

Demonstration of Sustainable Seaweed Culture and Processing in Aceh, Indonesia and the Philippines - Opportunities for Women to Improve Household Welfare

Food Safety and Value-Added Product Development/Activity/09FSV02NC

Hasan Hasanuddin and Coco Kokarkin
Ujung Batee Aquaculture Center
Banda Aceh, Aceh, Indonesia

Maria Rovilla J. Luhan
Southeast Asian Fisheries Development Center–Aquaculture Department
Iloilo, Philippines

Kevin Fitzsimmons
University of Arizona
Tucson, Arizona, USA

Russell J. Borski
North Carolina State University
Raleigh, North Carolina, USA

ABSTRACT

This project works with the local community to develop a more sustainable use of tambaks, other than the mono-culture of shrimp that was the norm before the 2004 tsunami. The use of polyculture and production of seaweeds were suggested as more sustainable aquatic farming methods. The project was conducted in collaboration with colleagues from the Philippines who had considerable experience with seaweed production, processing and marketing. A series of workshops were conducted to train the women and men who work together in the ponds to care for the seaweeds or in the case of the Philippines, how to culture seaweed in coastal environments. Another series of workshops focused on the women in the communities and teaching them recipes and preparation methods for using seaweeds and seaweed products in their family food supply.

The farmers have been very successful, with new cash crops of seaweed and soft shell crabs to go along with improved growth and survival of shrimp from the polyculture as well as improved water quality. The women from the training course workshops have learned several recipes for using seaweeds as vegetables and in snack foods. They also learned how to extract agar, which can then be used as a thickener or to make candies and desserts. Finally, farmers were aided in the construction of drying platforms that vastly improves the quality of dried seaweed and reduces contamination with sand and shell from drying on the ground. A commercial seaweed buyer has committed to purchasing 14 MT a month and is supplying baling equipment and additional tables. The success of the project was further underscored by the commitment of the government of Indonesia to provide funds for further development of seaweed culture in additional communities in Aceh province.

INTRODUCTION

Scientists from the Philippines have been leaders in the development of red algae harvesting, culture, domestication, and processing into marketable products (Hurtado 2002; Santelices and Doty 1989). This proposed activity was built largely upon the successful transfer of technology from the SEAFDEC in the

Philippines to other regions of the Philippines and the Aceh Province of Indonesia. Women were the primary beneficiaries of the earlier training in the Philippines and Indonesia. This was continued in this phase with repeated workshops for women. In fact, many of the world's leaders in seaweed culture are women, and women conduct many of the culture and processing activities. The farmers in Aceh, mostly women, specifically requested that additional training be provided from the experts in the Philippines to further develop the potential for seaweed production, processing and utilization for various products.

The technical and environmental benefits of polyculture of seaweeds in shrimp and fish ponds are well documented (Ryder et al. 2004a,b; Marinho-Soriano et al. 2002; Nelson et al. 2001; Neori et al. 2000). Polyculture of seaweeds in shrimp and fish ponds has proven popular in several coastal communities based on our current AquaFish CRSP. Large volumes of *Gracilaria* and *Eucheuma spp.* are produced in ponds with small volumes being used for home consumption as fresh sea vegetables or for agar for cooking. However, more seaweed is being produced than is needed for home use. Farmers need assistance to learn how to handle and process their raw seaweed into more valuable semi-processed forms that will be of interest to commercial agar buyers. Additionally, training of women on cooking and preparations of seaweeds for the kitchen would be beneficial to enhance household seaweed consumption and health.

Demand is significant for agar based candy and desserts in Indonesia and the Philippines. However, a suitable grade of agar is needed before it can be made into a marketable candy. The pharmaceutical grade agar used in microbiology demands a yet higher grade. In both cases, contamination and spoilage are the primary reasons for degradation. With the guidance of researchers and extension specialists, farmers have developed a method of off the ground drying on racks. The racks were constructed of locally available components (lumber, bamboo, ropes, and fish nets) and serve to elevate the seaweed and facilitate manually turning the seaweeds. This serves to increase the rate of drying, thus reducing spoilage, and it reduces contamination from soil, shells, and rocks that occur when the seaweed is dried on the pond bank or coastal shoreline. We would like to demonstrate to farmers in Aceh and additional locations in the Philippines how the seaweed can be partially processed to increase its value as an industrial source of agar.

OBJECTIVES

1. Demonstrate and train women to recognize the many advantages of utilizing seaweeds to improve family nutrition and as a potential cottage industry to improve household and community wealth.
2. Conduct a series of workshops regarding proper harvesting, handling, and drying of red seaweeds.
3. Build demonstration seaweed drying racks in three communities.
4. Conduct workshops on methods of using seaweed agar to make candy and desserts.
5. Demonstrate methods to partially process seaweed to increase its value as an industrial supply of agar and carrageenan products.

RESULTS

The first workshop was conducted by Ms. May Myat Noe Lwin and Hasanuddin from January 15-18, 2010. The subjects included polyculture of soft-shell crabs and seaweeds in shrimp ponds. This workshop, and two subsequent workshops in May, 2010 were added at the request of our partners at Ujung Batee as they had several farmers interested in soft shell crab production in polyculture with shrimp and seaweeds. The opportunity to incorporate an additional female scientist/farmer who was based close to Aceh was also a benefit to the project. These workshops, which were in slightly different locales, still including seaweed and agar content, but had a greater focus on soft shell crab in response to the local request. In April 2010, Fitzsimmons traveled to Banda Aceh to review seaweed and shrimp polyculture efforts. During meetings with Hasanuddin, Coco, Sarapuddin and Samsul, progress was reviewed and plans discussed for efforts under the new phase of the AquaFish CRSP project. We traveled to Pidie for



Ms. Lwin with January 2010 Workshop



*Farmers with seaweed drying on pond bank
bank April 2010*

on -site workshop and review of seaweed culture in shrimp ponds and to meet with farm families. Opportunities for Saudi scientists to visit Aceh who are interested in the polyculture technique were discussed. Fitzsimmons also met with Hasanuddin's MS advisor at local university and agreed to serve on graduate committee. Finally, we made plans for graduate student Sidrotun Naim to visit Aceh in August 2010.

During May 5-10, Ms. Lwin made another trip to Aceh to conduct additional workshops with Hasanuddin, Sarapuddin, and Samsul to expand upon the soft-shell crab and seaweed polyculture in shrimp ponds. In August 2010, Upton Hatch from North Carolina State University and Sidrotun Naim (Graduate student from Arizona) met in Banda Aceh to conduct interviews with farmers and Ujung Batee staff to evaluate the impacts of seaweed culture as part of the integrated polyculture system promoted to the former shrimp farmers in the region. Additional interviews were conducted by Dr. Hatch in August 2011 associated with project 09SFT06NC. The evaluation and results of the initial visit are part of the submitted trip report and recommendations included some of the activities outlined in this investigation. Overall, the report concludes that seaweed polyculture has an excellent opportunity to be incorporated into and provide several important benefits to the existing aquaculture system. However, some marketing and production constraints needed to be addressed before the potential can be fully realized. This included additional training on handling and drying seaweeds. Training workshops regarding proper harvesting, handling, and drying of red seaweeds for the region were planned and implemented in response to these recommendations. As this was considered to be a high priority, we scheduled this training to occur in conjunction with the agar as candy and cooking ingredient workshop. An additional recommendation was that financial support for purchase of drying racks for farmers who have had successful harvests using seaweed polyculture system would be useful. Although demonstration-drying racks for seaweed have been built through this project, additional, larger units will be required to produce the quantities of seaweed needed for wholesale distribution. Other recommendations suggest: 1) market opportunities be improved through establishment of certification process and facilitation of selling seaweed through forward contracting between farmer and production plant; 2) support for applied research and extension on understanding the relationship between white spot virus and other crops in polyculture system (tilapia, milkfish, and seaweed); and, 3) support for applied research and extension on understanding the relationship between odor and crops in polyculture systems (tilapia, shrimp, milkfish, and seaweed).

Largely based on AquaFish activities on the training and implementation of shrimp/finfish-seaweed polyculture in various communities of Aceh Indonesia (Pidie Jaya, Aceh Utara, Aceh Timur and Lhok Seumawe), the Central Government under the Directorate General Aquaculture is now interested in funding farmers to expand seaweed polyculture in the Aceh province of Indonesia. Following our preliminary surveys we have identified several opportunities to improve the success of *Gracilaria* culture in Aceh and the livelihood of its farmers. This includes building a market link for seaweed to include surveys of buyers in Indonesia, training farmers on seaweed drying, building a centralized seaweed processing center, providing key extension personnel and/or farmers some training in seaweed culture in Indonesian provinces (*i.e.* Sulawesi) where seaweed farming and marketing are more established, and identifying the potential problems some farmers perceive in culturing milkfish with seaweed relative to the success of shrimp-seaweed polyculture.

A series of workshops were held in July 2011 to further demonstrate seaweed culture and more importantly demonstrate drying and handling procedures in Aceh, Indonesia. Each of the local shrimp farmers typically have <1-hectare ponds (tambak) that they operate as the main source of income for the family. Most of the farmers have adopted the polyculture of *Gracilaria* seaweed in the ponds as we had recommended last summer. Many of the ponds have luxuriant growth of seaweed and improved survival and growth of the shrimp. However, their initial attempts to sell the seaweed to professional buyers had failed. The farmers had pulled the seaweed from the ponds and were drying it on the pond banks. The seaweed was contaminated with sand and snail shells and the bottoms of the piles was decomposing rather than drying properly. For the July workshops, our partners at Ujung Batee suggested we utilize the central school location at Sigli rather than try to hold three separate workshops. So, rather than workshops in Meuraksa, Lancang and Krueng, we held the consolidated workshops at the Sigli school. A major portion of the July 25 presentations prepared by Maria Luhan and Evelyn G. de Jesus-Ayson included discussions on the reasons that the seaweed for processing had to be dried properly and kept uncontaminated. They also described how to build sturdy tables of local materials for drying large quantities of seaweed and how the product would be further processed to make pharmaceutical grade agar (carraganeen).



Completion of first drying



Drying seaweed on table rather than pond

On July 26 we held a second workshop. In this workshop, Maria and Evelyn focused on home uses of *Gracilaria* and other seaweeds. They provided several translated recipes from the Hawaii Sea Grant publication “The Limu Eater: A Cookbook of Hawaiian Seaweed” (Fortner 1978) to participants who then broke up into three groups where each prepared a different product. The first group took finely chopped fresh *Gracilaria*, mixed it with wheat based flour and seasonings with a little water. A small ball of dough was then flattened through a tortilla type press. The resulting chip was then deep fried in



A confident seaweed chef



School kids learning about nutritious seaweeds



Women learning to cook seaweed dishes



Women attending second day of seaweed workshops

oil to make a seaweed flavored chip. The second group lightly cooked the seaweed (blanched) and then prepared a casserole style meal with onions, carrots, potatoes, tomatoes, and some local vegetables we did not recognize. The third group boiled their seaweed and then strained it through tightly twisted cheesecloth and collected the raw agar. The agar is then frozen and thawed and allowed to separate. This partly processed agar is commonly used for cooking as a thickener or as the main ingredient in several kinds of candy.

On July 28 a third workshop was held in Medan, with the team from Ujung Batee, several of the farmers and a seaweed buyer, Mr. Zarkasyi Bin Ismail, Drs. Hatch and DJ Ayson, and Maria Luhan. The workshop centered on values of products and on additional contributions from the seaweed buyer. The conclusions were that the buyer would loan money to the farmers to build four additional tables, beyond the tables AquaFish CRSP had sponsored. The farmers would repay the loan in quarters taken from their first four shipments of dried seaweed. The intent is to supply 600 MT per month from the Sigli farmers at a price of 3,500 rupiahs per kg.

A November report from Hasanuddin documents that farmers have now distributed 30 tons of seedling seaweed material to many other village farming areas (Kuala Simpang district, Lhok Seumawe district,

Biruen district, Batee village and other villages around Pidie) as part of the effort to meet the 600 MT per month target. The Sigli farms are also harvesting 2 MT per week themselves.

In December 2011, Fitzsimmons returned to Aceh to lead a small workshop to review progress and discuss the operation and construction of additional drying tables that were being used in Sigli. The new tables were constructed with plastic netting rather than bamboo slats as in the Filipino model first built. The tables used a multiple layer array that the farmers felt could dry more effectively by stacking thin layers of seaweed and then rotating the stacks. Four of these new styles had been built and installed at the ponds. The farmers decided they preferred to have the drying tables at the ponds rather than carrying wet seaweed to the homes, although this requires them to run out to the ponds to cover the seaweed during rain events.

The farmers also decided to test another style of production we had suggested. Line culture is more intensive. However, the buyers were complaining of contamination from the bottom culture and several of the farmers decided to try this system we had described before. So far the results are encouraging and the farmers report the shrimp still crawl around the suspended seaweed and graze on epiphyton.



New style of drying table



Line style culture of seaweed

Overall the mission was very productive. The farmers are on the verge of having a significant new revenue stream that comes entirely from a by-product of improving pond water quality. Evelyn Ayson and Maria Luhan had a great rapport with the women of Sigli. The women of the community have a new highly nutritious aquatic vegetable to prepare in several recipes. And they understand how to process the seaweed to generate agar for use as a thickening agent in cooking or as a base for making candies and desserts.

Dr. Borski visited SEAFDEC in the Philippines in December 2010 to discuss the implementation of seaweed culture workshops including seaweed drying and processing to agar. A workshop on “Small-scale Aquaculture and Livelihood Ventures: Seaweed Culture” was conducted in February 2011 in Roxas City in the province of Capiz on Panay Island (Visayas region) in the Philippines. This followed two other workshops conducted in January 2011 in two communities in Antique, Iloilo, one of the poorest provinces in Visayas region of the Philippines, that was coordinated with integrated culture of milkfish. Another workshop was held in Puerto Princessa, Palawan, Philippines in December 2011. These workshops provided training in seaweed culture, construction of rafts for coastal seaweed culture, seaweed processing for production of agar, and methods for pickling seaweed and making seaweed foods (crackers, tortillas) as a value-added nutritional product and income opportunity for households, whereby food products could be sold at local markets. The workshops in Roxas City and Puerto Princessa

included the training of 42 women on value-added seaweed processing and nutrition. Overall, the workshops supported development of seaweed culture and processing, and for production of foods that can improve household nutrition and income opportunities in much needed areas of the Philippines. Participants were enthusiastic and appreciative of the training received.

CONCLUSIONS

We are very pleased to see that the project appears to be headed to even greater success. We succeeded in conducting all of our workshops with even more attendees than we had hoped. The workshops targeted toward women were especially successful when our Filipino and/or Thai colleagues led the teaching efforts. The women in Pidie and Sigli regions of Aceh Indonesia and in the Panay and Palawan regions of the Philippines who have received training on the practical uses of seaweed and agar in the kitchen are beginning to use them in cooking and agar preparation. These foods that can also be sold at local markets for added income opportunities. The production and polyculture aspects have been widely accepted by farmers in the Aceh region. The farmers report improved growth and survival with seaweeds growing in the ponds. The farmers have the three drying tables completed and are now using them to meet the quality requirements of the professional buyers. The commercial seaweed buyer supplied additional tables and a baler and firm orders for 14 tons of dry seaweed have been placed. In the Philippines, fisherfolks learned how to grow seaweed in ponds as well as marine coastal habitats.

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