Impacts of shrimp and prawn farming on local environments and livelihoods in south west coastal part of Bangladesh

Md. Rashedul Islam
Student ID: 47136804
Department of Environment Systems
GSFS, The University of Tokyo
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Introduction

Shrimp farming has been started at early of 1980s and prawn farming at early of 1990s.

Rapid expansion took place due suitable agro-climatic condition and availability resources.

Occupied major economic activity in the south-west coastal part of Bangladesh.

Most of farms are constructed by transforming prime agricultural land.

Number of shrimp farmers: 538,000
Number of prawn farmer: 295,000

(Source: DoF, 2002, 2014)
**Culture Environment**

- **Saline water**
  - Shrimp farm in wet season
  - Shrimp farm in dry season

- **Freshwater**
  - Prawn-rice farm in wet season
  - Prawn-rice farm in dry season
### Production Cycle:

<table>
<thead>
<tr>
<th>Yield type</th>
<th>January-February</th>
<th>March-April</th>
<th>May-June</th>
<th>June-July</th>
<th>July-August</th>
<th>August-September</th>
<th>October-November</th>
<th>December-January</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shrimp</td>
<td>Light blue</td>
<td>Light blue</td>
<td>Light blue</td>
<td>Light blue</td>
<td>Light blue</td>
<td>Light blue</td>
<td>Light blue</td>
<td>Light blue</td>
</tr>
<tr>
<td>Prawn-rice</td>
<td>Light green</td>
<td>Light green</td>
<td>Light green</td>
<td>Light green</td>
<td>Light green</td>
<td>Light green</td>
<td>Light green</td>
<td>Light green</td>
</tr>
<tr>
<td>Rice</td>
<td>Light pink</td>
<td>Light pink</td>
<td>Light pink</td>
<td>Light pink</td>
<td>Light pink</td>
<td>Light pink</td>
<td>Light pink</td>
<td>Light pink</td>
</tr>
</tbody>
</table>

Fig. 3: Production cycle of different crops (Source: Field survey, 2014)

### Product Flow:

- **Shrimp and Prawn**
  - Domestic market: 15%
  - Export market: 85%
  - Local market: 3%
  - Supermarkets: 97%

Fig. 4: Major Export destination in 2012-2013 FY

(Source: BFFEA, 2014)
Study area objectives of the present study

Study area: Rampal and Dumuria Sub-district in southwest coastal part of Bangladesh

Objectives:

1. Assess the impact of shrimp farming and prawn-rice farming on local environments and livelihoods

2. A comparative study between Rampal sub-district and Dumuria sub-district to Justify the impact of shrimp and prawn rice farming

3. Cost-benefit study of three major crops i.e., shrimp farming, prawn-rice farming and rice farming to find their economic suitability as well as to find a conclusion of the study

Fig. 5: Shrimp and prawn farming zone in southwest coastal part
*white marks indicate present study areas
### Data collection and data source

*Both primary and Secondary data were collected*

<table>
<thead>
<tr>
<th>Data types</th>
<th>Specific fields</th>
<th>Data source</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Environmental</strong></td>
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</tr>
<tr>
<td>Soil salinity</td>
<td>Laboratory analysis (240)</td>
<td>Soil Resource and Development Institute</td>
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<tr>
<td><strong>Economic</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crop production</td>
<td>Department of Agriculture Extension</td>
<td></td>
</tr>
<tr>
<td>Livestock</td>
<td>Department of Livestock</td>
<td></td>
</tr>
<tr>
<td>Shrimp and prawn farms</td>
<td>Department of Fisheries</td>
<td></td>
</tr>
<tr>
<td>Cost-benefit</td>
<td>Questionnaire survey (90 )</td>
<td></td>
</tr>
<tr>
<td>(different farming types)</td>
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<td></td>
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<tr>
<td><strong>Social</strong></td>
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<td></td>
</tr>
<tr>
<td>Livelihoods and Income</td>
<td>Questionnaire survey (50)</td>
<td></td>
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<tr>
<td>Homestead forest</td>
<td>Statistics Department</td>
<td></td>
</tr>
<tr>
<td>Social facilities (education, sanitation, recreation etc.)</td>
<td>Questionnaire survey (50)</td>
<td></td>
</tr>
</tbody>
</table>

* Parentheses indicates the sample numbers
Major findings

Study area 1: Rampal Sub-district (*Shrimp farming zone*)

**Total Upazila area:** 27,644 ha

**Total cultivable land:** 20,718 ha

**Present shrimp farm area:** 14,877 ha

Fig. 6: Map of Rampal Sub-district with union boundaries

Fig. 7: Changes of land use pattern in **Rampal** over last three decades

(Source: DAE & DoF, Rampal, 2014)
Salinity intrusion in Rampal Sub-district

- From 1980, Shrimp farming gradually increasing soil salinity
- Recent laboratory analysis confirmed that, Soil salinity is still increasing
- Land are becoming unsuitable for crop production at all

Fig. 8: Trend of increasing sub-district average soil salinity over time

Fig. 9: Union level average soil salinity at different time periods

(Source: SRDI and Field Survey 2014)
Study area 2: Dumuria Sub-district (*Agriculture and freshwater prawn farming zone*)

- **Total Upazila area**: 44,797 ha
- **Total cultivable land**: 34,873 ha
- **Prawn farming area**: 8,226 ha
- **Shrimp farming area**: 5,855 ha

![Map of Dumuria Sub-district with union boundaries](image)

Fig. 10: Map of Dumuria Sub-district with union boundaries

Fig. 11: Changes of land use pattern in Dumuria over last three decades

(Source: DAE & DoF, Dumuria, 2014)
Soil Salinity in Dumuria sub-district

10 unions (Soil salinity <4 ds/m)
- at acceptable limit for all types of crops production

4 unions (Soil salinity <8 ds/m)
- salinity tolerant varieties grow well

In 1981: 34,360 ha
In 2014: 32,016 ha
Single crop land: 5,140 ha
Double crop land: 22,785 ha
Triple crop land: 4,092 ha

(Source: DAE, Dumuria, 2014)
Comparative study between two sub-district

A. Crops production

- Input material used:
  - Seed,
  - Fertilizer,
  - Pesticide
were found similar in both sub-districts

(Source: DAE, Rampal and Dumuria, 2014, Field survey, 2014)
Relationship between soil salinity and rice production in 2013-14

Soil salinity > 8 ds/m significantly reduce rice production (DAE, Rampal, 2014)

Fig. 15: Correlation between soil salinity and per ha rice production

(Source: DAE, Rampal and Dumuria, 2014, Field survey, 2014)
B. Livestock and poultry

Two major causes are:

- Reduction of grazing fields
- Scarcity of fodder (due to loss of agricultural crop production)

(Source: Department of Livestock, Rampal and Dumuria, 2014)

C. Homestead forest with settlement area

Two major causes are:

- Dying due to salinity stress
- Conversion into shrimp farms

(Source: Department of statistics, Rampal and Dumuria, 2014; DAE, 2014)
D. Impacts on livelihoods: marginal and landless farmers

In Rampal, shrimp farming ceased the livelihood options are:

- Sharecropping
- Agriculture labor
- Cottage industry

Loss of livelihood opportunities:
- Cattle fattening
- Milk production
- Livestock

New livelihood options:
- Shrimp farming 16%
- Collection of shrimp and prawn PL 20%
- Seasonal labor force 12%
- Rickshaw van pulling 24%
- Others 20%

In Dumuria, besides traditional livelihoods, prawn-rice farming -- involved large number of marginal farmers in this sector:

- Prawn-rice farming 20%
- Labor in prawn farms 16%
- Sharecropping 28%
- Agriculture labor 12%
- Cottage business 16%
- Livestock rearing 8%

Lower grade and low paid

Diversity of income generation sources

<table>
<thead>
<tr>
<th>Sub-districts</th>
<th>% of marginal household</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>More than 3</td>
</tr>
<tr>
<td>Rampal</td>
<td>0</td>
</tr>
<tr>
<td>Dumuria</td>
<td>28</td>
</tr>
</tbody>
</table>

(Source: Field survey 2014)
**Household income and access to social facilities**

Major income source of family members--
**In Rampal:**
--Larvae fishing
--Part time work at shrimp depot
--labor force at different sector

**In Dumuria:**
--livestock rearing
--cottage business
--agriculture labor
--labor at prawn farms and depots

(Source: Field survey 2014)
Cost-benefit analysis of three different crops

**Farm size:**
- Prawn farms are small, because:
  - Per unit production cost is high
  - mostly operated by small and medium scale farmers (84%)
  - convenience of management

(Source: Field survey 2014)

**Production cost:**
- Production cost of prawn farm is high:
  - very high price of prawn larvae
  - require supplementary feed
  - labor intensive

Fig. 20: Average farm size of different farming types

Fig. 21: Production cost of different farming types for one ha farm size
Percentages of breakdown cost

**Prawn-rice farming**

- Fixed cost: 11%
- Labor: 10%
- Dike repair: 3%
- Rice production cost: 15%
- Harvesting: 2%
- Fuel: 1%
- Fertilizer: 3%
- Feed: 20%
- Prawn PL stocking: 25%

**Fig. 22:** Item-wise percentages of cost involved in prawn-rice farming

**Shrimp farming**

- Lease value: 31%
- Labor: 14%
- Farm repair: 6%
- Shrimp PL stocking: 18%
- Harvesting: 6%
- Fertilizer: 12%
- Feed: 4%
- Carp fingerling: 9%

**Fig. 23:** Item-wise percentages of cost involved in shrimp farming
### Correlation of different variables with Net Profit by farming types

<table>
<thead>
<tr>
<th>Variables</th>
<th>Shrimp farming</th>
<th>Prawn-rice farming</th>
<th>Rice farming</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm area</td>
<td>-0.88</td>
<td>-0.56</td>
<td>0.22</td>
</tr>
<tr>
<td>Material cost</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shrimp/prawn PL number</td>
<td>0.93</td>
<td>0.85</td>
<td></td>
</tr>
<tr>
<td>Carp fingerling number</td>
<td>0.71</td>
<td>0.63</td>
<td>0.83</td>
</tr>
<tr>
<td>Feed</td>
<td>0.82</td>
<td>0.86</td>
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</tr>
<tr>
<td>Fertilizer</td>
<td>0.73</td>
<td>0.77</td>
<td></td>
</tr>
<tr>
<td>Labor cost</td>
<td>0.54</td>
<td>0.92</td>
<td>0.56</td>
</tr>
<tr>
<td>Total production cost</td>
<td>0.94</td>
<td>0.87</td>
<td>0.80</td>
</tr>
</tbody>
</table>

**In shrimp farming, minimum to maximum ratio**
- for production cost, 2.06 and for net profit 1.96

**In Prawn-rice farming, minimum to maximum ratio**
- for production cost, 1.82 and for net profit 1.65

The negative correlation between farm size and net profit may be because of:
- Higher amount of input supply
- Intensive management
- operated by lease holders
Net Present Value and Benefit-Cost Ratio of different farming systems

For calculation of NPV
- Time period considered: 10 years
- Rate of interest considered: 10%

Initial establishment cost:
- Rice farming system: BDT 0.00
- Shrimp farming system: BDT 101,400
- Prawn-rice farming system: BDT 126,750

Higher BCR in shrimp farming:
- more profitable in terms of quantity of cost involved

But, Higher NPV in Prawn-rice farming
- more profitable in terms of capacity of net earning from per unit area
Risk avoidance opportunity

Two major types of risks are associated with shrimp, prawn and rice production

1. Casualty risk (disease, mortality, flood, heavy rainfall and drought, pest attack)
2. Price risk (production, stock, demand of product in national or foreign market)

# In Bangladesh, there is no insurance policy in crop production sector
# So it is important for farmers to have an opportunity to avoid the risk
Despite lot of positive approaches, expansion of prawn farming mainly hindered by:

**High production cost**
- **Shrimp farming:**
  - Total production cost BDT 94,811 ha\(^{-1}\)
  - Price of Post larvae BDT 500/thousand
  - No use of supplementary feed
  - Average labor count 53 man days

**Intensive management**
- **Prawn-rice farming:**
  - Total production cost BDT 307,816 ha\(^{-1}\)
  - Price of Post larvae BDT 4000/thousand
  - Require supplementary feed, 1750 kg ha\(^{-1}\)
  - Average labor count 152 man days

**Action needed for promotion of prawn farming**
- Establishment of adequate hatchery
- Production of low cost feed
- Provision of soft loan for farmers
- Transfer of technology by extension services
- Demarcation of suitable shrimp farming areas by land zoning programs
- Awareness building among the locals
Conclusion:

- The findings clearly indicates that, shrimp farming is significantly increasing soil salinity and negatively impacting the local environments.

- Shrimp farming is also resulting in loss of livelihoods of marginal famers, reducing their income level and capacity of availing fundamental social facilities.

- Prawn-rice farming on the other simply voids salinity related controversies and also creates larger livelihoods opportunities for marginal people.

- Cost-benefit study also proves prawn-rice farming as more profitable venture than other framings, but the prime draw back is high production cost.

- Proper institutional arrangement (credit support, production of low cost feed and seed, extension services etc.) can inspired farmers to adopt prawn-rice farming instead of shrimp farming.

- More attention is needed in this sector not only to earn foreign exchange but also to create a healthy environment with elevated income level of the locals.
Thank You