Food & Business Knowledge Platform

Factsheet final findings Applied Research Fund Call 3

Selection of mangrove species to optimise aquaculture based livelihoods and biodiversity in climate smart designed polders of Bangladesh (Mangrove-Polders)

Summary

In Bangladesh, polders have been constructed to boost rice production, but subsequent saline water logging compelled farmers to replace rice with shrimp. Thereby, more areas were appropriated for shrimp farming with inevitable consequences on mangroves and coastal ecosystem. The overarching goal of the Mangrove-Polder project was to restore resilient livelihoods through integrated mangrove-shrimp farming, thereby contributing to food security and ecosystem services in the context of poverty, delta dynamics and climate change in Bangladesh. To this end, the project has been piloting two silvo-aquaculture models: planted mangroves along the dikes of redesigned shrimp ponds and primary canals in two southwest coastal districts Khaulna and Stakhira. Four mangrove species, namely, *Sonneratia apetala*, *Avicennia officinalis, Bruguiera sexangula and Heritieria fomes* were selected based on consultations with farmers and experts. The nutrient and anti-nutrient profiles of these mangrove leaves were analysed while the effects of leaf leachates on shrimp survival and growth were studied under both controlled and natural conditions. An economic modelling with these and other farm related data are being analysed to showcase and develop a comprehensive business model for mangrove-shrimp farming. On successful completion, this building-with-nature approach is expected to positively impact food security and livelihoods of coastal shrimp farming communities.

Final research findings

The research hypothesis was that integrated mangrove shrimp aquaculture (IMSA) would increase shrimp productivity while providing other ecosystem services to the benefits of smallholders. The results showed that mass loss of mangrove leaf litter correlated with shrimp post larvae (PL) growth and survival as decomposing leaves stimulated availability of natural food. The decomposition rate differed significantly among species. S. apetala leaf litter resulted in the highest PL growth rate, followed by A. officinalis, S. caseolaris and H. fomes. Growth performance increased further when PL was fed with 5% formulated feed. Interestingly, however, combination of the four species resulted in even better performance, with the combination of A. officinalis, S. apetala and H. fomes showing the highest growth of PL, suggesting synergetic effects of mangrove leave properties. A household economic survey revealed strong gender inclusiveness in the household economy because of other ecosystem services that mangroves provide including fruits, fodder and fuelwood for household purpose and the potential of developing local value chains for such mangrove-based products. The survey also revealed that farms traditionally practising IMSA generate more income than their non-IMSA counterparts despite high investment costs, suggesting IMSA to be a sustainable solution to realize many ecosystem benefits of mangroves.

Outcomes achieved

In addition to pond-based model, the project successfully implemented a primary canal based IMSA model, both for the first time in the country. Apart from being sceptical of the efficacy, IMSA farmers were initially reluctant to sacrifice their lands to extend the canal width for plantation. However, as the results of the leaf leachate experiment became apparent, farmers became proactive, provided important local knowledge for species selection and, most importantly, got personally involved in planting the mangroves. Md. Nuruzzaman, one of the participating famers in Debhata, Stakhira, narrated while receiving a national award last year that "being a son of this soil, I knew that mangroves were good but I thought/expected the [leave] extracts would

harm shrimp, but to my surprise not only shrimp performed well but the colour of shrimp looked excellent as well". The success story rapidly spread throughout the farming community and in the following year several farmers redesigned their ponds and planted mangroves. Likewise, a household economic survey was also instrumental in identifying many provisioning services of mangroves as one female community member, Usha Rani Mondal, from Koyra, Khulna mentioned: "I don't know whether mangroves are good for shrimp but they are certainly good for us as they provide us food, fuelwood and shade".

Project messages to

A) Actors from private sector:

- If selected and planted appropriately, mangroves will increase shrimp production through providing shelter, food and water quality maintenance.
- Mangrove-based product value chains will create additional income and business opportunities for the farmers and service providers.
- Invest in landscape redesign to promote environmentally sustainable shrimp culture practices for increased farm productivity to ensure uninterrupted supply of premium quality shrimps.

B) Civil society and practitioners organizations:

- Promote nature-based mangrove shrimp aquaculture for better livelihood of smallholder coastal communities.
- Disseminate the systems to integrate mangrove plants to reduce climatic risk and improve shrimp farm productivity.
- Engage in value chain development and mainstreaming of mangrove-based products.

C) Policy makers:

- Shrimp culture in coastal Bangladesh was not a deliberate choice; rather it was an adaptation for livelihood transition by farmers in response to waterlogging and salinity intrusion associated with polder construction.
- Stakeholders mobilisation has been undertaken to take actions on mangrove aquaculture to provide a range of protective, economic and ecological functions, thereby providing multiple benefits to the society.
- Investment in redesigning polder landscape to integrate shrimp with mangrove will not only increase shrimp productivity but also will provide other ecosystem benefits that, in turn, will motivate farmers to change customary attitude of ecosystem degrading farming practices.

Knowledge products

- Selection of mangrove species for shrimp based silvo-aquaculture in the coastal areas of Bangladesh. Journal of Coastal Conservation (2020), 24, 59.
- Non-Timber Forest Product Livelihood-Focused Interventions in Support of Mangrove Restoration. Forests (2020), 11:1-17.
- Training manual “Germplasm Conservation of Selected Mangrove Trees through Air layering” (available in Bengali language)
- 6. I. Alam et al. (2020). Nutrients and anti-nutrients in leaf litter of four selected mangrove species from the Sundarbans, Bangladesh and their effect on shrimp post larvae, manuscript submitted to Aquaculture.
- Training manual on “Integrated Mangrove Shrimp Aquaculture”.
- Infographs on “Non-timber Mangroves Products: status and potential for value chain development".

Knowledge networks

The research results were disseminated via a nationally telecasted video documentary and through participation at various local and national-level aquaculture fairs. Researchers also participated at the NWO-sponsored session of an International Conference held in the Philippines to have insights on global perspective of land-use planning, water management and mangrove plantation for IMSA. Coordination and network has been made with relevant stakeholders and the Ministry of Fisheries and Livestock include the business model of mangrove aquaculture in the National Action Plan for BT shrimp.

Knowledge co-creation

Co-creation in the form of a series of consultations with farmers at every stage of research design and implementation was at the heart of this pilot project. At the early stage of research, farmers provided local knowledge on the availability of mangroves and their potential uses, which the research team subsequently triangulated with global knowledge through critical appraisal of literatures. This has allowed the project to gain new insights and perspectives about the ethnobotanics’ knowledge of the farmers and their coping strategies with delta dynamism and landscape changes. The process of co-creation also brought together the complimentary strength of mangrove ecology and local and international expertise of KU and WUR with strong filed experiences of Solidaridad: Solidaridad leveraged the boots on the ground field experience and stakeholders’ commitments gained through the implementation of aquaculture projects in Bangladesh. Khulna University added value on local ecosystem knowledge and provided technical assistance on the implementation and monitoring of the research project. Wageningen UR’s Aquaculture & Fisheries (WUR-AFI) leveraged global knowledge and expertise on mangrove ecology for sustainable shrimp farming.

Consortium partners

- Solidaridad Network Asia
- Khulna University
- Wageningen UR – Aquaculture and Fisheries Groep

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Project website

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