Survey on Implementation of Traceability & HACCP System in Aquatic Animal

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ABSTRACT

The aquaculture industry in Bangladesh plays a vital role in meeting the nutritional needs of its growing population, with fish being a culturally significant and economically crucial commodity. As Bangladesh emerges as a key player in the aquaculture sector, ensuring the safety and quality of aquatic products becomes paramount, especially in the context of international concerns regarding shrimp quality. This research paper delves into the intricate web of traceability and Hazard Analysis and Critical Control Points (HACCP) systems in Bangladesh's aquatic animal industry. With a focus on Cox's Bazar, a prominent fish-producing district, the study explores current practices, challenges, and opportunities in implementing traceability and HACCP. The results highlight a positive trend in regulatory compliance, training, and the possession of governmental licenses. However, the study reveals areas for improvement, particularly in traceability practices and ethical concerns related to labour. The HACCP system analysis underscores commendable adoption of preventive measures, though challenges persist in chemical use and frequency of testing. Notably, the high adoption of footbaths as a Critical Control Point (CCP) indicates a collective acknowledgment of disease transmission risks. The research emphasizes the importance of active monitoring, documentation of customer complaints, and addressing gaps in critical control points for the industry's stakeholders. As Bangladesh navigates global trade complexities and strives for environmental sustainability, a thorough understanding of traceability and HACCP systems is essential. This study contributes valuable insights for informed decision-making, fostering economic growth, and ensuring public health within the burgeoning aquaculture sector of Bangladesh.

Key words: Aquaculture, Traceability, HACCP

CHAPTER 1

INTRODUCTION

In the dynamic landscape of global food safety and security, the aquaculture industry plays a pivotal role in meeting the nutritional demands of a growing population. Bangladesh, the fortunate in having potential water resources, is one of the world's leading fish producing countries with a total production of 43.84 lakh MT in Fiscal Year 2018-19, where aquaculture accounts for 56.76 percent of the total fish production (DOF , 2022). Fish is Bangladesh's most important and culturally preferred food, other than rice. It accounts for the largest share of per capita food expenditures after rice (Minten et al., 2010). Bangladesh earns a considerable amount of foreign currencies by exporting fish, shrimps and other fishery products. In 2021-22, the country earns BDT 5191.75 crore by exporting almost 74.04 thousand MT of fish and fishery products (EPB ,2022). As Bangladesh emerges as a significant player in the aquaculture sector, ensuring the safety and quality of aquatic products becomes paramount.

Shrimp importers, particularly those in the USA and European countries, express significant apprehension regarding the quality and safety standards of shrimp originating from exporting nations. In the past, emphasis was placed on maintaining quality in terms of decomposition, filth content, and pathogenic bacteria. However, contemporary standards go beyond these criteria. To address this, international organizations and buyers have implemented measures such as the Bioterrorism Act, Antidumping Act, Traceability, and HACCP, aiming to guarantee the quality and safety of shrimp products (Hussein and Islam, 2005).

This research paper delves into the intricate web of traceability and Hazard Analysis and Critical Control Points (HACCP) systems in the context of aquatic animals in Bangladesh. With the intensification of aquaculture practices and the expansion of seafood markets & export value, the need for effective traceability mechanisms has never been more pressing.

Traceability, the ability to trace the origin, processing, and distribution of aquatic products, is a fundamental component in ensuring transparency and accountability throughout the supply chain. In parallel, the Hazard Analysis and Critical Control Points (HACCP) system provides a systematic and preventive approach to identify, evaluate, and control potential hazards, thereby assuring the safety of seafood products. It also aims to comprehensively explore the current state of traceability and HACCP implementation in Bangladesh's aquatic animal industry. By examining existing practices, challenges, and opportunities, the study seeks to contribute valuable insights into enhancing the overall safety and quality of seafood products. Additionally, the research will shed light on the regulatory frameworks, industry collaborations, and technological interventions that facilitate or hinder the effective implementation of traceability and HACCP systems in Bangladesh.

As we navigate the complexities of global trade, consumer expectations, and environmental sustainability, a thorough understanding of traceability and HACCP systems in the context of Bangladesh's aquatic animal industry is essential. It will help to bridge the knowledge gap, foster informed decision-making, and pave the way for advancements that promote both economic growth and public health within the burgeoning aquaculture sector of Bangladesh.

CHAPTER 2

Concept of Traceability and HACCP system

The term "food" encompasses any substance or product, whether in a processed or unprocessed state, designed to be ingested by humans or reasonably anticipated to be so. For food to be considered safe, it must not pose harm to health and must be suitable for human consumption. Conversely, unsafe food is characterized by its potential to cause harm to health and its unsuitability for human consumption. HACCP offers a methodical strategy for managing risks, and concurrently, traceability improves openness, facilitating rapid recalls and ensuring the well-being of consumers. Together, these components play vital roles in preserving the quality of fish products and fostering consumer trust in the seafood supply chain.

2.1 Traceability:

Traceability can be defined as per Regulation (EC) 178/2002 Traceability means the ability to trace and follow a food, feed and food producing animal or substance intend to be or expected to be incorporated into a food or feed, through all stages of products, packing and distribution.

In essence, traceability primarily addresses food safety concerns. However, heightened awareness from environmentalists and humanitarian groups has broadened the scope to include additional issues. These encompass the well-being of laborers involved in food production, environmental considerations such as threats to mangroves and ecological imbalances, as well as sustainable fishing practices and biodiversity preservation. Traceability plays a crucial role in swiftly recalling products from the market, significantly mitigating the potential risks to consumer health and safety.

2.2 HACCP (Hazard Analysis and Critical Control Points):

Hazard Analysis and Critical Control Points (HACCP) is a systematic approach to food safety that aims to prevent, eliminate, or reduce potential biological, chemical, and physical hazards in the food production process (FDA, 2017).

HACCP is a process, the application of which can prevent shrimp from all sorts of possible contaminations from any possible sources beginning from culture up to the market (Hussein and Islam, 2005). HACCP principles formulated on the requirements for processing units as well as aquaculture.

The Hazard Analysis and Critical Control Points (HACCP) process involves the following main steps. (Codex Alimentarius Commission, 2003).

1. Conduct a Hazard Analysis.
2. Determine Critical Control Points (CCPs).
3. Establish Critical Limits.
4. Monitor CCPs.
5. Establish Corrective Actions.
6. Establish Verification Procedures.
7. Establish Record-Keeping and Documentation Procedures.

CHAPTER 3

MATERIAL AND METHODS

3.1 Study Area

Cox's Bazar stands as a prominent district in fish production. In the year 2022, the district achieved a total fish production of 24,035.12 metric tonnes, with shrimp contributing significantly at 17,202.28 metric tonnes (DOF ,2022). The research was centered on the junction of Sadar and Ramu upazila in the Cox's bazar district, with a specific focus on the within Dorianagar. The choice of this area was driven by its elevated presence of hatcheries.

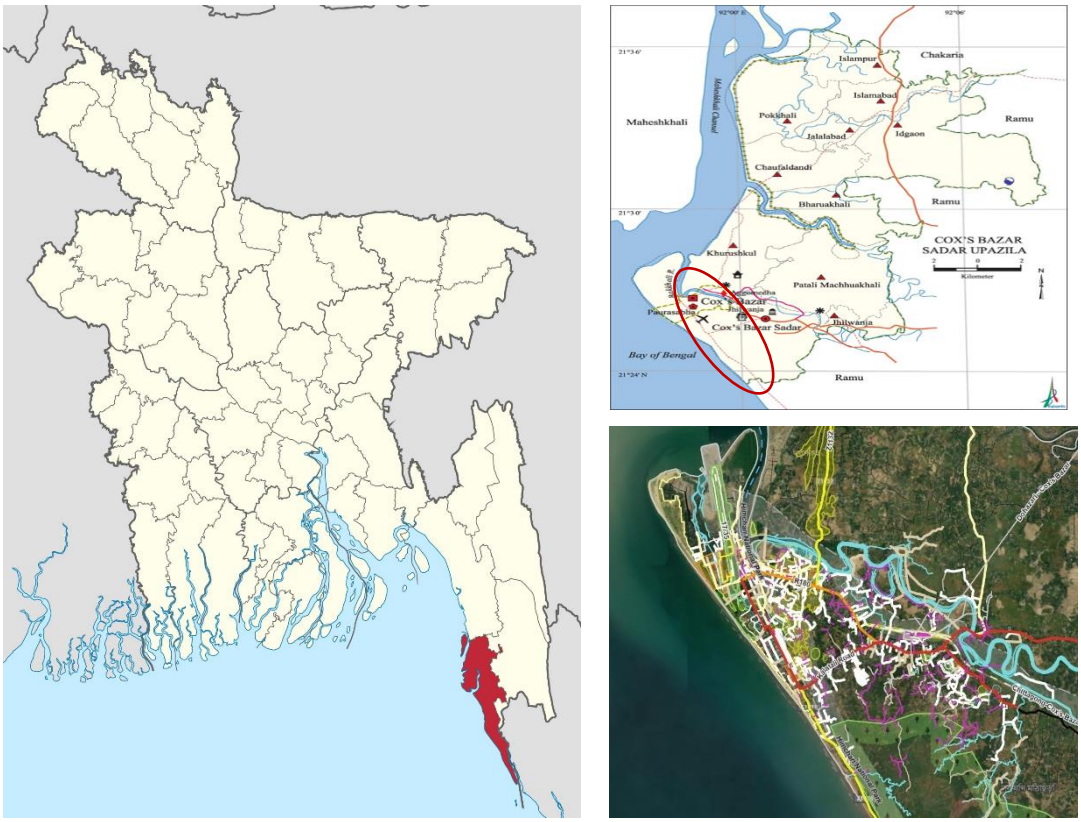

Figure 1: Location of selected Hatcheries

3.2 Methodology

The survey methodology was carefully designed, covering essential elements like Owner details, Hatchery information, fish production records, Caught Area, Uses of Veterinary drugs, Work environment, Work ethic, Biosecurity related data, Impact on Environment etc. Ten Hatcheries were included in the survey, and the data compilation involved direct interactions with owner/manager through interviews and on-site evaluations of their farming operations. Before the interviews began, respondents were thoroughly briefed on the nature and objectives of the study.

3.3 Study Framework

A study framework was created to steer the successful execution of the report's implementation (Subedi, 2013).

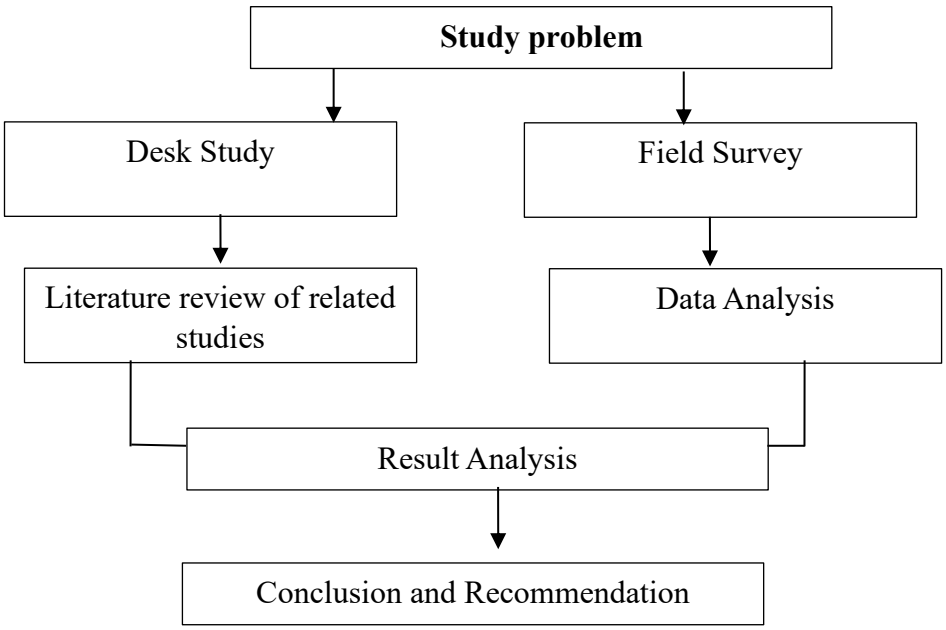

Figure 2: Schematic presentation of study framework

3.4 Data Tabulation and Analysis

The owner's/managers responses were carefully documented on interview schedules, and the collected data were systematically organized and tabulated. Numerical values were then expressed as percentages. The analytical examination of the productivity data followed the Completely Randomized Design (CRD) methodology detailed by Steel and Torrie (1980).

CHAPTER 4

Results and Discussion

4.1 Traceability

A majority of respondents (60%) do not utilize the farm ID as part of traceability, suggesting that a significant portion of the surveyed entities lack a specific identification system for the origin of aquatic animals.

All respondents reported no perceived threats to aquatic animals, which is a positive finding suggesting a secure environment for aquatic life.

Only 10% of respondents reported threats to the environment, indicating a potential area of concern that needs further investigation or mitigation strategies. The majority (90%) of respondents did not report any threats to the environment, which is a positive aspect in terms of environmental sustainability.

A portion (20%) of respondents admit to having labour under 14 years old, indicating a potential ethical concern or non-compliance with labour regulations.

70% of respondents received training, indicating a positive trend in terms of knowledge and skill development within the industry. 30% of respondents did not receive training, highlighting a potential area for improvement in ensuring that individuals involved in the industry are adequately trained.

All respondents possess a governmental license, suggesting that the entire surveyed population operates within the regulatory framework.

Generally, The absence of perceived threats to animals and the widespread possession of governmental licenses suggest a generally compliant and well-regulated industry. The majority having received training is positive for the successful implementation of traceability and HACCP systems.

Table 1 represents an overview of General information about Implementation of Traceability

Table 1: General Information about Traceability

Parameters	Categories	No of respondents	Percentage (%)
Caught Area (Farm Id)	Yes	4	40%
	No	6	60%
Any threat to animal	Yes	0	0%
	No	10	100%
Any threat to	Yes	1	10%
environment	No	9	90%
Presence of labour	Yes	2	20%
under 14 years old	No	8	80%
Training received	Yes	7	70%
	No	3	30%
Governmental License	Yes	10	100%
	No	0	0%

4.2 HACCP System

Based on the data presented in Table 3, several conclusions can be drawn regarding the housing system, feeding system, fodder cultivation, breeding system, and overall management system of the surveyed respondents:

4.2.1 *Conduct Hazard Analysis*

Possible Chemical Hazards

The use of Sumithion (60%) raises concerns about the potential impact on aquatic ecosystems as organophosphates can be harmful to non-target organisms. Oxytetracycline (30%), while effective against bacterial infections, may contribute to antibiotic resistance if not used judiciously. The use of Chloramphenicol, even at a low percentage, is noteworthy due to its associated health and environmental risks. It is essential to explore alternatives to minimize its use.

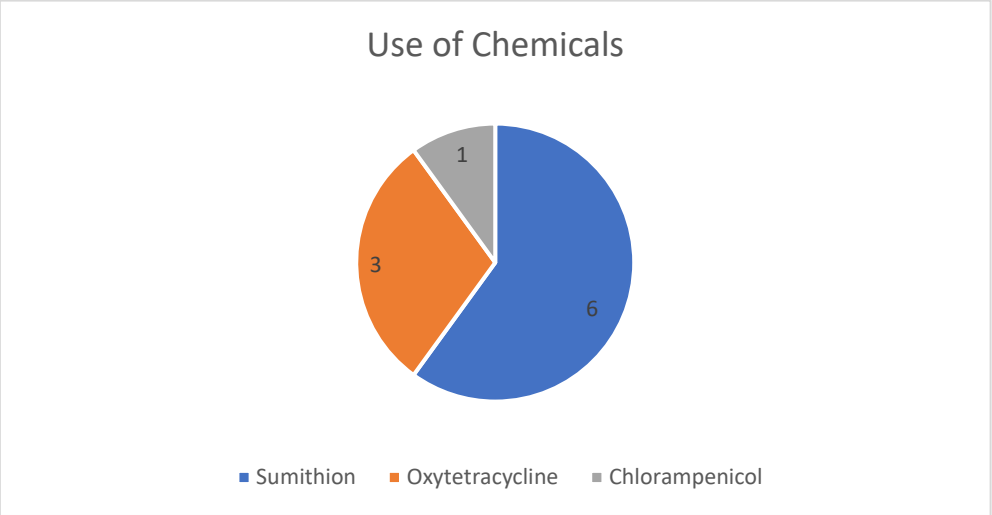

Chart 1: Use of Chemicals

4.2.2 *Identified Critical Control Point (CCP)*

Footbath

The high adoption rate (90%) of footbaths as a CCP suggests a collective acknowledgment among hatchery operators regarding the potential risks associated with disease transmission. Footbaths, when effectively implemented, serve as a robust barrier to the ingress and egress of pathogens, contributing to the overall biosecurity of the facility. Conversely, the 10% of hatcheries not employing footbaths as a CCP necessitate further exploration.

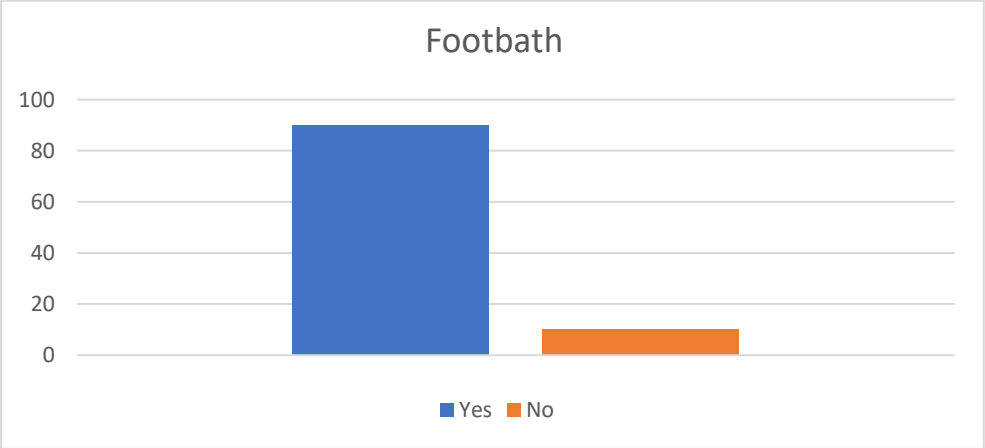

Chart 2: Use of Footbath

4.2.3 *Establish critical limits for each for CCP*

Pesticide MRL

Maximum Residue Limits (MRLs) for pesticides represent the maximum allowable concentration of pesticide residues in or on food commodities and are crucial for ensuring food safety. Compliance with these limits is essential to mitigate potential health risks associated with pesticide exposure.

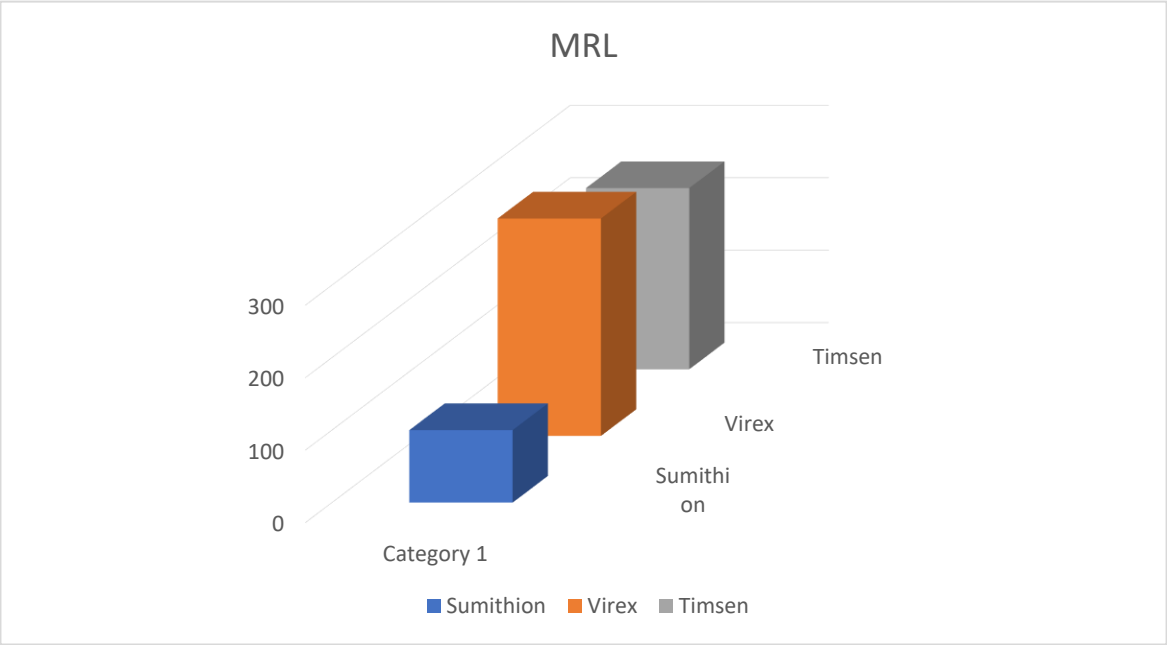

Chart 3: MRL Value

4.2.4 *Establish monitoring procedures*

Establish the frequency of testing

The majority of surveyed facilities, 50%, conduct testing once a week, indicating a proactive commitment to regular monitoring and risk management. Another significant portion, 30%, performs testing twice a week, reflecting an even higher level of diligence. However, 20% of facilities opt for a less frequent monthly testing schedule, prompting questions about the rationale behind this approach, which may be linked to risk assessment strategies or resource constraints

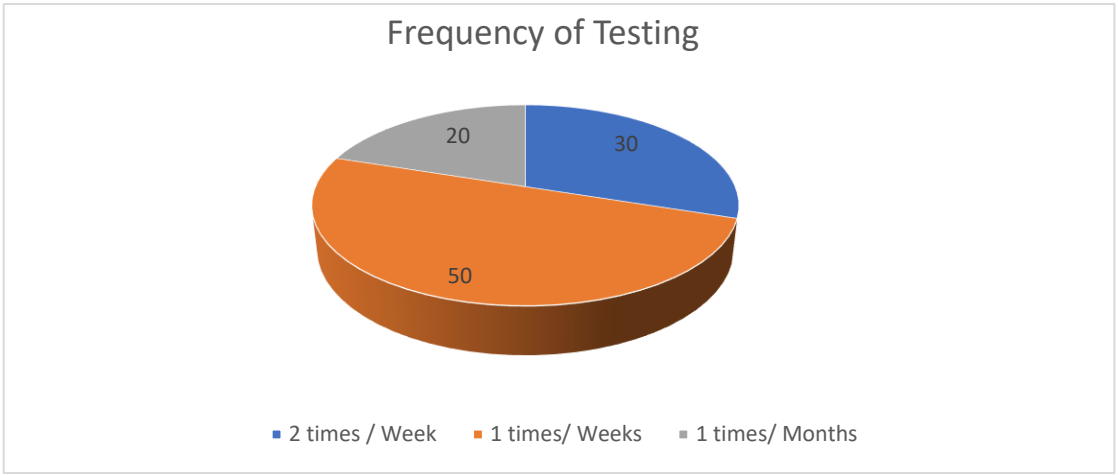

Chart 4: Frequency of testing

4.2.5 Establish corrective action procedures

Prevention of drug and chemical residue in aquaculture

A substantial 50% of the surveyed hatcheries reported taking immediate action in the prevention of drug and chemical residues. 40% of hatcheries reported engaging in pre-action, signifying a proactive but potentially less urgent approach to preventing drug and chemical residues. The 10% of hatcheries reporting no action raises concerns about the potential gaps in awareness.

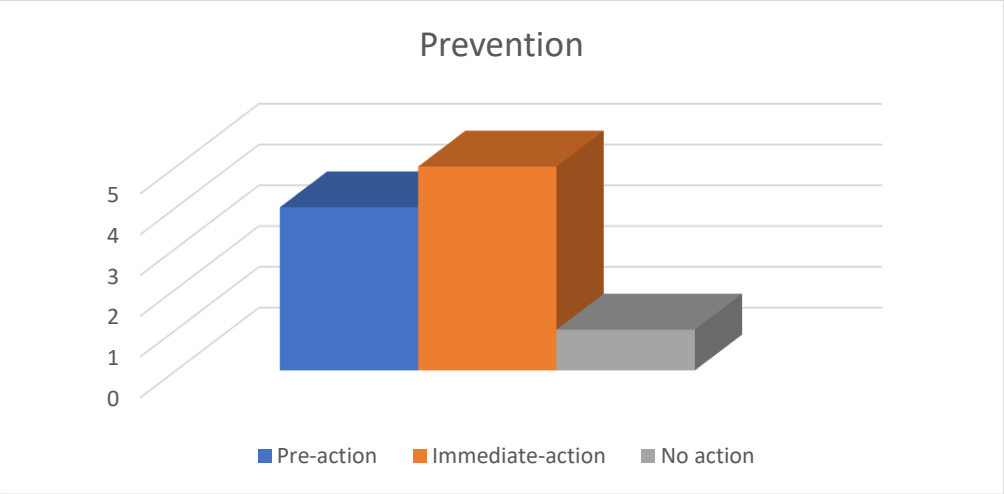

Chart 5: Prevention

4.2.6 *Establish verification procedures*

Active monitoring

The high adoption of active monitoring aligns with HACCP principles, emphasizing continuous vigilance for control point effectiveness. The 30% non-compliance raises concerns, suggesting potential barriers such as resource limitations or a lack of awareness.

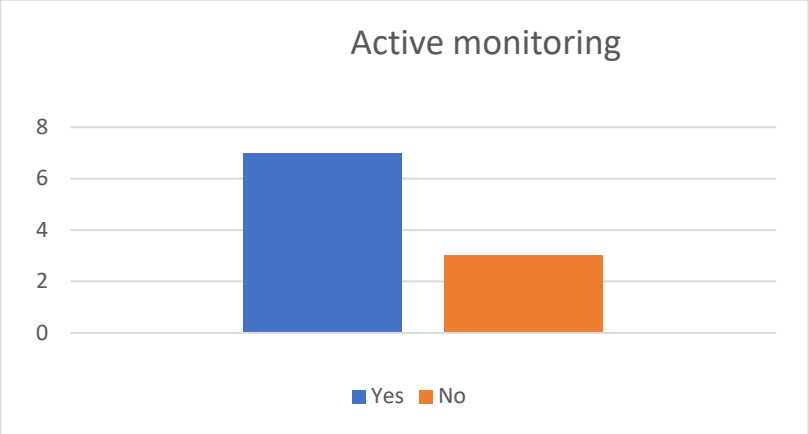

Chart 6: Active monitoring

4.2.7 *Establish documentation procedures*

Records of Raw material, Production, Monitoring data, Customer problem

Raw Materials Data

80% of respondents affirm the recording of raw materials data, indicating a relatively high level of awareness and commitment to traceability from the initial stages of production. This positive response suggests a recognition among aquaculture practitioners regarding the importance of documenting and tracing the origin of raw materials. This is crucial not only for compliance with regulatory standards but also for quickly identifying and addressing any issues related to raw material.

Production & Marketing Data

70% of respondents claim to record both production and marketing data, revealing a substantial but slightly lower commitment compared to raw materials data. The correlation between production and marketing data is vital for comprehensive traceability. The 30% not engaging in this practice may miss opportunities for optimizing production efficiency and responding to market demands effectively. Encouraging wider adoption of recording both aspects could foster a more integrated and responsive aquaculture industry.

Monitoring Data

40% of respondents indicate the recording of monitoring data, suggesting a significant portion actively monitors critical control points within their production processes. The 60% not documenting monitoring data may be at a risk of missing early signs of deviations or potential hazards in their processes. Encouraging a more widespread adoption of systematic monitoring practices is crucial for ensuring the effectiveness of the HACCP system in mitigating risks and ensuring product safety.

Customer Complaints

Only 10% of respondents claim to record customer complaints. The low percentage of respondents documenting customer complaints is noteworthy. Customer complaints serve as a valuable feedback mechanism, offering insights into product quality and safety from an end-user perspective. Increasing awareness about the significance of recording and analysing customer complaints could enhance the industry's responsiveness to consumer concerns and contribute to continuous improvement.

Table 2: Records of Raw material, Production, Monitoring data, Customer problem

Parameters	Categories	No. of respondents	Percentage (%)
Raw materials data	Yes	8	80%
	No	2	20%
Production & Marketing data	Yes	7	70%
	No	3	30%
Monitoring data	Yes	4	40%
	No	6	60%
Customer complain	Yes	1	10%
	No	9	90%

Conclusion

This research underscores the significance of traceability and HACCP systems in Bangladesh's aquaculture industry, crucial for ensuring the safety of aquatic products. Findings from Cox's Bazar reveal positive trends in regulatory compliance and training but suggest areas for improvement, notably in traceability practices and ethical concerns. The HACCP system analysis highlights commendable adoption of preventive measures and monitoring practices, though challenges persist, particularly in chemical use and frequency of testing. The study emphasizes the importance of active monitoring, documentation of customer complaints, and addressing gaps in critical control points, offering valuable insights for industry stakeholders.

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BIOGRAPHY

I am Md. Imran Hossain, born to Jesmin Akter and Ruhul Hossain. I successfully finished my SSC at Peshkar Hat High School, Noakhali in 2015 with GPA of 4.89. Subsequently, I completed my HSC at Milestone College, Dhaka in 2017, achieving GPA of 5.00. Currently, I am enrolled as a DVM student at Chattogram Veterinary and Animal Sciences University, where I am actively involved in my internship.

I possess a keen interest in microbiology, and I am considering the possibility of delving into this field more deeply in the near future.