

Priorities for Regional Research on Sustainable Shrimp Aquaculture

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THIS paper attempts to identify priorities in some of the sustainable shrimp aquaculture problem areas that could be effectively tackled by joint research between two or more countries. It is based on three sources of information, namely, two recent studies (FAO/NACA 1995; ADB/NACA 1995) and preliminary information from a regional survey of aquaculture research priorities and capacities, with the collaboration of the Food and Agriculture Organization of the United Nations (FAO). The countries/territories considered are Bangladesh, Cambodia, China, India, Indonesia, Malaysia, Myanmar, Pakistan, the Philippines, Taiwan, Thailand and Vietnam.

Overview: What Makes Shrimp Culture Unsustainable?

That the shrimp industry (and for that matter, aquaculture) should be sustainable is the fundamentally expressed objective of every country represented in this workshop. From this common point everyone thereafter proceeds to define the issues with varying degrees of divergence but also with some common areas of agreement. Notable among the agreements on basic issues are that:

- the shrimp culture industry can pollute itself out of sustainability;
- its sustainability is threatened by normal impacts from other activities; and

- it has both positive and negative impacts on society and the environment. If the negative impacts are not mitigated, they will ultimately impair its sustainability (Phillips 1995).

It is remarkable that none of the above threatens short-term profitability of individual farms. This observation suggests that research should simply focus on maintaining the biological productivity and economic efficiency of farms over a series of short-term horizons, while insulating the industry from external threats and eliminating emissions from farms that cause adverse ecological impacts. At first glance, this seems to move attention away from a longer term and holistic research outlook. On the contrary, it directs attention to assessing the immediate priorities of a production unit so that it does not collapse in the future. In so doing, it eliminates the temptation to get as much as one could today and never mind tomorrow, the basic motivation for the 'rip-and-run' behaviour that has largely been blamed for unsustainable management practices.

Framework for Identifying Priorities for Collaborative Research

Farm-based approach

A strategy based on a 'farming systems' approach seems to be an appropriate framework for identifying research activities. In essence, research oriented to farming systems seeks to ensure that the system is biologically feasible (the crop can grow and/or reproduce under a given agro-climatic condition), technically feasible (the farmer can grow the crop and market it) and economically viable (it pays to grow

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the crop). If what is not sustainable cannot continue to be profitable in the long term, there is support for the proposition that research should focus on ensuring farm profitability over a series of short-term horizons.

Regional approach

I tried to identify the opportunities for collaborative research simply by identifying the expressed areas of common concern. These are further classified into research areas that would apply to all systems (non system-specific) and those that are system-specific. For instance, research responsibilities that apply to extensive and improved extensive shrimp culturing systems could be shared by Bangladesh, Vietnam, and perhaps Sri Lanka, India and to a certain extent the Philippines. Those that apply to the intensive system could be shared by Thailand and others that look at the Thai system as a model which they may want their industry to emulate. I then attempted to identify examples of problem areas for collaborative research in disciplines of competence in the participating countries.

Common Concerns

Every country reported that better farm management techniques were a high priority, but it might help to focus on the components of this issue rather than treat it as a single research concern. The major concerns reported for each country/territory are listed in the Appendix. The most commonly expressed priority problems were as follows.

Seed

12 of 12 countries/territories. Issues ranged from concern for reliable supply (hatchery technology), risks of importing diseased seed, depletion of wild seed sources, destruction of other species during wild seed collection, and production of vigorous and healthy seed. Surprisingly, despite all the concern for broodstock development in previous sessions, only Thailand, Malaysia, the Philippines and Indonesia mentioned it as a priority problem.

Disease

10 of 12 (except Myanmar and Pakistan). The priorities included: capabilities for diagnosis; methods for treatment and control; studies on causes and predisposing factors; and development of immunostimulants.

Water and sediment management

9 of 12 (except Cambodia, Myanmar and Pakistan). The concerns in this area varied among countries. Thailand's concerns were for recirculating systems, biofiltration, bio-enhancers for effluent, sediment management and salination of crop lands. India and Malaysia focused on bio-enhancers, while the Philippines was concerned with adequacy of freshwater supply, land subsidence, salination of aquifers and adjoining crop lands, and the use of bio-enhancers (probiotics). All reporting countries listed proper water intake and drainage system as priorities.

Mangroves

10 of 12 (except China and Pakistan). Concerns were mostly on the allocation of mangrove areas for aquaculture, although priority has shifted towards rehabilitation and conservation. This shift should impact favourably on ecology and public image.

Site suitability

7 of 12 (namely Bangladesh, India, Indonesia, Malaysia, Pakistan, the Philippines and Thailand). Zoning was the main concern, with emphasis on carrying capacity. Sri Lanka did not express concern, perhaps because more attention was focused on ameliorating problem soils in present sites. Malaysia was concerned with having additional areas.

Pollution from outside, including red tides

5 of 12 (namely China, India, Malaysia, the Philippines and Thailand).

Low-pollution feed and feed quality

Very few countries reported this as a high priority. India, Sri Lanka and Indonesia were concerned with feed quality, and Thailand with both quality and less-polluting effects.

Other concerns

There are also concerns about the use of bio-fertilisers, rotational and polyculture systems, rehabilitation of non-active ponds, crop insurance schemes, optimum farm size (economies of scale) and social research to avoid conflicts. Taiwan is studying captive broodstock improvement, disease prevention, viral identification technology, and predator and plankton control. It is also investigating the relationships between water quality, nutrition, automatic monitoring and feeding systems.

From the above list of priorities, the research concerns that would be system-neutral are broodstock development, improved and healthy seed, site suitability, carrying capacity, water intake and drainage systems, research on avoidance or resolution of social conflicts, and economic studies. Those that apply more to the extensive and improved extensive systems are crop rotation, polyculture (including alternative species) and bio-fertilisers. Studies that apply to semi-intensive and intensive systems are water recirculation systems, low-polluting and high-quality feed, nutrition and feeding regimes, viral disease diagnostics and control, immunostimulation, vaccine development, bio-enhancers or probiotics, effluent treatment, and sediment management.

Sharing Research Responsibilities

The following exercise is only illustrative. It attempts to show how the competencies of the participating governments could be brought together to work on common problems for cost-effective collaborative research.

By research area

- Viral disease studies—Thailand, Australia
- Broodstock development (genetics)—Thailand, Malaysia, the Philippines, Australia
- Healthy seed and hatcheries—Philippines, Thailand, Malaysia, Australia
- Problem soils amelioration—Australia, Sri Lanka, India, Indonesia
- Integrated and rotational culture systems—China, Vietnam, Bangladesh, India, Indonesia, the Philippines
- Feed and nutrition—Thailand, Australia
- Low water-use systems—Thailand, Malaysia, Australia
- Bio-enhancers/probiotics—Thailand, Malaysia, Australia, Philippines, China
- Integration of aquaculture and mangroves—Vietnam, Bangladesh, Indonesia, Thailand, Malaysia

By research tool

- Biotechnology for disease studies—Thailand, Australia
- Biotechnology for studies on bio-enhancers/probiotics—Malaysia, India, China, the Philippines, Thailand, Australia
- Geographical information systems—Thailand, Australia, India, Malaysia (Sabah)

Researchable Issues and Research Needs

The following research issues were summarised from the recommendations made in recent country survey reports (FAO/NACA 1995; ADB/NACA 1995).

On-farm management issues

- Assistance with diseases of unknown origin
- Prevention of diseases
- Pond bottom soil and water analysis
- Effluent management
- Use of probiotics
- Feed from locally available material, cheaper pelleted feed
- Feeding regime
- Environmentally sensitive intensification
- Stocking densities that give maximum profitability
- Economies of scale—size of production area (pond and farm)
- Water circulation systems
- Quantity and quality of seed

Environmental issues

- Design of farming estates—separate intake and discharge canals
- Carrying capacity of watershed areas
- Problem soil management and amelioration
- Site selection
- Reservoir and sedimentation ponds
- Larger sized farms tend to be more involved in social conflicts
- Water quality and sediment management
- Less flushing, less water exchange
- Biological treatment, reduction in use of chemicals and drugs
- Buffer-zone areas
- Assessment of land use
- Zoning: identification and assessment of suitable shrimp zones

Policy issues

- Monitoring of external threats to aquaculture
- Insurance system to cover environmental changes
- Effluent discharge standards, optimum practical limits of effluent
- Mangrove management guidelines
- Integrated approaches to use of inland and coastal resources

References

- ADB/NACA (Asian Development Bank/Network of Aquaculture Centres in Asia-Pacific) 1995. Draft report of the regional study and workshop on aquaculture sustainability and the environment., Beijing, China, October 1995. Bangkok, Thailand, NACA, 520p.
- FAO/NACA (Food and Agriculture Organization of the United Nations/Network of Aquaculture Centres in Asia-Pacific) 1995. Regional study and workshop on the environmental assessment and management of aquaculture development (TCP/RAS/2253). NACA Environment and Aquaculture Development Series No. 1. Bangkok, Thailand, NACA, 492p.
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Appendix

Research Needs by Country/Territory

India

- Use of bio-fertilisers and bio-filters
- Improved feed and seed quality, bio-genetic capacity
- Definition of optimum levels of physico-chemical parameters, including optimisation of feeding rates

Malaysia

- On-farm water management
- Reduction in water exchange requirements
- Improvement of performance in acid sulphate soils
- Disease diagnosis and monitoring
- Water quality monitoring systems
- Biological filters/integrated systems

Philippines

- Broodstock development in ponds
- Water quality monitoring systems
- Integrated management system using biological filter organisms
- Reduction of pond water exchange
- Disease diagnosis, control and treatment
- Water pollution control
- Genetic improvement

Sri Lanka

- Effluent treatment
- Disease diagnosis, prevention and control
- Amelioration of acid sulphate soils and potential acid sulphate conditions
- On-farm water quality management and improvement in quality of water supply
- Management of pond sediment
- Social research to minimise conflicts

Taiwan

- Disease prevention
- Virus identification technology
- Relationship between nutrition and water quality
- Captive maturation technology to improve broodstock quality and fecundity
- Genetic improvement of captive matured stock
- Development of specific pathogen-free broodstock
- Improve productivity and feed for shrimp polyculture systems
- Optimum teaseed cake application for effective predator control
- Automatic monitoring and feeding systems

Thailand

- Feed, feed quality, feeding
- Use of chemicals and antibiotics
- Integrated coastal farming
- Shrimp broodstock development
- Environmental impacts of drugs and chemicals
- Impacts of effluent on ecosystems
- Environmental impacts of seawater irrigation systems
- Development of low water-use systems

Vietnam

- Disease prevention and cure
- Integrated shrimp/mangrove systems
- Survey of coastal ecological systems and effects of environmental change
- Conservation and rehabilitation of reservoirs, mangroves and brackish waters
- Improved extensive and semi-intensive systems