<u>Report</u>

"Evaluation of Economic Benefits of Aquaculture without Frontiers - Farmer to Farmer Program to

Implement Best Aquaculture Practices and Polyculture Systems

in Aceh Indonesia"

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This report was completed based on field visits, interviews and data collection in Aceh, Indonesia from August 8-15, 2010 with the assistance of Hasanuddin and Coco Kokarkin, Director of Brackish-water Aquaculture Development Center, Banda Aceh, Indonesia.

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Introduction

The Aquaculture without Frontiers - Farmer to Farmer (AwF-FTF) aquaculture program in Aceh, Indonesia has focused on promoting the adoption of best aquaculture practices (BAP) and polyculture systems. These systems involve a more sustainable use of small scale tambak culture systems that incorporate seaweed, shrimp and fish. Of particular interest to the AwF-FTF program is encouragement of small farmers to pursue BAP certification; that is, an important strategy of AwF-FTF program is to convince small farmers to: not only use BAP, but also take the additional step of documenting their use through BAP certification process. It is ultimately hoped that this certification will assist small farmers in convincing marketing channels that their products meet high quality standards. The program was pursued through training workshops, demonstrations and farm visits.

Based on interviews, farm visits and data collection, this report will provide an evaluation of the mission's activities and suggest improvements in future AwF-FTF aquaculture programs. Visits were made and interviews conducted during August 2010 at the Brackish-water Aquaculture Development Center in Banda Aceh, the ACIAR (Australia Centre International Agriculture Research) Samalanga demonstration site in Bireun District, Lancang in Pidie District, Trengadring Multi Species Hatchery in Pidie Jaya District Bayu in Aceh Utara District. The performance criteria used in this evaluation will center on the extent to which incomes of small-scale aquaculture farmers in Indonesia have improved through BAP. At the time of this report, the certification was only about to start in Aceh. The focus will be on the level of success of Acehnese farmers in aquaculture in general and how the addition of seaweed polyculture has affected these enterprises.

The discussion will proceed with a general description of the existing fish farming system that the polyculture of seaweed will need to complement; then followed with some observations on seaweed polyculture. The existing system greatly constrains the opportunity for seaweed, but it also provides an opportunity to benefit farmers not only through its own culture but also on positive interaction with the existing system. That is, an evaluation of the economic contribution of seaweed polyculture must be analyzed not solely in the cost and returns to seaweed, but of equal importance the effects on the cost and returns to the other crops in the polyculture system.

Current aquaculture system

The existing aquaculture system has centered on shrimp, milkfish and tilapia. Cultural practices (BMP's) for these fish and seafood crops and their combinations in various polyculture systems are recently established. However, optimal stocking and feeding rates have not been extensively researched under local conditions; most of these recommendation and actual farmer practices are based on trial and error and tilapia production in other locations. In addition, optimal feeds, e.g.

optimal protein level, and product quality have not been studied. Consequently, although farmers are reasonably satisfied with the benefits to aquaculture, they felt they could benefit from more research that documents the best stocking densities, feeding rates and feed quality and also marketing opportunity.

Milkfish is an extensively cultured, inexpensive source of fish protein for local markets and its culture has a long consistent history of successful production and marketing. Shrimp culture has experienced severe disease problems with white spot, yellowhead, Monodon Baculovirus and other viral and bacterial pathogens. There generally have been no disease problems with milkfish or tilapia. Common shrimp size range from 20-40/kg and tilapia are sold at about 400-500g. Typical stocking of tilapia and milkfish is in the range of 2,000-3,000 per ha; feeding at these densities will be 200 kg with a typical price of 6,000 -10,000 rupiah per kg., based on feed quality. This feeding rate results in final harvest of about 550 kg total (tilapia and milkfish). Seed are often from seed collectors who capture wild stocks.

Tilapia culture is still evolving both in production and marketing sense. Hired labor is generally not used. Neighbors help each harvest and each farmer does the various tasks during the season on his own. Harvest labor is the only task that requires a substantial effort in a confined period of time. Sales are almost totally to brokers; however, some farmers rent stalls in local markets with some success. The consumer expects the seller to clean fish as requested. Current prices per kg are approx 15,000 rupiah for black tilapia (*Oreochromis niloticus*), 8,000 for red tilapia (*O. mossambicus*) and 15,000 for milkfish. The possibility of cross breeding existing strains with *O. honorum* has been suggested to increase male population, but not tested.

Issues and observations

Racks

<u>Racks for drying seaweed have been inadequate.</u> The minimum quantity that market will purchase is 5,000 kg (from Medan); however, the racks needed would be several times larger to meet this requirement imposed by market. Farmers need more instruction on processing methods; training on this topic would be useful. Polyculture with seaweed will not be an economic success unless this minimum market size can be reached and farmers learn how to prepare seaweed for market efficiently. This is a substantially different process than most fish culture farmers are familiar with.

Seaweed marketing and processing

<u>A forward contracting system for seaweed would be good to investigate.</u> Because this is a new enterprise, some method to establish trust between farmers and brokers is needed. The certification process was intended, and once instituted may still, address this issue. In conjunction with certification, a forward contracting system would stabilize price for farmers and quantity for brokers; neither the buyer nor seller have any established history or relationship that

underlies confidence that both ends of contract will be met. With the help of a trusted government entity to initiate the process, an evolving market maturation process should lead to eventual functioning of the market without public sector facilitation. Assurance to buyers that the minimum quantity will be available on a consistent basis is crucial on the demand side and price stability is crucial for producers.

Odor

<u>The relationship between seaweed culture and odor in fish harvested should be investigated more thoroughly</u>. Best management practices need to be established and explained to farmers that minimize odor problem related to seaweed in polyculture ponds. There seems to be some confusion among farmers, extension and researchers, as to the exact situation and process that is occurring as it relates to negative odors of fish and shrimp harvested from seaweed polyculture ponds. Several observations were provided that indicate the odor in fish and seafood marketed from polyculture ponds needs serious scrutiny. Seaweed start to die within 1-2 months of culture cycle; at this time, it is not possible to remove affected seaweed due to damage to shrimp/milkfish/tilapia. The odor is mostly a problem in fish – milkfish and tilapia, and particularly milkfish – not shrimp. It was suggested that the shrimp are able to move under seaweed or mangrove roots to remain unaffected. Also, hypothesized was the possibility that as long as seaweed coverage in pond area is under 30%, dead or decaying seaweed and resulting odor in fish, is not likely to occur.

Shrimp virus

<u>White spot virus in shrimp may be mitigated by polyculture with seaweed and tilapia</u>. The white spot virus, carried by crustaceans, has decimated shrimp culture in Aceh area. The possibility that these polyculture systems reduce disease risk in shrimp is a major potential benefit to farmers. It is suggested that tilapia in pond canals and polyculture of shrimp with milkfish and seaweed in pond may have excellent disease management benefits. Also, there is evidence that rotation of ponds, that is, not growing same species in same pond each crop, is also a potential strategy to reduce white spot damage.

Some farmers overstock in anticipation of losses due to oxygen deficiency related to dying seaweed. Because, in general, shrimp die early in cycle (1-2 months), overstocking may be appropriate because feed will not have been wasted on shrimp that are not eventually harvested. Polyculture with shrimp also mitigates damage of white spot by allowing farmers to continue with fish crops if shrimp are severely damaged. Although lower shrimp stocking density is yet another potential solution to the white spot virus, these lower densities will likely reduce net returns substantially. It might be possible to increase stocking densities of the fish polycultures with the lower shrimp density, but the returns to milkfish and tilapia have been substantially lower than shrimp. The obvious conclusion from this discussion is that more research on BMP’s to mitigate white spot is needed.

Conclusions

Seaweed polyculture has an excellent opportunity to be incorporated into and provide several important benefits to the existing aquaculture system. However, this potential contribution has not yet materialized. Several marketing and production constraints need to be addressed before this potential will be realized. The uncertainty inherent in these constraints undercuts any attempts to increase adoption and this reticence by farmers is largely justified.

> **In terms of the production and marketing of seaweed, production effects are related to the drying process and marketing effects to obtaining secure markets and price stability.**

Drying is a constraint both in the physical area required to process the minimum market sale and in farmer's general lack of acquaintance and skill with the drying process.

> **In terms of effects on other elements of the polyculture systems, there is the positive effect on shrimp disease and the negative effect on fish odor.**

More emphasis should be placed on extension programs focusing on the positive effects of polyculture on shrimp production and research should address these effects in a more explicit manner to provide more assistance in BMP's to maximize this apparent effect. The relationship between seaweed polyculture and fish odor seems largely undocumented by research.

Recommendations

1. Conduct farmer training on drying process of seaweed (*Gracilaria)* in provinces where seaweed industry growth has been successful.

2. Financial support for purchase of drying racks for farmers who have had successful harvests using seaweed polyculture system.

3. Improve market opportunities through establishment of certification process and facilitation of selling seaweed through forward contracting between farmer and production plant.

4. Support applied research and extension on understanding the relationship between white spot virus and other crops in polyculture system. (tilapia, milkfish, and seaweed).

5. Support applied research and extension on understanding the relationship between odor and crops in polyculture system (tilapia, shrimp, milkfish, and seaweed).