampling method from the population of each of the unions i. e the sample size became 92.

Measurement of variables: Constraints for practicing small-scale aquaculture were the main focus of this study. At the same time, the following characteristics of the farmers were selected to explore relationships: age, educational qualification, family size, farm size, area under aquaculture, knowledge of aquaculture, annual income, income from aquaculture, training received, extension media contact, and organizational participation.

A total of 19 constraint items were considered to measure constraints face by the fish farmers in small scale aquaculture. Each farmer was asked to indicate the extent of difficulty caused by each of the constrains by checking any of 4 responses such as ‘high’, ‘medium, ‘low’, ‘not at all’ and weightage were as 3, 2, 1 and 0, respectively. An overall constraint score of small scale aquaculture was computed for each farmer by adding his constraints scores in all 19 constraints items. Thus the possible range of constraints facing score for each constrains can range from 0 to 3 and the possible range of overall constraints facing score for 19 constraints can range from 0 to 57. Here, 0 indicates no constraints for small scale aquaculture practice and 57 indicate very high constraints for small scale aquaculture practice. In order to make comparison among the constraints items, a

Constraints Facing Index (CFI) was prepared by using the following formula:

$$CFI = (C_h \times 3) + (C_m \times 2) + (C_l \times 1) + (C_n \times 0)$$

Where,

C_h= Number of responses indicating 'high' constraints

C_m= Number of responses indicating 'medium' constraints

C_l= Number of responses indicating 'low' constraints

C_n= Number of responses indicating 'not at all' constraints

Thus, the CFI score of a respondent varied from 0-276 where 0 indicates not at all constraints and 276 indicates high constraints level. Similar formula was also used by Noman (2012) and Parvez (2009).

Scored Causal Diagrams (SCDs) of Participatory Farm Management (PFM) were used to cross-check constraints for practicing small scale aquaculture (Galpin *et al.*, 2000). SCDs were used to examine in detail the causes and effects of constraints, to identify the 'root' cause which need to be addressed and to analyze the relative importance of the constraints.

Perceived scope for practicing small scale aquaculture: A group of 20 respondents to identify the perception of scope for practicing small scale aquaculture a Focus Group Discussion (FGD) was conducted. The group was divided into four sub-groups and each sub-group was asked about their perception regarding scope for practicing small scale aquaculture. Each group was allowed to work through discussion among themselves. The respondents were asked to indicate the importance of their perception about scope by mentioning whether it was high, moderate, low or not at all with the corresponding scores of 3, 2, 1, and 0 respectively. A 'Perception Index of Scope' was prepared for analyzing the degree of severity using the following formula (Noman, 2012):

$$PIS = f_h \times 3 + f_m \times 2 + f_l \times 1 + f_n \times 0$$

Where,

PIS = Perception Index of Scope

f_h= frequency of respondents mentioning the perception of scope as 'high'

f_m= frequency of respondents mentioning the perception of scope as 'moderate'

f_1= frequency of respondents mentioning the perception of scope as 'low'

f_n= frequency of respondents mentioning the perception of scope as 'not at all'

Thus, the PIS score of a respondent varied from 0-276 where 0 indicates not at all perception and 276 indicates high perceived score.

Instruments of data collection: For collecting data, an interview schedule was prepared according to objectives of the study. Closed and open form questions were included in the interview schedule. Focus Group Discussions (FGDs) were also arranged with the selected small fish farmers at the homestead. These group discussions were organized to identify and cross-check the constraints for practicing small scale aquaculture. Finally, data were collected from the study area during 1st March to 30th April 2014.

Data collection, processing and analysis: Before starting collection of data, the researcher met the respective District Fisheries Officer (DFO), Upazila Fisheries Officer (UFO) and Assistant Fisheries Officer (AFO). The collected data was compiled, tabulated, coded and analyzed for statistical analysis according to the objectives of the research. Descriptive statistic such as range, mean, number, percentage, standard deviation and rank order was used wherever necessary in

describing the selected variables. Pearson's Product Moment Correlation Co-efficient (r) was used to examine the relationships of independent variables for practicing small scale aquaculture (dependent variable). Statistical Package for Social Science (SPSS) was used to analyze the data.

Findings and Discussion

Constraints in Practicing Small Scale Aquaculture

Overall constraints in practicing small scale aquaculture: The respondent's constraints facing scores in all 19 selected constraints could range from 0 to 57. However, the observed constraints scores ranged from 26 to 52 with an average of 42.14 and standard deviation of 5.67. Based on their overall constraint scores, the respondents were classified into three categories as presented in Table 1.

Table 1 Categorization of the respondents according to their overall constraints facing in small scale aquaculture

Categories	Respondents		Mean	SD
	Frequency	Percent		
Low (up to 36)	17	18.5	42.14	5.67
Medium (37-48)	67	72.8		
High (>48)	8	8.7		
Total	92	100.0		

Data in the Table 1 indicates that majority (72.8 percent) of the respondents had faced medium constraints while 18.5 percent had faced low constraint and only 8.7 percent had faced high constraints in small scale aquaculture. The majority of the farmers (91.3 percent) clearly indicated that they faced low to medium constraints in small scale aquaculture.

Comparison among the individual constraints: For having a better understanding regarding constraints in practicing small scale aquaculture, it is necessary to have an idea about the comparative constraint facing in 19 selected constraints. For this purpose, a Constraint Facing Index (CFI) was computed. The computed CFI of the 19 selected constraints ranged from 74 to 229 against a possible range of 0 to 276 which are shown in Table 2.

Data in table 2 revealed that 'unavailability of fish fries in proper time' was major constraint for practicing small scale aquaculture. During April to June season; when farmers need fish fries for their pond, in most cases they do not get fish fries in proper time and proper quantity. Though they get in proper time but the amount is very little, qualities are very poor and cost remain very high. So, it is a immense problem for them in practicing small scale aquaculture and this constraint ranked as first with CFI value of 229. 'Lack of capital/insufficient fund' was second major constraints for practicing small scale aquaculture. For small scale aquaculture, farmers need instant cash money; most of the farmers' do not generally possess it. So, it is a massive problem for them in practicing small scale aquaculture and this constraint ranked as second with CFI value of 225. The third ranked constraint in the rank table is 'High price of fertilizer, feed and other inputs' with CFI value of 218. "Disturbance from otter and predatory bird" is the last ranked constraints in the rank table with CFI values of 74. The 18th and 17th ranked constraints in the rank table are "Problem of weeds/ shedding/ sunlight", "Fluctuation of market price" with CFI value of 88 and 136 respectively.

Table 2 Rank order of the selected constraints in practicing small scale aquaculture

Constraints	Extent of constraints by frequency				CFI*	Rank
	High	Moderate	Low	Not at all		
Lack of capital/ insufficient fund	55	25	10	2	225	2
Low profitability despite of higher investment	27	25	35	5	166	15
Lack of scientific technical knowledge	47	25	20	0	211	5
Poor access to training	45	22	25	0	204	6
Multi-ownership of pond	12	56	14	10	162	16
More preference in rice cultivation than small scale aquaculture	36	31	15	0	185	11
Unavailability of fish fries in proper time	55	27	10	0	229	1
Natural calamities/ hazards/ high temperature for fish culture	32	21	33	6	171	14
High price of fertilizer, feed and other inputs	68	0	14	10	218	3
Adulteration of feed	45	21	15	11	192	9
Water crisis in dry season	40	32	17	3	201	7
Security problem	50	25	17	0	217	4
Inbreeding problem revealed after fry buying	35	15	42	0	177	13
Occurrence of diseases	41	30	15	6	198	8
Disturbance from otter and predatory birds	0	22	30	40	74	19
Problem of weeds/shedding/ sunlight	14	8	30	44	88	18
Fish transportation	30	35	20	7	180	12
Fluctuation of market price	11	22	59	7	136	17
Fish preservation	25	46	21	10	188	10

*CFI: Constraints Facing Index

Constraints faced by the respondents in practicing small scale aquaculture were cross-checked through making Scored Causal Diagrams (SCDs) of Participatory Farm Management (PFM). Constraints were discussed with the respondents, assuming the 'end problem' being 'low practicing of small scale aquaculture'. Firstly, the constraints mentioned by the respondents were listed, secondly diagrams were drawn by them on the plain ground to show causal relationships between the constraints, and finally scoring of selected constraints were performed again by them. In this way, SCDs was prepared by the group of respondents (Figure 1). The constraints identified by the group has been listed here with their relative importance indicated by the original score numbers as shown inside the parentheses.

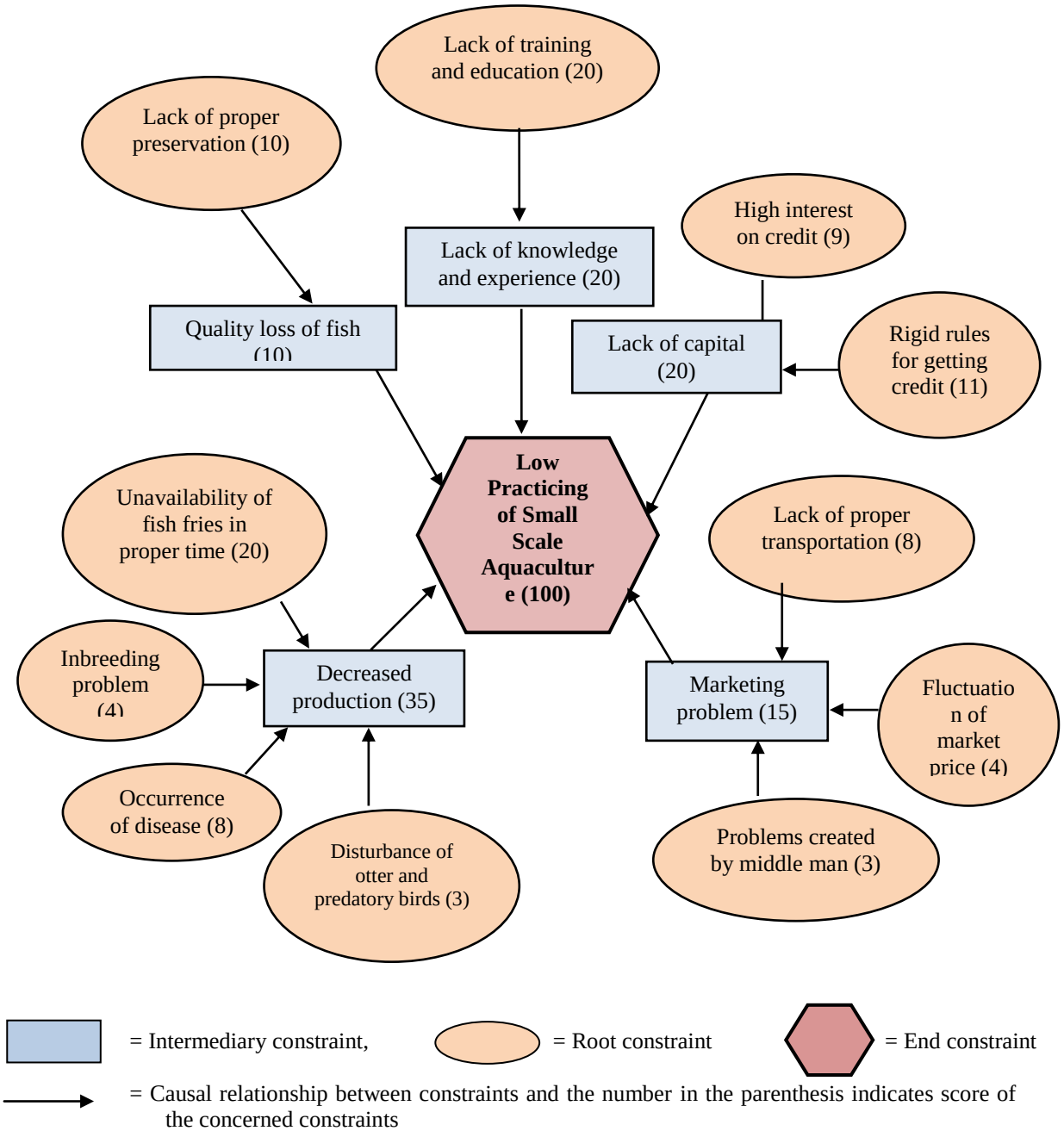

Figure 1 Scored Causal Diagram (SCD) prepared by the small scale aquaculture

End constraint: low practicing of small scale aquaculture (100)

Intermediary constraints: decreased production (35), lack of knowledge and experience (20), lack of capital (20), marketing problem (15), and Quality loss of fish (10).

Root causes: unavailability of fish fries in proper time (20), lack of training and education (20), rigid rules for getting credit (11), lack of proper preservation (10), high interest rate on credit (9), lack of proper transportation (8), occurrence of disease (8), fluctuation of market price (4), inbreeding problem (4), disturbance of otter and predatory birds (3), and problems created by middle man (3).

On exploration of the root causes of small scale aquaculture, eleven root causes have been identified by the fish farmers. Among the 'root' causes 'unavailability of fish fries in proper time (20)' and 'lack of training and education' got the highest score (20)' and was the most crucial root causes. Then 'rigid rules for getting credit' was the second root cause with a score of 11. It was highly logical because lack of training caused lack of knowledge, experience and unavailability of fish fries in proper time resulting in constraints facing and accordingly there was low practicing of small scale aquaculture.

Though the other root causes such as 'high interest rate on credit', 'lack of proper transportation' and 'disturbance of otter and predatory birds' bear less significance but these could never be avoided. These cause also some sorts of influences on the low practicing of small scale aquaculture.

Relationships between the selected characteristics of the fish farmers and their constraints in small scale aquaculture: Co-efficient of correlation (r) was used to explore the statistical significant relationship between the selected characteristics of the fish farmers and their constraints. The summary result of correlation test is presented in Table 3.

Table 3 Correlation coefficient between farmers' constraints and their selected characteristics

Selected Characteristics	'r' value with 90 d.f.
Age	-0.030
Educational qualification	-0.082
Family size	-0.057
Farm size	-0.330**
Area under aquaculture	-0.206*
Knowledge of aquaculture	-0.275**
Annual income	-0.132
Income from aquaculture	0.037
Training received	-0.426**
Extension media contact	-0.223*
Organizational participation	-0.005

** Correlation is significant at the 0.01 level

* Correlation is significant at the 0.05 level

Results in Table 3 revealed that farm size had negative significant correlation with the fish farmers' constraints in practicing small scale aquaculture. It may be concluded that farmers with larger farm were likely to have lower of constraints in small scale aquaculture. Similar relationship was found by Nahid (2005). Similarly area under aquaculture, knowledge of aquaculture, training received and extension media contact also had negative significant correlation with the fish farmers' constraints in practicing small scale aquaculture. The results might be due to that more area under aquaculture, more knowledge of aquaculture, more training received and more extension media contact helps to overcome the constraints in practicing small scale aquaculture. Similar relationship was found by Parvez (2009) and Karmaker

(2004). The remaining characteristics (age, educational qualification, family size, annual income, income from aquaculture and organizational participation) of the respondents did not show any significant relationship with their constraints in practicing small scale aquaculture.

Perceived scope for practicing small scale aquaculture: The respondents expressed their opinion regarding scope for practicing small scale aquaculture and the "Perception Index of Scope" has been presented in Table 4. The observed PIS value ranged from 182-262 against the possible range of 0-276.

Table 4 Perception Index of Scope (PIS) for practicing small scale aquaculture

Statements	Extent of perception for scope				PIS	Rank
	High	Moderate	Low	Not at all		
Small scale aquaculture (SSA) is profitable	78	14	0	0	262	1
SSA has better marketing facilities	51	22	14	5	211	4
SSA may improve nutritional status requirement	75	14	2	1	256	2
Creates employment opportunity for youth	74	16	3	0	254	3
Small scale aquaculture is sustainable	26	44	16	6	182	5

The highest perceived scope for practicing small scale aquaculture was found that 'Small scale aquaculture is profitable'. It was found that farmed tilapia production increased from 4,000 to 138,000 metric tons between 2002 and 2012 (Financial Express, 2013). By 2015, production is expected to reach 150,000 metric tons. Fish (including shrimp and prawn) is the second most valuable agricultural crop in Bangladesh. Official statistics estimate total fish production of 3.26 million tons, of which aquaculture accounts for 39%, or 1.06 million (DoF, 2013). Today people are more willing to invest in aquaculture sector for its profitable production. This is the reason; it appeared as 1st position with PIS of 262.

The lowest perceived scope was found **'**Sustainability of the small scale aquaculture'. Due to the result of poor management, further efforts are needed to improve resources use and appropriate environmental management. In the study, the farmers mentioned it at 5th PIS with the score 182.

Conclusions

About three-fourths (72.8 percent) of the farmers faced medium constraints, regarding overall constraints of practicing small scale aquaculture. Therefore, the constraints of practicing small scale aquaculture would not be minimized unless the capacity of farmers is adequately improved by the help of concerned public and private fisheries organizations. The knowledge on aquaculture of the respondents are very low, so, initiative can be taken in this regards, extension media contact can be increased which increase their knowledge, skill, and ultimately decrease constraints for practicing small scale aquaculture. For this fisheries sector

of the Farmers Information and Advice Centre (FIAC) can play an important role. Initiatives can be taken for organizing training on small scale aquaculture for farmers so that they can minimize their constraints in this regards easily.

As majority of the farmers were found to face medium constraints in practicing small scale aquaculture, The Ministry of Fisheries, and all other concerned departments should carefully observe the socioeconomic situation of the small scale aquaculture in the study area and come up with appropriate programs that the farmers can maximize their profit from aquaculture. Proper guidance and necessary help should be given to small fish farmers so that they can overcome their constraints of the financial inability. The concerned authorities should increase the availability of credit from any commercial banks or NGOs with low interest. The DoF and other NGOs should strengthen their extension services to overcome their constraints. In case of extension services, adequate motivational program through meeting at result demonstration, group discussion and other educational activities should provide for practicing small scale aquaculture to increase farmers' knowledge and extension media contact.

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