Sustainable Aquaculture for livelihood in South Western Coastal Zone of Bangladesh: An Integrated Conceptual Framework

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Abstract

Livelihoods in South Western Estuarine regions of Bangladesh are intrinsically dependent upon aquaculture. It has become imperative to formulate an integrated conceptual framework to make aquaculture sustainable in the face of changing climate and degrading ecosystem services. In this study the issue of sustainable aquaculture in southwestern coastal zone of Bangladesh has been addressed through the development of an integrated aquaculture model. As precursors to the development of this model, historical evolution of the aquaculture sector in this region has been discussed, as well as the factors acting as drivers behind these changes and the insufficiencies which eventually led to the opportunity for an integrated model. Sequential and chronological approach to the development of the aquaculture framework has also been laid out in detail. Weightages were assigned to different driving factors (both natural and physical or man-made) keeping expert opinion and field perceptions into account. Progress made in the development of the proposed model along with upcoming goals and actions have also been discussed.

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Changes in shrimp yield and cost-benefits in Southwestern Bangladesh

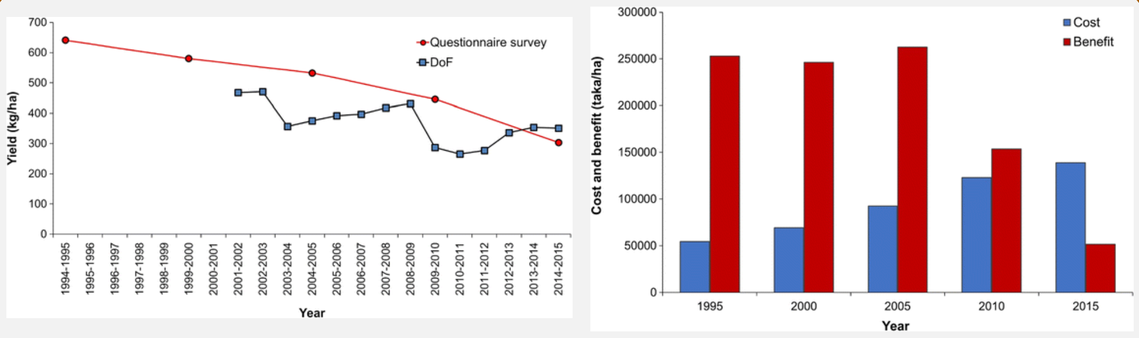

Figure 1: Temporal changes of shrimp yield and changes of total cost and total benefit of shrimp aquaculture (Akber et al. 2017)

✓ Aquaculture took place at the beginning in Bangladesh due to its higher economic returns.

✓ The increasing trends of environmental stressors (such as salinity, extreme weather, and natural disasters) impose potential threat on the sustainability of this aquaculture practice in this region.

✓ To Identify the effect of those factor, Bayesian Belief Network (BBN) has been used, which is a form of influence diagram which depicts the local or causal relations among its factors that influence the likelihood of outcome states of some parameter(s) of interest.

Figure 2: The pathway of BBN network for Aquaculture model as defined by expert knowledge

Table 1 : Variables List and Their ranges

Variables	Unit	Class	Range
Rainfall	mm/year	Low	> 750
		Mid	750 - 1000
		High	1000 <
Soil Salinity	ppt	Low	> 2
		Mid	2 - 10
		High	10 <
Water Logging	Ha	Low	> 200
		Mid	200 - 2000
		High	2000 <
Water Exchange	N.A.	Good	N.A.
		Poor	N.A.
Gher Size	Ha	Small	> 1.5
		Medium	1.5 - 2
		Large	2 <
Fish Feed	Tk/Ha-yr	Low	> 3000
		Mid	3000 - 4000
		High	4000 <
Cultivated Area	Ha	Low	> 5000
		Mid	5000 - 20000
		High	20000 <
Training	N.A.	Trained	N.A.
		Non-Trained	N.A.
		Partially Trained	N.A.
Production Rate	Kg/Ha-yr	Low	> 250
		Mid	250 – 450
		High	450 <
Household Income	Tk	Low	> 40000
		Mid	40000 - 60000
		High	60000 <

At this stage, the variables in the Bayesian network contain a set of factors influencing the preferred activities. In the Aquaculture model, expert opinions and a number of literatures were reviewed and investigated to identify the factors that affecting the preferred activity choice by theoretical and empirical study. A set of factors, mentioned in the table above, which are commonly mentioned by researchers in the aquaculture model were selected.

The integrated conceptual framework developed within this study will be useful to evaluate the indicative yield of aquaculture and its linkages with related environmental and human induced parameters. It would be a policy decision tool that will be able to provide knowledge for optimizing aquaculture production and protecting ecosystem.