Exploring Impact of Fish Farming in Changing Livelihood Status of Fishermen in Bangladesh

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Authors’ contributions

This work was carried out in collaboration among all authors. Authors SS and MNASM did the conceptualization, data collection and analysis, original draft preparation, funding acquisition and supervision. Review and editing by author MJH. All authors have read and agreed to the published version of the manuscript.

ABSTRACT

The current study was piloted in Muktagachha sub-district, Mymensingh District, Bangladesh to explore the impact of fish farming in changing livelihood status of the fishermen. Data was collected from 100 fishermen (10% of total population) by using a well-structured interview schedule. Sixteen of socio-economic characteristics of fishermen were selected as livelihood status features. Correlation coefficient (r) was employed to analyze the collected data. The findings exposed that majority of the respondents (58.3%) moderately altered their livelihood status as a result of fish farming, while 31.7% touched higher level and just 10% lowered their livelihood status. Out of sixteen livelihood status aspects, four (level of education, farm size, knowledge on fish farming, and annual income) were positively and significantly correlated with their livelihood status changes through fish farming. The study provides approvals for the planners to address the above-mentioned influential issues of the fishermen to improve their livelihood status in the study area. Moreover, non-formal educational programmes, proper training to enhance knowledge and skill on fish farming, appropriate extension services etc. could play an important role in increasing the livelihood status of the fishermen.
Keywords: Fish farming; fishermen; livelihood status; Bangladesh.

1. INTRODUCTION

Bangladesh is a Southeast Asian riverine country with one of the highest population densities in the world [1]. Fisheries sector, a potential and productive industry, contributes largely for the agrarian economic development of Bangladesh [2,3]. Globally, Bangladesh secured 3rd position in inland fish production and 5th in aquaculture production [2,4]. There are three types of aquaculture practices in Bangladesh such as inland capture, inland culture, and marine fisheries [5,6]. According to the Fisheries Resource Survey System [7], Bangladesh is currently self-sufficient in fish production and has begun to gain international attention as one of the world’s largest fish producers.

Fisheries sector contributes around 3.65% to the national gross domestic product (GDP) and 23.81% to the agricultural GDP [8] in the country. The fish and fish products supply more than 80 percent of the animal protein for Bangladeshi people [9]. Fish farming, a source of livelihood, provides employment opportunities to a large number of people [2,10,11,12]. Globally, about 880 million people depend on fish farming for their livelihoods [13,14], while in Bangladesh the number is more than 18 million [7].

In Bangladesh, fishermen groups are a vital community for upgrading the national economy [8]. Yet, they are one of the most vulnerable communities in the country who live hand to mouth [15]. They have to struggle for livelihood and their living conditions are degrading regularly [16]. The livelihood is a sense of security and trust if it can withstand and recover from shocks while maintaining or improving its resources and capabilities in the current reality [15]. As a result, assessing the changes in livelihood status of fishermen due to fish farming is a demand of time to improve their socio-economic condition.

Considering the above circumstances, a survey was carried out by the researchers to explore the impact of fish farming in changing the livelihood status of fishermen. The specific objectives of the present research were: to evaluate the socio-economic characteristics (livelihood status features) of the fishermen; to determine the changes in livelihood status of the fishermen; and to explore the relationships between socio-economic characteristics and changes in livelihood status of fishermen through fish farming. The results of the study may contribute significantly in adopting proper actions for the prosperity of the society as well as socio-economic advancement of fishermen in the study area.

2. METHODOLOGY

2.1 Study Location

The present study was conducted in Muktagachha sub-district, Mymensingh District, Bangladesh (Fig. 1). The sub-district is located between 24°75’ and 24°83’ North latitudes and between 90°26’ and 90°67’ East longitudes [17]. Mymensingh District is well-known for fish cultivation [18,19], where people mostly rely on fish farming [20,5] to maintain their livelihood.

Fig. 1. Map of Mymensingh district showing the study location
2.2 Population and Sample Size

The farm households depend on fish farming for their livelihood constituted the population of the current study. According to the data of sub-district fisheries office (local level organization providing extension services), there were a total number of 1000 fishermen in Muktagachha sub-district, Mymensingh District, Bangladesh, out of which, 100 fishermen were selected as sample for the study using Yamane’s formula [21], with 95 % confidence interval and 10 % level of precision (Equation 1).

\[ n = \frac{N}{1 + Ne^2} \]  

(1)

Where, \( N \) represents total vegetable farmers in the study area, \( n \) represents sample size and \( e \) represents level of precision.

2.3 Data Collection and Analysis

A structured interview schedule was used to obtain data from the fishermen through a face-to-face interview with them. The interview schedule comprised of 16 socio-economic features (livelihood status aspects) of the respondents i.e., age, level of education, family size, farm size, knowledge in fish farming, training exposure, annual income, experience in fish farming, housing condition, electricity coverage, drinking water facilities, health status, sanitation status, organizational participation, extension media contact, and savings. On the basis of suggestions from the experts in fish farming including academia, researchers, and extension agents, the interview schedule was revised and modified to make a complete interview schedule.

During January to May 2019, necessary data were collected from the fishermen. The collected data were coded and analyzed using Statistical Package for Social Science (SPSS) var. 20 and Microsoft Excel ver. 13. Tables and figures were utilized to show and interpret data. The socioeconomic features were presented in percentage (%) as a form of descriptive statistics. To explore the relationship between the explanatory variables and focus variable, Pearson’s product-moment correlation coefficient (\( r \)) [22] was computed (Equation 2).

\[ r_{xy} = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}} \]  

(2)

Where,
\( r_{xy} \) = Pearson’s product-moment correlation coefficient
\( \bar{x} \) and \( \bar{y} \) = Means of the variables \( x \) and \( y \), respectively

3. RESULTS AND DISCUSSION

3.1 Socio-economic Characteristics of the Fishermen

The socio-economic characteristics (livelihood status features) of the fishermen are presented and discussed here in the form of Table and Figure.

3.1.1 Age

Age distribution helps to estimate the potentiality of human resources. The investigation showed that majority of the fishers belongs to the medium aged (50%), while youth belongs to 28.3% and 21.7% of them were old aged (Table 1). It indicates that number of workable people was high. Results of the current study are similar with the findings of Ali et al. [23], who stated that 50% of the fishers belong to medium aged group in Mymensingh District, Bangladesh.

3.1.2 Level of education

In our present study, it was noticed that fishermen had diverse level of educational background. About 56.7% fishermen had primary education, while 31.7% received secondary education and just 3.3% received higher education. The rest of them (8.3%) were illiterate (Table 2). Our findings are similar with the findings of Sufian et al. [24] who had worked with fishers’ communities.

3.1.3 Family size

Family size of the fishermen were divided into three categories such as nuclear family medium family and joint family (Fig. 2). The data represent that majority (48%) of the respondents belongs to nuclear family followed by medium (42%) and joint family (10%) (Fig. 3). The above findings are similar with the result of Ali et al. [23], who reported that about 42% of the fishers lived in nuclear family, while about 57.50% in the joint family in Mymensingh District, Bangladesh.
Table 1. Age distribution of the fishermen

| Age (years)       | Respondent (%) |
|-------------------|----------------|
| Youth (up to 35)  | 28.3           |
| Medium (36-50)    | 50             |
| Old (above 50)    | 21.7           |

Table 2. Level of education of the fishermen

| Level of education (years) | Respondent (%) |
|----------------------------|----------------|
| Illiterate (0)             | 8.3            |
| Primary level (1-5)        | 56.7           |
| Secondary level (6-12)     | 31.7           |
| Higher (above 12)          | 3.3            |

Fig. 2. Family size of the fishermen

Fig. 3. Farm size of the fishermen
3.1.4 Farm size

Based on farm size, the fishers were classified into three categories which showed that the majority of the respondents as 57% had marginal sized farm, while 17% had medium farm and 26% had small sized farm (Fig. 3).

3.1.5 Knowledge on fish farming

The survey indicated that majority of the fishermen (70%) had medium knowledge, while about 30% had high knowledge on fish farming (Fig. 4). There was no one with low knowledge on fish farming.

3.1.6 Training exposure

The findings showed that 43.3% of the respondents had no training, while 23.4%, 25% and 5% received short-term, mid-term, long-term training, respectively (Table 3). Training plays a vital role in increasing knowledge and skills of the fishermen to improve their livelihood through profitable fish production [25].

3.1.7 Annual income

The findings displayed that about 66.66%, 23.33% and 10% of the respondents had moderate, high and low annual income (Table 4). However, majority of the respondents had moderate to high annual income due to medium family size along with more earning members and upgrading socio-economic conditions as well. Our findings are supported with the findings of Bappa et al. [26].

3.1.8 Experience on fish farming

The results specified that 35% of the fishermen had low experience, while 41.7% and 23.3% had medium and high experience in fish farming, respectively (Table 5). Here, more than half of
the respondents had medium level of experiences may be due to medium aged and collective involvement in fish farming.

3.1.9 Housing condition

The condition of houses of the fishermen is an indicator of their economic status. The majority of the respondents 47% had tinshed, while 17% had kacha, 26% had semi-paka but only 10% had paka or RCC building (Fig. 5). A researcher Mahmud et al. [27] reported similar findings in his study.

3.1.10 Electricity coverage

The results revealed that out of 100 interviewed, about 80% of the fishermen had electricity access, while minority about 20% had none (Fig. 6) which represents a better electricity consumption by the fishers in the survey area.

Table 5. Experience in fish farming of the fishermen

| Experience in fish farming (years) | Respondent (%) |
|-----------------------------------|----------------|
| Low (up to 10)                    | 35             |
| Medium (11-20)                    | 51.7           |
| High (21-30)                      | 23.3           |

Fig. 5. Housing condition of the fishermen

Fig. 6. Electricity coverage for the fishermen
Fig. 7. Drinking water facilities status of the fishermen

Fig. 8. Health status of the fishermen

Fig. 9. Sanitation status of the fishermen
3.1.11 Drinking water facilities

The clean and safe drinking water is the most important elements of a society. The study showed that 66.7% of the farmers had own tube-well but 33.3% collected drinking water from neighbours’ tube-well (Fig. 7). So, the availability of clean and safe drinking water for the fishers in the study area was good enough. Kabir et al. [16] found similar findings.

3.1.12 Health status

The findings revealed that 46.7% of the fishermen were dependent upon village doctors, while 5% were on kobiraj but majority (48.3%) received health service from Government sub-district hospital (Fig. 8). For fishing community, Ali et al. [23], Khan et al. [15] and Pravakar et al. [28] reported more or less similar condition in their investigations.

3.1.13 Sanitation status

During the survey, it was observed that three types of toilets were used by the fishermen such as i) Kacha toilet made of bamboo with leaf shelter with inadequate drainage disposal, ii) Semi-paka toilet made of tin or wood with inadequate drainage disposal, and iii) Paka toilet made of brick with good drainage disposal. About 3.5% fishers had unhygienic (kacha), while 68.3% had semi-hygienic (semi-paka) and only 28.2% had hygienic (paka) toilet (Fig. 9) which indicates a poor sanitary condition of the fishermen in the study area. A study piloted by Ali et al. [23] observed similar findings.

3.1.14 Organizational participation

Our survey revealed that 40% of the respondents had no organizational participation, whereas 25% had medium, 33.3% had low organizational participation, and only 6.7% had high organizational participation (Table 6) that may be due to unconsciousness and lower level of education.

3.1.15 Extension media contact

More than half of the respondents (60%) had low extension media contact, while 35% had medium but 5% had high media contact (Table 7). In current study area, a large number of fishermen had low extension media contact which may be caused by communication gap between the fishers and extension agent.

3.1.16 Savings of the fishermen

In the present study area, only 53% fishermen had savings from fish farming, business, service and other activities and 47% had no savings due to poor resources and household expenses (Fig. 10).

3.2 Livelihood changes of the fishermen through fish farming

The extent of livelihood changes of the fishermen has been presented in the Figure 11. The results indicate that more than half of the respondents (58.3%) moderately altered their livelihood status as a result of fish farming, while 31.7% touched higher level and just 10% lowered their livelihood status. The findings lead to explain that the majority of the fishermen (90%) in the study area faced medium to low level of changes in their livelihood status. The researchers Pravakar et al. [28], Kabir et al. [16] and Khan et al. [15] found similar findings in their respective studies.

3.3 Correlation between socio-economic characteristics and changes in livelihood status of fishermen through fish farming

Pearson’s product moment correlation of coefficient (r) present relationship between explanatory and focus variables (Table 8). Findings show that four (4) variables out of sixteen (16) explanatory variables, i.e., level of education, farm size, knowledge on fish farming, and annual income of fishermen exposed a significant positive relationship with the focus variable. As a result, the findings suggest that increasing all of the previously stated factors will enhance the level of changes in livelihood status of fishermen.

The results show that the value of ‘r’ between level of education and level of changes in livelihood status of the fishermen through fish farming was 0.372 which designates a positive and highly significant relationship exist between the concerned variables. This is due to educated persons of the study area have frequent contact with extension agents, Television programs, which lead them towards better culture method and increase livelihood status compared to the individuals with less educational background. Smrity et al. [29] found similar findings in her study.
The relationship between farm size and level of changes in livelihood status of the respondents through fish farming were found to be positive and significant ($r = 0.584$) (Table 8) which shows if farm size of fishermen increases, then their livelihood status will upgrade. Our findings are similar with the results of Haque et al. [10] and Smrity et al. [29]. On the other hand, the value of ‘$r$’ between knowledge in fish farming and level of changes in livelihood status of the fishermen was 0.311. As a result, the positive and significant correlations between the variables specify that with increase of knowledge in fish farming, the livelihood pattern of fishermen will be improved also. Finally, it was noticed that annual family income had a positive correlation ($r = 0.752$) with the level of changes in livelihood status of the respondents through fish farming (Table 8). Sufficient annual income supports the fishermen to buy necessary materials for their households. Thus, their livelihood status improved than the low-income groups. A study conducted by Haque et al. [10] observed similar results.

**Table 6. Organizational participation of the fishermen**

| Organizational participation (scores) | Respondent (%) |
|--------------------------------------|----------------|
| No participation (0)                 | 40             |
| Low (1-10)                           | 33.3           |
| Medium (11-20)                       | 25             |
| High (21-30)                         | 6.7            |

**Table 7. Extension media contact of the fishermen**

| Extension media contact (scores) | Respondent (%) |
|---------------------------------|----------------|
| Low (up to 10)                  | 60             |
| Medium (11-20)                  | 35             |
| High (20-30)                    | 5              |

**Fig. 10. Savings of the fishermen**

**Fig. 11. Livelihood changes of the fishermen**
Table 8. Relationships between explanatory and focus variables

| Focus variable | Explanatory variables | Correlation coefficient (r) with 98 df |
|----------------|-----------------------|---------------------------------------|
| Changes in livelihood status of the fishermen through fish farming | Age | 0.134 |
| | Level of education | 0.372** |
| | Family size | -0.208 |
| | Farm size | 0.584** |
| | Knowledge on fish farming | 0.311* |
| | Training exposure | 0.243 |
| | Annual income | 0.752** |
| | Experience in fish farming | 0.002 |
| | Housing condition | 0.147 |
| | Electricity coverage | 0.96 |
| | Drinking water facilities | 0.122 |
| | Health status | 0.80 |
| | Sanitation status | 0.76 |
| | Organizational participation | 0.69 |
| | Extension media contact | 0.132 |
| | Savings | 0.73 |

Degrees of freedom (df) = 98, *Correlation is significant at the 0.05 level, **Correlation is significant at the 0.01 level

4. CONCLUSION

The study present concluded that an overwhelming majority of the fishermen (90%) touched moderate to high level of livelihood status through fish farming in the study area which was not satisfactory. The degree of changes in livelihood status through fish farming is determined by the socio-economic characteristics of the fishermen. The level of education, farm size, knowledge on fish farming, and annual income of the fishermen were found more significant to the changes in livelihood status. There are several features like, proper housing condition, drinking water, electricity, sanitation facilities, etc. should be ensured by the local government for the fishermen. The findings specify a scope to work on those factors to improve livelihood status of the fishermen. Therefore, the study recommended that the concerned authority like Department of Fisheries (DoF) and other organizations (both GOs and NGOs) should provide well facilities, like training, easily accessible credits, and extension services, to the fishermen in order to make fish farming profitable that would enhance the livelihood status of the fishermen.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Sunny AR, Sazzad SA, Prodhan SH, Ashrafuzzaman M, Datta GC, Sarker AK, Rahman M, Mithun MH. Assessing impacts of COVID-19 on aquatic food system and small-scale fisheries in Bangladesh. Marine Policy. 2021;126: 104422. Available:https://doi.org/10.1016/j.marpol.2021.104422

2. Shamsuzzaman MM, Mozumder MMH, Mitu SJ, Ahamad AF, Bhyuian MS. The economic contribution of fish and fish trade in Bangladesh. Aquaculture and Fisheries. 2020;5:120-130. Available:https://doi.org/10.1016/j.aaf.2020.01.001

3. Paul B, Faruque H, Ahsan DA. Livelihood Status of the Fishermen of the Turag River, Bangladesh. Middle-East Journal of Scientific Research. 2013;18(5): 578-583. Available:https://doi.org/10.5829/idosi.mejsr.2013.18.5.81139

4. FAO. The State of World Fisheries and Aquaculture (Opportunities and Challenges), Food and Agriculture Organization of the United Nations, Rome; 2018.

5. Das AK, Uddin MN, Sarker MA, Mukta MZN, Mithun MNAS. Analyzing problems in fish fry marketing: A farm level study in Bangladesh. Discovery Agriculture. 2020;6(16): 159-168.

6. DOF. Fishery Statistical Yearbook of Bangladesh. Fisheries Resources Survey System, Department of Fisheries, Ministry of Fisheries and Livestock, Dhaka, Bangladesh; 2017.
7. FRSS. Fisheries Resource Survey System Bangladesh, Ministry of Fisheries and Livestock, People Republic of Bangladesh; 2017.
8. DOF. Fishery Statistical Yearbook of Bangladesh. Fisheries Resources Survey System, Department of Fisheries, Ministry of Fisheries and Livestock, Dhaka, Bangladesh; 2018.
9. Das MR, Ray S, Kumar U, Begum S, Tarafdar SR. Livelihood Assessment of the Fishermen Community in the South West Region of Bangladesh. Journal of Experimental Biology and Agricultural Sciences. 2015;3(4): 355-361. Available:http://dx.doi.org/10.18006/2015.3(4).353.361
10. Haque MZ, Sheheli S, Rahman MH, Mithun MNAS. Utilization of Aqua Drugs for Fish Health Management by the Fish Farmers: Field Level Analysis. Bangladesh Journal of Extension Education. 2019;31(1&2):69-75.
11. Sheheli S, Fatima K. Attitude of youth Pangas growers toward Pangas farming for improving their livelihood. Bangladesh Journal of Extension Education. 2013;25(1&2): 85-94
12. Rahman MM, Hossain MA, Tasnoova S, Ahamed F, Hossain MY, Ohtomi J. Fresh fish marketing status in the northwestern Bangladesh: Recommendations for sustainable management. Our Nature. 2012;10(1):128-136.
13. Allison EH, Delaporte A, Hellebrandt de Silva D. Integrating Fisheries Management and Aquaculture Development with Food Security and Livelihoods for the Poor. Report Submitted to the Rockefeller Foundation, School of International Development, University of East Anglia Norwich, UK; 2013;124.
14. Islam MM, Sallu S, Hubacek, K, Paavola, J. Vulnerability of fishery-based livelihoods to the impacts of climate variability and change: insights from coastal Bangladesh. Regional Environmental Change. 2014; 14(1):281–294. Available:http://dx.doi.org/10.1007/s10113-013-0487-6
15. Khan MR, Miah MI, Hossain MB, Begum A, Minar, MH, Karim R. Fish biodiversity and livelihood status of fishing community of Tista River, Bangladesh. Global Veterinaria. 2013;10(4): 417-423
16. Kabir KR, Adhikary RK, Hossain MB, Minar MH. Livelihood status of fishermen of the old Brahmaputra River, Bangladesh. World Applied Sciences Journal. 2012;16(6): 869-873.
17. Banglapedia. Muktagachha upazila. National Encyclopedia of Bangladesh; 2021. Available:https://en.banglapedia.org/index.php/Muktagachha_Upazila (Accessed on 18 September 2021)
18. Sheheli S, Kowsari MS, Mithun MNAS. Participatory Pond Fish Production as an Income Generating Activity: A farm level study. Bangladesh Journal of Extension Education. 2019;31(1&2):163-170.
19. Sheheli S, Fatema K, Haque S. Existing Status and Practices of Fish Farming in Trishal Upazila of Mymensingh District. Progressive Agriculture. 2014;24(1-2):191–201. Available:https://doi.org/10.3329/pa.v24i1-2.19172
20. Mithun MNAS, Kowsari MS, Sheheli S. Socioeconomic characteristics and constraints of participatory pond fish farmers in Mymensingh district, Bangladesh. International Journal of Agricultural Research, Innovation and Technology. 2020;10(2): 170-176. Available:https://doi.org/10.3329/ijarit.v10i2.51591
21. Yamane T. Statistics: An Introductory Analysis (2nd Eds.). Harper & Row, New York; 1967. Available:https://doi.org/10.2307/2282703
22. Pearson K. Notes on regression and inheritance in the case of two parents. Proceedings of the Royal Society of London. 1895;58: 240-242. Available:https://doi.org/10.1098/rspl.1895.0 041
23. Ali H, Azad MAK, Anisuzzaman M, Chowdhury MMR, Hoque M, Sharful MI. Livelihood status of the fish farmers in some selected areas of Tarakanda upazila of Mymensingh district. Journal of agroforestry and environment. 2009;3(2): 85-89.
24. Sufian MA, Kunda M, Islam MJ, Haque ATU, Pandit D. Socioeconomic conditions of fishermen of Dekar Haor in Sunamganj. Journal of the Sylhet Agricultural University. 2017;4:101-109.
25. Mithun MNAS, Hoque MJ, Rahman MH. Effectiveness of professional training of Sub Assistant Agriculture Officers. Journal of Bangladesh Agricultural University. 2020;18(1):189–193. Available:https://doi.org/10.5455/JBAU.9476 3
26. Bappa SB, Hossain MMM, Dey BK, Akter S, Hasan-Uj-Jaman M. Socio-economic status of fishermen of the Marjat Baor at Kaligonj in Jhenidah district, Bangladesh. Journal of fisheries. 2014;2(2):100-105.

27. Mahmud S, Ali ML, Ali MM. Present scenario on livelihood status of the fishermen in the paira river, southern Bangladesh: constraints and recommendation. International Journal of Fisheries and Aquatic Studies. 2015;2(4):23-30.

28. Pravakar P, Sarker BS, Rahman M, Hossain MB. Present status of fish farming and livelihood of fish farmers in Shahrasti upazila of Chandpur district, Bangladesh. American-Eurasian Journal of Agricultural and Environmental Science. 2013;13(3):391-97

29. Smrity AA, Hoque MJ, Rahman MZ, Mithun MNAS, Khan MAU. Rice Farmers’ Perception on Occupational Risk Exposure to Pesticides in Bangladesh. Journal of Agriculture, Food and Environment. 2020;1(4):41-47. Available:http://doi.org/10.47440/JAFE

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