

**IMPACT AND CONSTRAINTS ANALYSIS OF SHRIMP
FARMING IN SELECTED AREAS OF SATKHIRA
DISTRICT, BANGLADESH**

SUMON HOSSAIN



DEPARTMENT OF AGRICULTURAL STATISTICS

SHER-E-BANGLA AGRICULTURAL UNIVERSITY

DHAKA -1207

JUNE, 2021

**IMPACT AND CONSTRAINTS ANALYSIS OF SHRIMP
FARMING IN SELECTED AREAS OF SATKHIRA DISTRICT,
BANGLADESH**

BY

SUMON HOSSAIN

REGISTRATION NO. 14-06073

A Thesis

Submitted to the Faculty of Agribusiness Management,
Sher-e-Bangla Agricultural University, Dhaka,
in partial fulfilment of the requirements
for the degree of

MASTER OF SCIENCE

IN

AGRICULTURAL STATISTICS

SEMESTER: JANUARY - JUNE, 2021

Approved by:

.....
Md. Abdul Latif

Professor

Department of Agricultural Statistics
Sher-e-Bangla Agricultural University
Dhaka-1207

Supervisor

.....
Zulfikar Ahamed Reza

Professor

Department of Agricultural Statistics
Sher-e-Bangla Agricultural University
Dhaka-1207

Co-Supervisor

.....
Zulfikar Ahamed Reza

Chairman

Examination Committee
Department of Agricultural Statistics
Sher-e-Bangla Agricultural University



**DEPARTMENT OF
AGRICULTURAL STATISTICS**

**Sher-e-Bangla Agricultural University,
Sher-e-Bangla Nagar, Dhaka-1207.**

Web: www.sau.edu.bd

CERTIFICATE

This is to certify that thesis entitled, "IMPACT AND CONSTRAINTS ANALYSIS OF SHRIMP FARMING IN SELECTED AREAS OF SATKHIRA DISTRICT, BANGLADESH" submitted to the Faculty of Agribusiness Management, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE in AGRICULTURAL STATISTICS, embodies the result of a piece of bona fide research work carried out by SUMON HOSSAIN, Registration No. 14-06073 under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that such help or source of information, as has been availed of during the course of this investigation has duly been acknowledged.

Date:

Place: Dhaka, Bangladesh

.....
Md. Abdul Latif

Professor

Department of Agricultural Statistics
Sher-e-Bangla Agricultural University
Dhaka-1207

Supervisor

*Appreciation to my parents, siblings
and those cherished individuals
who are continue to mean so much to me*

LIST OF ACRONYMS AND ABBREVIATIONS

AEZ	Agro-Ecological Zone
BBS	Bangladesh Bureau of Statistics
BER	Bangladesh Economic Review
BCR	Benefit Cost Ratio
BFFEA	Bangladesh Frozen Foods Exporters Association
BSFF	Bangladesh Shrimp and Fish Foundation
DAE	Department of Agricultural Extension
GDP	Gross Domestic Product
GSP	Generalized System of Preferences
Ha	Hectare
HVAPs	High value Agricultural Products
SPSS	Statistical Package for Social Science

ACKNOWLEDGEMENTS

All laudations are conferred to the most merciful Allah, who vested the author to portray thesis paper entitled on the theme “Impact and constraints analysis of shrimp farming in selected areas of Satkhira District, Bangladesh” for the program M.S. in department of Agricultural Statistics at Sher-e-Bangla Agricultural University.

Now, the author would like to commit warm acknowledgement to his supervisor **Md. Abdul Latif**, Professor, Department of Agricultural Statistics, Sher-e-Bangla Agricultural University, for his enthusiastic suggestions and constructive propositions all over the study work and paper aggrandizement. Without his circumstantial outlines, this work would never actualize in time.

The author is highly appreciative to his Co-supervisor, **Zulfikar Ahamed Reza**, Professor and Chairman, department of Agricultural Statistics as well as all cordial departmental officials for facile co-operation during the apprentice period.

In addition, the author acknowledges to the 90 hatchery (gher) proprietors for their precious assistance during data collection process without which it would not be possible to frame this thesis.

Penultimately, solemn respect is not enough to expresses appreciation to authors parents and siblings for their ever-ending blessings and supports.

Finally, the author bemoaned to those individuals who exiled their life in the Corona pandemic. May Allah bestow them spiritual blisses in their burial lifetime.

June 2021

Sumon Hossain

LIST OF CONTENTS

Chapter no.	Title	Page
	LIST OF ACRONYMS AND ABBREVIATIONS	i.
	ACKNOWLEDGEMENTS	ii.
	LIST OF CONTENTS	iii.
	LIST OF TABLES	vi.
	LIST OF FIGURES	viii.
	LIST OF APPENDICES	ix.
	ABSTRACT	x.
CHAPTER 1	INTRODUCTION	
	1.1 Background of the study	02
	1.2 Research questions	03
	1.3 Objective of this study	04
	1.4 Justification of the study	04
	1.5 Research outline	05
CHAPTER 2	REVIEW OF LITERATURE	
	2.1 Signature legacy of shrimp farming	06
	2.2 Profitability of shrimp farming	07
	2.3 Constraints confronted at shrimp farming	08
	2.4 Impact of shrimp farming over environments	10
	2.5 Antecedent study deficits	12

Chapter no.	Title		Page
CHAPTER 3	MATERIALS AND METHODS		
	3.1	Contextual framework of the study	14
	3.2	Preferred survey areas	15
	3.3	Sampling model and sample size	16
	3.4	Survey time period	17
	3.5	Survey questionnaire summary	17
	3.6	Data Collection	17
	3.7	Data Processing	17
	3.8	Analytical technique	18
		3.8.1 Descriptive analysis	18
		3.8.2 Empirical analysis	18
	3.9	Assertion of defined constraints	19
	3.10	Survey integrity	21
	3.11	Survey etiquette	21
	3.12	Data survey limitations	21
CHAPTER 4	RESULTS AND DISCUSSION		
	4.1	Socio-economic situations	23
	4.2	Impact on shrimp farmers' socio-economic position	27
	4.3	Sources of inspiration for shrimp farming	28

Chapter no.	Title		Page
	4.4	Profitability analysis of shrimp farming	29
	4.5	Constraints confronted at shrimp farming	31
	4.6	Adverse impact of shrimp farming over environs	35
	4.7	Discussion	36
	4.7.1	Socio-economic circumstances of household and farm house	36
	4.7.2	Comparative profitability analysis between shrimp and another crop	37
	4.7.3	Explanation of constraints index values	37
	4.7.4.	Shrimp farming multi-facet impact	38
CHAPTER 5	SUMMARY AND CONCLUSION		
	5.1	Summary	41
	5.2	Applicable suggestions	42
	5.3	Conclusion	43
	5.4	Study limitations	44
	5.5	Opportunity for further research	44
	REFERENCES		46
	APPENDICES		51

LIST OF TABLES

Table No.	Title	Page No.
01.	Sampling structure of shrimp farm in the study area	16
02.	Constraints confronted during shrimp farming	19
03.	Age distributions of shrimp farmer in study area	23
04.	Earning source of shrimp farmer in study area	24
05.	Shrimp farmer's education level in study area	25
06.	Shrimp farmer's household scenario in study area	25
07.	Women participation at shrimp farming activities	26
08.	Distribution of the proprietors according to land under shrimp farming	27
09.	Impact on household economic and social security	27
10.	Source of inspiration for shrimp cultivation	28
11.	Analysis of costs and returns of shrimp farming	29
12.	Comparative turnover analysis of shrimp and other agrarian production	30
13.	Constraints confronted at shrimp cultivation and marketing activities	32
14.	Hostile post-effect of shrimp farming	36

LIST OF FIGURES

Figure No.	Title	Page No.
01.	Contextual framework of research study	14
02.	Survey locations at Satkhira district	15
03.	Cost-benefit analysis of shrimp farming	31

LIST OF APPENDICES

Appendix No.	Title	Page No.
I.	An English version of the interview questionnaire	51
II.	Summary output of socio-economic status of shrimp proprietors	54

IMPACT AND CONSTRAINTS ANALYSIS OF SHRIMP FARMING IN SELECTED AREAS OF SATKHIRA DISTRICT, BANGLADESH

ABSTRACT

The study was conducted to categorize and portray the constraints and vicinity impact of shrimp farming. Data and information were collected from 90 gher of selected three upazilas of Satkhira district in Bangladesh following purposive sampling technique. Among ten selected constraints “Over chances of virus intrusion” got the highest score (CCI-166) while “Biasness in partnership/muscle power crisis” got the lowest score (CCI-28) in Constraints confrontation index valued from 0 to 150. Meanwhile, the shrimp gher proprietors were privileged with comparatively more BCR (4.18) corresponding with Paddy (2.07), Brinjal (2.93) and Tomato (3.04). This led individuals to come forward in such aquatic activity inspired by family heritage. Over 90% hatchery household were advantaged by intaking nutritious food. Furthermore, about 85% had household development and 84% had recreational and educational feasibility. However, several catastrophes ascended due to shrimp commercialization motive. Exploration identified inadequacy of fresh drinking water, agrarian soil salinity acceleration, exploitation of natural fingerling as well as other aquatic organism multiplication and human disease outbreak prominently. Therefore, sustainable steps need to be followed to enhance the existing farm arena without hampering the environmental food chain.

Keywords: Shrimp commercialization, shrimp farming constraints, shrimp hatchery household, Shrimp farming adverse situation on environment

CHAPTER 01

INTRODUCTION

1.1. Background of the study

Shrimp cultivating is one of the dazzles developing economic practices in coastal zones of the Asia-Pacific areas, contributing over 85% of world's cultivated shrimp, where Bangladesh is the fifth major globally (FAO, 2014). Having blessed with positive atmosphere and cheap input accessibility, shrimp aquaculture has flourished in the most part under tropical and subtropical coastal lowlands. It is the third biggest extraneous exchange captivating product of Bangladesh, after garment and jute, shrimp contributing 9% to nationwide agricultural GDP (Mitra *et al.* 2014). These days, shrimp is the second most signature in Bangladesh. It is much of the time delineated as 'blue revolution' (Deb, 1998). The central shrimp-creating regions are Bagerhat, Pirojpur, Satkhira, Khulna, Cox's Bazar and Chittagong (Belton, 2011). As per the calculations from the Department of Fisheries of Bangladesh (FRSS, 2021) the exported amount of calcic shrimp was once 15,023 tons in 1988, which was multiple times higher (2,46,406 metric tons) in FY 2019-20. Uprising figures prescribed that around 19 million dwellers in Bangladesh are straightforwardly or in a roundabout way depend on the shrimp commercialization (MFL, 2014).

The most spectacular boost of shrimp farming has taken place in the Satkhira district where a large number of farmers have converted their rice as well as vegetable fields to profitable shrimp farms (Ahmed *et al.*, 2008). However, a number of studies have been conducted on shrimp farming in Bangladesh, including technical efficiency of shrimp farming (Begum *et al.*, 2015), economic analysis of shrimp farming (Alam *et al.*, 2007), shrimp culture in Bangladesh with social and economic status (Alauddin and Hamid, 1999), shrimp farmers livelihood analysis (Mamun *et.al.*, 2019), changing in shrimp culture practices in Southwestern region focusing on numerous

constraints (Parvez et.al., 2006) but producer end confronted constraints were hardly delineated. Therefore, this study was conducted to know the contemporary constraints of shrimp farming in the Southwestern region mainly in Satkhira district of Bangladesh as well as to formulate some suggestion for development of shrimp farming further.

1.2. Research questions

A well-designed research question possesses the entire research task focused, and relevant. Multi-facet rational questions are demonstrated to conduct the current study.

- a. What privilege level do the study area shrimp producers hold than other?
- b. How and up to what level of impact that shrimp farming possesses onto proprietor's household status and environments?
- c. Which constraints appear more and how they decelerate production?

This paper is arranged with a sequential step to represent the current queries with pertinent and coherent scenarios.

1.3. Objectives of the study

Keeping view aforementioned facets, the current study makes an effort to delineate the ensuing objectives in accordance with the study enquiries:

- a. To compare profitability between shrimp farming and another crop cultivation;
- b. To observe the post-impact of shrimp farming;
- c. To explore the constraints at the grass-root level farming.

1.4. Justification of the study

The shrimp sector of Bangladesh is one of the most productive and dynamic in the country, and it has played an increasingly important part in the economy in recent decade. However, numerous complexities arise time to time which hinder this sector flourishment badly. The solutions of these complexities often come not into limelight. Meanwhile, shrimp farming turnover rationally upgrade the farm proprietor's socio-economic status but has adverse impact on the locale environment which also remained under the shadow. Therefore, these aforementioned barriers need to be overviewed which may be fruitful for the academic researchers and extension policy makers to promote strategies and approaches for effective expansion actions.

1.5. Research outline

This paper is delineated with five major segments. At first, Chapter 1 introduces the basic info on current exploration. Next, prior study and expedition consequence as well as deficits are cited in the chapter 2 section. Succeeding that materials and methods (chapter 3) leads way of the entire study comprising with sampling and data survey techniques, index model installation, study credibility and etiquettes. Chapter 4 depicts the result and discussion of current survey. Last of all, chapter 5, the conclusion and summary will concise the whole paper and assert the substantial findings. In addition, pertinent suggestions, research deficiency and opportunity for farther research will be chronicled.

CHAPTER 02

**REVIEW OF
LITERATURE**

Attempts had been furnished to compile secondary data for constructing an inclusive literature review from several sources keeping apposite with study purposes.

2.1. Signature legacy of shrimp farming

Bangladesh is a relatively small territory with a large population where agrarian land area has constantly declined and farmers need to increase their incomes from their limited land holdings. Marine shrimp farming in rural Bangladesh appeared as a significant economic blessing for traditional farmers in the 1970s and has since gained increasing relevance in generating employment, reducing poverty, and increasing export earnings.

Most shrimp and prawn farms (53%) were in southwest Bangladesh mostly in the districts of Satkhira, Khulna and Bagerhat and produced 46% of country's total shrimp and prawn production (DOF, 2013). In 2010, the total area under shrimp and prawn farming was estimated to be around 275,274 hectares (DOF, 2013) while in 1980 it was 20,000 hectares, indicating an average increase of 35% per annum (DOF, 2013). At different regions of Bangladesh, many shrimp/ prawn farms have been established, but maximum production (78%) come from greater Khulna regions which covered 74.5% area of total shrimp/prawn farms of Bangladesh (DOF, 2012). The most remarkable boost of shrimp farming had taken place in the Satkhira district where a large number of farmers have converted their rice fields to profitable shrimp farms (Ahmed et al.,2008).

It is estimated that shrimp-based industries in Bangladesh directly employ almost 700,000 people with at least 3 million dependents. With their combined annual contribution of U.S. \$360 to 365 million, marine shrimp and freshwater prawn exports rank second only to garments in earning foreign exchange for Bangladesh.

Currently, marine shrimp farms cover about 170,000 ha in the coastal districts of Satkhira, Khulna, Bagerhat, Cox's Bazaar, Chattogram, Borguna, and Bhola.

2.2. Profitability of shrimp farming

Uddin (1995) directed a study named "An economic study on shrimp farming in some selected areas of Khulna and Satkhira district" and found that most of the growers in Satkhira district followed advanced method in shrimp farming which led to in higher yield. He also explored that per hectare net income in Satkhira and Khulna District were about 78 thousand BDT and 32 thousand BDT which means that net income in Satkhira district was 2.44 times higher than that of Khulna district.

Moreover, Shah and Karim (2001) surveyed on Shrimp culture and changes of land use pattern in coastal belt of Bangladesh: A spatial-temporal analysis. They identified the causes and extent of changes of physical, socioeconomic and ecological pattern. A total of 3932 households were included covering ten upazila of Khulna district in the survey. They presented that shrimp culture had created negative impacts on the physical, socioeconomic and environment of the areas as a whole. Some compulsory guidelines had been provided for sustainable shrimp culture activities in the areas.

In addition, Miah *et al.* (2002) stated that shrimp farming and related activities assisted the concerned proprietors, to increase their household income resulting in better livelihoods and socio-economic conditions. Shrimp industry was found to have the potential for absorbing the surplus women labor force of the coastal areas. The study also exposed that existing unplanned shrimp culture had adversely affected the production of cereal crops and vegetables, trees and plantation, poultry

and livestock, environment and ecosystem, which had moderately changed biodiversity.

Furthermore, Rahman and Hossian (2013) conducted a research on “Present Status and Potentiality of Shrimp in Bangladesh”. He found that shrimp and prawn together formed the second largest exportable items contributing to extraneous exchange earnings of Bangladesh. Shrimp farming was found to have significant impact on environment and economy. The productivity of galda and T. Aman rice was found 505 kg/ha and 3497 kg/ha, respectively. About 72 percent famers of the study area were choose galda farming as the main occupation and shared 83.4. percent of their annual income whereas, rice shared 8.88 percent only. So, galda had significant importance to the socioeconomic and livelihood status of the proprietors.

Laterly, Rasha (2013) conducted an exploration on “Profitability and resources use efficiency of shrimp farming in some selected areas of Bagherhat district in Bangladesh” and it was found that per hectare gross return and total expenditure were found to be Tk. 364222.00 and Tk. 148291.00 respectively. Benefit Cost Ratio (BCR) was found 2.46 for shrimp farming.

Besides, Karim and Mustari (2015) also delineated the shrimp cultivation and coastal livelihood. Hossain *et al.* (2013) and Saha (2017) portrayed the impacts of shrimp farming on the coastal environment of Bangladesh.

2.3. Constraints confronted at shrimp farming

In Bangladesh, grass root level proprietor confronted numerous hinderance in the pathways of shrimp farm flourishing. Some of crucial constraints are mentioned below:

2.3.1. Diseases disaster

Intensive farming makes the shrimps exceptionally prone to diseases. When physio-chemical factors like pH scale, temperature, dissolved oxygen fluctuated continuously, shrimps became vulnerable to stress and ultimately brought about diseases (Paez-Osuna et al., 2003) like red color, tail rot, soft shell and black gill (Alam et al., 2007). Meanwhile, excessive use of feed and high stocking density polluted water quality. Bangladesh mislaid 44.4% of its entire shrimp production due to White Spot Syndrome Virus in 1996 (Alam et al., 2007).

2.3.2. Natural calamities

Recently two cyclones (known as Aila and Sidr) hit the south-west region of the country. These natural events have brought about remarkable environmental and social changes in this region. Between 2000 and 2020, the southwestern coastal zone of Bangladesh experienced five mega cyclones which caused enormous economic, agricultural, infrastructural and human losses. These swiped away the farm hectare after hectare from different time to time.

2.3.3. Lower market price and other constraints

One of the most important problems was lower market price of products. Meanwhile, drought, lack of transport facilities, long distance of market, poor road facilities, harassment by professional fish seller, stealing of shrimp and flood were common problems. Das (1993) also mentioned lack of scientific knowledge and lack of marketing facilities as major problems during shrimp culture which were similar with the present findings.

2.4. Impact of shrimp farming over environments

Despite a range positive factors like foreign exchange, employment and food, the industry has terrible environmental impacts. Abdullah *et al.* (2019) quoted that spontaneous and indiscriminate shrimp farming procreated numerous adverse ecological results. Environmental effects like loss of biodiversity, mangrove destruction, saltwater interruption and contamination were seen to be the key impediments for the advancement of sustainable shrimp commercialization. Unplanned and chaotic growth of shrimp culture has an adverse influence on the coastal ecosystem. Distinguished adverse impact of shrimp farming are undermentioned:

2.4.1. Natural shrimp habituation breakdown

Shrimp fry collection from the wild is a destructive fishing method. Bag nets (behundi jal) are generally used in the rivers of Khulna and Satkhira (Hasan, 2019). Besides, bringing in of shrimp seeds without isolation had spread different viral and contagious maladies all through Bangladesh (Deb 1998). Mother shrimps as brood stock collected by trawl fishermen from the deep ocean that performs a principal function in the loss of fisheries (Primavera, 2006). When the shrimp industry uses maritime fish as trash to manufacture fish meal, and eventually to produce pellet feed, it diminished the wild fishery resources (Naylor *et al.*, 2000). Catches of wild shrimp in both open sea and coastal ecosystems had declined due to overexploitation and adulteration in the coastal region (Paez-Osuna, 2003).

2.4.2. Destruction of the local aquatic ecosystem

Aquaculture production of shrimp becomes the foremost continual destroyer of massive areas of tropical wetlands. Variety of shrimp ponds developed alongside the periphery for catching shrimp fry shrinks the reserve location of the mangrove forest (Wahab, 2003). The excess level fishing strain grasped shrimp fries as well as other vital aquatic species that moved within the coastal regions (Anwar, 2003)

2.4.3. Human disease outbreak

The saltwater intake was partly responsible for waterborne diseases acceleration including diarrhea and dysentery (Warner *et al.*, 2012; Saha, 2017). Additionally, salinity is associated with changes in women menstruation and led miscarriage rates (Warner *et al.*, 2012; Saha, 2017). In addition, Dasgupta *et al.* (2015) strongly connoted that drinking water salinity is a significant determining factor of gestational hypertension and infant mortality in coastal Bangladesh. Likewise, Abedin *et al.*, (2015) portrayed that adolescent girls' skin became lumpy and unpleasant because of the continual use of saline water, which led these girls less-attractive potential marriage partners. Sometimes women and adolescent girls are harassed even by adolescent boys when they travelled to distant places to pour freshwater (Abedin *et al.*, 2015)

2.4.4. Salinity intrusion in water and soil layers and impact on agriculture

Shrimp farming invaded soil and water quality in the agrarian land. The unleashed saline water from shrimp ponds consecutively accelerated the salinity in neighboring bucolic lands (Rahman *et al.*, 2013). The southwestern Bangladesh the mean values of water salinity at the low, medium and high saline zones were 1.2 - 1.64, 4.25 -

5.14, 9.75 - 9.17 ppt, respectively (Islam, 1999). Continued submersion impeded nitrogen fixation and halted mineralization, therefore demolishing soil fertility (Wahab, 2003). Excessive saline water flow usually enters into the plants by osmosis. Consequently, the agrarian crops were agonized from water starvation and created physiological drought conditions (Ghafur *et al.*, 1999; Hagler, 1997).

2.5. Antecedent study deficits

Frequent inclusive evidence and significant researches had been observed to figure out major constraints and farming impact on environs. However, cumulative studies were found quite absent that expressed the aforementioned contextual challenging factors behind shrimp industry regeneration and the post impacts on surroundings. Therefore, an effort has been made to study the predominant adverse factors that affect the shrimp industry more. Meanwhile, privileges as well as adverse effects on environs are also brought into limelight so that compatible actions can be exercised to reach the SDG assignment formatted by United Nations proficiently.

CHAPTER 03

**MATERIALS AND
METHODS**

Methodology is the avenue for any study actualization. Consequently, methodology along with factual informative questionnaire (including most of the quantitative data) has played the role of alleyway for this comprehensive study. The methods and materials portrayed in this research are being described below:

3.1. Contextual framework of the Survey

In methodological study, selection and measure of variables is a key task. The circumstantial framework of Barbbie (2012) was followed while establishing layout for the confronted constraints which is exposed in Figure 01. This current study is attempted to locate on two scenarios: the first, the constraints confronted at shrimp farming and secondly, the pro-cons impact/consequences of shrimp farming.

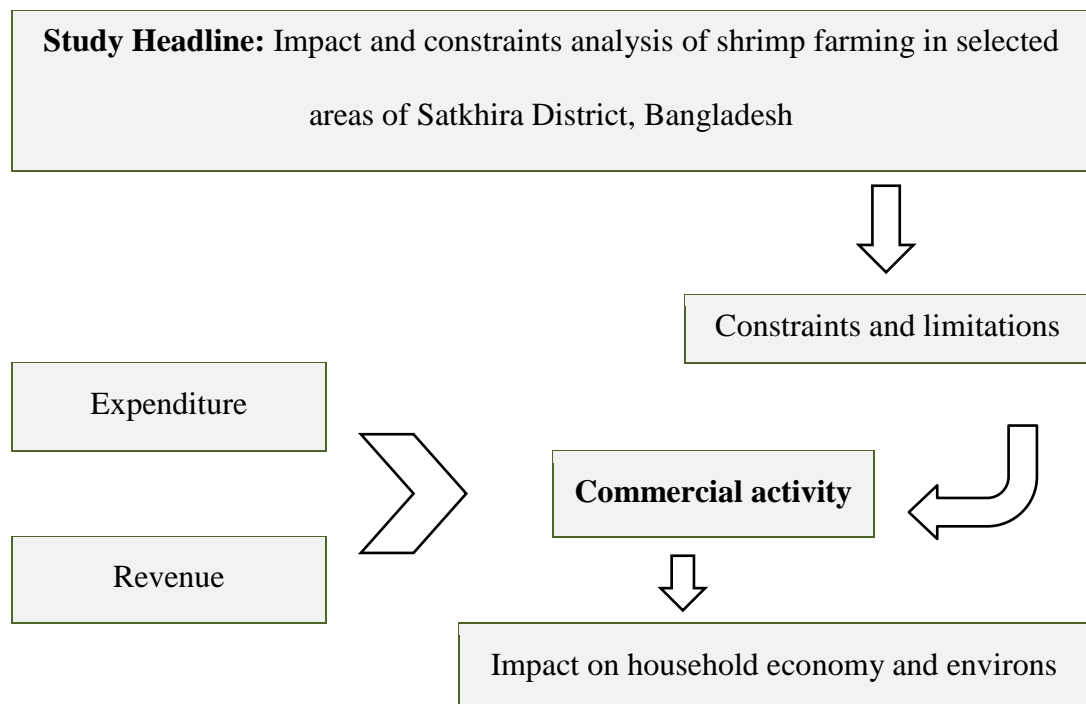


Figure 01: Framework of research task

(Source: Researcher’s own strategy, 2022)

3.2. Preferred survey areas

The exploration was conducted in three distinguished upazila of Satkhira district. The study areas belong to the AEZ of 'High Ganges River Floodplain'. This district is located at 88°54' to 89°20' E and 21°36' to 22°54' N (BBS, 2011). In this study region almost 40% of the working population is involved in agriculture (BBS 2020).

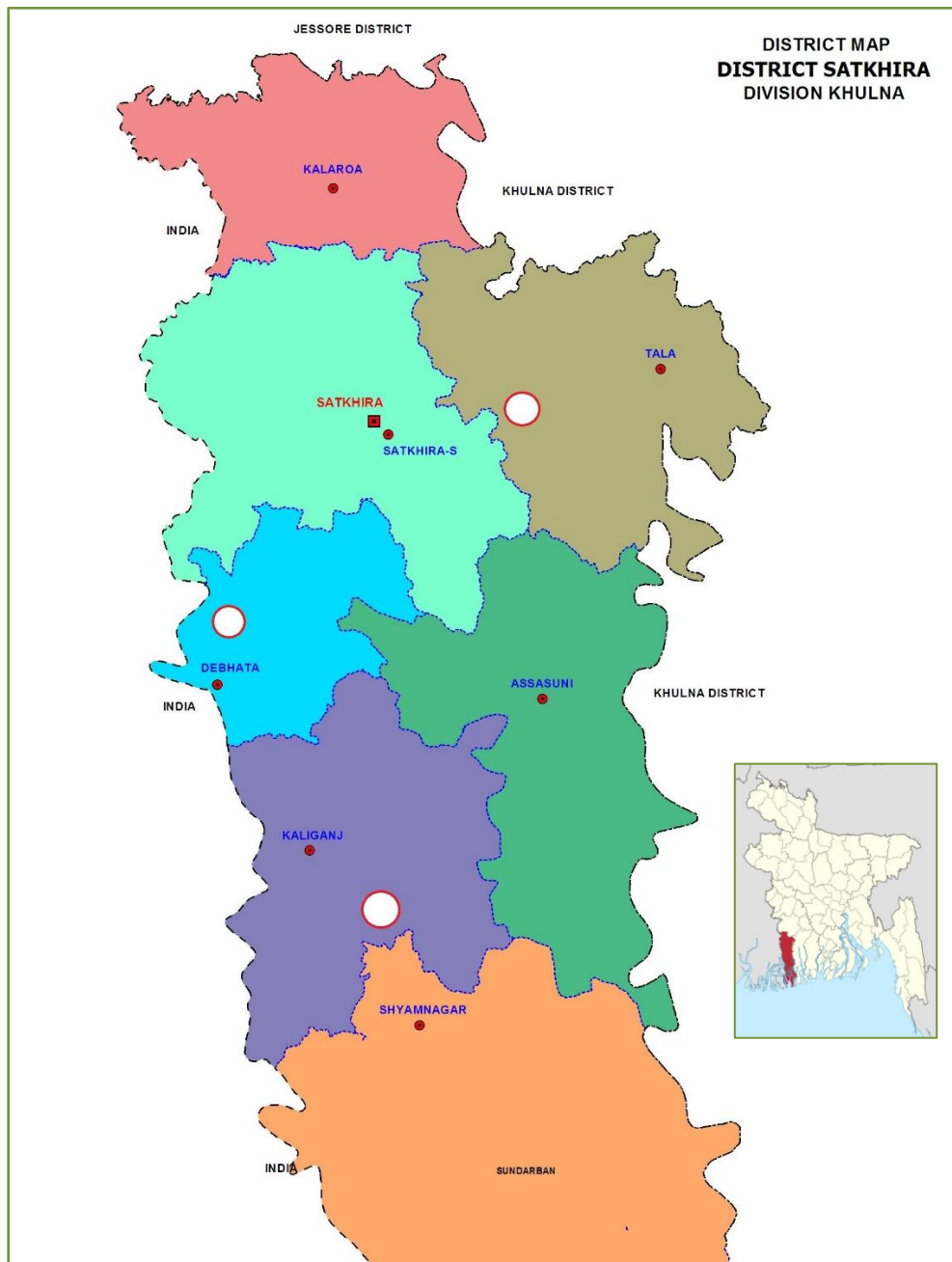


Figure 02: Study sites at Satkhira districts (Signified with inner white and bold red colored circumference)

Antecedently, Mamun *et al.* (2020), Matin *et al.* (2016) and Prodhan *et al.* (2019) conducted research work on commercial scenario of shrimp farming, its profitability and socio-economic circumstantial of farm household in Satkhira district. Therefore, this survey area is selected for exploring the confronted constraints and the aftermath of shrimp farming.

3.3. Sampling Model and Sample Size

A two-stage purposive sampling design was considered to accumulate sample respondents for this research. At the initiative stage, three adjacent upazila (including Debhata, Kaligonj, Tala) were carefully selected.

After that, one union was selected from each upazila for detailed data collection. Debhata union from Debhata, Mautala union from Kaligonj and Khalishkhali union from Tala. Finally, a total of 90 households including 30 from each union were purposively chosen for interview in terms of info feasibility as well as expediency and logistic facilitation.

Table 01: Sampling structure of shrimp farm in the study area

Upazila	Union	No of each type proprietor			In total
		Single	Partnership	Co-operative	
Debhata	Debhata	24	3	3	30
Kaligonj	Mautala	22	1	7	30
Tala	Khalishkhali	25	2	3	30

(Source: Sample study, 2022)

3.4. Survey Time period

Certain time management lets the researcher to attain the study efficiency. Thus, a specific time schedule was brought under consideration to compile apposite information. The data collection dated was December 2021 to January 2022.

3.5. Survey questionnaire summary

A set of multi-sectional premeditated survey questionnaire was composed keeping relevance with the objectives of this paper. Close-ended questions were enquired according to the survey outline.

3.6. Data Collection

Face-to-face interview was followed to collect information according to survey outline. It was challenging as some did not stated all the hidden fact as well as exaggerated about own selves. To overcome such labyrinths, all tactical efforts (including market exploration, met with local SAAO) were exercised to settle evidence. Each respondent was described about the purpose of researchers' Master's study mission.

3.7. Data Processing

Strategies were followed to lessen the confronted errors. The processed data were revised and then transferred into tabular format pertinent with this paper's objectives. After that, data was analyzed in computer with the help of Statistical Package for Social Science (SPSS) software.

3.8. Analytical Technique

3.8.1. Descriptive analysis

Tabular and graphical approaches were reasonably used to represent socio-economic scenario of the proprietor household and adverse impact on environs.

Methods were followed with SPSS software entering the revenue and expenditure for benefit cost ratio estimation of shrimp. The BCR model is stated as:

$$\text{Benefit Cost Ratio} = \text{Total revenue} / \text{Total expenditure}$$

3.8.2. Empirical analysis

3.8.2.1. Construction of constraints confrontation index

A technical concept of Confronted constraints index (CCI) function may be applied according to constraints severity. By using a structured questionnaire, the proprietors were enquired to give their opinion on 10 selected constraints during data collection. A three-point rating scale was used for computing the constraints score of a respondent. The respondents were given three alternative responses (including acute, medium and not at all) for each of the ten selected problems.

The specification of the constraints index for shrimp farming was as follows:

$$\text{CCI value} = P_A \times 2 + P_M \times 1 + P_N \times 0$$

Where, **CCI** = Constraints confrontation index value

P_A = Number of respondents confronted the constraints as acute

P_M = Number of respondents confronted the constraints as mediocratic

P_N = Number of respondents confronted the constraints as not at all

Constraints Confrontation Index (CCI) for any one of the selected hinderance could range from 0 to 2, where, 0 indicating tolerable/no problem confronted (ultimately facile condition) and 2 indicating excessive problem confronted. After obtaining the CCI for each of the ten problems, a rank order would be set.

3.9. Assertion of defined constraints

Ten specified constraints are undermentioned for facile thesis interpretation.

Table 02: Constraints confronted during shrimp farming

Constraints headline		Description
i.	Lack of quality fingerling	Adulteration of weak shrimp fry with the healthy ones. Sometimes, naturally harvested fingerling would not match up the artificial hatchery environs. In addition, inadequacy of quality fry arose its price.
ii.	Insufficient training and DAE service feasibility	Both technical and subjective knowledge required to operate farm. However, lack of proper training facilities and apathy of DAE assistance timely made the situation more worsen.
iii.	Natural calamities	Frequently, natural disasters including flood, cyclone hampered the hatchery arrangement and flashed away shrimps.

Constraints headline		Description
iv.	Over chances of virus intrusion	Diverse incidences made virus as well as predator intrusion in the farm. Ultimately, entailed havoc losses.
v.	Storage inadequacy	Export awaiting harvested shrimp often deteriorated due to inadequacy of cold storage facilities.
vi.	Credit mismanagement	Actual proprietor did not get the facile credit and government incentives. Meanwhile, wicked individuals experienced the unusual privileges.
vii.	Inappropriate market infrastructure	Lack of transportation feasibility, immoral transactions, weak quarantine standard made the market more fragile.
viii.	Asymmetrical cost and revenue	Presence of high feed cost and syndicate disturbance entailed more expenditure than before. High price often repulsed the rank and file customers.
ix.	Stealing possibility	Stealing nuisance procreated several anxieties and resulted high cost on protection segment.
x.	Land/Partnership/Local muscle power crisis	Immoral muscle powers shackled the facile hatchery operation. Even partnership collision and land department bureaucracy impeded the farm aggrandizement.

3.10. Study integrity

This expedition was 90 hatcheries oriented; at least twenty from each three upazila. Market survey as well as discussion with community inhabitants were made for detailed assessment. Information purveyed from these later two sources were 95% similar the collected data from proprietors. Therefore, data accuracy and reliability can be legitimately confirmed.

3.11. Survey etiquette

Consent were taken before farm house exploration and each proprietor was well informed about the outline and purpose of the study. No exaggerated or misleading questions were enquired which might disrupt the secrecy aspects. Transparent responses were documented.

3.12. Data survey limitation

The elementary bound was the time limit. Additionally, continual exploration was not plausible during Covid-19 pandemic circumstances. Moreover, unexpected interference from the side-talkers often arose while collecting data from the target entities.

CHAPTER 04

**RESULTS AND
DISCUSSION**

This chapter delineates the hatchery proprietor's socio-economic scenario, existing production status comparing with previous time period, impact on respondents' socio-economic position, turnover analysis of shrimp with other agrarian crops, major constraints confronted at shrimp farming and adverse effects of shrimp farming on to environs.

4.1. Socio-economic classifications

The socio-economic situation is essential to have a comprehensive idea about the existing proprietor household performances. Therefore, info concerning respondents age distribution, education knowledge, occupation nature, household size with family labor support, degree of women involvement, hatchery size was documented below:

4.1.1 Age distribution

Proprietors of the hatchery farms (73.3%) were in the age group between 35 to 50 years succeeded by age group above 50 years (17.7). Very miniscule percent was 9% under the age group less than 35 years (Table 03).

Table 03: Age distribution of shrimp farmer in study area

Categories (years)	Responded household heads				
	Debhata	Kaligonj	Tala	Total	% in total
Young aged (18- 35)	3	3	2	8	9
Middle aged (35-50)	20	22	24	66	73.3
Old (above 50)	7	5	4	16	17.7

(Source: Sample study, 2022)

4.1.2. Occupation nature

Considering their household income bases, the respondents were classified into several sorts: agriculture, business, remittance privileged, official job (public/private), apprentice and other earning sources. Table data exposed that the highest proportion of the respondent (67.8%) had revenue from agriculture merely while 15.6% had to earn livelihood through shrimp farming activities as well as non-agricultural business.

Table 04: Earning source of shrimp farmer in study area

Categories	Responded households				
	Debhata	Kaligonj	Tala	Total	% in total
Agriculture	20	18	23	61	67.8
Business	4	7	3	14	15.6
Remittance privileged	3	0	2	5	5.5
Official job (public/private)	2	3	2	7	7.8
Institutional apprentice	1	2	0	3	3.3

(Source: Sample survey, 2022)

4.1.3. Level of educational and technical knowledge

About 21.1 percent farm owner had higher education and majority of the respondents (66.7%) were secondary literate. Little portions were primary literate or basic educated. However, their traditional family experience superseded any other bookish knowledge.

Table 05: Shrimp farmer's education level in study area

Categories (class)	Responded farmers				
	Debhata	Kaligonj	Tala	Total	% in total
Primary (1-5)	4	3	4	11	12.2
Secondary (6 – 10)	19	19	22	60	66.7
Higher (over 10)	7	8	4	19	21.1

(Source: Sample study, 2022)

4.1.4. Household size and family labor availability

The average household size comprises six members per family, which is much higher than national statistics (4.21) (BBS, 2021). Most of the household members (73%) assisted in this shrimp farming directly or indirectly.

Table 06: Shrimp farmer's household scenario in study area

Categories	Responded households				% family members associated with shrimp farming
	Debhata	Kaligonj	Tala	Mean	
Family members	6.25	6.12	7	6.47	73
Active earning member	3	4.25	3.5	3.58	
Available family labor for shrimp	4.5	4.75	5	4.75	

(Source: Sample study, 2022)

4.1.5. Women participation/assistance

Females involvement was found significantly in labor sources under the survey areas. Overall medium level participation rate was higher (50%) in this area. High women assistance feasibility depicted less labor cost in other sense and met up SDG target five (gender equity) ultimately. Due to village social as well as religious value, a little presence of women was found in the market. Household women's active participations made a handsome turnover by minimizing the hatchery's expenditure.

Table 07: Women participation at shrimp farming activities

Categories (score)	Responded households				
	Debhata	Kaligonj	Tala	Total	% in total
Low participation	9	8	10	27	30
Medium participation	15	14	16	45	50
High participation	6	8	4	18	20

(Source: Sample survey, 2022)

4.1.6. Farm size

In this present exploration the land under shrimp cultivation of the farmers were classified into different categories. It is evident from the Table 4.9 that 33.4 percent, 54.4 percent and 12.2 percent of the farmers were small land, medium land and high land separately.

Table 08: Distribution of the proprietors according to land under shrimp farming

Categories (score)	Responded households				
	Debhata	Kaligonj	Tala	Total	% in total
Small (0.13-1 ha)	10	11	9	30	33.4
Medium (1.01-3 ha)	16	16	17	49	54.4
Large land (above 3 ha)	4	3	4	11	12.2

(Source: Sample survey, 2022)

4.2. Impact on responded participants socio-economic position

Shrimp farming has made outstanding impact on the respondent households in this explored area. Survey results exposed that 90.7% respondent household consumed some extent on nutritious food consumption (Table 09). Furthermore, about 86% proprietors upgraded their living place and about 84% were privileged with educational and recreational conveniences. Lastly, over 44% household were involved with numerous economic and charitable organizations.

Table 09: Impact on household economic and social security

Categories	% of household responded				% in All areas
	Debhata	Kaligonj	Tala	Mean	
Nutritious food intake increase	83	80	82	81.7	90.7
Infrastructure upgrading	74	78	80	77.3	85.9
Recreation & educational convenience	75	75	77	75.7	84.1
Social community engagement	40	42	38	40	44.4

(Source: Sample survey, 2022)

4.3. Sources of inspiration for shrimp farming

Proprietors mentioned numerous sources that influenced or inspired them towards shrimp farming. The landslide source was family tradition (91.1%) reported by the survey respondents (Table 10). Secondly, about 3.3% farm owners opined that they were influenced by surrounding neighbors. In addition, some (2.2%) stated that they were incited by extension department mostly.

Table 10: Source of inspiration for shrimp cultivation

Medium	% of proprietors responded				% in All areas	Rank order
	Debhata	Kaligonj	Tala	Mean		
Family traditions	84	80	82	82	91.1	1
Neighbors & Relatives	2	3	4	3	3.3	2
Radio / TV / Newspaper	1	2	0	1	1.1	5
Extension department	1	3	2	2	2.2	3
Businessmen/Traders	2	1	1	1.33	1.5	4
Village association	0	1	1	.67	.08	6

(Source: Sample survey, 2022)

4.4. Profitability analysis of shrimp farming

4.4.1. Profitability analysis of shrimp farming

Proprietors were inquired about their variable as well as fixed cost and gross return.

Both cost and return are brought under attention to measure the BCR.

The cost of shrimp farming varies depending on fingerlings, human labor, lime, Urea and TSP, compost/manure, feed, sales and marketing, pond rent, utility mainly. Tables showed the expenditure distribution at different locations along with revenue.

Table 11: Comparative analysis of costs and returns of shrimp farming

Particulars		Quantity (Unit/ha)	Price (Tk./Unit)	Cost (Tk.)
A.	Gross return			
	Marketable shrimp	1010	870	878,700
	Accessory harvests	250	135	33,750
	Total =			912,450
B.	Fixed cost			
	Pond rent			82,500
	Utility services			12,550
	Total =			95,050
C.	Variable cost			
	Fingerlings	0.75	32,500	24,375
	Human labor	125	450	56,250
	Lime	15	200	3,000
	Urea	20	76	1,520
	TSP	26	100	2,600
	Compost/Manure	1.5	1,500	2,250
	Feed	47	455	21,385
	Sales and marketing	13	910	11,830
	Total =			123,210

Particulars		Quantity (Unit/ha)	Price (Tk./Unit)	Cost (Tk.)
D.	Total cost			218,260
E.	Net profit (A-D)			694,190
F.	BCR			4.18

(Source: Sample survey, 2022)

4.4.2. Comparative turnover analysis of shrimp with other agrarian crops

Respondents were queried about their variable as well as fixed cost and gross return. Cost and return of both shrimp and potential agrarian crops are compared for concluding the superior ones. Here, Benefit-cost ratio of several salient harvests are presented tabular form followed by bar chart.

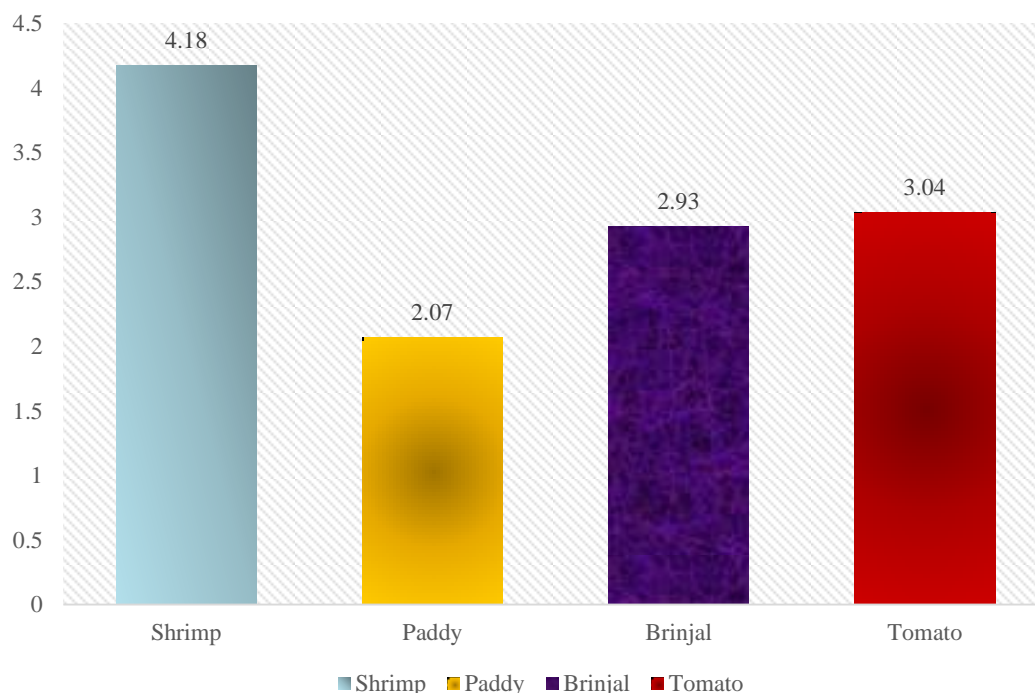
Table 12: Turnover analysis of shrimp and other agrarian production

Particulars		Shrimp	Paddy	Brinjal	Tomato
A.	Gross return	912,450	393,500	610,500	642,500
B.	Fixed cost	95,050	71,500	82,600	81,450
C.	Variable cost	123,210	118,300	125,400	129,800
D.	Total cost	218,260	189800	208,000	211,250
E.	Net profit (A-D)	694,190	203,700	402,500	31,250
F.	BCR	4.18	2.07	2.93	3.04

(Source: Sample survey, 2022)

Apparently, BCR of shrimp superseded the BCR of rice and vegetable crops all the times which led commercial profit-making shrimp farming than other agrarian crops.

Figure 03: Comparative BCR analysis of shrimp and other agrarian crops



(Source: Sample survey, 2021)

4.5. Constraints confronted at shrimp farming

Shrimp farming was proved a welfare ladder for countryside individuals, however they had to pass through hassle most of the time. The salient features of the problem confrontation in shrimp cultivation by the producers have been presented in Table 13.

The central complications were virus intrusion possibility (CCI score 166) and natural calamities (CCI score 153). Furthermore, cold storage inadequacy (CCI score 136), credit infeasibility (CCI score 117) and inappropriate market infrastructure (CCI score 124) were also mentioned higher at household levels.

Table 13: Constraints confronted at shrimp cultivation and marketing activities

SI. No	Constraints	Extent of constraints confrontation			CCI	Rank order
		Excessive	Moderate	Tolerable		
01.	Lack of quality fingerling	67	17	6	151	3
02.	Insufficient training and DAE service feasibility	37	33	18	107	7
03.	Natural calamities	70	13	7	153	2
04.	Over chances of virus intrusion	79	8	3	166	1
05.	Storage inadequacy	60	16	14	136	4
06.	Credit mismanagement	41	35	14	117	6
07.	Inappropriate market infrastructure	47	30	13	124	5
08.	Asymmetrical cost and revenue	33	22	35	88	8
09.	Stealing possibility	11	8	71	30	9
10.	Land/Partnership/Local muscle power crisis	11	6	73	28	10

(Source: Sample survey, 2022)

4.5.1. Over chances of virus intrusion

The majority of the respondents pointed out that virus intrusion is a major problem in the study area. Out of 90 respondents, 79 faced this problem to an acute level, 8 faced this problem to a medium extent, 3 proprietors stated that up to a tolerable level. In this case, the computed value of CCI was $166[(79 \times 2) + (8 \times 1) + (3 \times 0)]$ against a possible range of 0 to 180.

4.5.2. Natural calamities

Environmental catastrophes appeared as a second major problem in the survey area. Out of 90 respondents, 70 confronted this problem to an acute level, 13 confronted this problem to a medium extent, 7 proprietors stated that up to a tolerable level. In this case, the computed value of CCI was $153[(70 \times 2) + (13 \times 1) + (7 \times 0)]$ against a possible range of 0 to 180.

4.5.3. Lack of quality fingerling

A good number of proprietors mentioned that the lack of quality fingerling is a problem in production enhancement. In this case, the computed value of CCI was $151[(67 \times 2) + (17 \times 1) + (6 \times 0)]$ against a possible range of 0 to 180.

4.5.4. Storage inadequacy

Storage shortage was determined as the fourth ranked problem of the constraints index. The CCI value was $136[(60 \times 2) + (16 \times 1) + (14 \times 0)]$ for this problem. Proprietors asserted their harvest has gradually deteriorated because of the storage facilities and due to have insufficient capital, they were not able to afford those high-priced storage.

4.5.5. Inappropriate market infrastructure

Market infeasibility made the situation more worsen in COVID-19 pandemic time period. Producers confronted half market price of their harvests due to fragile export chain. This made such constraints in the fifth position.

4.5.6. Credit mismanagement

Formal credit from different institutions is very troublesome to get and required complicated procedures. Therefore, sometimes they borrowed money from informal money lenders, or relatives and neighbors, against higher interest rates. The CCI value was 117 $[(41 \times 2 + (35 \times 1) + (14 \times 0))]$, which scored the sixth largest value range from 0 to 180 of the problems in the constraints index.

4.5.7. Insufficient training and DAE service feasibility

Hatchery farmer often felt needed to be solved by the government or other organizations in time. Nonetheless, they had to continue their farm on the basis of family experiences.

4.5.8. Asymmetrical cost and returns

Respondents pointed out that low profit margin as the eight largest rank, as they reported more advanced technique required to increase their production. Asymmetrical cost and return CCI value was 88 $[(33 \times 2) + (22 \times 1) + (35 \times 0)]$, which scored the eight largest value range from 0 to 180 of the constraints index.

4.5.9. Theft possibility

Theft was not a major problem in the selected areas, as the CCI value of stealing possibility was 30. The selected ghers were situated near to the local market and

encompassed with several safety measures. However, co-operative facilities were comparatively better to seize the pilferage.

4.5.10. Land/Partnership/Local muscle power crisis

Crisis in land/partnership/local muscle power crisis was labeled as the lowest possible problem of the specified ten constraints faced by farm proprietors, with a CCI of 28 [(11 x 2) + (6 x 1)]. Most of the respondents asserted that their co-operative bias and muscle power emersion hardly discouraged them for doing such shrimp farming.

Therefore, the authorities should concern about virus-infection probability, disease monitoring, and distribution of new systematic knowledge among the farmers which are important for the extinguish of the current shrimp farming as well as to achieve sustainable development of the rural shrimp.

4.6. Adverse impact of shrimp farming over environs

Shrimp farming had brought about substantial changes in community physical, economical and environmental scenario. Unplanned widespread commercialization motive endangered the environment.

The major post-effect environmental complications were scarcity of fresh drinking water (index score 170) and imbalance in natural shrimp fry habitation (index score 159). Furthermore, human disease outbreak (index score 144), salinity intrusion in neighbored agrarian land (index score 143), and Aquatic flora-fauna extinction were also mentioned sophisticated at community levels.

Table 14: Hostile post-effect of shrimp farming

SI. No	Constraints	Extent of environs adversity			Cumulative index	Rank order
		Acute	Medium	None		
01.	Imbalance in natural shrimp fry habitation	72	15	3	159	2
02.	Aquatic plant (Lily, hyacinths, algae) extinction	31	54	5	116	6
03.	Aquatic animal (viper, lizard, tortoise, crab) extinction	45	35	10	125	5
04.	Fresh drinking water scarcity	81	8	1	170	1
05.	Human disease pandemic	58	28	4	144	3
06.	Salinity intrusion in neighbored agrarian land	62	19	9	143	4

(Source: Sample survey, 2022)

4.7. Discussions

4.7.1. Socio-economic circumstances of household and farm house

Study found active age group ranged 35-50 years majorly up to 73.3% followed by the age group over 50 years. Study also exposed that the highest proportion of the respondent (67.8%) were involved directly with agrarian activities while subsequent

highest respondents (15.6%) had income from non-agrarian business solely. Most of the proprietors (66.7%) were secondary literate. The average family size comprises 6.47 members per family in which over two-third number of the household members assisted in shrimp farming directly or indirectly. Medium level farm proprietors were explored mostly over 50%. These individuals were mostly influenced by family tradition to operate shrimp farming.

Women contribution was found medium level regularly about 50%. High women involvement feasibility depicted less labor cost and met up SDG target five (gender equality participation) ultimately.

4.7.2. Comparative profitability analysis between shrimp and other crops

With the advancement of time period, experienced farmers were more cognized with technical practicing, women labor execution and shrimp selling market. Gher had an incentive level (BCR 4.18). Meanwhile, paddy cultivators confronted BCR of 2.07 and vegetable producers got something higher (for brinjal BCR 2.93 and for tomato BCR 3.04). Apparently, BCR of shrimp superseded the BCR of other agrarian crop all the times.

4.7.3. Explanation of constraints index values

‘Over chances of virus intrusion’ got the highest score (CCI-166) and hence was measured as the 1st ranked problem. During fingerling release or flood devastation, virus could be easily spread with hosts. The problem ‘Natural calamities’ got the 2nd highest scores (CCI-153) which was considered as the 2nd ranked problem. This may be due to the adverse weather condition and disaster-prone southern location traits. In addition, lack of quality fingerling was considered as the 3rd ranked problem (CCI-

151). This may be due to lack of proper management of natural fingerling collection or high mortality rate of artificial cultivated fry. Storage inadequacy and syndicated market infrastructure were the 4th and 5th concerned constraints in shrimp farming flourishing.

There were another five problems among them 'Biasness in hatchery partners or local muscle power' got the lowest score (CCI-28) which was considered as the 10th ranked problem and got the last position in the order. This portrayed a well peace relation among local atmospheres.

Therefore, the authorities should concern about virus-infection probability, disease monitoring, and distribution of new systematic knowledge among the farmers which are important for the extinguish of the current shrimp farming as well as to achieve sustainable development of the rural shrimp.

4.7.4. Shrimp farming multi-facet impact

4.7.4.1. Welfare impact on proprietor's household status

Almost 90.7% household were privileged with a diurnal nutrition advantage and most of them led a reformed life with three-time meals a day. More than 85% proprietors developed their household and over 84% were progressed in recreational as well as educational conveniences. In addition, over 44% household were familiarized with societal organizations. A well-defined economic feasibility was explored in shrimp farming households.

4.7.4.2. Adverse effect of shrimp farming over environs

Exploration distinguished several negative impact of shrimp cultivations in the whole study areas in terms of salinity intrusion with the consequences of drinking water scarcity, local aquatic organism exploitations, food chain devastations, imbalance in natural fingerling habituation and finally disease outbreak in human community. Several erosions of genetic diversity of a wide range of flora-fauna, agricultural crops and forest plants led to this survey location more disaster prone. Consecutive calamities hit and wiped out the gher boundary which led economic injury in farm level. Therefore, unplanned gher structures need to be re-furnished to avoid environmental change as well as minimize financial damage.

CHAPTER 05

SUMMARY AND

CONCLUSION

This is the brief chapter of whole paper. Section 5.1 delineates a summary of the exclusive exploration. Applicable suggestions, conclusion, insufficiency of the study and further research opportunities are chronologized in sections 5.2, 5.3, 5.4 and 5.5.

5.1. Summary

Extensive aquatic endowment territory of Bangladesh and its hardworking inhabitant's agrarian activities were asserted initially. Afterwards, shrimp farming was introduced with its financial dominance followed by its perplexities. Household were more enthused onto commercial production and made reasonably more turnover from domestic as well as extraneous markets which was comparatively tough in other agrarian crops. Finally, shrimp farming post impacts onto household economy were delineated along with vicinity complications were delineated and this part welcomed the undermentioned literature review section.

In literature review, antecedent explorations were evaluated and chronologized with respect to research purposes. Shrimp farming signature heritage, comparative profitability, perplexities and post impact on household economy as well as environment were constructed by collecting information from numerous sources.

In third chapter, materials and methods was asserted with reliable process. A constraints confrontation index (CCI) was constructed with the corresponding ten constraints. Three upazila under Satkhira district were kept in the limelight to survey influential problem factors categorized with proper labeling scale.

Finally, the results and discussion chapter were last but not the least that portrayed socio-economic scenario, comparative profitability analysis of shrimp with different agrarian harvest, constraints confronted at farming, post-impact of shrimp farming

over household and environs with apposite sample survey outcomes. Ten premediated constraints were delineated elaborately with degree of confrontation.

5.2. Applicable suggestions

On the basis of the findings of the study it is manifest that shrimp farming is profitable enterprises and this can generate more turnover and employment opportunity to the bucolic grass root level. As shrimp culture technology was being enhanced day by day in greater Southwestern locations of Bangladesh, some suggestions are provided based on the constraints confronted by the proprietors to improve shrimp production further.

01. Proper attention must be given so that adverse effect on other types of cultivation due to shrimp culture can be minimized. Motivation programs for the farmers should be strengthened to protect various shrimp and fish juveniles during fingerling collection.

02. Root level farmers should be helped to get legal market value of shrimp as low market value can threat the total culture method. Therefore, marketing and preservation policy must be improved so that seller and buyer related to shrimp business can be more attractive and encouraged.

03. Regular monitoring of shrimp related farms and sectors by the respective regulatory bodies are necessary. Research institutes, extension authorities and merchant associations should support producers as a joint dynamism.

04. Water management infrastructures (sluice gates, canals, dikes) and embankment construction related activities should be conducted to identify the real causes of shrimp viral diseases and its outbreak. To overcome this problem, methodical use of

chemicals should be ensured and supplementary supply of artificial irrigation should be arranged in dry season.

05. Application of feed and fertilizer in relation to stocking density needed to increase the production of shrimp. Fair prices of inputs should be safeguarded.

06. Organizational participation can play a vital role on shrimp as it helps the respondents in different farming activities. Meanwhile, ensuring women engagement in this signature farming would cut the extraneous labor cost and ultimately aggrandizes the farm turnover.

07. Rules and regulation as stated under Bangladesh Fisheries Act must be strictly followed and enforced. If required necessary action to be taken by Government to update the rules and regulation for the betterment of the fishery and sectors.

5.3. Conclusion

The shrimp sector has been exposed as a viable alternative to aquatic production providing rational revenue opportunities for rural residents. However, grass root level proprietors met numerous traumas during farming activities. The purpose of this study was to delineate the constraints confronted at the niche level mostly. In addition, the comparative profitability of shrimp cultivation over other agrarian crops was demonstrated. Exploration found positive impact on proprietor's socio-economic welfare and adverse impact on vicinity environs. Therefore, sustainable shrimp cultivation should be maintained to ensure social, economic and ecological stability. Finally, minimizing the existed farming perplexities with effective measures could ease more investment as well as production and ultimately lead toward welfare procession.

5.4. Study limitation

Taking into account the economic, time and other requisite resources accessible to the researcher, it was necessary to impute some margins as stated below:

- i.** The study was kept to ninety selected gher/hatchery of three specified upazila.
- ii.** Only ten major constraints feature of were taken for survey in this study.
- iii.** The researcher relied on the data asserted by the respondent limited within the proprietors of the farm with their memory during interview.
- iv.** For some cases, the researcher confronted unexpected exaggerated interference. However, the researcher tried to handle this problem as far as possible with sufficient sagacity and skill.
- v.** Several perplexities entailed due to unplanned shrimp commercialization. However, only six environmental complications had been reflected in this exploration.

5.5. Opportunity for further research

Basic motive behind this research was to expose the degree of some pre-asserted constraints confronted at grass root farm/gher level. However, inadequacy of time, capital and other obligatory possessions, it was quite tough to cover other south-western locations rather than Satkhira district merely. Hence, only selected areas of three upazila in Satkhira were taken for simplistic survey. In addition, post environmental impacts due to shrimp commercialization were not elaborately interpreted. Thus, this certain research finding may not specify the farming scenario as a whole in Bangladesh. Consequently, an ample scope of farther survey to

measure other pertinent complication factors and other AEZ region corresponding with this study area is conceivable for conclude the result more significantly.

REFERENCES

- Abedin, M.A., Habiba, U. and Shaw, R. (2015). Health: Impacts of salinity, arsenic and drought in south-western Bangladesh. *Environment and Disaster Risk Management*. **13**:165-193.
- Alam, S.M.N, Pokrant, B., Yakupitiyage, A., Phillips, M.J. (2007). Economic returns of disease affected extensive shrimp farming in southwest Bangladesh. *Aquaculture International*. **15(5)**: 363-370.
- Anwar, M.S. (2003) Effect of shrimp culture on ecology in the coastal areas of Bangladesh. *Human Landscape Ecology*.
- Babbie, E. (2012). The Practice of Social Research. *Cengage Learning*. p. 159.
- BBS. (2011). Year Book of District Statistics. Bangladesh Bureau of Statistics, Statistics and Informatics Division, Ministry of planning, Government of the People's Republic of Bangladesh.
- BBS. (2020). Year Book of Agricultural Statistics. Bangladesh Bureau of Statistics, Statistics and Informatics Division, Ministry of planning, Government of the People's Republic of Bangladesh.
- BER. (2021). Bangladesh Economic Review. Finance Division, Ministry of Finance, Government of the People's Republic of Bangladesh.
- Belton, B., Karim, M., Thilsted, S., Collis, W. (2011). Review of aquaculture and fish consumption in Bangladesh: studies and reviews 2011. The World Fish Center.

- Das, L. (1993). Economics of shrimp culture in some selected areas of Bangladesh. MS Thesis, BAU, Mymensingh.
- Deb, A.K. (1998). *Fake blue revolution: environmental and socio-economic impacts of shrimp culture in the coastal areas of Bangladesh. Ocean Coastal Management. 41(1): 63-88.*
- FAO (2014). The state of world fisheries and aquaculture. 243.
- FRSS. (2012). Fisheries Statistical Yearbook of Bangladesh. Fisheries Resources Survey System, Department of Fisheries, Bangladesh.
- Ghafur, A., Kamal, M., Dhaly, M.R., Khatun, S. (1999). Socio-economic and environmental impact of shrimp culture in south-western Bangladesh: An integrated approach. Nijera Kori and IDPAA at Proshika, Dhaka, Bangladesh.
- Hagler, M. (1997). Shrimp: the devastating delicacy. **In:** Green peace report, Greenpeace, Netherlands.
- Hasan, M. (2019). An assessment of impacts from shrimp aquaculture in Bangladesh and prospects for improvement.
- Hossain, M., Uddin, M. and Fakhruddin, A. N. M. (2013). Impacts of shrimp farming on the coastal environment of Bangladesh and approach for management. *Environmental Science and Bio Technology. 12.*
- Islam, A. (1999). Effects of shrimp farming on the physicochemical and biological qualities of water. M.S. Thesis. BAU, Mymensingh.

- Karim, A.H.M.Z. and Mustari, S. (2015). Shrimp cultivation and coastal livelihood: a focus on Bangladesh coastal vulnerability, *Asian Social Science*, **11(28)**: 109-115.
- Mamun, M.A.A., Ara, M.G., Azad, K.N., Fatema, J., Ahmed, Z.F., and Fatema, M.K. (2020). Present status of shrimp farming in Satkhira, a southwestern district of Bangladesh. *Research in Agriculture Livestock and Fisheries*. **7(2)**:311–320. Retrieved from: <https://doi.org/10.3329/ralf.v7i2.48874>
- Matin, M., Chakraborty, S., Amin, M.A. and Ghosh, A. (2016). An assessment of shrimp aquaculture in selected coastal areas of Bangladesh. *Journal of NOAMI*. **33**: 103-116.
- MFL (2014). National Shrimp Policy. Ministry of Fisheries and Livestock, Dhaka, Bangladesh.
- Miah, A. A., Islam, M. S. and Wahab, M. A. (2002). Socio-economic and environmental impacts of alternate shrimp crop farming in Bangladesh. *Bangladesh Journal of Agricultural Economics*. **25(1)**: 63-76.
- Mitro, S., Khatun, R. and Baten, M.A. (2014) Socio-economic and environmental impacts of shrimp culture in some selected areas of Bagerhat District. *Environment Science and Natural Resource*. **7(1)**: 265-269.
- Naylor, R.L., Goldburg, R.J., Primavera, J.H., Kautsky, N., Beveridge, M.C.M. (2000). Effect of aquaculture on world fish supplies. *Nature*. **405**: 1017-1024.

- Paez-Osuna, F., Gracia, A., Flores-Verdugo, F., Lyle-Fritch, L.P., Alonso-Rodriguez, R. (2003). Shrimp aquaculture development and the environment in the Gulf of California ecoregion. *Maritime Pollution Bulletin*. **46(7)**: 806-815.
- Primavera, J.H. (2006). Overcoming the impacts of aquaculture on the coastal zone. *Ocean Coastal Management*. **49**: 531-545.
- Primavera, J.H. (1991). Intensive prawn farming in the Philippines: ecological, social and economic implications. *Ambiology*. **20(1)**: 28-33.
- Prodhan, S., Sikder, B. and Nasreen, M. (2019). Impacts and challenges associated with shrimp cultivation in Parulia union, Satkhira, Bangladesh: An empirical study. *Journal of the Asiatic Society of Bangladesh Science*. **45**: 55-69.
- Rahman, M. M. and Hossain, M. M. (2009). Production and export of shrimp of Bangladesh: Problems and prospects. *Progressive Agriculture*. **20(1)**: 163–171.
- Rahman, M.M., Giedraitis, V.R., Lieberman, L.S., Akhtar, M.T. (2013). Shrimp cultivation with water salinity in Bangladesh: the implications of an ecological model. *University Public Health*. **1(3)**: 131-142.
- Rasha, R.K. (2013). Profitability and resources use efficiency of shrimp farming in some selected areas of Bagherhat district in Bangladesh. M.S. Thesis. SAU, Dhaka.

- Saha, S.K. (2017). Cyclone, salinity intrusion and adaptation and coping measures in coastal Bangladesh. *Space and Culture*. **5(1)**: 12-24.
- Shah, M. S., and Karim, M. R. (2001). Shrimp culture and changes of land use pattern in coastal belt of Bangladesh: A spatio-temporal analysis. Bangladesh Agricultural Research Council and Khulna University contract research project report.
- Shahriar, A., Dhrubo, B., Sazzad, M.H. (2019). Environmental impacts of commercial shrimp farming in coastal zone of Bangladesh and approaches for sustainable management. *International Journal on Environment Science*. **20(3)**: 556038. Available at: DOI:10.19080/IJES.2019.20.556038.
- Shamim, A.H. (2015). Deterioration of soil and water quality by practicing shrimp culture in Satkhira, Bangladesh. *Journal of Soil and Nature*. **8**:7-13.
- Wahab, M.A. (2003). Environmental impacts of shrimp farming in the coastal areas of Bangladesh. **In**: Wahab MA (Ed.), Environmental and socioeconomic impact of shrimp farming in Bangladesh, technical proceeding BAUNORAD workshop. BRAC Center, Dhaka, pp. 19-32.
- Uddin, M.H. (1995). An economic study on shrimp farming in some selected areas of Khulna and Satkhira district. M.S. Thesis. BAU, Mymensingh.
- Warner, K., Van-der G.K., Kreft, S., Huq, S., Harmeling, S., Kusters, K. and Sherbinin, A.D. (2012) Evidence from the frontlines of climate change: Loss and damage to communities despite coping and adaptation.

APPENDICES

Appendix I

DEPARTMENT OF AGRICULTURAL STATISTICS
Sher-e-Bangla Agricultural University

An Interview Schedule for a research study entitled

**IMPACT AND CONSTRAINTS ANALYSIS OF SHRIMP FARMING IN SELECTED
AREAS OF SATKHIRA DISTRICT, BANGLADESH**

(Please response the following questions and put-check mark whenever application)

01. **Preliminary information of farmer:** Sample no:.....

Name: Village: Upazila:

02. **Age:** How old are you? Years.

03. **Educational status:** Primary (0-5) / Secondary (6-10) / Higher (over 10)

04. **Revenue sources:** Agriculture / Business / Transport service / Remittance / Official job /
Student / Others (more than one may be applicable)

05. **Family financial condition:**

5.a. Number of family member: 5.b. Number of earning family member:

5.c. Availability of family labor support in shrimp farming:

06. **Relevance with shrimp farming:**

6.a. Type of farming: Seasonal/Year-round 6.b. Relevance time period: years

07. **Who encourages the farmer for shrimp cultivation?**

Family tradition	Neighbors & Relatives	Radio / TV /	Agents and traders
	Extension department	Newspaper	Community association

08. **Type of activity:** (a.) Single (b.) Partnership (c.) Co-operative

09. **Farm size:**

Sl. No.	Type	Local land Unit (Decimal)	Hectare
A.	Own land under own cultivation		
B.	Land taken on lease		
C.	Land taken on mortgage		

10. **Shrimp expenditure and revenue** (BDT calculation per hectare)

Expenditure	Fingerling	Labor	Lime	Urea	TSP	Compost	Feed	Land rent	Other	Total cost
Revenue	Production (Kg)			Per kg market price			Total income		B.C.R.	

11. **Opportunity cost from another crop cultivation**

Crop	Probable expenditure	Probable revenue	B.C.R.
(i.)			
(ii.)			

12. **Women participation**

12.1. Number of women participations:

12.2. Women participation score: (put-check mark the degree of participation)

Sl no.	Technologies	Degree of participation		
		Frequently (2)	Occasionally (1)	Never (0)
i.	Fry collection and sorting out			
ii.	Shrimp take care & harvesting			
iii.	Shrimp grading and marketing			

Women participation range: Low (0-2), Medium (3-4) and High (5-6)

13. **Social-economic position of farming household:**

Particulars	High	Medium	Not at all
Additional nutritious food intake			
Infrastructure development			
Recreation and educational privilege			
Societal organization / community involvement			

14. Constraints confronted at production and marketing

(put-check mark on the right side of the preferred options)

Hindrances	Acute	Medium	None	Hindrances	Acute	Medium	None
Lack of quality fingerling				Credit mismanagement			
Insufficient training and DAE service feasibility				Inappropriate market infrastructure			
Natural calamities				Asymmetrical cost and revenue			
Over chances of virus intrusion				Stealing possibility			
Storage inadequacy				Land/Partnership/ local muscle power crisis			

15. Adverse impact on environs:

Subjects	Acute (2)	Medium (1)	None (0)	Subjects	Acute (2)	Medium (1)	None (0)
Imbalance in natural shrimp fry habitation				Inadequacy of fresh drinking water			
Aquatic plant (Lily, hyacinths, algae) extinction				Disease pandemic			
Aquatic animal (viper, lizard, tortoise, crab) extinction				Salinity intrusion in neighbored agrarian land			

16. Household own perception / opinion / expectation:

.....

Thank you for your earnest assistance

Date:

.....
Signature of Responded participant

.....
Signature of Interviewer

APPENDIX II

Summary output of socio-economic classification of survey proprietors

Categories		Responded households			Total	% in total
		Debhata	Kaligonj	Tala		
Age distribution	Young aged (18 - 35)	3	3	2	8	9
	Middle aged (35 - 50)	20	22	24	66	73.3
	Old (above 50)	7	5	4	16	17.7
Earning sources	Agriculture	20	18	23	61	67.8
	Business	4	7	3	14	15.6
	Remittance privileged	3	0	2	5	5.5
	Official job (public/private)	2	3	2	7	7.8
	Institutional apprentice	1	2	0	3	3.3
Education level	Primary (1-5 class)	4	3	4	11	12.2
	Secondary (6 – 10 class)	19	19	22	60	66.7
	Higher (over 10 class)	7	8	4	19	21.1
Household labor	Family members	6.25	6.12	7		
	Active earning member	3	4.25	3.5		
	Available family labor for shrimp farming	4.5	4.75	5		
Women involvement	Low participation	9	8	10	27	30
	Medium participation	15	14	16	45	50
	High participation	6	8	4	18	20
Farm size	Small (0.13-1 ha)	10	11	9	30	33.4
	Medium (1.01-3 ha)	16	16	17	49	54.4
	Large land (above 3 ha)	4	3	4	11	12.2