

Opportunities in sustainable coastal aquaculture for the very poor

RIU

Validated RNRRS Output.

Easy, low-cost methods for adding value to sea foods—fattening low-value soft-shell crabs into high-value hard-shell crabs, producing good quality dried fish, molluscs and seaweed—help the coastal poor enter local markets. The lives of many poor people in coastal areas who traditionally depended on fishing and foraging are seriously threatened. Now, small-scale producers with very modest assets and skills can produce less familiar but high-value sea foods for both local and export markets. The very poor in coastal areas in Bangladesh, and also in Vietnam and the Philippines are already seeing quick returns on their investments using these methods. Such ventures have great potential for improving livelihoods in almost all Asian coastal regions.

Project Ref: **AFGP10:**

Topic: **3. Improving Fishers Livelihoods: Better Fishing Management & Aquaculture**

Lead Organisation: **University of Stirling, UK**

Source: **Aquaculture & Fish Genetics Research Programme**

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Description

AFGP10

Research into Use

NR International
Park House
Bradbourne Lane
Aylesford
Kent
ME20 6SN
UK

Geographical regions included:

[Bangladesh](#), [Philippines](#), [Thailand](#), [Vietnam](#),

Target Audiences for this content:

[Fishers](#),

A. Description of the research output(s)**1. Working title of output or cluster of outputs.**

Promoting opportunities for sustainable coastal aquaculture production and value chain development in coastal communities, to create improved livelihood diversification options and address poverty and vulnerability.

2. Name of relevant RNRRS Programme(s) commissioning supporting research and also indicate other funding sources, if applicable.

Aquaculture and Fish Genetics Research Programme AFGRP/DFID, SUFER/DFID

3. Provide relevant R numbers (and/or programme development/dissemination reference numbers covering supporting research) along with the institutional partners (with individual contact persons (if appropriate)) involved in the project activities.

R6011, R8094, R8288, A05, D07, D11, T02, T04,

Philippines: Philippine Council for Aquatic and Marine Research and Development; Department of Sociology, University of the Philippines (R8288, D11)

Bangladesh: University of Khulna, University of Chittagong, Bangladesh Agricultural University, COAST, CARE, Proshika; BFRF; Danida Noakhali programme (T02, T04)

Vietnam: University of Can Tho, University of Agriculture and Forestry, University of Fisheries (R8094, D07)

UK: Institute of Aquaculture, University of Stirling (R6011, T04); Nautilus (R8094, T04, D07), Marine Resource Assessment Group Ltd., London (R6011); University of Reading (R8288)

International: FAO (A05)

4. Describe the RNRRS output or cluster of outputs being proposed and when was it produced? (max. 400 words). This requires a clear and concise description of the output(s) and the problem the output(s) aimed to address. Please incorporate and highlight (in bold) key words that would/could be used to select your output when held in a database.

Many developing states have significant concentrations of poor people in coastal margins. Traditionally dependent on small-scale agriculture, fishing, foraging in coastal forests, and basic food processing, vulnerability is high and rising. Though significant wealth is generated in some areas by shrimp culture and its global trade, well-documented concerns tend to confirm very limited social equity and impacts on the environment. However, there are other less recognised forms of aquaculture, many of which can involve small-scale producers using low-input processes, entering and adding value to local market chains. This proforma shows how these can be more widely promoted and address the issue of environmental unsustainability of shrimp culture.

A series of AFGRP projects have explored culture of mud crab, sea weed, mollusc, tilapia, seabass and milkfish, lobster culture in cages, dry fish production and their value chain analysis, and carrying capacity of coastal aquaculture ponds and cages which is key to sustainable coastal production, primarily in Bangladesh, but also in Vietnam and the Philippines. The sustainability of such ventures depends upon viable technologies, development

of management tools, effective resource management, and integration between producers and consumers (exporters) in the marketing channel. With respect to culture technologies a range of technical and marketing issues were assessed and responses developed which demonstrated positive output and financial returns, accessible with very modest levels of skills and assets, and capable of developing local value chains to domestic and some export markets. In addressing the environmental sustainability issue of shrimp culture a mathematical dynamic nutrient model and practical guidelines for the estimation of carrying capacity of coastal aquaculture systems were developed.

Central to these outcomes was the close involvement of producers and others in market links and management decisions, with a mix of legal and institutional support, and community empowerment to develop markets, address environmental capacity issues and allocate resources to maintain equity and social benefit. This had been particularly true for higher value export-oriented products including shrimp, sea weed, crab and dried fish. Public investment for infrastructure development and for providing business support services (ice, transport, packing materials etc.) would be important but could generate good social and financial returns.

To ensure sufficient co-location of skills and resources, the approach would be based on producer clusters linked with poor communities, together with NGOs, CSOs, and public sector agents, including knowledge specialists, built round community capacity building, information and market support. These would also be linked with policy development as appropriate.

5. What is the type of output(s) being described here?

Please tick one or more of the following options.

Product	Technology	Service	Process or Methodology	Policy	Other Please specify
X	X	X	X	X	

The cluster of outputs is based around specific technologies, processes and products but incorporates aspects of service and policy development, depending on the context.

6. What is the main commodity (ies) upon which the output(s) focussed? Could this output be applied to other commodities, if so, please comment

The main commodities are cultured fish, shellfish and aquatic plants

7. What production system(s) does/could the output(s) focus upon?

Please tick one or more of the following options. Leave blank if not applicable

Semi-Arid	High potential	Hillsides	Forest-Agriculture	Peri-urban	Land water	Tropical moist forest	Cross-cutting
	X			X	X		X

The output is appropriate to a range of production systems within the coastal area where aquatic production takes

place.

8. What farming system(s) does the output(s) focus upon?

Please tick one or more of the following options (see Annex B for definitions).

Leave blank if not applicable

Smallholder rainfed humid	Irrigated	Wetland rice based	Smallholder rainfed highland	Smallholder rainfed dry/cold	Dualistic	Coastal artisanal fishing
	X	X			X	X

This output has potential in coastal farming systems where a holistic approach to the management of production would be beneficial.

9. How could value be added to the output or additional constraints faced by poor people addressed by clustering this output with research outputs from other sources (RNRRS and non RNRRS)? (max. 300 words).

From Natural Resources Systems Programme - Caribbean: Institutional arrangements for coastal zone management; Trade-off analysis for coastal zone conservation and development; MPA guidelines; Achieving alternative livelihood strategies

From Fisheries Management Science Programme - Enhancement of marine fisheries

The information and management models within this output could be shared across a range of systems in the coastal environment. The various mixes of public, private commercial, NGO and poor producer involvement in these networks is a potential model for other commodities, especially where there are challenges in identifying and actioning pro-poor production strategies.

Other technical outputs from the aquaculture cluster would also be relevant where a coastal perspective is the overriding factor.

Validation

B. Validation of the research output(s)

10. How were the output(s) validated and who validated them?

Research outputs were validated with extreme poor and moderate poor producers in coastal areas where research had taken place through application of techniques for improved mud crab, mixed culture of tilapia and seabass, seaweed culture and good quality dry fish production technology. Validation of the research outputs was an integral part of the original research programmes. This was made possible by inclusion of local partner

NGOs in each research programme design with clear mandate to validate outputs by completion. Assessment techniques involved data collection from secondary and primary sources following site selection after discussion with relevant project personnel. The log frames of the concerned projects were considered as the starting reference materials while different PRA tools were used for primary data collection. Indicator-based guidelines for the estimation of carrying capacity of shrimp culture ponds was jointly developed with farmers and used to “ground truth” or cross check these estimates.

11. **Where and when** have the output(s) been validated?

The outputs from the studies on mud crab, mixed culture of tilapia and seabass, seaweed culture and good quality dry fish production technology and their marketing channel were validated in three coastal areas of Bangladesh namely Munshigonj, Satkhira and Kaligonj of Khulna district during June-August 2006 and in Chakaria of Cox’s Bazar district in May 2004.

The dynamic model was calibrated independently for two commercial intensive shrimp farms and cross-validated in Thailand in the mid 1990s. The validation of guidelines for the estimation of carrying capacity was carried out in Khulna in Bangladesh and Can Giao and Do Son in Vietnam in 2005.

Current Situation

C. Current situation

12. **How and by whom** are the outputs currently being used? Please give a brief description (**max. 250 words**).

By linking with NGO’s the researcher was successful in targeting the poorer households. This link enabled the crab collectors, small farmers and poor dry fish producers to have an input into the design and as a result an easy method for fattening the low-value soft-shell crabs into high-value hard-shell crabs in a short cycle of 2 weeks, good quality dry fish, mollusc and sea weed production technology was developed. In financial terms this means a mud crab catcher could now potentially get a net return of around Tk. 1,500 from fattening of 60 crabs in 12-14 days.

In fact, a number of enthusiastic individuals, mostly tribal poor women involved in shrimp larvae collection, are currently trying this technique for quick return of their investment. There are some local NGOs who have already initiated adopting this technologies among their members or are actively planning to venture upon such activities in near future. These NGOs include *Shushilon* and *Gono Unnayan Shangstha* (GUS) in Khulna and COAST Trust, ESDA and Shastho, Paribesh O Jono Unnayan Shangstha (SPJUS) in Cox’s Bazar.

The dynamic model developed has been extended to incorporate a sludge nitrogen pool and remineralisation process jointly by Centre for Reverine Landscapes, Griffith University in Queensland, Australia and Environmental Science and Technology, Imperial College in UK. Both sludge removal and instantaneous water exchange of more than 0.3 day⁻¹ are recommended to maintain the carrying capacity and sustainable production.

These practices together with the guidelines developed for estimation of carrying capacity are widely recognised as Better Management Practices (BMPs) in the shrimp farming industry.

13. *Where are the outputs currently being used? As with Question 11 please indicate place(s) and countries where the outputs are being used (max. 250 words).*

Outputs are currently being used in a number of coastal locations in Bangladesh particularly in Paikgacha, Munshigonj and Rampal of Khulna and Chakaria, Moheskhal, Teknaf of Cox's Bazar,; related outputs are also used in Nha Trang and Can Tho Provinces in Vietnam and in Luzon State, Philippines. Although the research was only conducted with few households, many others showed an interest in the technology and attended workshops and meetings where the training on different technology was being given. About 500 households in Chittagong and Khulna areas are now using the new technology.

The dynamic model and the guidelines for the estimation of carrying capacity are applicable in all most all Asian coastal shrimp aquaculture to optimise water and pond management in order to maintain the carrying capacity of the pond and the environment and thereby ensure a sustainable production.

14. *What is the scale of current use? Indicating how quickly use was established and whether usage is still spreading (max 250 words).*

In trial areas in Bangladesh the new technology was used immediately because the research was participatory, supported by training and dissemination with partner NGOs. However, further spread did not keep up initial partly due to the need to develop seed supplies and define further open water locations for placing the cage for mud crab, bamboo structure for sea weed and mollusc production. Market capacity also needed besides, lack of market access is another factor that makes potential new users unsure of the success of culture techniques.

With respect to maintenance of carrying capacity in coastal shrimp pond culture both sludge removal, adequate water exchange and the indicators based guidelines to estimate carrying capacity are widely recognised as BMPs in the shrimp farming industry irrespective of the scale of operation and country.

15. *In your experience what programmes, platforms, policy, institutional structures exist that have assisted with the promotion and/or adoption of the output(s) proposed here and in terms of capacity strengthening what do you see as the key facts of success? (max 350 words).*

The most notable fact that has supported the growth of mud crab fishery is the possibility of live export of crab, marine dry fish from Bangladesh and a few exporters residing in the capital are facing no bureaucratic obstacles in exporting crab on a daily basis. Thus, the government's favourable export policy is ensuring the steady growth of this sector. Besides, the licensing system from the department of forest is also very simple, which enables wild catchers to collect crabs from the mangrove area of Sundarbans Reserved Forest.

A number of BMP Programmes, both WB/NACA/ WWF/ FAO/ UNEP Consortium programme case studies and national programmes that NACA was involved with in Asia-Pacific region in coastal aquaculture to demonstrate a practical way of development, uptake and benefits of using responsible management practices have been benefited from the outputs related to estimation of carrying capacity.

Current Promotion

D. Current promotion/uptake pathways

16. *Where is promotion currently taking place? Please indicate for each country specified detail what promotion is taking place, by whom and indicate the scale of current promotion (max 200 words).*

Currently, promotion for individual cell-based cage culture is taking place in Shamnagar, Satkhira, Munshigonj and Paikgacha of Khulna district and Chakaria area of Cox's Bazar district. The promotions are taking place in the form of training and demonstration for the poor women fisher and university sponsored seminars/workshops for researchers, NGOs and policy planners. The crab whole sellers as well as local NGOs considering provide small-credit for crab collectors to enter into crab fattening.

The dynamic model as well as the guidelines for the estimation of carrying capacity will contribute towards sustainable coastal aquaculture in Asia-Pacific region as NACA in its Fourth Five-year Work Programme (2006-2010) identified sustainable coastal aquaculture production as a priority area in which support to the development and widespread adoption of better management to be continued.

17. *What are the current barriers preventing or slowing the adoption of the output(s)? Cover here institutional issues, those relating to policy, marketing, infrastructure, social exclusion etc. (max 200 words).*

In Bangladesh, the most marginalized segment of coastal population especially landless people, widows, orphans and tribal people have the potential to engage in programme activities but often live on government land with no tenure security. Social taboo over catching and eating crabs lead to low status for crab collectors and deprived access to certain social institutions. Similar constraints have been observed for poorer coastal groups in Vietnam and the Philippines, specifically concerning social status, and access to resources.

Coastal marketing systems commonly face problems including poor communications, absence of government services, low levels of market competition, and transport constraints for higher value product. In many cases also communities are highly fragmented, with low levels of social and organisational strength. This weakens not only their socioeconomic position but also their performance as a market player, making them vulnerable in bargaining with other market actors such as depot owners, commission agents and exporter who have better capital endowments. This can be further aggravated by the lack of transparency and asymmetric information flows, lack of capital for investments in improved technology.

Institutional mechanisms that lack promotion of BMPs through education, extension and farmer associations to raise standards constrained the wide adoption of management tools help in maintaining the environmental carrying capacity.

18. *What changes are needed to remove/reduce these barriers to adoption? This section could be used to identify*

perceived capacity related issues (max 200 words).

An effective support package is required to accompany the production and value opportunities, depending on the local context. This may include policy support for securing land and water access rights, if only over defined lease periods, micro-credit facilities to allow communities to take up production opportunities and develop markets, linking producers with domestic and international market by forming collectors' association through GO/NGO initiatives.

Programmes would proceed involving local capacity building with appropriate technical training but over the medium term should incorporate a partnership between NGO, local community organisations, research and training specialists, and public sector agencies, to create an effective learning and development process around the evolution of technical and market strength and in support of stronger self-determination and livelihood potential for the communities involved.

A set of BMPs may be packaged with policy statements and commitments to develop code of practices to guide and influence the private sector, regulatory framework, environmental screening processes and extension in favour of environmental carrying capacity.

19. What lessons have you learnt about the best ways to get the outputs used by the largest number of poor people? (max 300 words).

Meaningful partnerships are a necessary foundation for poverty focused research

Attitude to partners can make or break research impact

Poverty focused research requires the need to understand the bigger picture

A change in livelihood outcomes requires more than just research

Research that leads to uptake requires an appreciation of the way the poor make decisions

Participatory approach provides sense of ownership and impact on the uptake of developed technology and management tools.

For women to benefit from output there needs to be serious commitment with explicit incorporation of gender issues into the research design.

Impact on Poverty

*E. Impacts on poverty to date**20. Where have impact studies on poverty in relation to this output or cluster of outputs taken place?*

Impact studies were carried out in the coastal region of Bangladesh particularly in Shamnagar, Khulna and Chakaria, Cox's Bazar, Limited impact studies were also carried out in Vietnam and the Philippines in associated contexts.

Impacts at Farmers level and environment

Key lessons have emerged on how to make research more relevant to poor people's livelihoods. This assessment was not intended to provide a deep academic analysis of the socio-economic and livelihood impacts. Rather the purpose of the assessment was to provide information as to what some of the impacts have been to date and what lessons are emerging that can usefully inform future development research in order to scale up the impact of research in reducing poverty.

The awareness and knowledge on crab fattening, dry fish production, Sea weed and mollusc production have been gained and improved noticeably. Technical skill and capacities on crab fattening, dry fish production, Sea weed and mollusc production were developed aided by previous training and experience. The beneficiaries have developed skills to solve most of the constraints of crab fattening, dry fish production, Sea weed and mollusc production by themselves. Respect and dignity of farmers and their family level improved to some extent through the new skills, additional income and more scope of economic activities.

Crab fattening, dry fish production, Sea weed, Sea bass and tilapia and mollusc production can potentially provide double benefits for the rural poor: nutrition and income. It is now treated as both food crop and cash crop. Poor people doing crab fattening, dry fish production, Sea weed and mollusc production are getting more benefit from aquatic product production because they are now paying loan from the income.

Employment opportunities for the participating rural poor in the working areas have increased since these projects started.

The IDL Group that undertook the impact study therefore focused on identifying trends and broad lessons that could be learnt from the output of these two research projects.

The approach offered in the development of guidelines to estimate environmental carrying capacity is now being adapted at local level in both Vietnam and Bangladesh. The core of this approach is simple and can be widely disseminated among low intensive small-scale farmers in developing simple nutrient budgets as a framework for discussing possible environmental problems and appropriate management measures. Thus, maintenance of environmental carrying capacity will positively impact on the sustainability of livelihoods of poor.

21. Based on the evidence in the studies listed above, for each country detail how the poor have benefited from the application and/or adoption of the output(s) (max. 500 words):

The main focus of evidence was in Bangladesh where the poor benefited by having access to new production opportunities, being able to use their skills and resources effectively for income and food security, interacting with NGOs to adjust their options (eg short season for crab) by having greater market power in relationships with the conventional supply chains.

With the local aratder (whole seller) seeing the potential for the supply of quality crabs, dry fish and mollusc the likelihood that he will support the poor households through loans to buy the technology is extremely high (in Chakaria Upazila willingness to provide loans to crab catchers has already been demonstrated through loans to buy crab traps).

Women members of the household played an important role in the fattening of the mud crabs, dry fish production and sea weed and mollusc culture. Apart from feed preparation and feeding, they were responsible for watching the ponds, cages in the day time to prevent theft.

Whilst the eel is collected easily and freely from the wild, it is a natural resource that has a small market value (20 taka per kilo) and at times can be used to supplement household income. By fattening the crabs with this eel a trade off has to be made. The research generated interest among intermediaries (NGOs) who participated in the research as well as those who attended the training. Requests are now being received for technical support in reproducing the cages.

Environmental Impact

H. Environmental impact

24. What are the direct and indirect environmental benefits related to the output(s) and their outcome(s)? (max 300 words)

It is expected that the dissemination of the new drying technology, will impact positively on physical environment as solar drying minimises rancidity.

Development of culture technology with low inputs contribute significantly towards conserving the environment in two ways: by adopting an environmentally sustainable culture technology, which uses little or no external outputs in terms of feed, chemical or other organic or inorganic ingredients or changing the water quality regimes and second by promoting a fair trade policy from producer to the consumer through appropriate policy and intuitional arrangements. The individual cell-based cage culture for mud crab fattening requires bamboo made cage, which is affordable, locally available and biodegradable. Moreover, the feed for crabs culture also cheap and locally available, which does not require exhaustion of natural resource base as with shrimp and other commercially important aquaculture species.

On the other hand, more intensive production systems can be more efficient in terms of resource use and production and thereby can help reducing environmental and resource use problems provided BMPs are adopted to prevent pollution problems. The dynamic model has a direct positive impact on good management practices of intensive coastal pond culture systems supporting the use of resources more efficiently. Intensive systems require less area opposed to extensive systems which require large areas of land, potentially contributing to minimise degradation of habitat in some areas. The majority of shrimp farms are extensive or semi-intensive, and the highly publicized problems of wetland degradation are often associated with extensive systems.

25. Are there any adverse environmental impacts related to the output(s) and their outcome(s)? (max 100 words)

The fattening of crabs with soft shelled and inadequate gonad has a perceived threat of over harvesting of these two types from the wild if demands created by applying this technology outweigh the supply of these types of crabs from the current practise of harvesting from the wild and supplying them from the depots.

The dynamic model which advocates higher water exchange rates in intensive pond culture systems to discharge particulate and dissolved nitrogen to maintain pond carrying capacity may have an effect on nutrient and organic enrichment in receiving waters unless effluent treatment is incorporated into the practice to remove particulate and dissolved nitrogen.

26. Do the outputs increase the capacity of poor people to cope with the effects of climate change, reduce the risks of natural disasters and increase their resilience? (max 200 words)

The area is extremely vulnerable to disasters and many households have few if any assets and limited cash flows making it difficult for them to withstand any natural disasters and calamities. Thus, promotion and mass adoption of this technology by the segment of this vulnerable group of people in the disaster prone coastal area might increase their capabilities to cope with the natural disasters and food security related problems.
