

TRAINING IN SUSTAINABLE COASTAL AQUACULTURE TECHNOLOGIES IN INDONESIA AND THE PHILIPPINES

Mitigating Negative Environmental Impacts/ Activity/ 07MNE02NC

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ABSTRACT

Shrimp monoculture in Indonesia and the Philippines has led to a decline in mangroves, degradation of water quality, diseases in shrimp, and low prices due to over-production. The aim of this investigation was to provide training and techniques through a series of workshops for more sustainable shrimp farming that incorporates culture of seaweed and tilapia-shrimp polyculture and soft shell crab farming as an alternative. These objectives were met through a series of workshops and demonstration projects. A large number of shrimp farmers in Indonesia and to a lesser extent in the Philippines have adopted these more sustainable techniques. Many shrimp farmers in the Pidie and Beuren Districts have adopted tilapia and shrimp polyculture. Others have adopted seaweed / shrimp polyculture and have begun to harvest and process seaweeds in addition to the shrimp. After a soft shell crab workshop, a few shrimp farmers have started placing crab cages in their ponds. The farmers are starting to produce soft shell crabs, but it is unclear if they are doing this as a polyculture or have switched entire ponds from shrimp to crab culture.

INTRODUCTION

The 9.0 magnitude earthquake that struck the Aceh Province of Indonesia impacted 30,000 households who had registered with aquaculture being the primary household livelihood. The vast majority of these families had small tambaks (ponds of less than one hectare) that were used for monoculture of penaeid shrimp. The survivors would like to return to aquaculture, but recognize that the removal of mangroves may have contributed to the scope of the disaster. Further, even before the tsunami they were impacted by degradation of water quality, diseases in shrimp, and low prices due to over-production.

Researchers at SEAFDEC have pioneered mangrove friendly shrimp farming technologies and have been active in publication and dissemination of these methods (Primavera 2000;

Tadokoro et al. 2000). These include use of mangroves, seaweeds and bivalves as biofilters. In earlier CRSP activities, Central Luzon State University researchers worked with farmers to develop and document the tilapia – shrimp polyculture system that has spread through the Philippines. The University of Arizona has developed red algae (*Gracilaria*) farming techniques that are especially useful to integrate with a shrimp and/or tilapia production to remove nutrients from effluents (Nelson et al. 2001). Similar work in China (Yang et al. 2005), Colombia (Gautier 2002) and Thailand (Menasveta 2002) provides additional examples from several distinct environments.

Changes to more sustainable farming should also translate into improved household income as additional products should be available for sale or consumption and costs for disease treatments and feed associated with monoculture of shrimp are reduced. This study addresses issues in the adoption of aquaculture technology applicable to similar situations in other countries. It also addresses questions of coastal disaster rehabilitation and diversification of livelihoods. Through its links with the SEAFDEC, the project is connected with a regional and global research and development network.

OBJECTIVES

- a. Conduct a series of short courses in affected communities in Aceh Province and in the Philippines demonstrating alternatives to monoculture of shrimp
- b. Transfer techniques developed in the Philippines for seaweed, oyster, and tilapia-shrimp polyculture to Aceh Province.
- c. Provide oversight and review of matching funds provided by Aquaculture without Frontiers for training in sustainable coastal aquaculture
- d. Provide training to surviving farmers and to NGO volunteers who are providing restoration assistance
- e. Determine if farmers receiving training adopt some of the techniques rather than returning to shrimp monoculture.
- f. Determine if crop diversification and more sustainable farming techniques have improved household income.

RESULTS

Training and Adoption (objective a-e)

In the first year of the project, three workshops were conducted in Aceh, Indonesia and Visayas (Guimaras) region of the Philippines. The workshops provided training and techniques for more sustainable shrimp farming that incorporates culture of seaweed and tilapia-shrimp polyculture. The first workshop was held in Kabupaten Pidie, Banda Aceh (Sumatra), Indonesia on April 29-30, 2008. Thirty-one shrimp growers including 5 women participated. The second workshop held at Ujung Batee Aquaculture Center (BBAP, Banda Aceh, Indonesia) on May 1-2, 2008 included 34 participants from BBPA, NGOs and the private sector. The AquaFish CRSP USAID workshops were led by Anne Hurtado, Nelson Golez, Hasanuddin and staff at Ujung Batee and were co-sponsored by Aquaculture without Frontiers, who provided cost match on this project, as well as AUAID. Lectures included fundamentals on sustainable shrimp farming; culture system, management and nutrition; and seaweed (*Gracilaria*) farming and polyculture. Hands-on practical feed preparation and native agar extraction of seaweed was provided. Participants showed much interest in closed-water recirculating shrimp culture to include *Gracilaria* as one of the biofilters, preparation of shrimp feed and native agar extraction. Farmers showed willingness to incorporate new technologies into shrimp farming. Participants also wanted to know more on the biology and ecology of seaweed, including the seasonality of their local *Gracilaria* to determine the

availability of ‘seedlings’ for possible culture. It was recommended that a closed- water recirculating shrimp culture system (shrimp- oysters-tilapia-*Gracilaria*) be developed to demonstrate sustainable and environment-friendly shrimp aquaculture. Development of a village-level agar extraction to include product applications was also suggested. Several farmers eventually developed zero exchange shrimp and seaweed polyculture ponds.

A third workshop was held at the Igang Marine Station, Southeast Asian Fisheries Development Center (SEAFDEC), Aquaculture Department in Igang, Nueva Valencia on the island of Guimaras, Philippines on August 29-30, 2008. The workshop was attended by 29 people, 16 females and 13 males, from the Local Government Unit, Bureau of Fisheries staff, and private sector in nearby towns and barangays of Nueva Valencia. AquaFish CRSP USAID workshops were led by Anne Hurtado and Nelson Golez of SEAFDEC with assistance from Reginor Argueza of Central Luzon State University. Lectures were provided on pond preparation and fertilization, feed formulation, shrimp culture with emphasis on biosecurity and disease control. An integrated shrimp-mollusc-seaweed culture in a recirculating water system were highlighted to prevent disease outbreak. Lectures were also provided on *Gracilaria* biology-ecology, culture and post harvest management.. A hands-on preparation of feeds, and native agar extraction using a village-level extractor, was conducted. Additional lectures on disease and crop management of seaweeds, particularly a cultured red seaweed, *Kappaphycus “cottoni”*, was provided as Guimaras coastal seaweed farming was recently adversely affected by an oil spill. In the final year we have completed two additional workshops demonstrating alternatives to monoculture of shrimp in affected communities of the Visayas and Luzon regions of the Philippines. The first workshop provided training on nursery and growout of seaweed and was held in Punta Punting, Sabang, Sibunag, Guimaras, Philippines, on November 12, 2008. This AquaFish CRSP USAID workshop was led by Anne Hurtado of SEAFDEC and involved the participation of 44 seaweed growers, including 16 women, and 3 SEAFDEC. This workshop was supplemental to those outlined in the original project workplan that was requested by the seaweed farming community. It provided training on the distribution, biology-ecology, farming, crop management/diseases, post-harvest, marketing and product applications of seaweed (*Kappaphycus ‘cottonii’*) in a region previously impacted by a 2006 oil spill. The second workshop held at the Golden Sunset Resort in Calatagan, Batangas, Philippines (Luzon Region) was held on January 15-16, 2009, included 47 participants from Central Luzon State University, North Carolina State University, University of Arizona, SEAFDEC, Philippines Bureau of Fisheries and Aquatic Resources, local government officials, feed companies, and 24 seaweed, tilapia, and shrimp growers. Lectures included fundamentals on sustainable shrimp farming; culture system, management and nutrition; tilapia-shrimp polyculture and seaweed farming and polyculture. Information was provided on pond preparation and fertilization, feed formulation, shrimp culture with emphasis on biosecurity and disease control. An integrated shrimp-mollusc-seaweed culture in a recirculating water system were highlighted to prevent disease outbreak. A hands-on preparation of feeds, and native agar extraction was conducted.



Borski and Fitzsimmons traveled to Aceh to make arrangements for the next series of workshops in late January 2009. We discussed the current state of the project, reviewed facilities and met with Ujung Batee staff. Fitzsimmons continued onto India to present the results of the project at the India Aquaculture Meetings.

A third series of supplemental workshops on soft-shell crab farming was held in Aceh province of Indonesia at BBAP Ujung Batee (Aceh Besar) on July 21, 2009 and at Kota Langsa (Aceh Timur) on July 23, 2009. These workshops were part of the Aquaculture Rehabilitation Project in Aceh, Indonesia and included the participation of 40 farmers, 8 fisheries/aquaculture specialists from BBAP, Ladong Fisheries School, and JFPR; and 11 fisheries/aquaculture government specialists from Dinas Kelautan, Perikanan dan Pertanian Kota Langsa (Fisheries staff of Kota Langsa and Aceh Timur district). Due to disease outbreaks associated with shrimp culture, farmers in Aceh are interested not only in polyculture techniques for more sustainable shellfish/fish culture, but also in alternative crops. Soft shell mud crabs are a lucrative product that can be grown in polyculture with existing aquatic crops. However, problems with high mortality and the methodology for producing soft shell crabs remain a concern. Specifically, some farmers remove walking and swimming legs and claws to produce soft-shell crab. This technique has been met with considerable ethical concern and is inconsistent with the religious and social values of the community of Aceh. It also results in excessive stress and mortality to the crabs. A series of workshops was conducted by Ms May Myat Noe Lwin (C NN Aquaculture and Supply Company, Bangkok-Thailand), a volunteer with Aquaculture without Frontiers (AwF), with cooperation from AquaFish CRSP staff and various local government and college staff. The workshops were supported by AquaFish CRSP, Aquaculture without Frontiers (AwF), Australian Centre for International Agricultural Research (ACIAR), and the Directorate General of BBAP Ujung Batee. Ms. May Myat Noe Lwin, along with help from Rafael Martinez, an AquaFish CRSP graduate student at University of Arizona, provided training on natural methods of producing soft-shell mud crab, similar to techniques on her own farm in Thailand; crab biology, design and lay-out of soft-shell farming, stocking techniques, inspection, feeding and feed, water management, pond preparation, processing and packing and also business planning and management. Collectively, these and the other workshops on seaweed and fish polyculture were met with considerable enthusiasm with frequent requests for follow-up training.

Subsequent to the training, ACIAR purchased several hundred soft-shell cages from Thailand and provided these to some of the participants so that they could implement the techniques that had been taught. We have been informed that the farmers are successfully using the cages and selling crabs.

Determine if crop diversification and more sustainable farming techniques have improved household income (objective f)

A graduate student was scheduled to conduct a survey of farmers to evaluate the impact of these cultural changes. Unfortunately the student backed out of the project and the full survey of our participants was not completed. A few of the farmers have provided anecdotal reports that shrimp survival rates have increased, seaweeds are being harvested for local processing and consumption, and that their incomes have improved. In addition a colleague with the Network of Aquaculture Centers in Asia (NACA) has conducted a separate survey of farmers conducting polyculture in Aceh. The survey results demonstrate a significant improvement in

household welfare, and include several of our participant villages. As the participants are anonymous, we cannot be certain that our participants are included, but we assume so as the participant numbers seem to include most of the community (Table 1).

Survey questions and responses on polyculture

1. What changes have been made as a result of the polyculture system?
 - *The productions have been increased, so the stock densities have been more increasing and the period of production faster than before.*
2. Clearly identify the reasons for change in income.
 - *Before, the farmer can produced their fishpond 2 times per years, but after polyculture, the production of tambak farmer become to 3 times.*
 - *Production have been increasing 40%, no debt more, the tambak not shallow again, no need find and look out the job for get some money for tambak operational cost.*
3. What were their experiences with the Best Management Practices?
 - *the farmers can understand what are pH, Salinity and other parameter*
 - *Penerimaan Training (Training received)*
 - *the farmers have increased their capacity, understand better management practices*
4. Describe their thoughts about changes in farming strategies. When will you be restocking for your next cycle of production?
 - *that already stocked into second crop, with 3 month age*
 - *Most of farmers have done restocking, and the farmers use the seed from agent/nursing, because the seed from hatchery too small and the water situation from hatchery too different situation between in the field*
5. What notable differences have occurred to the quality of their life. E.g. better living standards (and what specifically e.g. diet, clothes, house renovation, motor cycle, television).
 - *before, the farmers can't cover their requirements, but now their life has been better,*
 - *Didn't get the profit more, because sometime the fish price is low, so they need to add capital more.*
6. What notable differences have occurred to the quality of their family dependent's lives (e.g. Children's schooling, wife's activities).
 - *The children's schooling have been continuing to one level more increasing than before.*
7. Describe how your wife assists you in your business operations
 - *Mostly their wife not participated into their business operation, but some area, sometime they help their husband tambak activities like feeding, harvesting process.*
 - *Rarely, their wife participates into their husband activity, mostly their wife take care of their children in the home.*
8. Has there been any changes to your tambak (pond) ownership since operation (i.e have they become indebted to Toke – buyer who fronts money)?
 - *There is no changed of ownership of tambak, but some farmers have been rented other tambak for improved their activity on Aquaculture. There is no debt with toke more, and the farmers feel free to sell the fish and shrimp anywhere.*
 - *There is not pressure the price from toke/buyer so the profit more transparent.*

Table 1. Survey of farmers in Aceh, Indonesia

No	Groups	Location	Farmers	Kilograms		Group income/cycle after tsunami	Average income/Far mer
				Shrimp	Fish		
1	KELOMPOK BAGI BEUSARE	DESA PANTE RANUP	15	3366	11922	185,258,100	12,350,540
2	KELOMPOK ADE BEURATA	DESA PANTE RANUP	16	4021	9748	192,767,325	12,047,958
3	KELOMPOK HARKAT BERSAMA	DESA PANTE RANUP	16	2758	10147	142,871,250	8,929,453
4	KELOMPOK KUDA LAUT	DESA JANGKA ALUE U	37	228	33040	227,765,888	6,155,835
5	KELOMPOK BAROENA	DESA JANGKA ALUE U	32	195	33247	242,226,538	7,569,579
6	KELOMPOK KELONG JAYA	DESA JANGKA ALUE U	33		28217	184,151,180	5,580,339
7	KELOMPOK USAHA TANI	DESA JANGKA MESJID	11		9,926	64,125,000	4,275,000
	KELOMPOK USAHA TAMBAK	DESA JANGKA MESJID	11		10363	70,680,000	4,712,000
8	KELOMPOK TIMUR JAYA	DESA JANGKA ALUE BIE	19	285	14,457	122,093,100	6,425,953
9	KELOMPOK SABAN PAKAT	DESA JANGKA ALUE BIE	19	140	13536	97,339,075	5,123,109
10	KELOMPOK BAGI ADE	DESA JANGKA ALUE BIE	15	413	14,487	146,134,020	9,742,268
11	KELOMPOK USAHA BINTANG	DESA JANGKA ALUE BIE	11	179	15,000	58,201,950	5,291,086
12	KELOMPOK PASIFIK	DESA JANGKA ALUE BIE	14	630	14,884	150,508,650	10,750,618

13	KELOMPOK SARENA	DESA JANGKA ALUE BIE	14		13,218	90,384,225	6,456,016
14	KELOMPOK MUJAIR	DESA NASE MEE	20	2,454	14,164	143,678,375	7,183,919
15	KELOMPOK BANDENG PRESTO	DESA NASE MEE	23	1,090	18,235	147,088,400	6,395,148
16	KELOMPOK UDANG LAUT	DESA NASE MEE	22	2,232	14,804	142,773,900	6,489,723
17	KELOMPOK BANDENG PUTIH	DESA ALUE LEUHOB	14	1,802	8,221	57,909,607	4,136,401
18	KELOMPOK UDANG BREUH		15	1,138	9,475	48,074,748	3,204,983
19	KELOMPOK DAMAI	DESA CALOK	31	2,371	16,652	115,655,625	3,730,827
20	KELOMPOK SEJAHTERA		31	2,290	17,428	119,494,663	3,854,667

CONCLUSIONS

Overall the project included more training workshops than originally proposed and the number of participants exceeded our original expectations. The suggestions and advice offered in our workshops have been adopted and adapted by several communities in the Philippines and in Aceh. The yields of shrimp are increasing, with alternative and polyculture crops increasing at a more rapid pace. Tilapia, seaweed, soft-shell crab, and grouper fingerlings are becoming more available in the markets. The partnerships with AwF, SEAFDEC, ACIAR and NACA have been fruitful and the collaborations have provided important synergies while avoiding duplications. We are pleased to see the application of polyculture and other more sustainable farming practices in the Philippines and Indonesia. Although we were not able to complete the impact survey ourselves, it is apparent from an associated survey conducted by one of our colleagues that there has been a positive impact to the communities trained.

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