Impacts of Shrimp Farming on Local Environments and Livelihoods in Bangladesh

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Abstract: - Commercial shrimp culture has been dramatically expanded over the last three decades in the coastal zone of Bangladesh. The reason behind such expansion is high demand of shrimp in international market and its potential for making quick profit. The suitable agro-climatic condition and availability of resources such as seed, feed, water and labor force also trigger rapid horizontal expansion of this sector. The present study was carried out in two coastal sub-districts in the southwestern part of Bangladesh. One of these sub-districts named Rampal sub-district is dominated by saline water shrimp farming and other one named Dumuria sub-district is dominated by agriculture and freshwater prawn farming. The aim of the study is to expound the impact of shrimp and prawn-rice farming on agriculture, livestock and livelihoods of local marginal farmers who are the majority of the society. The results showed that effects of salinity intrusion due to shrimp farming significantly reduced the crops and livestock production, and ceased many livelihood options of the local people in Rampal sub-district over last three decades. On the other hand in same time period crops production in Dumuria sub-district has been significantly increased and prawn-rice farming system creates versatile employment opportunities of the local people.

Key-Words: - shrimp farming, prawn farming, soil salinity, crop production, livelihoods

1 Introduction

Commercial shrimp culture has been dramatically expanded over the last three decades in the coastal zone of Bangladesh. The reason behind such expansion is high demand of shrimp in international market and its potential for making quick profit. The suitable agro-climatic condition and availability of resources such as seed, feed, water and labor force also trigger rapid horizontal expansion of this sector [1]. Initially the shrimp farming area comprised just 20,000 ha in 1980, growing rapidly to approximately 210,053 ha in 2012-13 [2]. Thus, shrimp sector plays important role in the national economy of Bangladesh. However, instead of attaining efficiency in production system, horizontal expansion of shrimp farms by replacing crop fields are degrading the local ecosystem and impacting the livelihoods of local marginal peoples. Now days, salinity intrusion due to shrimp farming not only upholding this sector as a controversial one but also threatening the sustainability of the local environments [3].

On the other hand Freshwater prawn come rice farming (hereafter prawn-rice farming) is comparatively a new intervention, which has been started from early of 1990s. Since then it got popularity among the local farmers and farming area is gradually increasing at different parts of south-west coastal region of the country. The farming area extended from 6000 ha in 1994 to an estimated 65,221 ha in 2012 [2]. The most positive approach towards prawn-rice farming is that, unlike shrimp farming, it does not require saline water; therefore in prawn-rice farming no conflict arises regarding the negative consequences related to salinity intrusion.

The present study was carrying out at two sub-districts named *Rampal* and *Dumuria* (Fig. 1). These sub-districts are located in the south west coastal part of Bangladesh. In *Rampal* sub-district most of the cultivable lands are occupied by shrimp farms. On the other hand in *Dumuria* sub-district

most the lands are used for crop production and freshwater prawn farming.

The objectives of the present study are; I) assessment the impact of shrimp farming on local environments (agriculture, livestock and livelihoods); II) a comparative study between *Rampal* sub-district (shrimp farming zone) and *Dumuria* sub-district (prawn -rice farming zone) to Justify the impacts of shrimp farming.

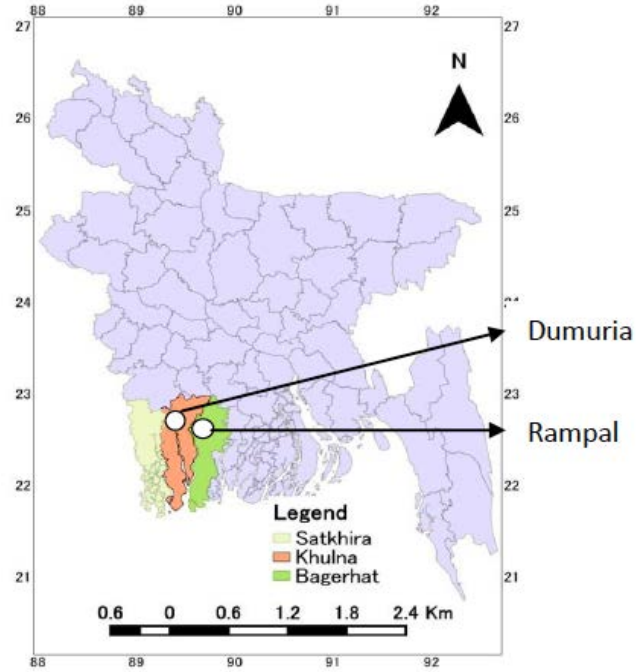

Fig.1: Shrimp and prawn farming zone in Bangladesh
*white marks indicate present study area

2 Materials and Method

2.1 Sampling and laboratory analysis

In order to assess the magnitude of salinity intrusion due to shrimp farming by holding saline water long time in the farms, the present study has performed laboratory test of soil sample, collected from different shrimp farms crop fields of *Rampal* sub-district. At the same time soil from shrimp farm, rice-prawn farm and rice-farm were collected from *Dumuria* sub-district to figure out a comparison of present salinity between two sub-district as well as its impact on crop production and local environment. From *Rampal* sub-district a total of 200 soil sample and from *Dumuria* sub-district a total of 140 soil sample was collected for laboratory analysis. The sample were collected between April and May of 2014. The experiment was carried out in "Soil and Water Chemistry Laboratory" of Soil Science Discipline in Khulna University, Bangladesh. The collected soil samples were air dried at room temperature to measure the electrical conductivity by means of saturation paste extract method. In case of *Rampal* sub-district previous salinity data were collected from Soil Resource and Development Institute, Khulna regional office, Bangladesh.

2.2 Questionnaire interview

Through questionnaire survey, cost-benefit data for three different cropping types and socio-economic information of the land less people have been accumulated. Three major cropping types include year round shrimp farming, freshwater prawn-rice farming and year round rice (two crops) farming. 30 farmers from each category accounts a total of 90 farmers were interviewed. In case of marginal and landless people 25 from each sub-districts accounts a total of 50 people were interviewed with a short structured questionnaire. In both cases interviewees were the head of households who were selected randomly. Structured questionnaire was used for gathering the desired information. However, additional information provided by the interviewees were kept recorded for explaining the research outcomes.

2.3 Secondary data collection

Secondary data were collected from district and sub-district level different government department. Semi-structured questionnaire was used to collect the secondary data because during data collection according to the research objectives some valuable information were presented by the government officials and those information were included besides the structured questions.

3 Result and Discussion

3.1 Expansion of shrimp farming and salinity intrusion in *Rampal* sub-district

Rapid horizontal expansion of shrimp farming was took place very rapidly in *Rampal* sub-district after 1980s. High market price of shrimp and suitable location and availability of critical inputs for shrimp farming motivated the locals of *Rampal* sub-district to adopt this farming practice. In 1980 total shrimp farm area was 860 ha, which increased to 4,528 ha in 1984, 9,028 ha in 1990, 12031 ha in 2001 and 14,877 ha in 2014. Long term holding of saline water gradually increased the soil salinity and in many parts it exceeded the tolerant limit of

maximum crops. The average soil salinity which was only 2.85 ds/m in 1984 increased to 14.46 ds/m in the year of 2014 (Fig. 1), which is beyond the tolerant limit for growth of maximum agricultural crops.

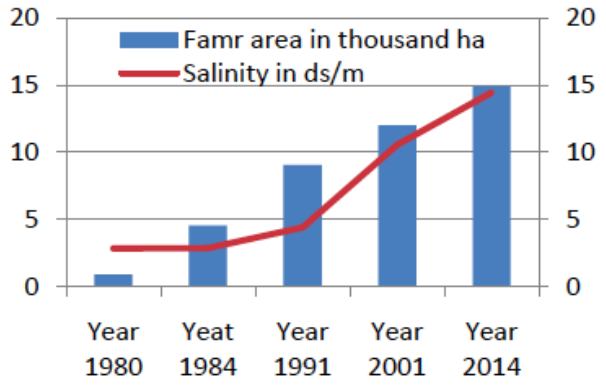

Fig. 2: Tread of increasing Shrimp farm area and soil salinity in Rampal sub-district (Source: SRDI, Khulna [4] for 1987, 1992, 2002; present study for 2014)

3.2 Loss of crop production and livestock in *Rampal* sub-district

Introduction of shrimp farming in *Rampal* sub-district dramatically changed the traditional cropping pattern and the production of major crops were declined significantly (Table 1) due to effects of elevated soil salinity. Loss of grazing field and crisis of fodder crops on the other hand gradually declined the livestock production in the area. Per household number of cattle was 4.4 in 1981 which dropped to only 0.7 in 2011. Production of goat and buffalo also reduced by 84% and 95% respectively during last three decades (Table 2).

Table 1: Trend of major crops production in *Rampal* sub-district [5]

Types of crops	Production per ha in MT			
	Year 1983-84	Year 1990-91	Year 2000-01	Year 2013-14
Rice (Boro)	2.28	2.71	2.31	2.05
Rice (Aman)	1.68	1.87	1.64	1.38
Wheat	1.77	1.98	0	0
Oil seed	0.75	0.58	0.36	0
Pulses	0.86	0.98	0.53	0.45
Vegetables	15.29	12.84	9.82	6.52

Table 2: Trend of domestic animals in *Rampal Upazila* (Numbers per household)

Types of animals	Year 1981	Year 1991	Year 2001	Year 2011
Cattle	4.4	2.8	1.2	0.7
Buffalo	1.3	0.6	0.12	0.04
Goat/sheep	3.8	2.2	0.9	0.4
Duck	18	10	5	3.5
Chicken	20	16	10	6

3.3 Trend of agricultural crop production and prawn rice farming in *Dumuria* sub-district

In *Dumuria* sub-district, saline water shrimp is produced only in some low-lying parts alternatively with Aman rice. Therefore, salinity intrusion is not a big concern in this area. Average soil salinity in 2014 was found 3.79 ds/m, which is at acceptable limit for production of almost all agricultural crops (Fig. 3). Use of high yield varieties, chemical fertilizer and pesticides, and irrigation facilities significantly increased major crops production in *Dumuria* sub-district (Table 3). From mid of 1990s prawn-rice farming got popularity in *Dumuria* sub-district, since then its area is increasing gradually. Prawn-rice farming area was only 3460 ha in the year 2000 which increased to 8226 ha in 2014.

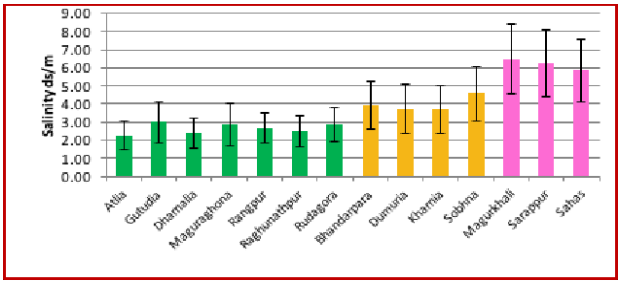

Fig. 3: Union level average salinity in *Dumuria* sub-district in 2014.

Table 3: Trend of major crops production in *Dumuria* [6]

Types of crops	Average production per ha in MT			
	Year 1983-84	Year 1990-91	Year 2000-01	Year 2013-14
Rice (Boro)	2.32	2.68	3.31	3.79
Rice(Aman)	1.64	1.89	2.12	2.52
Wheat	1.9	2.2	2.75	3.15
Oil seed	0.84	1.06	1.44	1.76
Pulses	0.96	1.15	1.52	1.65
Vegetables	15.8	16.6	18.4	21.3

3.4 Livelihoods of marginal farmers in *Dumuria* and *Rampal*

Livelihoods of the marginal people of *Rampal* sub-district, a saline water shrimp farming zone, has been negatively impacted by introduction of shrimp farming due to loss of traditional income generation sources. The marginal farmers of *Dumuria* sub-district, a prawn-rice farming zone, possessed versatile livelihood options compare to the marginal farmers of *Rampal* sub-district. Average monthly income of the marginal farmers of *Dumuria* sub-district (BDT 13,700) was almost double to that of *Rampal* sub-district (BDT 7,718). Marginal farmer of *Dumuria* sub-district also availed more social advantages in terms of access to safe drinking water, use of sanitary latrine, electricity connection and education of the children (Fig. 4).

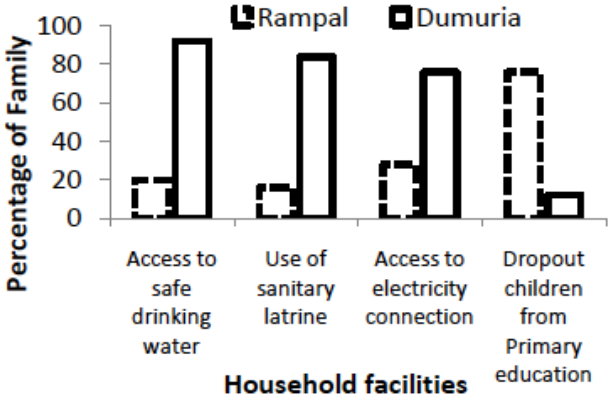

Fig. 4: Differences of availing social facilities by marginal households in two sub-districts

4 Conclusion

The effects of salinity intrusion due to shrimp farming significantly reduced the crops and livestock production, and ceased many livelihood options of the local people in *Rampal* sub-district over last three decades. On the other hand in same time period crops production in *Dumuria* sub-district has been significantly increased and prawn-rice farming system creates versatile employment opportunities of the local people.

From findings of present study it come into view that, apparently prawn-rice farming have no mentionable adverse impact on local environments. Moreover, prawn-rice farming gives more employment generation opportunities to the local marginal people. So it may be concluded that prawn-rice farming in fact more sustainable than shrimp farming in terms of both environmental and socio-economic aspects. Arrangement of proper institutional support (e.g., credit support, production of low cost feed & seed, technology transfer) may play fundamental role to expand prawn-rice farming among the locals.

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