USAID Mekong Adaptation and Resilience to Climate Change (USAID Mekong ARCC)

Gap Analysis on the Rice-Shrimp Aquaculture Systems in the Vietnam Mekong Delta

A Specific Focus on Thuan Hoa Commune, An Minh District of Kien Giang Province

February 2015

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EXECUTIVE SUMMARY

The development of the aquaculture sector in Vietnam has been a success story in terms of both increasing production volume as well as value. According to Vietnam's general directorate of statistics (2012), aquaculture production over the last ten years has increased from 845,000 metric tons (MT) in 2002 up to 29,304,000 MT in 2011.

Aquaculture systems in Vietnam and throughout the region vary a great deal. Some are run by large commercial businesses with products targeted for the global market and are highly intensive with a significant level of technology applied in management, while other systems are more traditional in nature and rely only on inputs from villagers, e.g. extensive household systems used for food security purposes and local consumption, or targeting niche overseas markets. One of these aquaculture systems is the rice-shrimp systems that are practiced in coastal communes in the Mekong Delta in Vietnam. These systems integrate agriculture (rice) with aquaculture (shrimp) in coastal areas where it is more suitable to mix both rather than focus on just one alone.

The objective of this report is to provide the USAID Mekong Adaptation and Resilience to Climate Change project (USAID Mekong ARCC) an analysis of the gaps in the current rice-shrimp aquaculture systems in the Mekong Delta in Vietnam, with a specific focus on Thuan Hoa Commune in An Minh District of Kien Giang Province where they are providing targeted assistance. A number of practical and easy-to-implement pilots have been identified and these have fed into approaches and reports produced by USAID Mekong ARCC's implementing partner in Vietnam, the Asian Management and Development Institute (AMDI), that were based on participatory planning processes with local community leaders and selected households.

The findings from this report indicate that the rice-shrimp farming systems are resilient systems that can produce shrimp in an ecological, low-impact manner. Already existing impacts of climate change in the Vietnam Mekong Delta have led to changed timing of the wet season, increase in salinity of the water, and changes in temperature, which has meant that the farmers in Thuan Hoa cannot grow the rice and the shrimp as they previously did. Some adjustments are therefore required for farmers to continue to generate income from shrimp now and in the future, and at the same time meet the Government of Vietnam's food security policy in the commune, which indicates that rice should be part of the rotational system. As such, four climate change friendly aquaculture production systems are recommended for the zones in the Commune identified in the map below. These are:

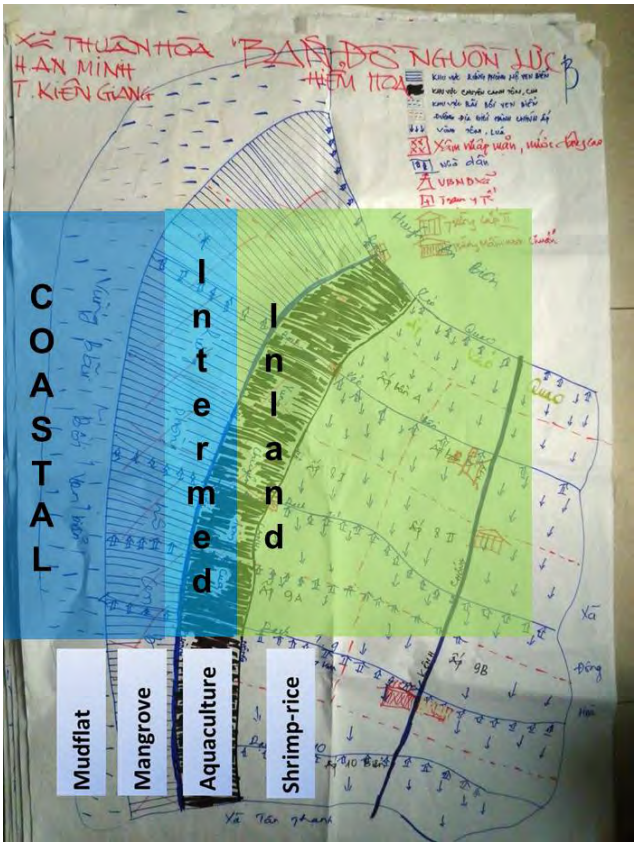
1. Rice-shrimp systems with a nursery option, suitable for inland and intermediate zones;

2. Rice-shrimp systems with a nursery option and alternative salt-tolerant rice strain, suitable for inland and intermediate zones;
3. Rice-shrimp systems with a nursery option and sedge grass that is salt tolerant, suitable for inland and intermediate zones; and
4. Rice-fish or fish-only option (potentially tilapia), which can tolerate some salinity and grow to market size in 5-6 months, suitable for intermediate and coastal zones.

For all the suggested system adaptations, it is of crucial importance that farmers can access high quality shrimp post larvae (PL) and juvenile fish to stock the ponds. The commune extension service and the project should help farmers with this in the beginning until a farmer group or the commune extension service is able to handle this independently.

Furthermore, it is suggested that the commune and the farmers, with help from USAID Mekong ARCC and AMDI, engage buyers to help negotiate a better price for the shrimp produced in these systems as the quality of the shrimp is high and the systems are ecological healthy with no use of veterinary drugs or other chemicals. Currently no premium is paid to farmers for the high quality products they provide.

A final suggestion is for the establishment of a monitoring program to help farmers monitor the farming environment and to help the commune document any changes, for example in the water and soil salinity levels. It will be important information for the commune to know and help support zoning and development in the commune.



1. BACKGROUND

Aquaculture is the farming of aquatic organisms, including aquatic plants and non-food products. According to the United Nations Food and Agriculture Organization (FAO), total global aquaculture production was 79 million tons valued at about US$125 billion in 2012. Aquaculture is very diverse and currently more than 600 different species are farmed around the world in fresh, brackish and marine waters. Products from aquaculture are widely traded on the global market and simultaneously provide an important source of animal protein for national consumers. The development of aquaculture has been remarkable during the last few decades. There has been a steady growth of global aquaculture production, with a growth rate of 4.5 percent per year between 2002 and 2012, and over the last five years, a slightly faster growth rate of 5.0 percent per year.

In 2012, half of the seafood for human consumption came from aquaculture, primarily sourced from Asia. The world's top five producers by volume are the Peoples' Republic of China, by far the world largest producer, followed by India, Vietnam, Indonesia and Thailand. In terms of value, the Asia-Pacific region contributed US$108.34 billion, with an average annual growth rate of 6.4 percent from 2002 to 2012.

In Vietnam particularly, the development of the aquaculture sector has been a success story in terms of increase in production volume as well as value. According to the general directorate of statistics of Vietnam (2012), production over the last ten years has increased from 845,000 MT in 2002 to 29,304,000 MT in 2011. Aquaculture systems, both in Vietnam and in the region, vary. Some are very intensive with a high level of technology and are run by large commercial businesses with products targeted for the global market, while other systems are more traditional in nature and rely on little input, e.g. extensive household systems for food security and local consumption, or targeting niche overseas markets.

One system practiced in coastal communes of the Mekong Delta in Vietnam is the rice-shrimp system. Rice-shrimp systems integrate agriculture (rice) with aquaculture (shrimp) in coastal areas where it is more suitable to combine both rather than cultivate one or the other. This dual system has been practiced since 2000, when farmers shifted to rice-shrimp systems from rice-fish culture on recommendation from the Vietnamese government. Currently there are about 40,000 ha of these rice-shrimp systems being cultured[1], producing over 10,000 MT of shrimp (the Tiger prawn variety, *peanus* monodon) and about 100,000 MT of rice each year. The shift to shrimp from fish has been suitable and the shorter production time and higher market price for the shrimp have been well received by farmers.

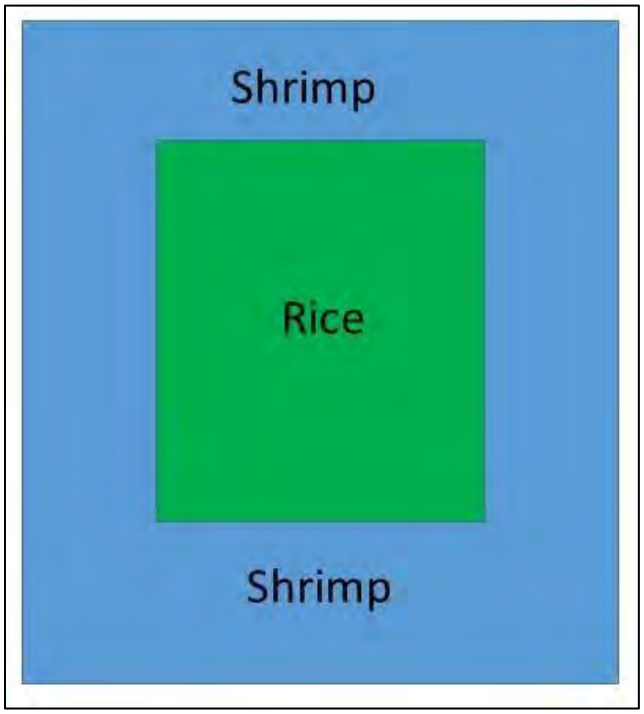
The rice-shrimp systems are a modified rice production system. The modification is that a canal, about 1.0–1.3m deep, is dug around the perimeter of the rice paddy providing an environment for the shrimp to grow (see Figure 1). The central part of the pond is about 80 percent of the total pond area, and the canal occupies the remaining 20 percent of the total pond surface. The shrimp feed on naturally available biofilm that is growing on substrate in the pond and on the submerged part of the rice.

The production of shrimp in these systems is very extensive and range from around 50–500 kg/ha/year. Compared to intensive shrimp farming these numbers can sound diminutive, but for the farmers

[1] Brennan et al.

implementing these rice-shrimp systems, these shrimp are their main source of income and of crucial importance for the households involved. There is little to no commercial pellet or crumble feed used in these systems as the shrimp subsist on naturally occurring feed in the ponds. The whole production cycle is typically about four to five months long in the dry season and the size of the shrimp harvested is about 20–25 pieces/kg. In a 2006 study[2], survival rates of more than 80 percent of total stocked post larvae (PL) were observed from ponds stocking between 1.5–3 PL/m^2. The total harvest from the ponds in this study was above 350 kg/ha.

Figure 1: An illustrative schematic diagram of the rice-shrimp systems that can be found in the coastal communes of An Minh District, Kien Giang Province, Vietnam.



Saline intrusion is a naturally occurring dynamic that is affecting land use in the coastal communes of the Mekong Delta, making it challenging for farmers to produce only rice or only shrimp in intermediate zones between land and sea. It has been argued that shrimp farming increases or hastens saline intrusion in intensively farmed areas. In a 2003 study, a comparison was made between rice-shrimp systems and rice monoculture in coastal areas of Vietnam's Bac Lien and Soc Trang provinces both experiencing saline water intrusion. The study indicated that soil salinity was generally lower in rice-shrimp fields than in rice monoculture fields, due to the relative position of rice monoculture and rice-shrimp fields in the system. Rice-shrimp fields are generally located near canals and are engineered to allow effective water exchange. Farmers can take advantage of this to leach the salt from the system at the beginning of the rainy season. In contrast, the salinity that builds up in some rice monoculture fields due to capillary rise during the dry season could not be flushed away in areas lacking sufficient access to canal water.

[2] Minh et al.

The most commonly farmed shrimp in the world is the White Leg shrimp (*Peaneus vannamei*) and white leg shrimp are normally sold at a smaller size than the shrimp farmed in the rice-shrimp systems. The species farmed in An Minh district is *P. monodon* (Tiger Prawns) which farmers can grow to a larger size than a majority of global production. This could be a comparative advantage for the farmers.

In general terms the rice-shrimp system can be viewed as a best management practice for achieving a balance between economic developments, minimizing risks and conserving the environment. The areas used for rice-shrimp farming have traditionally been used for wet season agricultural crops and do not impinge on mangroves. The shrimp farmed in this system are stocked at low densities and feed inputs to the ponds are low. The freshwater rice crop provides a buffer between the brackish water shrimp crops.

According to the *USAID Mekong ARCC Climate Change Impact and Adaptation Study - Fisheries Report* released in 2013, aquaculture - due to its diversity of systems, scales of production, inherent manageability, and more control over cultivation environments - offers more scope for adaptation to climate change than capture fisheries.

USAID Mekong ARCC and its local partner AMDI completed a vulnerability assessment in Kien Giang province which identified the rice-shrimp systems as crucial for income generation. However, these systems are also most at risk from climate change impacts such as increasing temperatures, changing rainfall patterns and increasing salinity caused by a combination of salt water intrusion from rising sea levels and from rice-shrimp farmers growing shrimp into the rice season due to shifting rainfall patterns.

2. OBJECTIVE

The objective of this report is to provide an analysis of the gaps in the rice-shrimp aquaculture systems in the Mekong Delta in Vietnam, with a specific focus on the Thuan Hoa Commune in An Minh District of Kien Giang Province. The report outlines desired goals that will be expected as part of suggested adaptations to climate change. The report also provides a detailed plan of action for the suggested adaptation training, implementation of models and suggestions for monitoring of progress. The plan of action takes into account USAID Mekong ARCC's already defined milestones for the adaptation activities and the production cycle of the rice-shrimp aquaculture systems.

3. METHODOLOGY

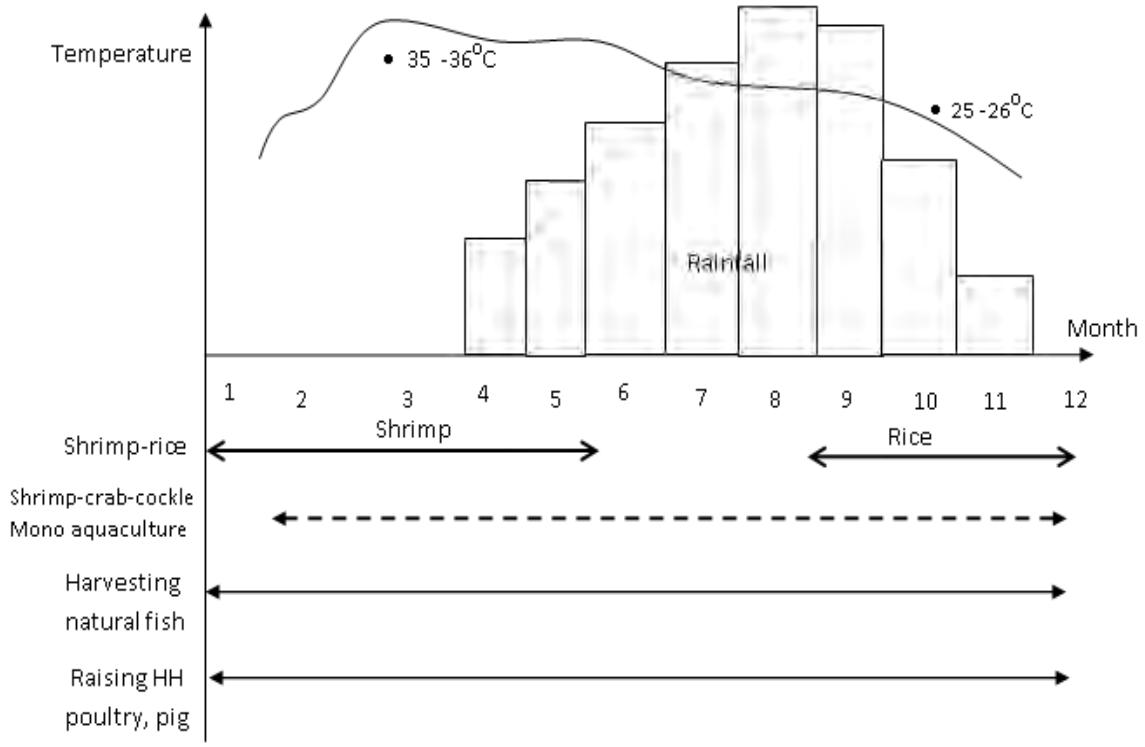
The methodology used for compiling this report is a combination of desk research and a field visit to Thuan Hoa commune in October 2014 with USAID Mekong ARCC's implementing partners, Asian Management and Development Institute (AMDI) and the Vietnam Red Cross (VNRC), to interview farmers and key stakeholders at the commune and district level. The field visit was prepared for by reviewing current USAID Mekong ARCC reports on local livelihoods and climate change impacts together with additional literature on rice-shrimp farming in the Mekong Delta. During the two-day field visit, seven farmers in the commune, who practice either rice-shrimp farming or alternative practices, were interviewed together with a number of district and commune government officials. The farmers were interviewed using a semi-structured interview guide with mostly open-ended questions (see **Annex 1**), and the government officials were interviewed in completely open-ended interview form.

Based on the information from the field visit, a number of presentations were given by the consultant and AMDI to inform project stakeholders about the situation and the potential activities that farmers could pilot during the adaptation phase of the project (see **Annex 2**). The initial findings from the gap field visit resulted in a number of suggested pilots which were presented by the consultant to AMDI and commune leaders at a meeting in Hanoi during 28–29 October 2014.

4. RESULTS AND ANALYSES ON RICE-SHRIMP AQUACULTURE SYSTEMS IN THUAN HOA COMMUNE

Since farmers in Thuan Hoa began implementing the rice-shrimp system thirteen years ago, it has functioned well. However, recent changes in the climate such as rainfall patterns, higher temperatures and a changed dynamic of the saline gradient that is moving inwards, are impacting farmers' ability to follow the normal management practices that they had successfully followed in years past (see Figure 2). The immediate impact has been that farmers cannot grow the shrimp to the size they used to be able to. In response to this, farmers prolong the culture period into what should be the draining and rice growing periods in attempts to grow shrimp to prime market size.

Figure 2: Temperature and rainfall pattern in the commune and how the production of rice-shrimp and other activities are aligned with the weather pattern. Problems arise when the rainfall and temperature pattern shift without farmers changing production. (AMDI, 2014)



Interviews with commune officials, local Red Cross extension workers and the Thuan Hoa People's Committee revealed that the policy of the government is to have as many rice-shrimp systems as possible. Most farmers try to follow the policy guidelines, but some still only grow shrimp. The policy in the province is to avoid lowering the area currently producing rice due to food security concerns for the commune if the rotational rice production is taken out if the system. The production of shrimp from the current rice-shrimp systems in the commune is about 1,200–1,300 MT/year, and an additional 600–700 MT/year from other systems.

A need to shift the production calender to adjust to climate changes such as changing rainfall patterns and increase in salinity was raised in these interviews. These changes and adjustments should be done so farmers can continue farming both rice and shrimp to generate income and to ensure food security. There may also be a need to train farmers in selection of PL shrimp and nursing practices, together with the commune extension system that is already in place. As there is no outside investment in aquaculture in the area, any training and capacity building will directly benefit the local community, and more efficient use of resources will benefit the local community first and foremost.

The Thuan Hoa People's Committee noted the following main issues with rice-shrimp systems:

- Fluctuation in shrimp prices
- Climate changes such as prolonged periods of heat and dry weather
- Increased salinity in the soil and water
- Variability in timing and strength of rainfall (e.g. heavy rain leads to overflow of dikes)
- Diseases of the shrimp as water quality is more difficult to manage

There are alternative aquaculture practices in the commune but most are at a smaller scale and less important for income generation than shrimp. The alternative species are mud crab, clam, cockles, turtles, crocodiles and a few farmers also try to grow seabass. Often the crab are cultured together with shrimp in the rice-shrimp systems as another income-generating source.

In interviews with the seven farmers, they explained they all had changed from rice-fish production to rice-shrimp production between 2000-2005 and were satisfied with the change. The shorter production cycle and the better price were the main reasons for the change. When they changed to rice-shrimp, most farmers were provided with a short training courses on how to raise the shrimp. Farmers also shared information through informal networks with neighbors and friends. Most of the farmers mentioned the changing weather conditions as a major problem as there was less rain and temperatures were too high in January and February, when they should normally have cooler weather.

The average pond size among the interviewed farmers was around two hectares (ha) (see Figure 3). The ponds are stocked with about three to five post larvae (PL) per square meter (m^2). Most farmers conduct multiple rounds of stocking of PL with varied practices. Some farmers stock 1–2 times with a high number of PL (e.g. 150,000 PL in a 2 ha pond), while others stock 4–6 times with medium stocking levels, or even stock every month of the season with a very small number of PL. One farmer mentioned that they had to do this to adapt to changing weather patterns. Some farmers are innovative and tried to adapt to the changing rain pattern, while others follow the standard calender and do business as usual.

Farmers purchase PL from local distributors that drive around the community on motorbikes and sell PL. The farmers do not know where the PL are from and do not conduct any qualty control or checking of the PL when they buy them. As there is no feeding in the systems and no usage of chemicals, the cost for PL is the only production cost the farmers have.

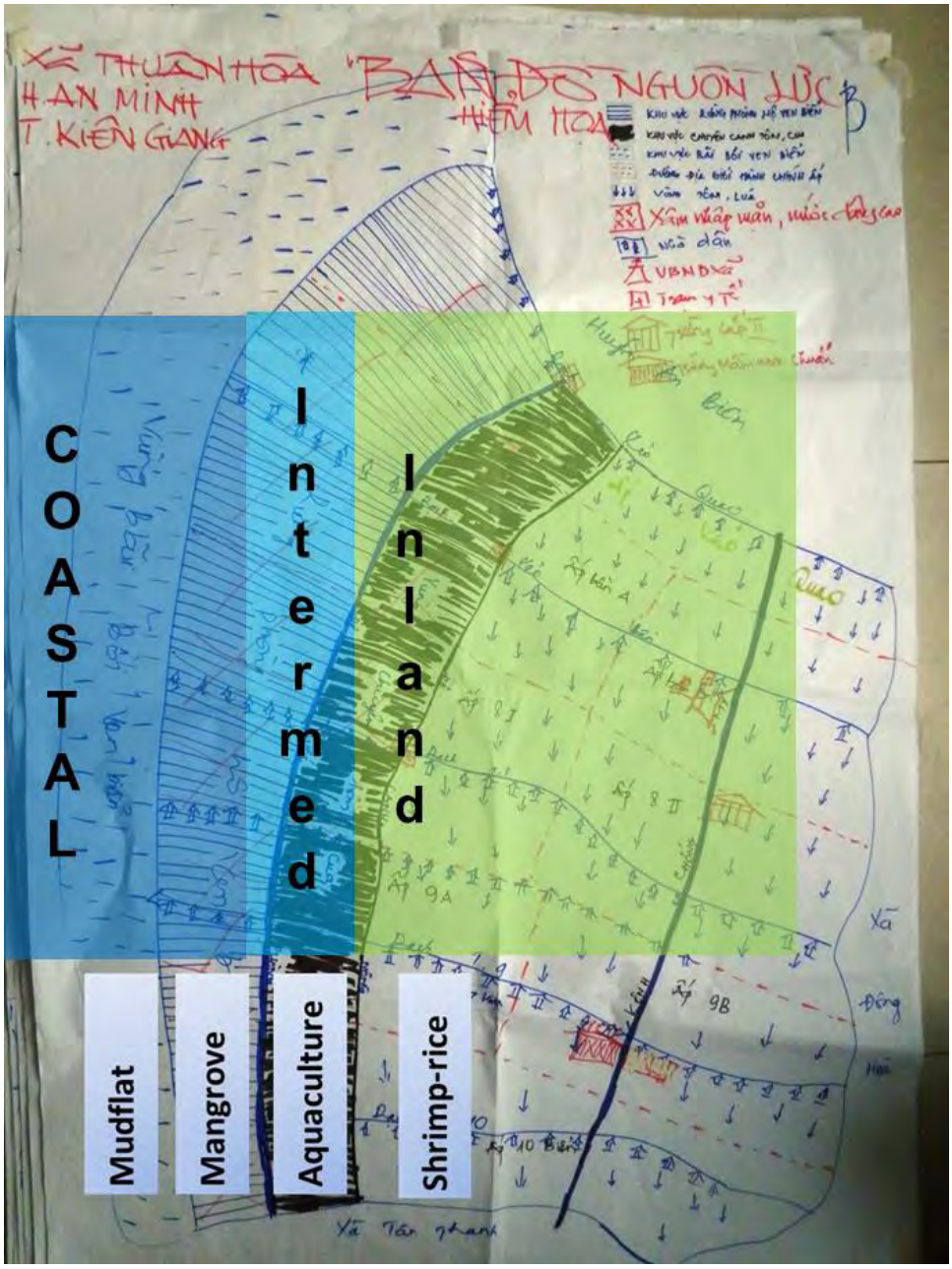
Once every five or six years the farmers undertake major cleaning of the ponds to dig out sludge and mud. The sludge is used to rebuild dikes and to fertilize horticulture around the ponds (e.g. bananas and household garden). Maintainence of the ponds are important and the usage of the slude illustrates how aquaculture can be integrated with agriculture in these less intensive systems.

Figure 3: Ponds are extensive and some farmers already experiment with alternatives to rice. (JHClausen, 2014)

Some farmers that were interviewed mentioned the need to work together on management of the water in the public canals. Some farmers complained that if the neighboring farm continued to have shrimp in his pond and the pond was still saline, this affected his ability to start growing his rice. This was also mentioned by the commune leader as a point he would like to address further.

There are clear "zones" that relate to the state of the rice-shrimp farming systems (see Figure 4). The **inland zone**, where the rice-shrimp systems seems to be running nearly as they should, follow the production guidelines provided by the commune Fisheries and Aquaculture Officer. The second zone is the **intermediate zone**, which is between inland and coast, where they are already facing problems with the rice-shrimp systems. The third zone is the **coastal zone** which is about one kilometer (km) inland from the mudflat/mangrove belt. In this coastal zone the rice-shrimp systems are not working and farmers are facing the repercussions. The system and the production calendar of the rice-shrimp systems are not in sync with the changed climate and weather patterns, so there is little to no income for farmers in this zone.

Figure 4: Map indicating the zonal division of the coastal, intermediate and the inland zones in the coastal commune of Thuan Hoa as observed by the project and the local community. (AMDI, 2014)



Some alterations to the existing practices can be suggested and should be feasible to implement at a pilot scale in tandem with some capacity building activities such as training pilot farmers and commune extension workers. Some suggested alterations to improve the system:

- To shorten the shrimp production cycle, a nursery stage can be inserted to "boost" the initial growth of shrimp in the post larvae stage. Also alternative rice strains and grasses that are tolerant to some salinity in soils and water can be introduced to continue production in areas where water is now saline.

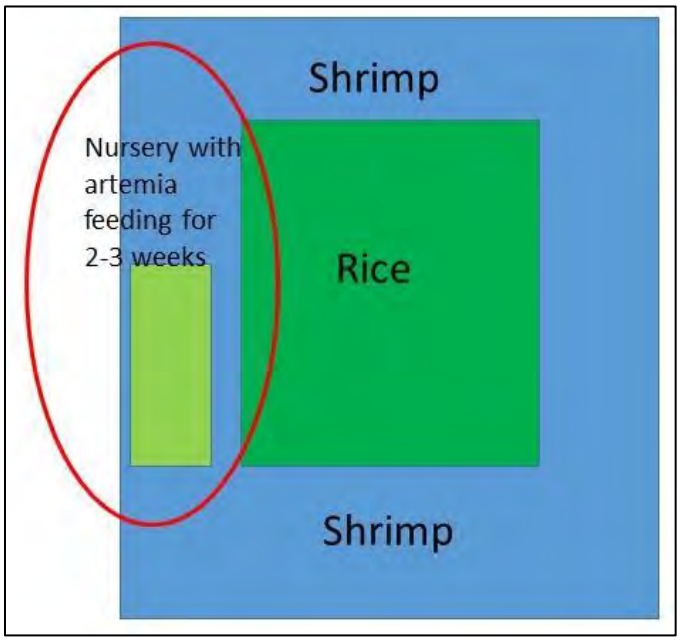
- In order to monitor the dynamic of the saline gradient and the rate of movement inland, a monitoring program should be established to monitor salinity and dissolved oxygen (DO) both at selected farms and at strategic monitoring points along the canal system where farmers take water to their ponds.
- There is also a need to better coordinate farm management between individual farms. For example, farmers would benefit from a community water management plan to which they agree it is not possible for a farmer to grow rice in his pond/paddy if all surrounding farmers are still culturing shrimp in saline water.=

5. CONCLUSIONS AND RECOMMENDATIONS

To help farmers increase their resilience to climate change, it is important to protect and improve household income and ensure the optimal use of time and resources. Four alternative aquaculture production systems are suggested as part of this gap analysis:

1. Rice-shrimp systems with nursery option (see Figure 5), which is suitable for **inland** and **intermediate** zones;
2. Rice-shrimp systems with nursery option and alternative salt-tolerant rice strain, which is suitable for **inland** and **intermediate** zones;
3. Rice-shrimp systems with nursery option and salt-tolerate sedge grass, which is suitable for **inland** and **intermediate** zones; and
4. Rice-fish or fish-only option (potentially tilapia), which can tolerate some salinity and grow to market size in 5–6 months for **intermediate** and **coastal** zones.

Figure 5: A schematic drawing of the proposed nursery intervention. There are several ways of creating the nursery. This figure is one suggestion.



One option to help farmers better understand the value of their production systems and to eventually ensure a better price for the shrimp would be to engage buyers to visit the farms. Buyers can see what the systems deliver and exchange information with farmers on what is needed to get a premium price for their product. The rice-shrimp farming systems are a good system that can produce shrimp in an ecological low-impact way, which should be able to get a higher market price if connection to the right buyer(s) can be facilitated.

A training course will be held for farmers and extension workers as the main stakeholders on the ground to support implementation of the pilot interventions. Also a Standard Operating Procedure (SOP) book together with a log book will be provided to farmers to register their shrimp production cycle (see **Annex 3–5**).

A monitoring program for farmers is included in the simple log book that is provided however, if there is a need for a more comprehensive monitoring program to monitor canals, it will be most efficient to work through local partners. There should be a clear capacity building aspect of such a program, so the local government extension services can continue monitoring in the future. The buy-in and inclusion of the local authorities is crucial for any successful adaptation pilot practice to be scaled up.

A zonal management model should be facilitated in the commune, where a group of farmers, commune leaders and other water users could work together to determine how best to manage water in the common canals.

Based on feedback from the commune received during the briefing in Hanoi with AMDI, Option 4 above will not be implemented as there is some hesitation from the farmers in using tilapia due to the longer grow-out time for tilapia compared with shrimp. However, an alternative to conducting the pilot activity would be conducting a field visit for farmers to see successful tilapia farming. There are several good examples of smallholders doing successful farming of tilapia in the neighboring provinces.

Additionally, a study tour for farmers to see aquaculture systems and solutions in neighboring communes could be a way to diversify the production systems and ensure better resilience both to climate change and other potential negative impacts like disease and changing prices for rice and shrimp.

Figure 6: The nursery option does not have to be a pen in the center of the pond but also can be fending of the canal, like in the picture below.

ANNEX 1: INTERVIEW QUESTIONS GUIDE FOR FARMERS

Question	Answer	Notes
1) What is your name?		
2) Have you taken part in any previous surveys of the project?		
3) How long have you been doing aquaculture?		
4) Do you have any alternative sources of income other that aquaculture (rice-shrimp)		
5) Do you see any changes in climate (e.g. increased temperatures, water levels)?		
6) How do you mitigate these changes?		
7) What is your background for doing aquaculture (e.g. government training, experience, learnt from family, friends?)		
8) Have you participated in any training sessions on aquaculture (feeding, disease management, etc.)		
9) What would you like to include in a training session?		
10) What are the main problems you are facing with your farming system?		
11) How many shrimp do you stock in your pond?		
12) How large is your aquaculture pond (also ask how many ponds he have)?		
13) How many kg of shrimp do you harvest after each crop?		
14) Can you explain to me the cycle of the rice-shrimp farming cycle? Time of planting rice, stocking shrimp, cleaning pond etc.)		
15) Is it good to do rice-shrimp?		
16) Have the way you do rice-shrimp changed over the years?		
17) Would you like to change your practice (e.g. do agriculture or other		

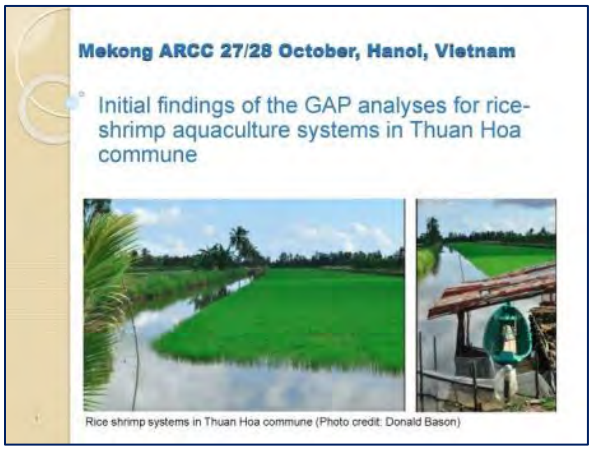
Question	Answer	Notes
aquaculture)?		
18) Why did you stop farming rice?		
19) Can you explain to me the production cycle of you shrimp farming?		
20) Do you see any alternatives to doing shrimp farming, and would you like to change to an alternative form of farming?		

ANNEX 2: PRESENTATIONS ON GAP REPORT TO STAKEHOLDERS

The following presentations were given as part of the gap field work and dissemination of the gap analyses results.

A. Presentation of initial findings and results to implementing partner, AMDI and community representatives in Hanoi, Vietnam on 27 October 2014.
B. Presentation of initial findings and results to USAID representation in Hanoi, Vietnam on 28 October 2014, as part of the project briefing to USAID representation (Short version of presentation No. A).
C. Presentation of findings and suggested pilot adaptations to USAID Mekong ARCC's annual partner meeting in Bangkok, Thailand on 21 November 2014.

A) and B)



Mekong ARCC 27/28 October, Hanoi, Vietnam

Method for getting information to GAP

- Review of project reports, other litterature.
- Discussions with key stakeholders including:
  - Academics
  - Goverments officials (Province, District and Commune level)
- Semi-structured interview with selected farmers.
- Discussions with national experts on developing pilot trials and training of selected "pilot farmers".

Mekong ARCC 27/28 October, Hanoi, Vietnam

Initial findings of the GAP

- Zonal/cluster management approach is needed to coordinate saline water intake and release. This is mentioned both by farmers and extension workers.
- No one pilot fits all due to the zonal differences.
- Most farmers have basic understanding of water quality (e.g. salinity measurements).
- Especially in the intermediate zone the farmers are experimenting with the production cycle (if successful, this could be a nice example of linking local knowledge and science!)

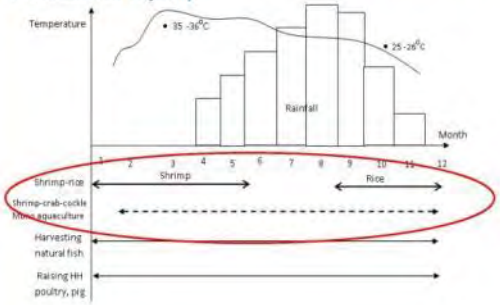
Mekong ARCC 27/28 October, Hanoi, Vietnam

Initial findings of the GAP

- There is a clear division in "zones".
  - **Inland zone:** In the inner zone the rice-shrimp systems seems to be running nearly as they should do following the DOF calender.
  - **Intermediate zone:** This zone is between inland and coast and here there are already problems with the rice-shrimp systems not being in balance.

Mekong ARCC 27/28 October, Hanoi, Vietnam

"Standard" production cycle (from the livelihood assessment report)



Mekong ARCC 27/28 October, Hanoi, Vietnam

Initial findings of the GAP

- **Coastal zone:** About 1 km inland from the mudflat/mangrove belt, the rice/shrimp systems are not working and farmers are generally in trouble.

  Very low income and a picture of "nature is taking back the ponds". No income as the rice-shrimp system promoted in the area does not work due to changed conditions, and no income or knowledge to invest in changed practices.

See also the "Livelihoods Assessment Report" on the zones.

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"Alternated" production cycle (from farmer information)

- Most farmers have 2-3 main stocking of shrimp post larvae (PL) at very different densities (ranging from 2-10 PL/m2)
- Some farmers stock throughout the season in very small numbers (Maybe based on when cash is available)
- In the coastal area, some farmers stock shrimp PL every month (12 month!) but harvest very small number of shrimp.
- Also the number of month used for shrimp is varying in especially the intermediate and the coastal zone.

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Suggested adaptation models

- Rice/Shrimp system with nursery option (inland zone + intermediate zone(?))
- Rice/Shrimp with alternative salt tolerant rice strain (Intermediate zone)
- Serge/Shrimp (Intermediate zone)
- Rice/Fish option with maybe tilapia, which can tolerate some salinity and grow to market size in 5-6 month (Intermediate and coastal)

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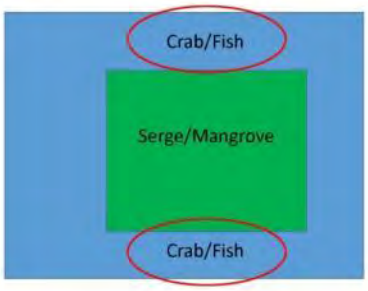
Example on adaptation to coastal zone



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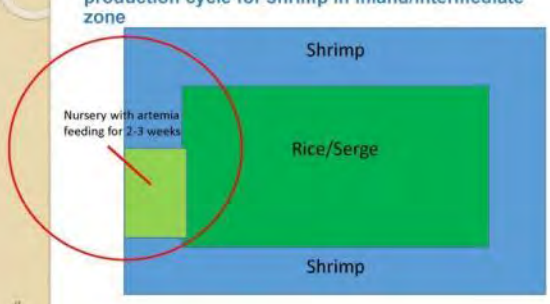
Example on simple adaptation to shorten the production cycle for shrimp in inland/intermediate zone



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Suggested adaptation models

- Shrimp/Fish option (coastal zone)
- Mud crab production (coastal zone)
- Shrimp/mangrove (coastal zone) ???

  Recent article on how this is successfully done in Ca Mau Province.

Preparing Mud Crab for Chinese buyer
Photo credit: Donald Bason

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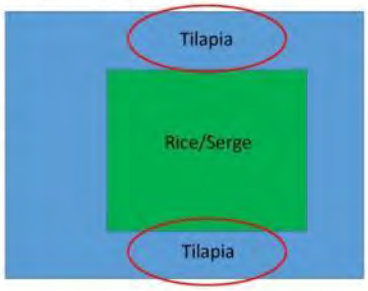
Example on simple adaptation to change to a fast growing fish species in intermediate zone

Cost of feed to the tilapia.

Availability of tilapia fingerlings

Slower growth of tilapia if salinity get above 10ppt



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Suggested training models could, besides the changed management, include:

- Session on monitoring salinity in soil and water
- Monitoring shrimp health
- Shrimp size (aim for 20-25ps/kg)

The monitoring could help farmers manage their aquaculture system and at the same time give M-ARCC on the ground information e.g. how is the salinity gradient from coastal to inland areas and is it moving!

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Selection of pilot farmers

Photo credit: Donald Bason

Willing and able to participate!

Have experience with aquaculture.

We have to decide if we want an existing champion or raise a less successful farmer to be a champion.

Have a production cycle that aligns with the project (expected start in Mid January 2015.

Minimum 2 farmers representing the inland zone.

Minimum 2 farmers representing the intermediate zone.

Representatives from the coastal zone ???

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Points we need to clarify the next two days

- Agree on what pilot interventoions we will do.
- Selection and criteria of farmers to participate in the pilots.
- Timing to be aligned with other AMDI work/field visits in particular.
- Others??

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Plan for implementation

- **First week of November:** Final draft of the GAP analyses of aquaculture is circulated for comments.
- **First half November:** Development of pilot modules and training modules with input from AMDI and Khiem including outline of desired performance outcomes.Selection of pilot farms (field visit by AMDI?).
- **2nd week of December:** Pilot training of farmers by AMDI and consultant together with the extension worker(s).
- **Beginning of January:** Interventions done at pilot farms (e.g. construct the nursery enclosure, pond preparation)
- **Mid January:** Pilot starts aligned with the start of the

C)

Mekong ARCC, 21 November, Bangkok, Thailand

Better Management Practices in Aquaculture

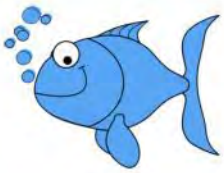
Presented by

Jesper Hedegard Clausen
Aquaculture for M-ARCC

(Photo by: Donald Bason)

Mekong ARCC 21 November, Bangkok, Thailand

"Where there is water, there should be fish"
(Dr. Luu Retired Director for RIA1)



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Background and Aquaculture in Asia

- Fastest growing food sector in the world supplying half of global seafood for human consumption.
- Continued growth is forecasted and **needed** to meet domestic, regional and export demand for seafood products.
- Concerns about resources (e.g. good quality water, feed, suitable areas)

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Intensive aquaculture

- High initial investment
- High feed and feed additive cost
- Several employees on farm
- Often managers have/need BSc degrees or higher
- Often international markets
- Production xx MT/ha

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- Aquaculture is a part of farming in SEA and as such not a "new" activity.
- Production of species for export e.g. Pangasius, tilapia and shrimp is relatively new (developed over the last 10 years or so) and have been a economic success!
- Increasing concern on how impacts from climate change will affect availability of resources.

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Extensive aquaculture

- Low initial investment
- Small volumes of feed
- Household operated
- Diverse range of systems and species cultured
- Local/domestic consumption
- Production xxx kg/ha!

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But what is better management practices and what is suitable in the context of rural/coastal poor that are affected by impacts from climate changes?

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Better Management Practices

Principle 1: Locate aquaculture according to national planning and legal frameworks in environmentally suitable locations.

Principle 2: Design and construct aquaculture farms in ways that minimize environmental damage.

Principle 3: Minimize the use of "new" water.

Principle 4: Use feed management practices that make efficient use of available feed resources.

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Better Management Practices

Principle 5: Aquatic Animal Health management plans should be adopted to reduce use of chemicals, minimize risks of disease and increase food safety.

Principle 6: Develop and operate farms in a socially responsible way that benefits the farm, the local communities and the country.

Principle 7 (??): Should there be a 7th principle to ensure that we think future impacts from climate change into development?

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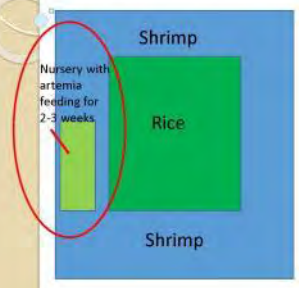

KEY POINTS FOR SUCCESS

- Low cost and basic training
- Adjustment to existing system
- No conversion of land
- Experts and community agree
- 99% Climate Proof

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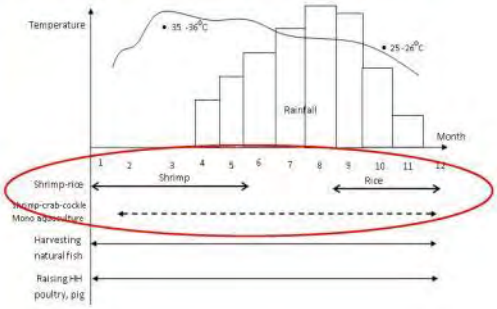
Example from Vietnam with Rice/Shrimp



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Catfish farming

- Very popular in Thai traditional cooking (Picture at right is grilled catfish and is tasty!)
- Not difficult to grow for farmers.
- Typically a supplement to household income or for home use
- Can be done at very low and basic

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Suggested adaptation models to address the change in rainfall pattern and increase in salinity

- Rice/Shrimp system with nursery option (inland zone + intermediate zone(?))
- Rice/Shrimp with alternative salt tolerant rice strain (Intermediate zone)
- Serge/Shrimp (Intermediate zone)

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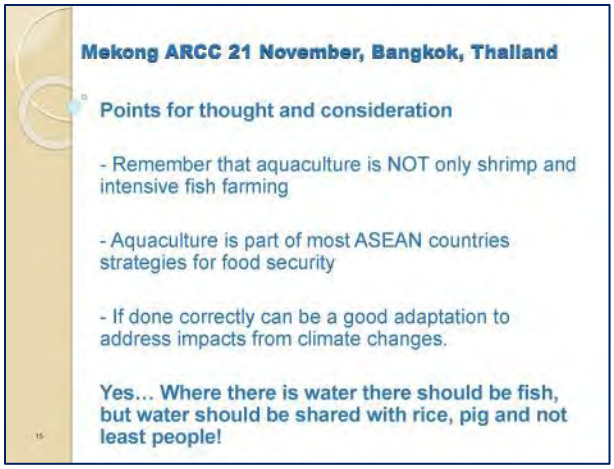
Picture: FAO, 2009

Intensive catfish farming in small concrete tanks in Stung Treng, Cambodia. Aim to provide households with a source of food and income, as well as water storage that can be used for irrigating home vegetable gardens (WFC).

Very extensive and low tech (example from Bangladesh, but also seen in Thailand and other SEA (FAO).

Maybe no need for expert!

Picture: World Fish Center, 2010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Points for thought and consideration
- Remember that aquaculture is NOT only shrimp and intensive fish farming
- Aquaculture is part of most ASEAN countries strategies for food security
- If done correctly can be a good adaptation to address impacts from climate changes.
Yes… Where there is water there should be fish, but water should be shared with rice, pig and not least people!

ANNEX 3: STANDARD OPERATING PROCEDURES (SOP) FOR IMPLEMENTATION OF PILOT RICE-SHRIMP TRIAL

These standard operating procedures have been developed by the USAID Mekong ARCC Project with local partners, AMDI and local authorities in Thuan Hoa Commune in Kien Giang province.

The standard operating procedures (SOP) will be guidelines for farmers and extension workers to use in implementing the pilot trials on rice-shrimp nursery adaptation. After the pilot trials, the SOP will be evaluated and changed according to feedback from farmers and other partners.

The SOP will be supplemented by a Farmers Log Book (see attached), which will be handed out to all farmers taking part in the trial with instructions for use. Please note that we should NOT give these documents to farmers that are control farmers in our adaptation trial.

Step 1: Pond preparation

- The farmers should shield off one part of the pond for the nursery. This can be a net inside the main pond or can be a separate pond smaller pond, depending on how the farm is now.
- The farmer should make sure that there are no fish or other aquatic animals in the nursery that will prey on the PL.
- The farmer should ensure that the nursery is closed so PL cannot escape and predators cannot enter.
- The nursery should be constructed 4–6 days before the PL are stocked.

Step 2: Selecting shrimp post larvae (PL)

- The farmers should get help to purchase PL by the extension service.
- The PL should be bought directly from the nursery or through the main distributor in the province.
- Demand to see certification from the nursery or distributor.
- Buy the PL together (farmer group or extension center) to get better quality and price from nursery or distributor.
- PL batch should be checked for disease by PCR. This should be done by nursery, or facilitated by extension worker.
- Get big size PL between PL_{12-15} if possible.

Step 3: Releasing post larvae to nursery

- When PL is delivered to the farm, the farmers together with the extension worker should ensure the PL are healthy and active.
- When PL are released into nursery, make sure to rest the closed bags in the pond water until temperature is similar in bag and pond water.
- Check that salinity in bag and pond water is similar. Ask extension worker before receiving the PL what the salinity in the bags will approximately be.
- Be very careful when opening the plastic bag with PL and releasing the PL. Don't stress the PL, but slowly let the water from pond and bag mix, and let the PL swim out the bag into the nursery.
- Stocking date to be advised by the extension worker.

Step 4: Feeding shrimp in nursery

- The farmers should use "crumble feed" a shrimp starter feed, in the first 3 weeks of nursing.
- Keep purchased feed in dry, clean and cool place. Use it as soon as possible to avoid the feed get dampened and spoiled.
- Make sure the Date of Expiration has not passed.
- The right dissolved oxygen (DO) levels (4 mg/L) are essential for efficient feeding. Therefore the farmers together with extension workers should monitor the DO levels and feed accordingly.
- Feeding in the morning when oxygen levels start to increase but for correct time, please use DO levels.
- Feeding once or twice per day is sufficient and second feeding should be 8 hours after first feeding.
- Make sure to spread the feed evenly around the nursery. This will help ensure even growth of the shrimp and minimize cannibalism among the shrimp.
- You should adjust the quantity of feed based on observing the actual consumption. General rule: Normally it should be about 10-20 percent of the total weight of the shrimp in the nursery.

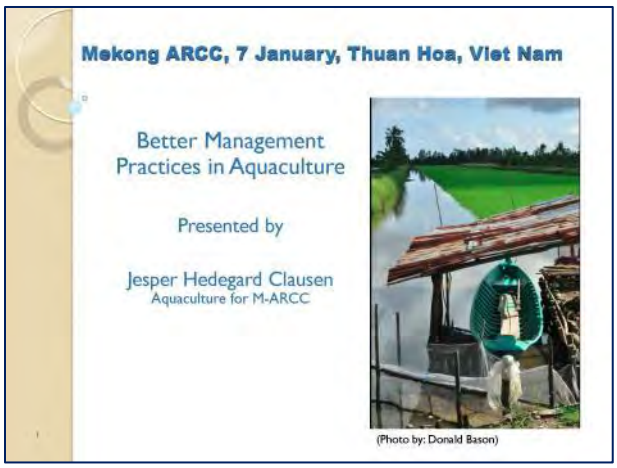
Step 5: Measuring pond conditions

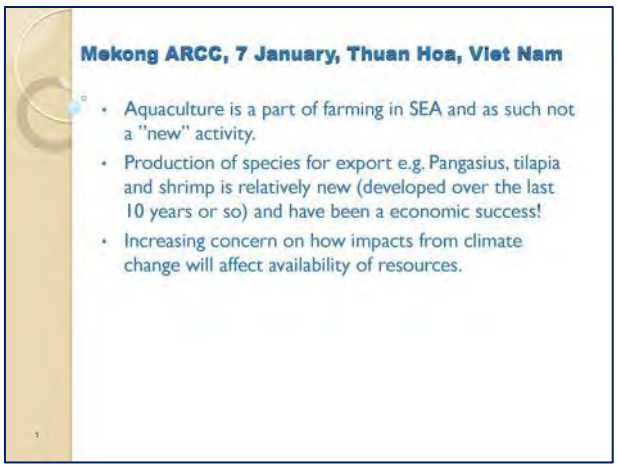
- Famers should measure water salinity and water temperature twice daily. This can be done at the same time as feeding, but can be done anytime, as long as it is at the same time every day. The measurements should be written down in the log book.
- Extension workers together with farmers should measure oxygen levels in ponds to construct a 24-hour oxygen profile with one-hour measurement intervals before stocking. This is to determine the best time of feeding in the morning hours.
- The oxygen measurements should then be done weekly from 5 am to 10 am with one hour intervals during the rest of the shrimp growing season.

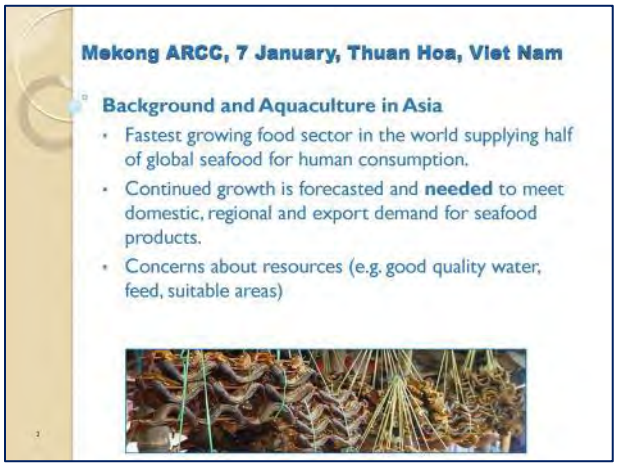
ANNEX 4: BASIC RICE-SHRIMP FARMERS LOG BOOK TO LOG INFORMATION ON THE SHRIMP PRODUCTION CYCLE

Day	Salinity (ppt)	Temp (°C)	O2 (mg/L)	Time of feeding	Harvest (size and total kg)	Price/kg
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
xx						
xx						
100						
110						

ANNEX 5: PRESENTATION FOR FARMERS TRAINING IN THE COMMUNE







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Extensive aquaculture

- Low initial investment
- Small volumes of feed
- Household operated
- Diverse range of systems and species cultured
- Local/domestic consumption
- Production low kg/ha!
- Produce a niece product e.g. larger shrimp from ecological farming system.

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Better Management Practices

Principle 3: Minimize the use of "new" water.

Considerations:

Efficient water use in aquaculture systems will be critical in any adaptation plan.

Integrated management plans on water usage will be important.

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Better Management Practices

Principle 1: Locate aquaculture according to national planning and legal frameworks in environmentally suitable locations.

Considerations:

Climate change, areas that were once considered suitable for siting aquaculture ponds may no longer be appropriate.

Use your local knowledge and only develop within local plans and regulations.

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Better Management Practices

Principle 4: Use feed management practices that make efficient use of available feed resources.

Considerations:

Relying on locally available feed resources builds resilience to climate change.

Combine use of commercial feed and "natural available feed" from your ponds might be a good adaptation.

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Better Management Practices

Principle 2: Design and construct aquaculture farms in ways that minimize environmental damage.

Considerations:

Use resources effeciantly. That will protect environment and **increase your income!**

Healthy shrimp and an healthy environment give happy farmers and consumers!

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Better Management Practices

Principle 5: Aquatic Animal Health management plans should be adopted to reduce use of chemicals, minimize risks of disease and increase food safety.

Considerations:

What are your problems with shrimp disease?

The higher stocking density (intensive) your system, requirements for disease management increase!

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Better Management Practices

Principle 6: Develop and operate farms in a socially responsible way that benefits the farm, the local communities and the country.

Considerations:

Do you have problems with neighbors due to production (e.g. you farm shrimp in saline water, while he wants fresh water to grow rice?)

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Better Management Practices

Principle 7: Understanding climate change in the development of new systems, and in the improvement of existing facilities.

Considerations:

Climate change will affect you (maybe already now!).

How can we adapt and increase resiliance?

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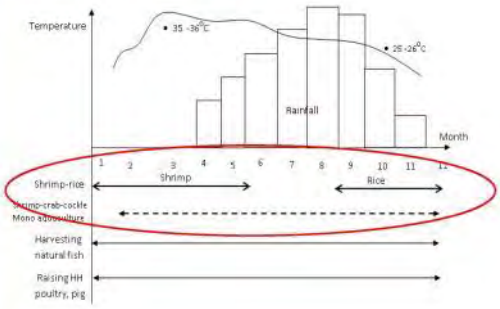
Rice/Shrimp in Thuan Hoa



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Suggested adaptation models to address the change in rainfall pattern and increase in salinity

- Rice/Shrimp system with nursery option (inland zone + intermediate zone(?))
- Rice/Shrimp with alternative salt tolerant rice strain (Intermediate zone)
- Serge/Shrimp (Intermediate zone)

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KEY POINTS FOR SUCCESS

- Low cost and basic training
- Adjustment to existing system
- No conversion of land
- Experts and community agree
- 99% Climate Proof

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Farmer adaptations

- Selection of shrimp post larvae (PL) is VERY important for a successful shrimp crop.
  - Farmers, together with commune extension workers should make sure the PL are healthy (check using PCR at University or government lab facility (Research Ins. for Aquaculture 2).
  - PL should be PL15 if possible.

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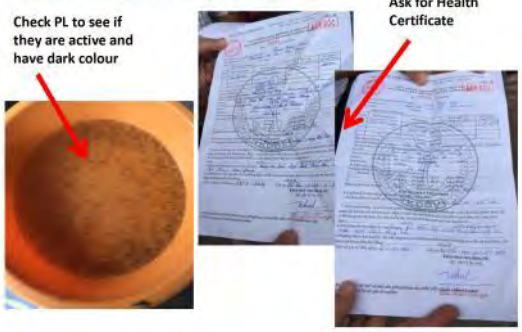
Farmer adaptations (Shrimp PL)



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Farmer adaptations (Feed)

- Keep the feed in dry, clean and cool place. Use it up soonest possible. Once the bag is opened to avoid the feed get damped and spoiled.
- You should adjust the quantity of feed based on observing the actual consumption. General rule: Normally it should be about 10-20% of the total weight of the shrimp in the inlet.

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Farmer adaptations (Feed)

- Suggested to use "shrimp starter" feed management.
- Feeding once or twice per day is sufficient.
- Spread the feed evenly around the pond.
- - Pay attention to the water temperature and feed consumption so as to adjust the feed amount properly.

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Farmer adaptations (Feed)

Crumble feed for three weeks

After three weeks, pellet
(but we will not do!)

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Farmer adaptations (Feed)

- Keep the feed in dry, clean and cool place. Use it up soonest possible. Once the bag is opened to avoid the feed get damped and spoiled.
- You should adjust the quantity of feed based on observing the actual consumption. General rule: Normally it should be about 10-20% of the total weight of the shrimp in the inlet.

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Farmer adaptations (Nursery)

Option 1: Construct a "pen cage" as nursery in the main canal of your rice/shrimp farming system.

- The pen cage should be with "natural bottom" and not suspended net.
- Fine mess net so PL cannot escape
- Make sure the pen is situated where there is some water current and 1-1.2m of water depth.

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Farmer adaptations (Nursery)

- Option 2: Construct a soil dyke as a nursery in the main canal of your rice/shrimp farming system.
  - Keep the construction light structure and make sure it is easy to release shrimp after three weeks.
  - Make sure the area is not too small and minimum about 10 x 7 m.

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Format for group work

- We will divide all into 4 groups (about 10 in each)
- Each group will spend 20 min to discuss and answer the 4 questions provided on next slide.
- Each group will nominate a presenter, who will present the replies in plenary (max 5 min per group)

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Farmer adaptation (Water measurements)

- Famers should measure salinity of water and water temperature twice daily. This can be done at the same time as feeding, but can be done anytime, as long as it is at the same time of the day.
- **Note down in log book (we can provide if needed).**

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Group Questions

- Is it a good idea to have the young shrimp in a nursery for 3 weeks before release to large pond? Please answer why you have answered yes or no
- What is the most difficult in the process of seleting PL for stocking?
- How will you manage your feeding of shrimp?
- How much are you getting for your shrimp today when you sell them?

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Points for thought and consideration

- Use your existing knowledge, but adjust to increase resilience.
- Get more knowledge about who is buying your shrimp and what they can sell for. Make sure you get the right price for the shrimp.
- Thank you for farming shrimp. Many people around the world appreciate your good products!