The United Nations University
FISHERIES TRAINING PROGRAMME

TOWARD OPTIMAL USE OF BANGLADESH HILSA RESOURCE: BIO-ECONOMIC MODELLING

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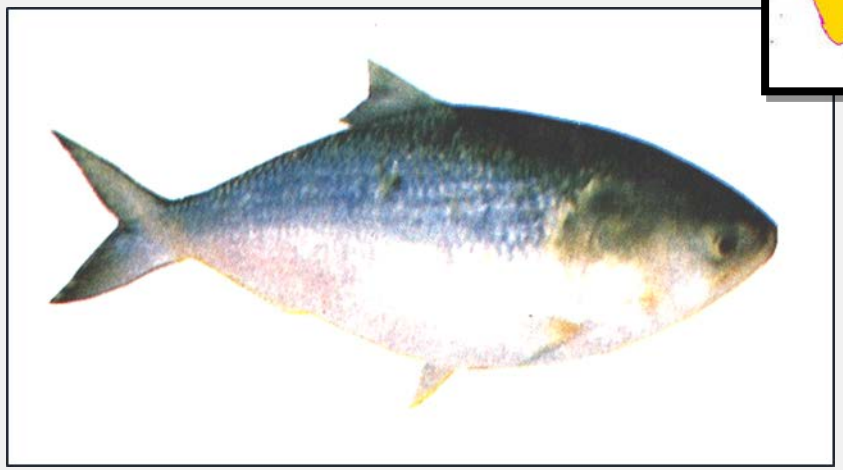
Presentation Outline

- Introduction
- Background
- Method: Theory of Modelling
- Model: Static and Dynamic Bioeconomic model
- Summary out put from the model
- Recommendations

INTRODUCTION

- **As a single species Hilsa (*Tenualosa ilisha)* production is about 11% of total fish**
- **60% of world's hilsa production**

In 2012-



- **Catch 347 thousand mt :**
- **Worth 1.384 Billion**
- **Export 6 Thousand MT**
- **Earning about 36 Million USD**
- **Livelihoods:**
- **About 464 thousand fishermen (184 thousand families) are involved and 2% (3 million people) of total population**

BACKGROUND

Hilsa (*Tenualosa ilisha)* fishery is primarily exploited through open access-

- Recruitment over-fishing (indiscriminate catching of *jatka*)
- Growth over-fishing (indiscriminate killing of gravid hilsa)
- The increasing fishing mortality due to excessive fishing effort
- Up-to-date studies are not available
- A very few studies of the economics of the fishery.

Current management

- To maintain the hilsa stock mainly biological management controls: area and time closure, gear restriction
- These measures have not been entirely successful in preventing decline in the stock
- More importantly, these measures are not capable

  to maintain the flow of net economic benefits from utilising the stock
- Or socially and economically optimal level of fishing effort

OBJECTIVES:

The overall objective of the study was to develop static and dynamic bio-economic models for the hilsa fishery

More specifically :

1) **Assessment of the current hilsa fishery**

2) **A bio-economic model was developed to make sensible policy for hilsa resource in Bangladesh**

3) **A theoretical solution for effort controls trajectories in stock rebuilding of hilsa fish.**

4) **Progressive policy recommendations were developed for the implementation of the constructed model.**

MODELLING:

Theory (Modified Schafer Model)

(Net Biomass Growth function)

$$\dot{x} = \alpha \cdot x - \beta \cdot x^2 - y_t$$

(Harvest function) $y = q \cdot e.x^{\delta}$

(Profit function) $\pi = p \cdot y - C(e)$

Biological part of the model

(Biomass growth, OSY, MSY,

Parameters

$\alpha, \beta, \delta, q\ etc.estimations$ **)**

Economic Part of model

(Cost, Revenue, profit, MEY estimations)

Link between Biological and Economic Model

Sustainable Hilsa fishery model

Optimal equilibrium effort

Dynamic Model:

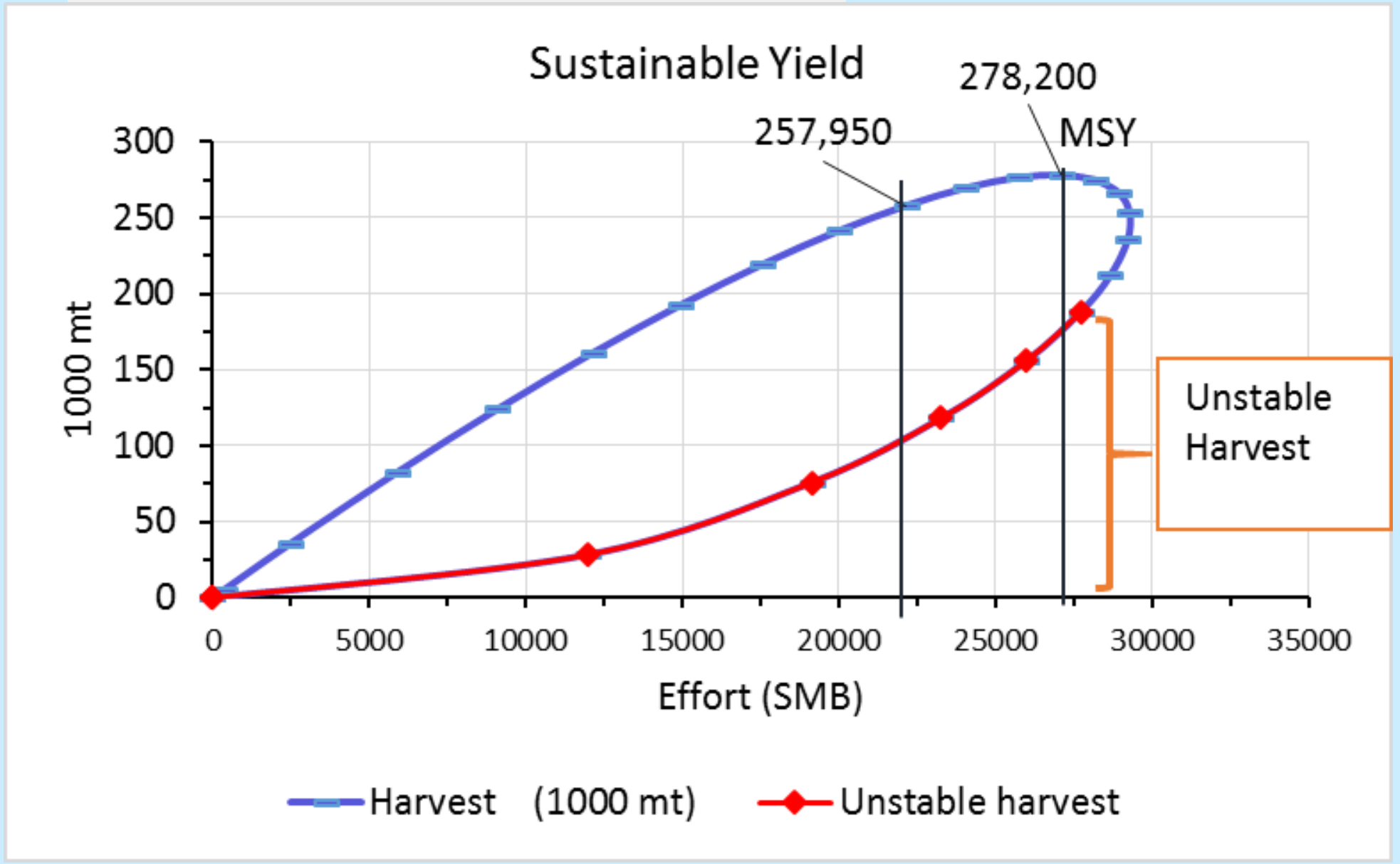
Optimal and moderate path

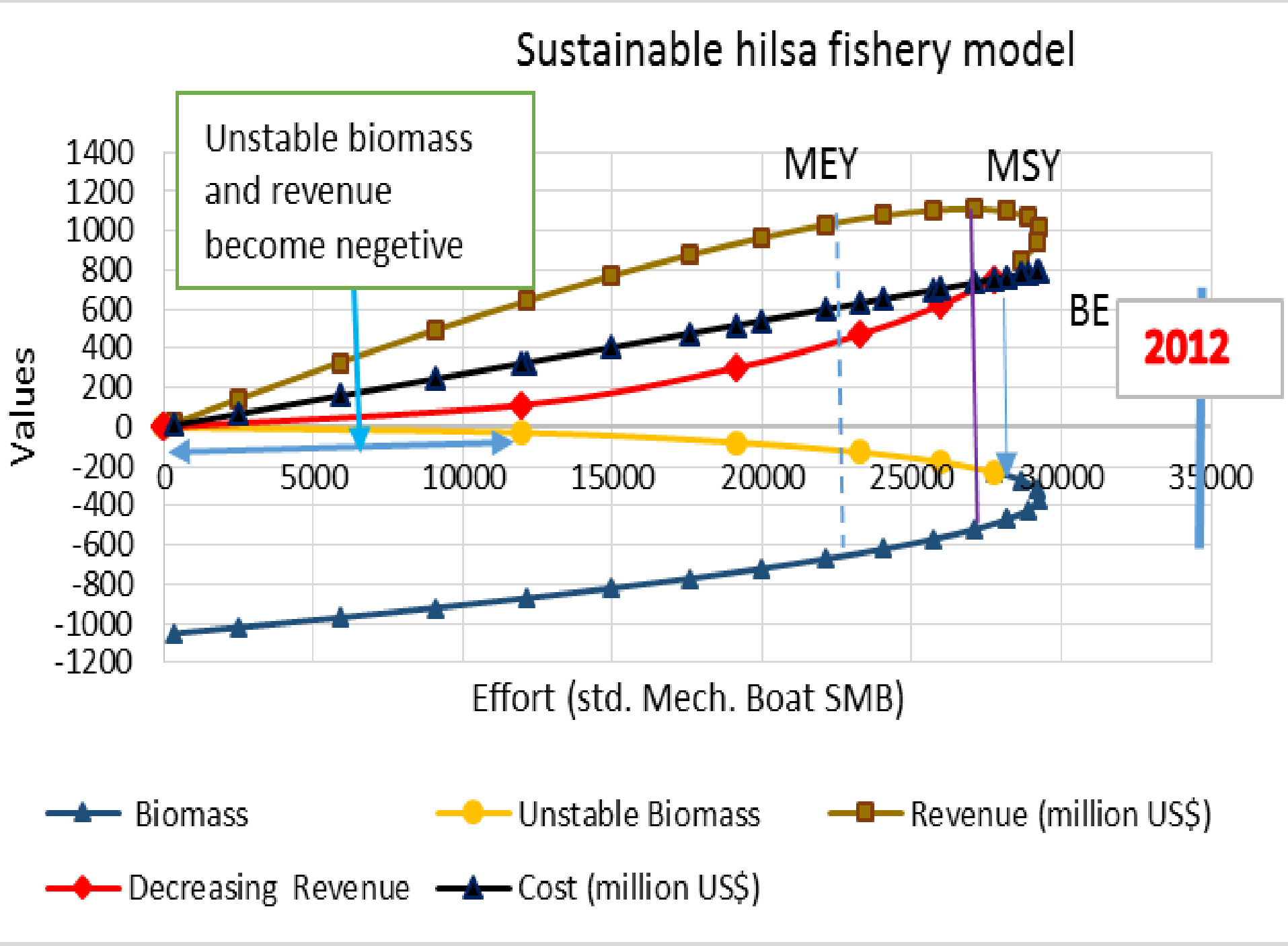
Compare with present situation and Optimal policy Recommendations

DATA SOURCES:

1) **Data types: Aggregate catch, effort, Cost and Price data.**
2) **Primary Data (Interviewing) eg: cost and price data**
3) **Aggregate Catch and effort data: from DoF-FRSS**
4) **Biological, Socio economic : published article, report, books**

DEVELOPED SUSTAINABLE YIELD MODEL




Sustainable hilsa fishery model
Unstable biomass and revenue become negetive
MEY
MSY
BE
2012
1400
1200
1000
800
600
400
200
0
-200
-400
-600
-800
-1000
-1200
Values
0
5000
10000
15000
20000
25000
30000
35000
Effort (std. Mech. Boat SMB)
Biomass
Unstable Biomass
Revenue (million US$)
Decreasing Revenue
Cost (million US$)

MSY, MEY,BE and current (2012) harvest, cost and profit for a Sustainable Bangladesh hilsa fishery Model

	Biomass (1000 mt.)	Effort (Std.Mech .Boat-SMB)	Total Harvest (1000 mt)	Revenue (million US$)	Cost (million US$)	Profit (million US$)
2012	510	34,101	347	1386	928	458
MEY	670	22,146	257	1032	601	430
MSY	520	27,111	278	1113	736	377
BE	228	27,736	188	753	753	0

Dynamics Adjustment Path for the hilsa fishery

Optimization of effort-Discount rate-20 year plan

1) Optimal Dynamic Adjustment path (Bang-bang)

- Most Rapid Approach

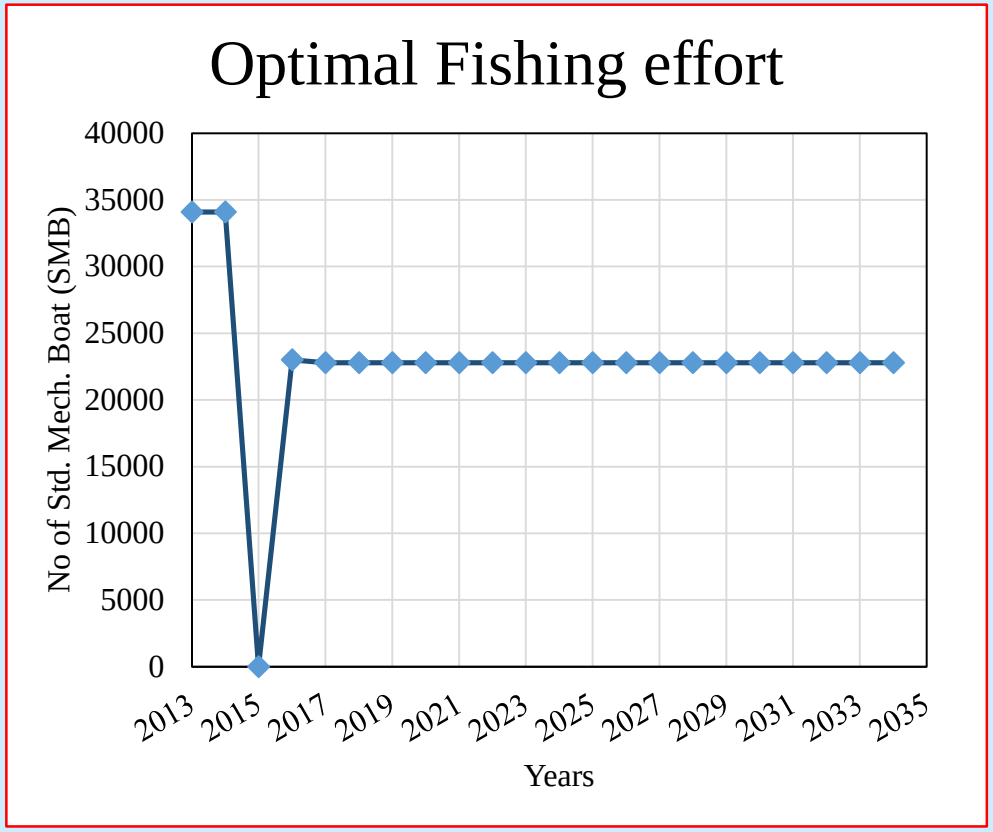
2) Moderate Adjustment path

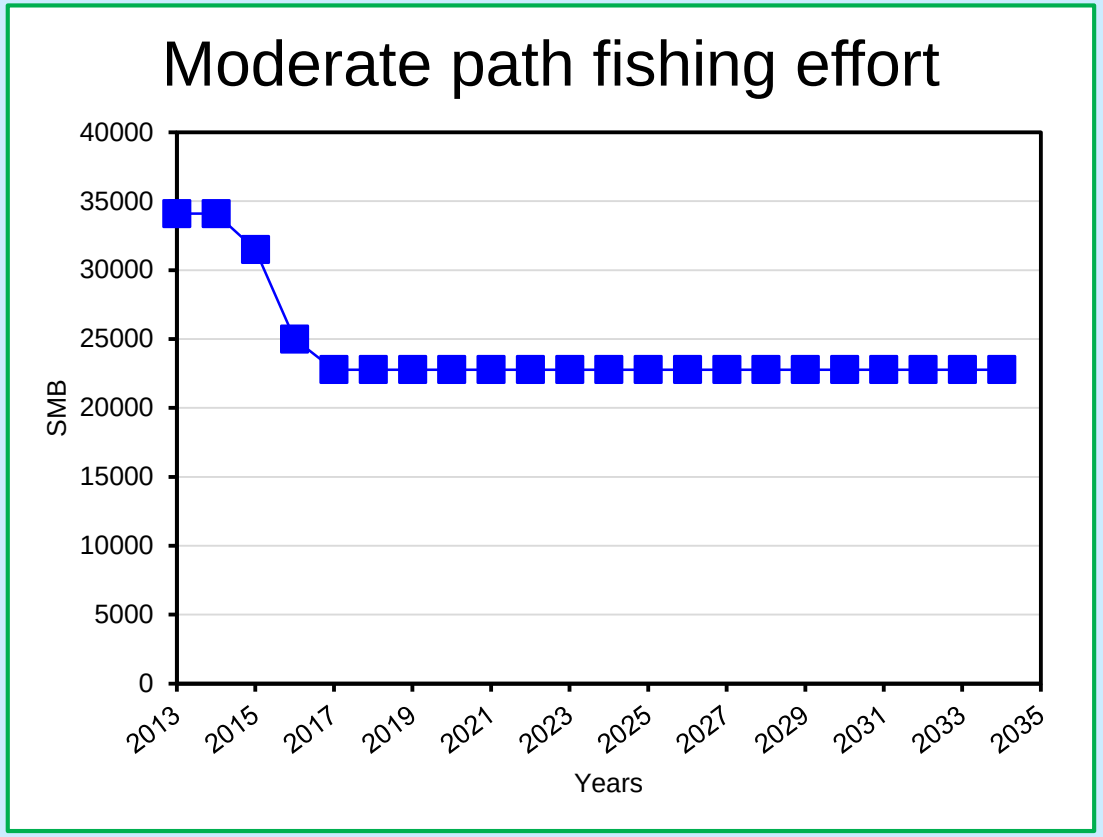
- Socio economically more acceptable

3) Competitive Dynamics:

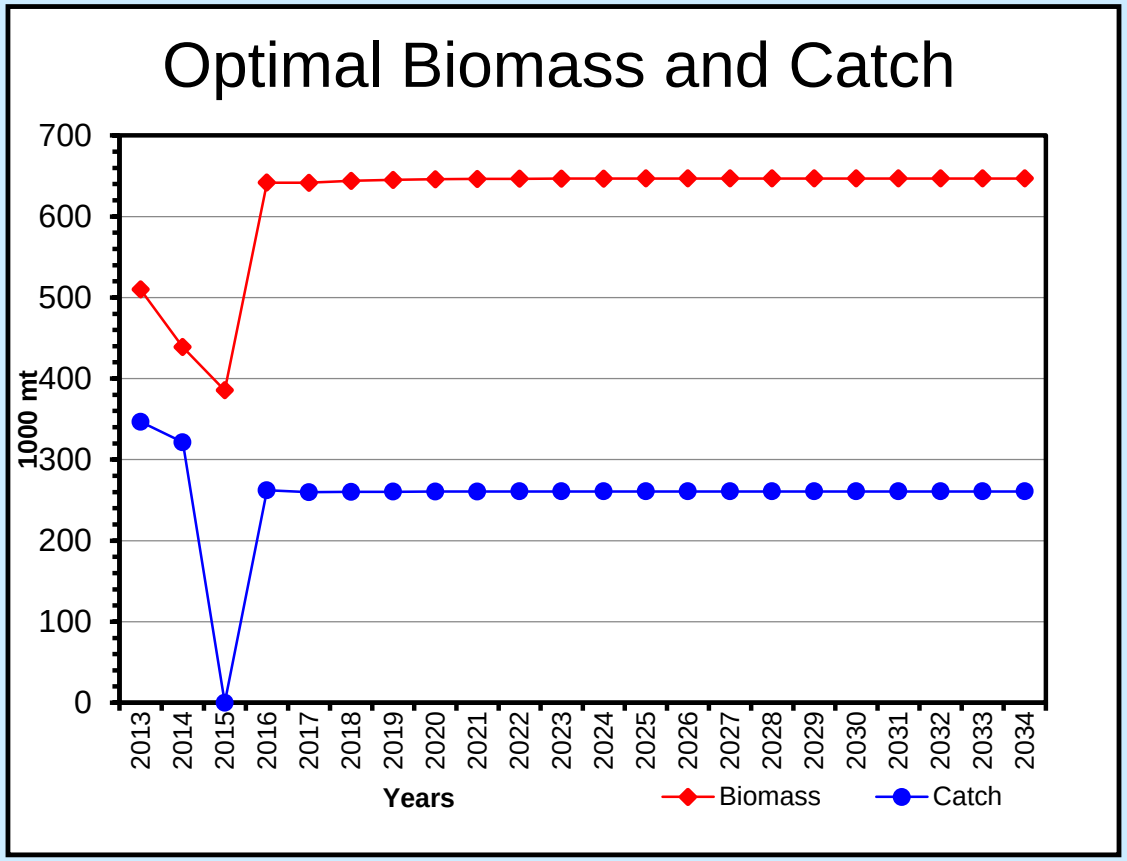
- For unmanaged fishery

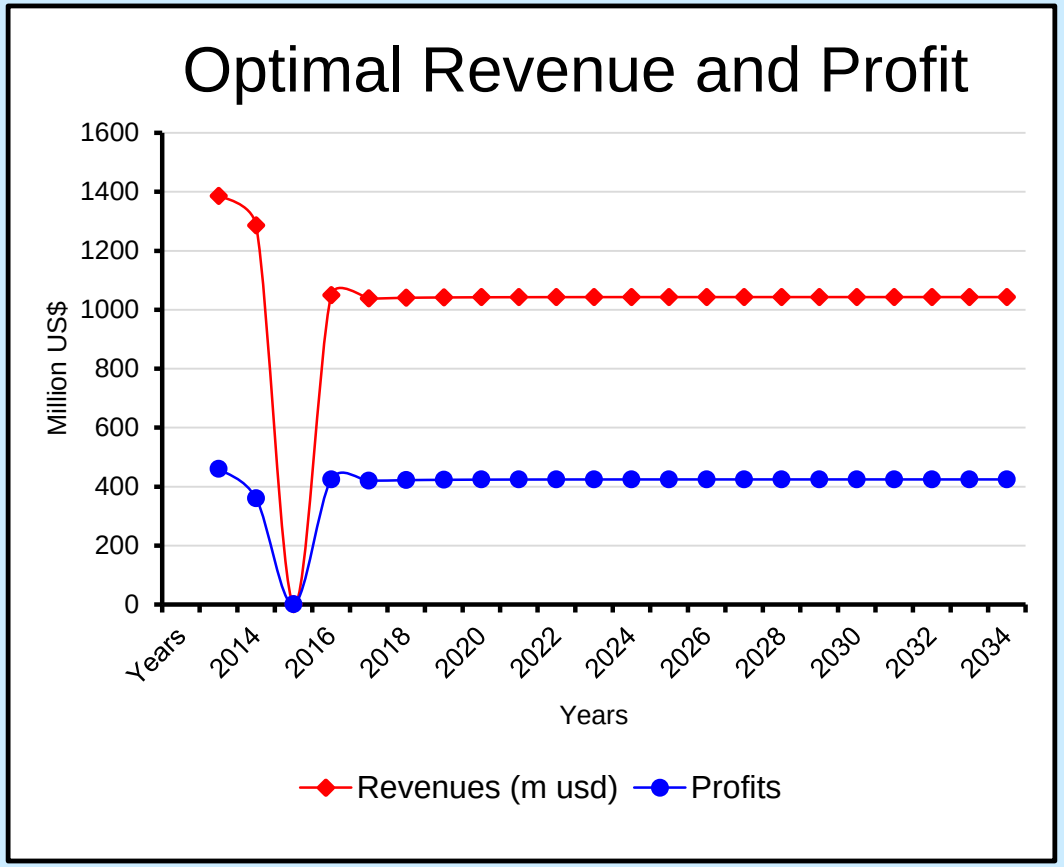
Dynamics of The Fishery: Fishing effort



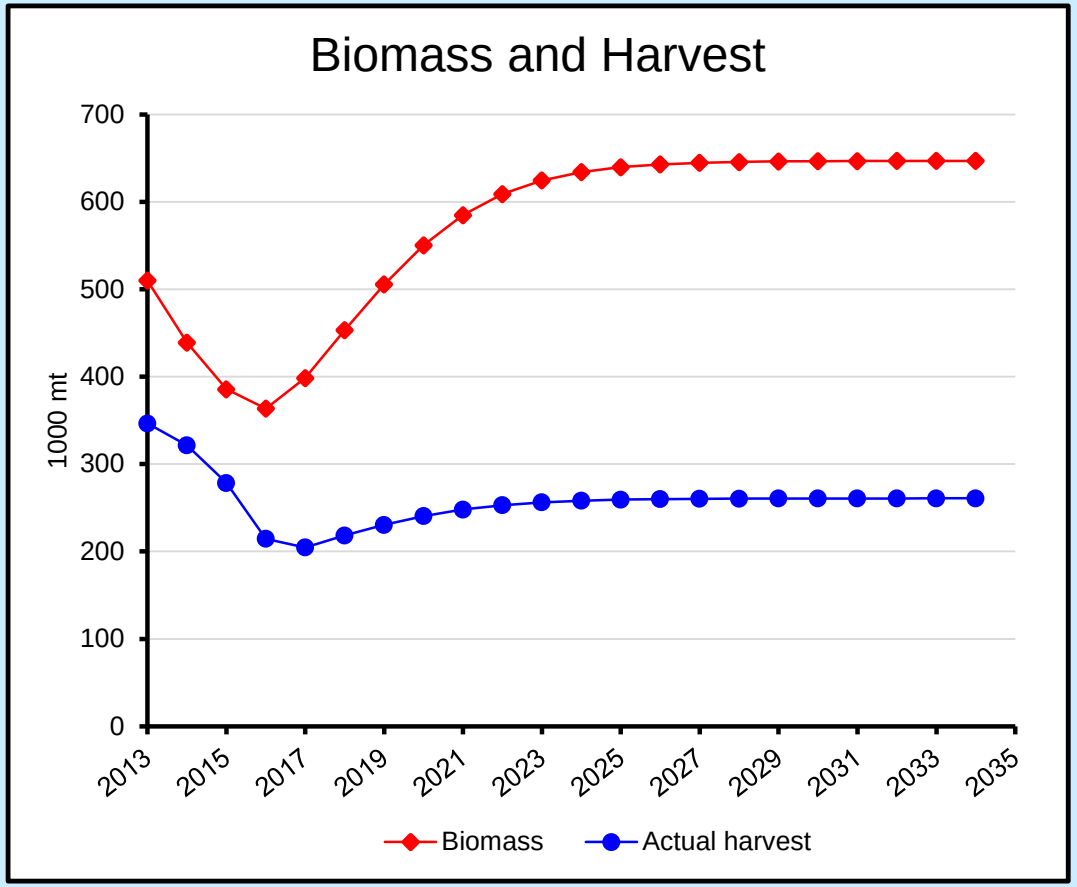


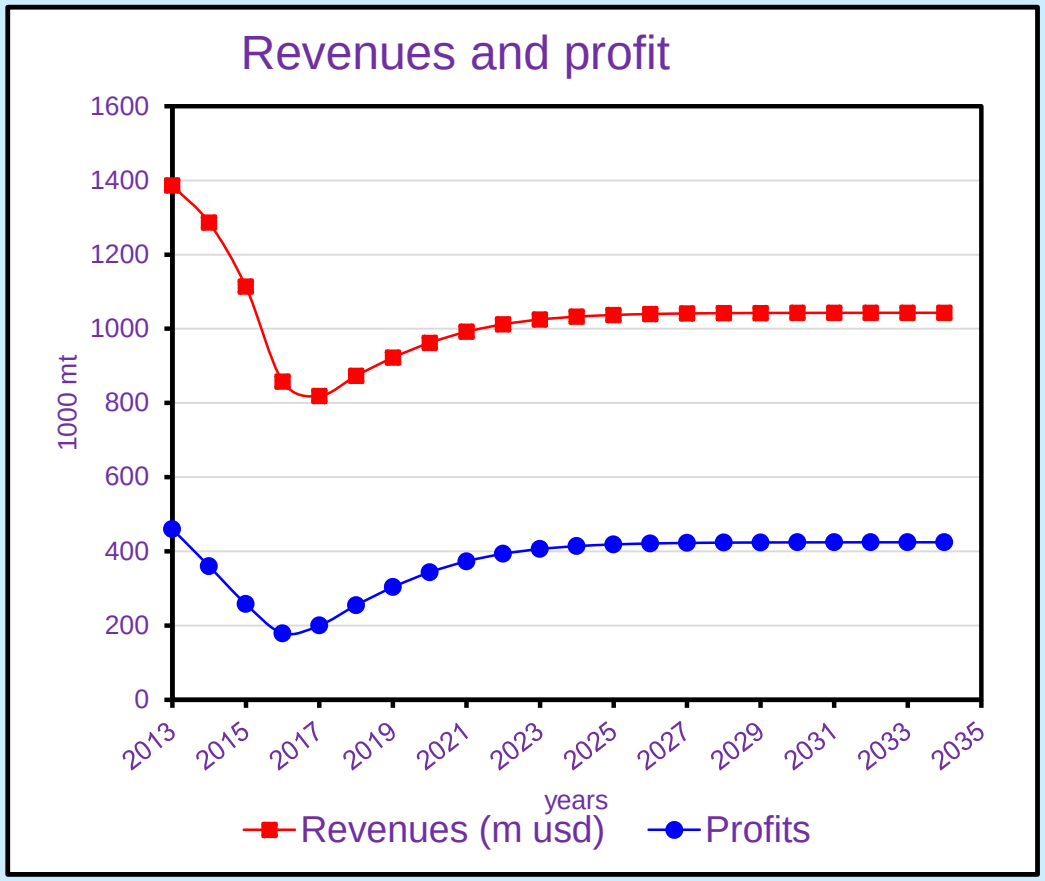
Optimal dynamics of the fishery



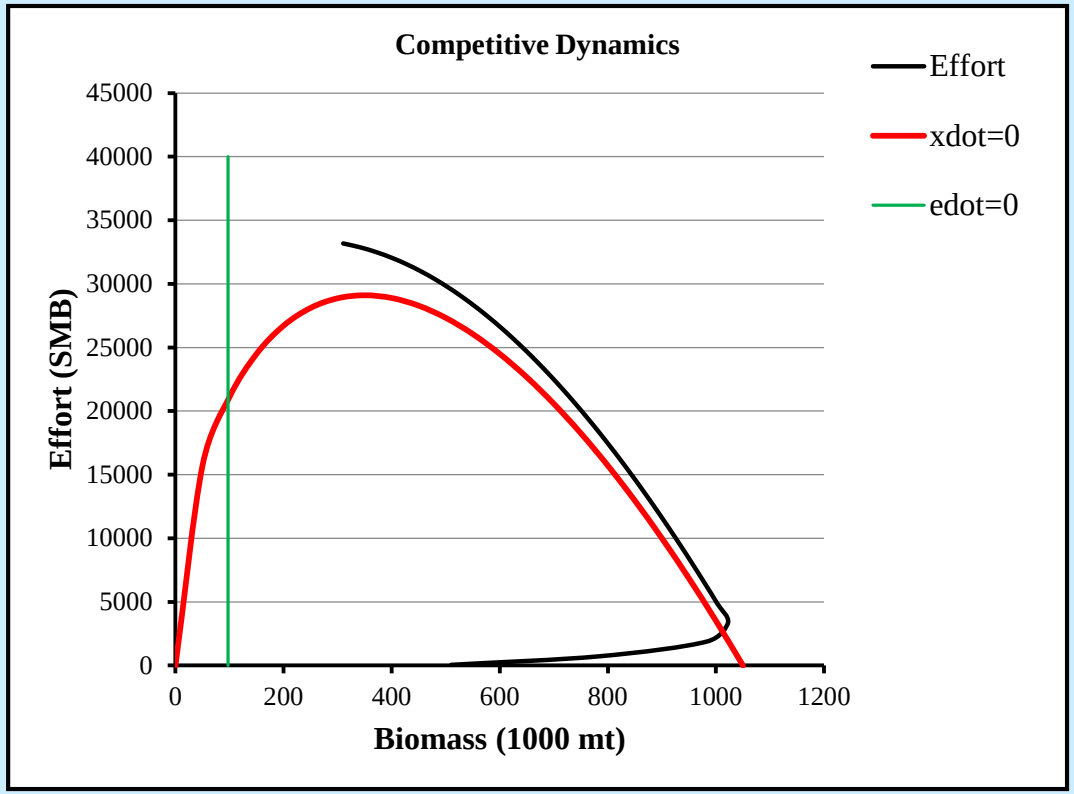


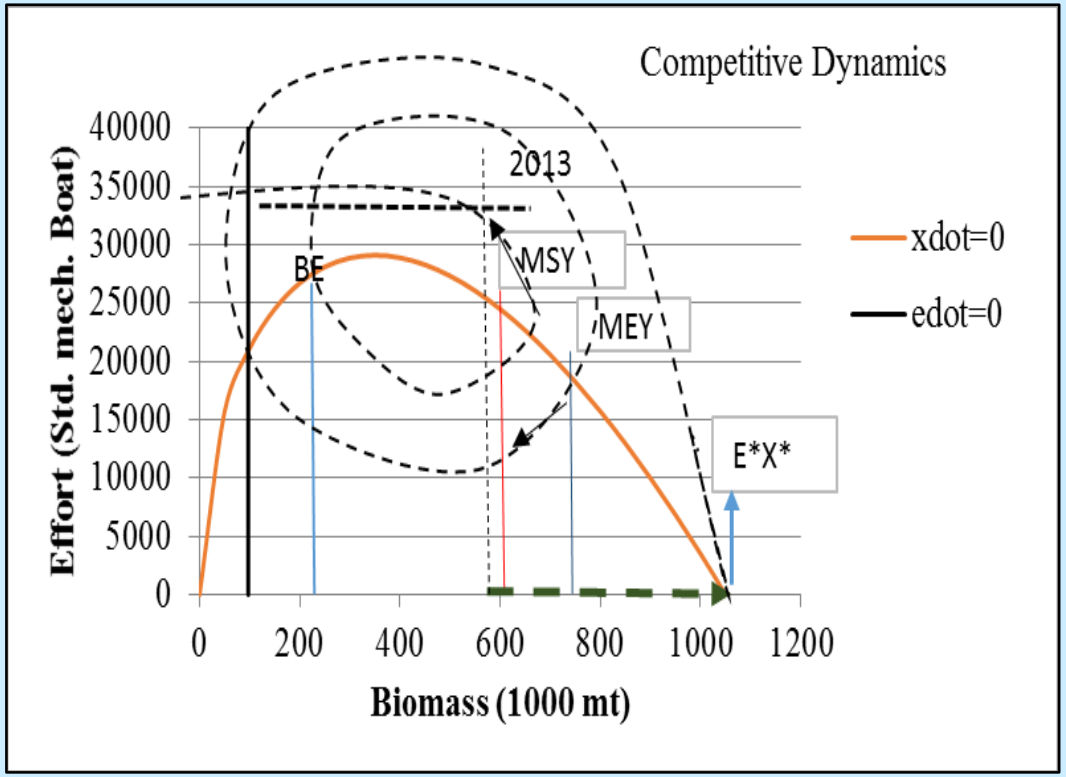
Moderate path of adjustment





Competitive Dynamics





Comparative summary of the adopted optimal dynamic (bang-bang) and moderate adjustment paths on present value, effort, harvest and biomass.

Path.	Present value of profit (PV) (million US$)		Effort (SMB)		Harvest (1000mt)		Biomass (1000 mt)		Total PV (Million US$)
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	
Optimal Path	366	0	23,000	0	262	0	647	386	7,545
Moderate path	254	152	3,150	22,783	278	233	647	363	7,030

Recommendations

- ❖Static sustainable model indicates instability of the fishery
- ❖Most rapid approach is ‘Bang-bang’
- ❖Considering socio economic reality It is recommended the most reasonable path is Moderate path of adjustment
- ❑Further study is necessary on the basis of more reliable data
- ❑Bangladesh could also look to solicit funds from GEF, World Bank to implement it
- ❑Comprehensive plan for the best use of decommissioned vessels and fishermen rehabilitation

Thank you all

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-Special Thanks to-

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