

# An evaluation of the sustainability of farming systems in the brackish water region of the Mekong Delta (ASEM/1995/119)

**Donna Brennan**

<b>Project number</b>	ASEM/1995/119
<b>Project name</b>	An evaluation of the sustainability of farming systems in the brackish water region of the Mekong Delta
<b>Collaborating institutions</b>	<ul style="list-style-type: none"><li>■ Australia: University of Sydney, CSIRO Marine Science, University of Western Sydney, Australian National University</li><li>■ Vietnam: Can Tho University; University of Agriculture and Forestry, Ho Chi Minh City; Sub Institute of Water Resources, Southern Institute of Water Resources Research; Geological Survey of Vietnam</li><li>■ Philippines: International Rice Research Institute</li></ul>
<b>Project leaders</b>	Donna Brennan, Nigel Preston and Vo Tong Xuan
<b>Duration of project</b>	1 July 1997 – 31 December 2002
<b>Funding</b>	\$1,172,350
<b>Countries involved</b>	Australia and Vietnam
<b>Commodities involved</b>	Rice, shrimp

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## Related projects

- FIS/1994/012 – Mixed shrimp farming – mangrove forestry models in the Mekong Delta
  - FIS/1994/011 – Prawn health management and disease control to sustain hatchery and pond production systems
  - SP843 – Investigation of the key researchable issues in the sustainability and productivity of coastal shrimp aquaculture in Thailand
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## Motivation for the project and what it aimed to achieve

The rapid adoption of rice–shrimp farming in the Mekong Delta during the late 1980s led to widespread concern about the sustainability of the farming practice. These concerns were partly motivated by the general environmental problems experienced in shrimp-production systems in Asia, but also by emerging issues experienced under local conditions. These included concern about the potential salinisation of rice fields following inundation of saline water during the dry-season shrimp cycle; concern stemming from evidence of land loss associated with sediment build-up on farms; issues associated with sourcing seedstock; and concern about the financial sustainability of the rice–shrimp farming system.

The project aimed to investigate the sustainability issues using on-farm field experiments and economic analysis. The emphasis of the field work was to determine appropriate on-farm management strategies to enhance the economic sustainability of the practice. The interdisciplinary nature of the project involved collaboration between eight organisations in Australia and Vietnam, as well as the International Rice Research Institute. A strong emphasis was placed on local collaboration, with farmers and provincial government officials taking an active role throughout the project.

## What the research project produced

The project found that rice–shrimp farming could be a sustainable practice and recommended a range of management practices to ensure its environmental and economic sustainability.

Research on the rice component identified a variety suited to salinised field conditions, quantified the relationship between salinity stress and yield at different stages of the phenological cycle, and quantified a model of soil-water salinity in the rice–shrimp field. It was found that there was sufficient leaching of salts during the wet season to avoid a build-up of salt in the soil in the My Xuyen district of Soc Trang province.

Research on the shrimp component identified feeding strategies for shrimp stocked at different intensities, characterised pond water quality in the shrimp cycle and recommended a range of management strategies to improve shrimp survival and growth. These included the use of sediment ponds, shrimp-pond preparation, the practice of low water exchange, and strategies to improve early stage survival of post-larvae. The prevalence of white spot virus was identified as a key issue, and PCR technology was introduced to Can Tho University to assess white-spot status of post-larvae and broodstock.

A socioeconomic profile of farm households and farming practices was developed that identified a wide variety of shrimp-production practices and large differences in economic performance of farms. The information was used to inform the design of the second-year experiments that emphasised water exchange and prompted an emphasis on natural biota as shrimp feed in the low-input systems in the Gia Rai district of Bac Lieu province.

Economic models were developed to assess issues relating to environmental sustainability (particularly sedimentation) and economic sustainability associated with farm financial risk. It was demonstrated that rice – *Peneaus monodon* systems were economically sustainable, but that rice – natural shrimp systems were not.

Collaborators at Can Tho University were exposed to new techniques in shrimp science and economic analysis. Collaborators in the provincial governments and at the farm level gained new knowledge about the benefits of rice – *Peneaus monodon* systems and best management practices.

The project produced two PhD degrees in economics, a Masters degree in shrimp science, a Masters degree in soil science, and a Masters degree in agricultural economics.

### Adoption—how the project outputs are being used

Two factors led to high uptake of rice–shrimp farming (and recommended shrimp practices) in the region. These were the substantially higher profits attained compared with traditional rice monoculture, and the interest and promotion by local leaders from the agriculture and fisheries departments. The research finding of the project—that rice–shrimp farming is sustainable—has underpinned the active participation



Harvesting the rice in a rice–shrimp field, My Xuyen district, January 2008.

of the local government officers in promoting the system. The fact that these local leaders were so closely involved throughout the project (participating in every project workshop and the initial focus groups, and supporting the experimental work at the farm level) contributed to this positive outcome for the project.

The project produced extension material for better shrimp management that was disseminated to farmers in the region. To a large extent these improved practices have been adopted, although in Soc Trang province the integrated rice–shrimp practice has been dropped in favour of intensive shrimp monoculture. Project scientists had expressed some concern over the potential environmental and economic sustainability issues associated with more-intensive shrimp farming. The exposure of provincial government officers to the project has meant that they are continuing to try to discourage monoculture and encourage a return to rice–shrimp farming, and are working on rice varieties to improve productivity.

Research results on the sustainability of rice – *Penaeus monodon* prompted a major undertaking by the Bac Lieu provincial government to provide a suitable water-management regime for rice–shrimp culture in Hong Dan, Phuoc Long and Gia Rai districts. The operation of sluice gates allows the control of water salinity throughout the year and provides saline water in the dry season and fresh water in the wet season in 20,300 ha of farmland. There is believed to be 100% adoption of rice–shrimp culture in this area. The shrimp-management practices recommended by the project have been included in extension material provided to the farmers in this new rice–shrimp area.

Uptake of project results, in particular the shrimp-husbandry practices, is attributed to the clear economic incentives for improving survival and growth in the shrimp cycle, and the active steps taken to promote adoption. The earliest adoption was through the on-farm research collaboration, where a leading farmer



Aeration equipment used to support high stocking rates in a shrimp monoculture pond. This farm was previously a rice–shrimp farming pond but the field has been dug out to provide a deeper pond for shrimp monoculture.



A polder in the newly developed rice–shrimp farming area of Gia Rai district.

was selected to provide the experimental site, was trained intensively in farming techniques during the experimental period and later became a source of advice for other farmers. Subsequently, the project developed extension material that was promoted to farmers, and since that time the collaborating Vietnamese institutions (Can Tho University and the district government offices) have provided ongoing training workshops and updated extension material.

The Fisheries Department at Can Tho University has now widely adopted the use of data loggers to enable detailed investigation of aquaculture water quality in field research, a technique that was first introduced by the project. The department has used the PCR technology introduced there not just for research but also as a service to the community.

The two PhD scholars from the project (Tran Thanh Be and Le Xuan Sinh) have returned to senior positions at the university with a stronger basis in economic analysis and the integration of economics and science. Both Vietnamese Masters scholars are now studying for doctorates.

### **Impact—the difference the project has made or is expected to make**

As the rice–shrimp system was a relatively new practice, little scientific knowledge was available about the salinity dynamics in the field, performance of rice varieties, water quality and nutrient availability in the shrimp pond. The research conducted under the project provided a substantial contribution to knowledge. Anecdotal evidence suggests that the best management practices for shrimp culture that were developed by the project have been widely adopted. Improvements in survival associated with better shrimp management have undoubtedly occurred but it is difficult to quantify these because many farmers have



Dr Tran Thanh Be with Mrs Luu, the winner of Soc Trang Provinces 'best rice crop in rice–shrimp system' award, designed to encourage interest in rice farming. The backdrop is an advertisement for shrimp feed.

changed to intensive shrimp culture which the project (and management practices) was not designed to address. Survival in intensive shrimp ponds appears to be relatively poor, so data at aggregate level cannot be used to infer benefits of improved survival in the rice–shrimp system.

Substantial income benefits associated with rice–shrimp have been observed in the new 20,000 ha area developed for rice–shrimp culture in Bac Lieu. The annual income benefit to farmers in this region alone is around A\$35 million. However, this benefit must be attributed to a number of investments besides the ACIAR project, including the International Rice Research Institute water-management project, infrastructure modification and ongoing extension activities in the province. Nevertheless, the ACIAR project was the initial driver for all the subsequent activities, and probably had the most influence in terms of verifying the sustainability of the practice.

The project did not focus on shrimp monoculture, although it was of some concern during our activities. It is possible that the success of the project—in promoting better shrimp-production practices—indirectly encouraged the adoption of shrimp monoculture. For example, the collaborating farmer in My Xuyen became so successful at shrimp farming in the rice–shrimp operation that he thought he could improve his income by converting to intensive shrimp monoculture.

It is likely that intensive shrimp monoculture is creating adverse environmental impacts in the region.