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by

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ABSTRACT

This paper aims to study the alternative strategies and benefits of adopting small-scale innovations in the milkfish industry using pilot case studies in small-scale nursery, grow-out production and processing operations. Specifically, this study seeks to present alternative technologies in the form that can be easily taken up by farmers by virtue of its adaptability and low capitalization requirements that has the potential to be transferred or replicated in other parts of the country. Such technologies carry with them the opportunity to enhance the productivity performance and income of the poorer stakeholders. Hence, the overriding goal of this is to spur economic activities at the countryside, especially in milkfish producing areas by creating more jobs and livelihood opportunities among the small-scale milkfish operators.

Keywords: Small-scale milkfish technologies, pilot-testing of technologies, feed management, milkfish processing, fingerling nursery, milkfish polyculture

1. INTRODUCTION

Milkfish is one of the most important aquaculture species grown in the Philippines. In 2005, its production consists of nearly 52% (289.2 thousand mt) of the total aquaculture output of fish and shellfish valued at PhP17,577 million or US\$318.25 million (BAS, 2007). It is grown largely in 7 out of the 16 regions of the country which are located mostly in the northern and central Philippines, i.e., Central Luzon (31%), followed by Western Visayas (25%) and Northwestern Luzon (14%).

Research and development efforts by national agencies, private sector and regional

agencies such as SEAFDEC-AQD have made significant contributions to the milkfish industry through providing a wide array of choices and options for the milkfish farmers in terms of modification and improvements in grow-out practices, i.e., adoption of multiple and high-input production systems, feed formulation, broodstock (milkfish breeder) management and hatchery technology. However, there seems to be a wide gap between the current production systems as practiced by farmers and the state of the art of new milkfish technologies. Hence, there is an urgent need to disseminate the current innovations in the grow-out culture, hatchery/nursery and processing technologies to the farmers in order to attain the full benefits from these developments.

On the demand side, consumer preference for milkfish has traditionally been very strong in the Philippines where it is hailed as the national fish. With the growing domestic market, as well as expansion of markets internationally (basically due to large scale migration of Filipino workers in the Middle East, Europe and the United States), there is a need for milkfish production to cope up with demand, else milkfish imports has to expand.

In view of the importance of the milkfish industry in the country, dissemination of appropriate technologies to milkfish farmers, especially the small-scale operators becomes imperative to enable them to achieve more economically and environmentally sustainable operations. Hence the project entitled “Dissemination and Adoption of Small-scale Milkfish Aquaculture Technologies in the Philippines” (hereinafter referred to as the “Milkfish Project”) was jointly conceptualized by the National Integrated Fisheries and Technology Development Center of the Bureau of Fisheries and Aquatic Resources (BFAR-NIFTDC), Aquaculture Department of the Southeast Asian Fisheries Development Center (SEAFDEC-AQD), University of the Philippines in the Visayas and The WorldFish Center. Through wide-scale dissemination

of new milkfish technologies, the country can secure the long term viability of the sector, especially in the pre- and post- production chain. As new market segments of the industry developed such as: a) hatchery and nursery operation for fry and fingerlings (representing the pre-production linkages); and b) processing and value-adding activities (representing the post-harvest linkages), extension and dissemination of these technologies can offer an opportunity to helping the milkfish industry, especially the smaller stakeholders.

2. RATIONALE AND OBJECTIVES

The Milkfish Project focuses on the current structure of the industry by examining the development and changes in the production and processing technologies, and product demand, markets and institutions over the past decade. In particular it looks into the policy structure, the role of research and technology, and identification of parameters/variables that has enhanced and/or hindered technology adoption by the small-holder operators, e.g., farmers, traders and processors. Hence, the general objective of the project is to study the production, market and policy structures of the milkfish industry in the Philippines in order to identify the constraints and opportunities for the future growth of the industry with emphasis on the adoption and impact of technological development using case studies in small-scale hatchery/nursery, grow-out production and processing systems that can be transferred or replicated in other parts of the country. The specific objectives of the study are as follows:

1. Documentation of the evolution of the milkfish industry in the Philippines, including recent trends in policies, institutions, technology and trade.
2. Identify the policies, institutional and socioeconomic factors that has helped or hindered the adoption and uptake of various technologies and growth of the milkfish industry in the Philippines.

3. Examine the production, market (supply-demand requirement in domestic and international markets), institutional, macroeconomic factors affecting the performance of the milkfish industry in the country.
4. Assess the role of research and technology transfer in the development of the industry in the Philippines.
5. Develop profiles of production and post-harvest technologies for milkfish, and examine their social and economic viabilities and environmental sustainability.
6. Formulate an extension roadmap based on the results of the pilot-tested production and post-harvest technologies that were prioritized for poor and smallholder operators.

It is important to note that the particular thrust of this paper is focused only on objective #6. Specifically, it aims to present the results of the technological interventions implemented by the project by using pilot case studies in small-scale nursery, grow-out production and processing operations and provide strategies for wider-scale dissemination and implementation. The pilot case studies hope to present alternative scenarios that will serve as the basis for formulating a milkfish extension roadmap that contains strategies and recommendations for nationwide dissemination of small-scale milkfish technologies at the municipal and provincial levels. Specifically, the extension roadmap hopes to lead the way towards the promotion and development of the small-to-medium-scale production and processing sector of the milkfish industry.

Given the pro-poor focus of this study, the pilot case studies aimed to showcase production and post-harvest technologies that were prioritized by the project for smallholder operators. By targeting the small-scale and medium-scale producers/operators, the participation of the small milkfish producers and operators in the supply chain will be encouraged, thus

incorporating them in the production and marketing loop of the industry. This, in turn, will help increase the income of rural households. Similarly, production of milkfish in fresh and value-added forms will also increase, thus contributing to enhancing the food security objective of the country.

3. METHODOLOGY

To achieve the objectives of the Milkfish Project, tasks were divided into four components, namely: a) Policy and Socioeconomic Review and Identification of Constraints Component; b) Technology Review and Screening Component; c) Overall Framework and Baseline Information Component and d) Pilot Testing and Dissemination of Technology Component. The activities of these project components are interrelated and their respective outputs were jointly used as inputs to come up with strategies and recommendations to develop the small-scale milkfish industry. The conceptual framework of the project is shown in Figure 1.

The core of the Milkfish Project's activities (and the main topic tackled in this paper) is focused around the pilot-testing component, which was implemented by BFAR-NIFTDC. To support the activities of the SEAFDEC-AQD team in selecting technologies for pilot dissemination in the study areas, site visits and interview of prospective cooperators were undertaken by the NIFTDC team. Technologies being developed in the Center and those recommended by the SEAFDEC-AQD team were prioritized for pilot-scale transfer to the selected barangays/municipalities of the project.

3.1 Site Selection

The criteria used for selection of the pilot sites include the following: a) the study areas should have similar coast line for geographic homogeneity; b) poor coastal community belonging from 3rd to 6th class municipality to ensure that milkfish cooperators will have small-scale

operations; c) existence of infrastructure to support technology adoption; d) few interventions from government and private sectors to better isolate effects of the project interventions; e) receptiveness of the community to adoption of piloted technologies; and f) good peace and order situation in the area. The choice of the specific barangays as pilot sites of the project was done in consultation with the MAOs of the respective municipalities. The selected pilot sites for the project are: a) Barangay Dulao in the municipality of Aringay, La Union; b) Barangay Raois in the municipality of Sto. Tomas, La Union; c) Barangay Malacapas in the municipality of Dasol, Pangasinan and d) Barangay Nayom in the municipality of Infanta, Pangasinan.

Benchmark information on the study areas were gathered through baseline surveys of the milkfish producers and other residents in the identified four barangays in order to obtain a basis for future comparison of the likely effects of the project's technology interventions. Aside from the baseline surveys, benchmark information regarding the project sites were obtained through FGDs and KIs of barangay officials and fishpond/fish pen operators. Secondary information about the barangays/municipalities were also obtained from the Municipal Agriculturist Office and respective barangay officials.

3.2 Demo farms for Nursery and Grow-out Operations

Milkfish production trainings cover both fry nursery and grow-out operations. In the case of fry nursery training, farmers were taught better pond preparation, e.g., use of chemical fertilizer or organic manure for pond fertilization and liming in order to grow natural food for the fry. This practice has the potential to lower cost of production by reducing the use of commercial feeds. Through the promotion of the growth of naturally occurring planktons, filamentous algae and *lablab* in the pond, organic food can be made available which serves as an ideal alternative to formulated feeds.

On the other hand, the demo farms on feeding management under pond culture were established in NIFTDC in order for the milkfish farmers to have a better understanding of the importance of proper feeding management on the growth of milkfish stock and income. Two ponds were established side by side for this purpose. One of the demo ponds was implemented under a controlled feeding practice while the second demo pond was operated under an existing farmer's practice (i.e., wherein stock are fed ad libitum). Each pond was stocked with 900 milkfish fingerlings. Natural food and commercial feeds were used simultaneously. Amount of feed given for the milkfish in the experimental controlled-feeding pond depended on the average weight of the fish stock as recommended by SEAFDEC-AQD, i.e., 3.5% of body weight. On the other pond, feeding was based on the satiation of the fish stock. The effects of feeding practice on milkfish growth, survival rate, yield and income were monitored and compared.

Lastly, a new culture system demonstrated in this project was milkfish polyculture with shrimp under a pond environment. Incidentally, shrimp is one of the most popular and profitable polyculture species for milkfish since the practice allows better utilization of natural food due to their complimentary feed usage. In this case, milkfish can be reared as a primary or secondary crop depending on the interest and resources of the farmer.

In the project experiments, milkfish is treated as the major culture species while shrimp (*P. vannamei*) serves as a secondary crop. The project used two ponds for this experiment: one pond contained 900 milkfish fingerlings and 6,138 post larvae of *P. vannamei* which were fed with natural food and commercial feeds while the other pond was stocked with 8,000 pieces of PL 10 *P. vannamei* and was fed to satiation. The amount of feeds given to the stocks, as well as daily activities done in the pond, were monitored. The gathered data were analyzed to determine if *P. vannamei* is an effective polyculture species to milkfish by computing for the profitability

of milkfish farming with *P. vannamei* and comparing it to the profits gained from milkfish monoculture.

3.3 Extension of Milkfish Post-harvest Technologies

The SEAFDEC-AQD recommended milkfish deboning, smoking and other value adding activities for milkfish like “lumpiang shanghai” and bottling of milkfish to be piloted in the project sites. This intervention consisted of two activities. First activity is the conduct of training sessions for capacity building and second is the setting up of a barangay processing center. The barangay processing center, equipped with running water, screened processing area, freezers and various tools and utensils were set up by the project with the help of the local government in each study sites. Also, drum-type smokehouses for processing smoked milkfish were distributed to every barangay processing centers. Interested residents can avail of the facilities of the barangay processing center where standard fees were levied on the users to cover maintenance and operation costs.

The selection of cooperators for milkfish processing was facilitated by educational tours and orientation seminars. Participants of the study tour to fish processing establishments in Pangasinan, e.g. Anjo’s Farm and St. John Multi-purpose Cooperative Incorporated, were able to observe different methods of processing milkfish products from cleaning to packaging and storing. On the other hand, the orientation seminars included topics on milkfish processing methods, business planning and financing. As part of the training, the trainees were organized into business groups and each group drafted their own business plan. Details of the business plan which included lay-out of processing area, production flow, organizational set-up and duties/responsibilities of key personnel were discussed by the NIFTDC training team with the prospective cooperators.

4. RESULTS AND DISCUSSION

4.1 Milkfish Nursery Production

In the municipality of Aringay, selection of cooperators was concentrated in the vicinity of the lagoon that was not affected by subsidence brought about by the 1990 earthquake. A total of twelve farmers were selected as cooperators for the initial run of the pilot activity (Table 1). Their fishponds were assessed on the basis of pond size, susceptibility to flooding, accessibility to roads and water source, and ability of farmers to adopt the technology.

Orientation/training workshop on nursery production was conducted where each participant was encouraged to present their past experiences on their current pond management practice. During the training, the recommended technology protocol of SEAFDEC-AQD was presented by NIFTDC team with some slight modifications based on the following reasons. First, only available fishponds of selected farmer-cooperators can be utilized, hence it will be costly to re-design their fishponds based on the ideal design. Second, considering the limited resources of the cooperators, alternative inputs like chicken manure and teaseed were recommended in lieu of tobacco dust. Similarly, other inputs like lime, ammonium sulfate fertilizer and urea were not strictly imposed since some ponds are flood-prone and difficult to drain. Finally, adoption of a new technology often takes time for farmers to fully adopt hence adaptation (instead of blind adoption) of the recommended technology was deemed a better option.

The usual stocking density practiced in the area ranged from 30-60 per m². This intensive method of milkfish culture made the farmers dependent on commercial feeds since natural food is often not sufficient. The NIFTDC team recommended a stocking density of 30 pieces per m² in the pilot sites based on the shallow depth of the existing ponds and their less than ideal water quality.

To hasten technology dissemination, milkfish farmers were enticed to adopt the piloted nursery technology by giving them access to milkfish fries from BFAR-NIFTDC hatcheries at a discounted price. Based on the project's experience during the pilot testing experiments, this type of scheme proved to be more effective than the "stock now, pay later" scheme that was introduced in the initial runs of the experiment. Specifically, the "stock now, pay later" scheme resulted to mass default in loan payment, which the cooperators attributed to a variety of reasons ranging from high mortality of fingerlings to their inability to market the produced fingerlings. However, a deeper probe on the problem revealed that the cooperators felt that the milkfish fries that were given to them should have been free by virtue of other past projects with "dole-out" nature that were operated in their area and hence there was no need for them to pay for them. Therefore, to effectively implement future culture of milkfish fingerlings thru nursery technology, it must be made clear to the adopting farmers that what is being extended is the technology and not inputs. Nevertheless, helping the farmers to obtain microcredit to finance their initial operation will help boost the adoption of such technology.

The NIFTDC team regularly monitored the nursery projects. Participants were taught to keep records of their project daily activities and expenses (pond preparation, stocking density, harvest, etc.). Based on the results of the nursery case studies in the municipalities of Aringay and Dasol, farmers were able to earn additional incomes ranging from 1,000 to 50,000 PHP depending on the size of the nursery pond and stocking density (Table 1).

The harvested fingerlings were either sold to nearby farms or used as stock to own farms. A NIFTDC staff was always present during the harvesting of fingerlings. The actual schedule of harvest depended on the preferred size of fingerling and availability of buyers. The benefit of disseminating this type of technology in other milkfish growing areas is to promote steady

supply of milkfish fingerlings especially in localities that are far from private or public hatcheries. Similarly, the growing demand for larger milkfish fingerlings used for seeding mariculture cages and juveniles (used as tuna baits) both present good opportunities to develop this new segment of the milkfish market.

4.2 Milkfish Grow-out Culture

During the 3rd year of the project, four demo farms were established to demonstrate the growth performance of milkfish in different culture methods and to help the milkfish farmers better understand the importance of proper feeding management to the environment. As proposed by the SEAFDEC-AQD team, proper feeding management needs to be introduced to milkfish operators since most of them have a tendency to feed their stock ad libitum. This is especially true for those that have external financiers and do not have problem with feed supply. Such training intervention is expected to result to the reduction of both the feeding cost and the polluting effect of excess feeds.

Four ponds in NIFTDC were used in the experiments as follows: a) Pond #1 - Milkfish Polyculture with *P. vannamei*; b) Pond #2 - Monoculture of *P. vannamei*; c) Pond #3 - Milkfish with feed management and d) Pond #4 - Milkfish with ad libitum feeding. Each of the four ponds had an area of 1,500 m². All ponds were fertilized using teaseed before seeding. Also, Decis (an insecticide) was applied at 10 ml per pond to control predators. The demo farm experiment on milkfish polyculture was conducted for two production runs.

4.2.a Milkfish Polyculture with P. vannamei

In the milkfish polyculture with shrimp (pond #1), milkfish was the major species while shrimp (*P. vannamei*) served as a secondary crop which was expected to utilize the excess food and wastes from milkfish production. A control pond (pond #2) for shrimp monoculture was

established to compare its growth performance with that of polyculture with milkfish. Biometric data were gathered to determine if *P. vannamei* is an effective polyculture species to milkfish by computing for the profitability of milkfish farming with *P. vannamei* and comparing it to the profits gained from milkfish monoculture.

In the first run of the demo farms, pond #1 contained 900 milkfish fingerlings and 6,138 post larvae of *P. vannamei*. The stocks were fed with natural food for 7 days after stocking and were given commercial feeds onwards. The amount of feeds given was based on the body weight of milkfish. On the other hand, pond #2 was stocked with 8,000 pieces of PL 10 *P. vannamei* and was fed to satiation. The amounts of feeds given to the stocks as well as daily activities done in the pond were monitored and recorded.

Results of biometric sampling of milkfish polyculture and the shrimp monoculture for the first run of the demo ponds are presented in Tables 2, 3 and 4. For pond #1, after 53 days of culture, the average weight of milkfish increased to 38.1grams, 161.6 millimeter in length and 34.7 millimeter in width. Likewise, the average weight of shrimp also increased to 3.2 grams, 183.5mm in length and 9.3mm width after 42 days of culture. Mass mortality occurred on January 10, 2007. This could be attributed to the decrease in water level which led to detrimental reduction in dissolved oxygen. For pond #2, the average weight gain of shrimp was 13.70 grams after 79 days of culture period. The average length and width increased to 92.50 mm and 18.30 mm, respectively.

4.2.b Ad libitum feeding vs. controlled feeding

For the demo ponds on feeding management, two ponds were established side by side inside the NIFTDC compound. One of the demo ponds (pond #3) was implemented under a controlled feeding practice while the second demo pond (pond #4) was operated under an

existing farmer's practice (i.e., wherein stock are fed ad libitum). Note that the grow-out demo farms on feeding management could only be implemented under a pond environment since controlled water condition is important in the experiment (a condition which cannot be achieved under a pen or cage system).

Fifty three days after stocking, the average weight gain of milkfish in Pond #4 increased to 11.25 g (Table 4). The average length and width increased to 97.66 mm and 21.95 mm, respectively. For pond #3, the average weight of milkfish increased to 10.15 mg after fifty three days culture period (Table 5). Average length and width increased to 93.73 mm and 20.72 mm, respectively.

4.2.c Comparative Analysis of Different Treatments

Comparison of milkfish growth for the three treatments from November 2006 to January 2007 in terms of average weight in grams revealed a positive response for all the three experiments. But polyculture with shrimp yielded the best result (Figures 2, 3 and 4). The same trend was observed in the average length and width accumulation for the three treatments. Based on the calculated feed conversion ratio, milkfish polyculture yielded the best result, followed by milkfish with controlled feeding, *P. vannamei* monoculture, and milkfish ad libitum. This result shows the efficiency of feed consumption under the milkfish-shrimp polyculture.

Based on the cost and return analysis of one season cropping of milkfish polyculture with shrimp for a 1,500 m² pond resulted to a total net income of P15,635 (9,435 from milkfish + 6,200 from shrimp) vs. P9,435 for milkfish monoculture (Table 6). This is about 66% increase in income due to the addition of the shrimp crop.

Based on Table 7, the cost and return analysis of one season cropping for milkfish grow-out production with proper feed management, a 5% increase in net income was achieved through

controlled feeding vs. ad libitum use of feeds (P1,153.52 vs. P1,094.60, respectively). The increase in income was sourced through lower feed cost which was calculated to be 33% lower in the former (P337.90 vs. P253.98). These results lend support to the economic soundness of the piloted technologies.

4.3. Dissemination of Milkfish Processing and Value-added Milkfish Products

Training on processing milkfish into different product forms to widen its market base were undertaken to prepare the co-operators in their milkfish processing business. Deboned milkfish, which are often processed into smoked or marinated in garlic and vinegar, is the most popular value-added milkfish product. These products enjoy a good market domestically and in other countries with large overseas Filipino communities. The production of deboned milkfish have given rise to many other value-added products as trimmings and bits of the flesh that are invariably removed with the bones are processed into fishballs, *lumpiang Shanghai*, *quekiam* and *embutido*. The skin can also be fried and made into cracklings.

Aside from the training of cooperators, a training of trainers was also conducted by the NIFTDC team in order to sustain the technology dissemination in the country side when the Milkfish Project is over. This was attended by 22 Municipal Agriculturists and 1 representative from DA-BAR. The participants were taught how to debone, marinate and smoke milkfish. At the same time, value-addition in the form of milkfish lumpia making and bottling milkfish sardines were also extended. Other topics include good manufacturing practices, HACCP, product packaging and labeling. The participants were similarly toured to the different fish processing establishments in Dagupan City and San Fabian, Pangasinan. The training aimed to tap the participants as future trainers for wider replication of the project in other milkfish producing areas. Also, representatives from financial institutions were invited during the conduct

of seminars and trainings to discuss their requirements for accessing loans and financial assistance.

Based on the pilot study, the processing technology is best disseminated using the group or family approach. Trainees were organized into groups and each group was trained and assisted in drafting a business plan to help them initialize their business venture. The business plan helped the co-operators to obtain credit from rural microfinance institutions. This activity was particularly popular among women and elderly members of the households. Based on the results of the 333 co-operators on milkfish processing in the three pilot barangays, the average additional income that an individual can earn from this activity, ranges from 277 to 665 PHP per operation per day (Table 8).

It should be noted that the full support of the local government was instrumental to the success of the milkfish processing project in the pilot sites. The municipal government honed the potential of the project and made it a model livelihood program of the barangay. For example, in less than a year since the group of cooperators in Bgy. Malacapas started their production, the group were able to implement gradual improvements in their processing center. By sourcing funds from the barangay livelihood fund, the installation of screens for the door and windows of the processing center, installation of an electric water pump, procurement of a chest freezer, purchase of 2 electric fans and fabrication of a long work table was made possible. On the latter part of 2005, the Barangay Council provided an additional P8000 capitalization for the processing center. Similarly, the municipal Mayor regularly monitored the progress of the project and assisted in the marketing of the products (through a buy and sell scheme). This case best illustrated the potential and strength of the support of the local government in instrumenting success into the piloted technologies.

5. CONCLUSION AND RECOMMENDATION

Dissemination efforts in the area of technology adoption, especially in the form that can be easily taken up by farmers due to its adaptability and low capitalization requirement has a strong potential in enhancing the productivity performance and income of small-scale stakeholders. Milkfish farming presents a host of production opportunities as one moves along the marketing chain. The ability of the milkfish market to be highly segmented provided much flexibility in the industry to open new channels for its produce.

The benefits of extending new innovations can be inferred from the chain of activities that can be mobilized by the introduction of new milkfish technologies in the target areas, i.e., from fingerling production to grow-out culture and processing of harvested fish. These activities will serve as a strong catalyst for growth among the rural households as income benefits flow from the backward linkages of aquaculture such as production and marketing of fish seeds and aquafeeds to its forward linkages such as processing, value-addition, packaging, transport and storage which effectively reinvent the traditional way milkfish is consumed.

The attendant employment opportunities created by these new market segments can not discount the overall benefits of the dissemination activities. This goes without saying that higher milkfish productivity can help make food fish more affordable through lower prices. In addition, proper dissemination and adoption of small-scale milkfish technologies can be a tool in addressing the poverty alleviation mandate of the government especially in the countryside.

There are several issues and concerns that need to be addressed to come up with a sound extension delivery system that will promote the nationwide dissemination of small-scale milkfish technologies, namely: a) logistic issues, b) site selection, c) project monitoring and evaluation

and d) credit issues. The following discussion presents the extension strategies that are recommended by the study that will lead to the achievement of the overall goal of the project.

6.1 Recommendation on Addressing the Logistic Concerns in Extension Delivery System

As a consequence of the government devolution, the extension arm of the Bureau of Fisheries and Aquatic Resources (BFAR) was transferred to the local government units (LGUs). At present, BFAR has seven Regional Fisheries Training Centers (RFTCs) that are mandated to be the extension provider for the fishery sector. Aside from these Centers, there are other fisheries-related institutions at the national and local levels that are similarly tasked to undertake extension services in the countryside, e.g. state and local universities and colleges and other non-government fisheries agencies. Since different extension providers have different institutional mandates, the extension delivery system in the country is deemed fragmented with overlapping objectives.

Coupled with the highly politicized and under-staffed bureaucracy, such phenomena were often blamed to be the root cause of poorly coordinated and weak extension delivery system in the country. Note however that this observation is pervasive not only in the fisheries sector but in agriculture and forestry sectors as well.

To be more effective, the existing national extension programs needs to be strengthened both in terms of structure and management. More importantly, they need to be client-responsive. Given the current set-up of the local government, most Municipal Agricultural Officers (MAOs) generally cater to the needs of the agricultural and aquaculture farmers including fishermen and foresters. But since most MAOs are BS Agriculture graduates, this severely compromises their ability to address problems and issues of their clients outside the realm of crop agriculture, e.g, aquaculture and fisheries.

6.1.a Capacity building

Information campaigns and training of fisheries technicians and extension workers in milkfish producing areas should be conducted prior to dissemination at the grassroots level to build capacity of LGU officials on nursery and grow-out production (re: proper feeding management and polyculture with shrimp), as well as milkfish processing and value addition. The trainings for the LGU officials from the different milkfish producing areas can be conducted by the BFAR-NIFTDC.

6.1.b Training manuals for milkfish grow-out and processing

Several technology manuals that were developed by the BFAR-NIFTDC and SEAFDEC under the BAR-funded Milkfish project on the topics of small-scale milkfish grow-out, nursery and processing technologies (e.g., deboning of milkfish, smoking and marinating of deboned milkfish) can lend very well as resource materials for these trainings. These materials can also help standardize the existing manuals on the abovementioned technologies that are currently being used for training of milkfish farmers.

Moreover, the training manuals will be available in multi-language versions, i.e., English, Tagalog, Ilocano and Visayan to suit the requirements of the clientele. Such instruction materials will facilitate the transfer of the various milkfish technologies to the small-scale milkfish operators.

6.1.c Strengthening Linkages with Partners

The Extension Roadmap will harness the existing linkages and coordination between BFAR regional offices and fisheries training centers (RFTCs), state and local colleges and universities (SCUs and LUCs), local government units (LGUs) and other non-government fisheries agencies who are directly working with the local communities along the line of

technology transfer. Officers from these institutions shall form the core group of extension staff that can be tapped to train and disseminate the identified technologies to the farming households. Similarly, Technical Working Groups (TWGs) can be formed at the regional and provincial level to plan and implement training and extension of selected milkfish technologies to the rural communities. The TWGs can also initiate further translation of the training manuals into other local dialects that are not yet available.

Based on the logistical plan, regional BFAR Officers will be trained as trainers, who in turn will train the PAOs/MAOs and other LGU officials. These local government officers will be expected to extend the selected technology packages to the target clientele which includes small-scale milkfish growers, private individuals and potential investors. In this way, the capacity of the PAOs/MAOs and other government officers who are directly linked in extension service can be strengthened. At the same time, they will be better equipped to assist the farmers.

6.2 Recommendation on Addressing the Criteria for Site Selection

The major issue in site selection for the nationwide dissemination of the piloted milkfish technologies is setting the criteria that will help isolate the small-scale operators in milkfish production from their large-scale counterpart. Using BFAR definition, milkfish pond operation is considered small-scale if the operated area is <1 ha and investment is ≤ Php 50,000. However, in actual practice for milkfish aquaculture, very few ponds are less than one hectare. For example, based on 2002 records of the Fishpond Lease Section under the Fisheries Regulatory and Quarantine Division of BFAR, of the 4,935 FLA-holders in the country, only 2% (less than 100) of the holdings has an area of at most 1 hectare.

The over-riding criteria that will be used to identify the target areas for milkfish production intervention should include municipalities or barangays that are classified as class C

or D to ensure the existence of smallholder milkfish operators. Similarly, to broaden the potential coverage of the extension program among small holders, the benchmark FLA holding was increased to 10 hectares. About 55% of the total holdings fall under this category. The most number of holders consisting about 37% of the total holders are located in the following provinces: a) Iloilo (9%); b) Negros Occidental (7%); c) Aklan (5%); d) Quezon (5%); e) Capiiz (4%); f) Pangasinan (4%) and g) Cebu (3%).

Moreover, area where old production technology is still being practiced will also be a good candidate for site selection since farmers in these areas will benefit much to the introduction of new farming practices and processing technologies in milkfish production. On the other hand, the recent introduction of milkfish mariculture in the country also presents a fresh opportunity to include medium-scale operators in the scope of the roadmap. These operators often have access to capital and have high potential for more efficient production given appropriate extension services.

In the case of small-scale milkfish processing, the criteria for identifying target areas are being focused on milkfish areas with surplus production and high population of poor households that can supply the needed manpower. Aside from the suitability of small-scale processing technologies to the poorer members of the rural sector, especially its women members, there is also a greater scope for efficiency and productivity in this operation due to the hands-on nature of this enterprise. Based on the BFAR commodity roadmap for milkfish production (2004), the surplus production areas are concentrated in the following three regions contributing 85% of the country's total surplus production, namely: a) Region 6 in Western Visayas (32%); b) Region 3 in Central Luzon (27%) and Region 1 in Ilocos (26%). The remaining 15% of surplus production are found in the following regions, namely: a) Region 4A (CALABARZON, 7%); b) Region 12

(SOCCSKSARGEN, 5%); c) Region 9 (Zamboanga Peninsula, 2%); d) Region 11 (Davao, <1%); and e) Region 4b (MIMAROPA, <1%).

6.3 Recommendation on Monitoring and Evaluation (M&E) System

Monitoring and evaluation (M&E) of extension projects are usually under the responsibility of the LGUs who are tasked to implement them. M&E is an important aspect in measuring and documenting the changes that are associated to any technology intervention that is being implemented in the project sites, especially those that pertain to livelihood, employment and income of cooperators. Through the performance evaluation of the current adoptors of the disseminated technologies, the impact of these technologies can be assessed, thus giving the implementers relevant information regarding the continuation, expansion or curtailment of the intervention activities.

The beauty of extending simple and easily adaptable technologies to small-scale farmers and operators is that outcomes of the technology transfer can be realized readily in the very short term. For example, increased household income can be seen as an immediate impact of technology transfer. This success can be a motivating factor that will bring confidence to extension workers and the clientele themselves. Once this process is started, technology transfer can be self-reinforcing and sustainable.

Measuring the economic impacts of the disseminated milkfish technologies will be an important consideration in determining the success of the extension project. In the case of the nursery technology, benchmark measures of economic impacts can be set as follows: a) at least 10 operators in each target area will adopt the milkfish fingerling nursery technology and b) at least 10% increase in income will be realized by the adopting operators.

Moreover, in the case of the milkfish grow-out operators, the following impact benchmarks can be set as follows: a) at least 10% in the total number of grow-out operators will adopt recommended feeding management; b) at least 5% in the total number of grow-out operators will adopt milkfish polyculture with shrimp; c) at least 10% increase in income of grow-out operators due to adoption of recommended feeding management or milkfish polyculture with shrimp.

Finally, in the case of milkfish processing, the benchmark measures can be set as follows: a) at least 10-15 operators will adopt milkfish processing technologies in the target areas; and b) at least 5% increase in income of operators engaged in milkfish processing and value-adding.

Other criteria and measures for the M&E can also be identified for more holistic assessment such as: a) increase in skills and knowledge among extension workers; b) effect of the extended technology on aquatic resources and c) policy support of LGUs. The task of M&E can be relegated to independent agencies and institutions such as SUCs, NGOs and zonal centers of PCAMRRD. Transparency and accountability must be exercised in all undertakings. Focus should be made on building confidence in government capability especially at the local level to provide the needed extension services. As such, government personnel must be equipped with skills necessary to extend the new milkfish technologies and promote value adding activities that develop new products to enhance non-farm employment in the context of smallholder operation.

6.4 Recommendation on Credit Concerns

Credit is an important factor in raising investments for the adoption of new technologies and building human capital. However, despite the availability of agricultural loans that is mandated in the Agri-Agra Law (Presidential Decree 717), credit for small-scale agricultural production remained to have low priority from financing institutions. Worse is the case for

fisheries loans which only consists of 4% of the total agricultural loans in 2005. This can be traced to the inefficiencies in the rural banking system that stemmed from inconsistent policies related to agricultural loans like credit subsidies and loan targeting among others leading to inefficient resource allocation and low returns to their lending operations and poor loan repayment. As a result, there is a strong reliance for informal sources for credit access among the small-scale operators.

Access to credit plays a significant role in aquaculture production in terms of sourcing funds for farmer's need for inputs. With access to credit, the ability of the small-scale operators to invest in and adopt labor-saving, productivity-enhancing technologies will increase. As of May 2005, a number of government lending programs that cater to fisheries and fisheries-related projects have been identified. However, most of these are programs which provide loans/funds to rural financial institutions or lending conduits for relending to eligible sub-borrowers involved in aquaculture and fisheries. Below is a list of some government financing programs which milkfish operators/operator-cooperatives and milkfish processors/processor-cooperatives can tap for their business ventures, namely: a) QUEDANCOR Program for Self Reliant Team; b) QUEDANCOR Program for Agri-Fishery Small and Medium Enterprises; c) QUEDANCOR-Cooperative Development Authority Cooperative Financing Program; d) QUEDANCOR Program for Micro Entrepreneurs and e) Todo Unlad Program.

Aside from the government's lending programs, the small-scale milkfish operators can also tap some of the existing credit programs of microfinance institutions (MFIs). The MFIs or microfinance service providers give micro or small loans without collateral at market rates of interest to its clients. Since these loans are non-collateralized, the poor and low-income households can have access to much-needed funds to start, sustain or expand small

entrepreneurial activities. For the poor who are knowledgeable in milkfish processing, MFIs are excellent loan source for needed capital in starting or expanding a milkfish processing business.

MFIs are emerging as an efficient source of loans for small-scale operators. However, its outreach is limited to those areas where they have branches/offices. There is a need to expand their operations in areas with high magnitude of poor families and where access to microfinance is limited. A potential hindrance however, is inadequate capacity of the MFIs especially NGO-MFIs to lend to more clients, either going down-market to poorer households or going-up market to bigger microenterprises/small enterprises (Llanto, 2004). Government and donors should therefore develop a systematic and sustained program of providing technical assistance to the MFIs in various aspects such as financial management, human resource development, risk management, and loan delinquency management among others. Note however that credit alone does not work. Enhancing the availability and accessibility of credit should still be aptly supported by improved technology, infrastructures, extension services and markets to make financing efforts to the fisheries sector more effective and beneficial.

The success of technology dissemination lies heavily on the acceptability of the formulated strategies as a national policy/program of the Bureau of Fisheries and Aquatic Resources or as a GMA Program under the Department of Agriculture. As such, the extension strategies put forward by this study will attain the much needed support from the government in order for it to help small-scale operators in the milkfish industry. Much of the success also lies on the willingness and ability of the local government to implement the embodied extension strategies. At the same time, there is a need for the regional BFAR offices to monitor the implementation of the proposed extension strategies and the compliance to the attendant policies that will help push the adoption of these technologies.

Similarly, for more effective implementation, the recommended extension services require a unified approach so that efforts can be focused towards the continuous adoption and adaptation of technology transfer to changing conditions in the countryside. This calls for a systematic strategy of trainings, field visits and teamwork among stakeholders. Hence, it goes without saying that the responsibility for the success of the technology dissemination rests not only on the shoulders of the government extension officers. The milkfish farmers must also share in this responsibility through their cooperation and willingness to adopt the recommended technologies. Similarly, the ability of the local markets to absorb the increased output of the adopting farmers will spell the difference between success and failure of the dissemination process. For example, the nursery technology needs to be promoted near milkfish hatcheries in order to make the fries readily accessible. At the same time, the location of the nursery farms should be near the grow-out farmers who are the prospective buyers of the produced fingerlings. Without these market considerations, the extended technology may not be economically feasible and the dissemination efforts will just be futile.

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Republic Act No. 8550 The Philippine Fisheries Code of 1998.

Table 1. Production and income data on milkfish nursery technology

Name of Cooperator	Number stocked	Area (m ²)	Seeding Rate (pcs/m ²)	Yield (pcs)	Survival rate	Selling price (PhP)	Net income (PhP)
1 st run (Aringay)							
Freddie Algas	30,000	1,122	27	15,000	50	1.00	8,900
Delailah Lacadue	30,000	5,335	6	20,000	67	1.00	11,570
Dulao Fisherfolk's	30,000	3,300	9	23,000	76	1.30	22,790
Alex De Castro	15,000	1,763	8.5	3,000	20	1.00	960
Pedro Gatchalian	15,000	4,620	3.2	7,500	50	1.10	5,130
Laudencio Medriano	15,000	725	20.7	7,500	50	1.40	7,566
Rosalina Algas	15,000	5,141	2.9	5,000	33	1.00	1,440
Laudencio Yaris	15,000	2,052	7.3	6,500	43	1.00	2,180
Juanito Cotillon	15,000	936	16	7,000	47	1.20	4,320
Demtrio Yaris	15,000	240	31.2	6,000	40	1.30	4,390
Lodivico De Castro	15,000	3,160	4.7	7,000	47	1.00	2,870

2nd run (Aringay)

Name of Cooperator	Date Sold by BFAR	Number stocked	Area (m ²)	Yield (pcs)	Survival rate	Selling price per fry (PhP)	Net income (PHP)
Delailah Lacadue	March	31,000	5,330	23,000	74	1.00	18,175
	24 May 2	40,000		26,000	65	1.00	19,115
	June 16	50,000		31,000	62	1.00	23,180
Freddie Algas	April 5	30,000	1,330	9,800	32	1.00	4,946
	May 3	50,000		48,000	96	1.00	39,016
Juanito Cotillon	April 21	40,000	5,220	25,000	63	1.10	18,490
	May 9	50,000		20,000	40	1.00	11,940
Laudencio Medriano	April 19	45,000	1,450	25,000	55	1.00	17,120
	July 11	100,000		50,000	50	1.00	35,080
Alex De Castro	May 2	70,000	1,530	52,000	74	1.20	52,280
	June 29	60,000		42,000	70	1.30	32,980

3rd run (Dasol)

Name of Cooperator	Date Stocked	Number stocked	Area (m ²)	Yield (pcs)	Survival rate	Selling price per fry (PhP)	Net income (PHP)
Frieda Briz (Pond 1)	April 11, 2006	35,000	560	27,000	77	1.00	21,460
Frieda Briz (Pond 2)	April 18, 2006	70,000	2870	10,000	14	1.00	1,150

Table 2. Results of biometric sampling of milkfish polyculture with *P. vannamei*

Species Cultured	Date of Sampling	Samples (pcs)	Average Weight (g)	Average Length (mm)	Average Width (mm)
Milkfish	Nov. 20, 2006	10	1.49	51.00	10.90
	Dec. 12, 2006	10	3.79	83.80	16.40
	Jan. 12, 2007	10	38.10	161.60	34.70
Shrimp	Nov. 7, 2006	10	0.001	19.90	2.65
	Nov. 20, 2006	10	1.18	53.32	4.65
	Dec. 12, 2006	10	3.20	83.5	9.3

Table 3. Results of biometric sampling of *P. vannamei* (monoculture).

Date of sampling	Quantity of samples (pcs)	Average Weight (g)	Average Length (mm)	Average Width (mm)
Oct. 25	10	0.005	20.70	2.80
Nov. 20	10	3.02	81.40	7.67
Dec. 12	10	6.67	91.05	12.00
Jan.12, 2007	10	13.70	92.50	18.30

Table 4. Results of biometric sampling of milkfish (ad libitum)

Date of sampling	Quantity of Samples (pcs)	Average Weight (g)	Average Length (mm)	Average Width (mm)
Nov. 20, 2006	10	1.49	51.00	10.00
Dec. 12	10	7.50	92.8	19
Jan. 12, 2007	10	11.25	97.66	21.95

Table 5. Results of biometric sampling of milkfish (controlled feeding)

Date of sampling	Quantity of samples (pcs)	Average Weight (g)	Average Length (mm)	Average Width (mm)
Nov. 20, 2006	10	1.49	51.00	10.00
Dec. 12	10	3.70	73.10	15.10
Jan. 12, 2007	10	10.15	93.73	20.72

Table 6. Production and income data from trial experiments of milkfish Polyculture with shrimp

Treatment	Date of Stocking	Stocking Density	Area (m ²)	Yield (pcs)	Survival Rate	Selling Price (Php)	Net Income
Polyculture: Milkfish	Mar 21, 07	900	1,500	821	91%	<u>49kg@ 50/kg; 127</u>	9,435
P. vannamei	Mar 21, 07	6,200	1,500	3,100	50%	<u>@ 55/kg</u> 200	6,200
Monoculture P. vannamei	Mar 21, 07	8,000	1,500	6,000	75%	200	10,512
Ad libitum Milkfish	Nov 20, 06	900	1,500	875	97.20%	5	1,095
Control Milkfish	Nov 20, 06	900	1,500	870	97%	5	1,154

Table 7. Cost and return of milkfish grow-out production under varying feed management

Items	Ad libitum feeding	Controlled feeding
Cash Return		
Sales of Milkfish (Quantity x Price)	(for 875 pcs)	(for 870 pcs)
Total Returns	4,375.00	4,350.00
Cash Costs		
Milkfish Fingerlings (900 pcs. x P1.00/pc)	900.00	900.00
Pond rent	900.00	900.00
Feeds	337.90	253.98
Fertilizer	40.00	40.00
Organic Pesticide (1/2 sack teaseed@625/sack)	312.50	312.50
Decis R	50.00	50.00
Chicken Manure (1 sack @ 40/sack)	40.00	40.00
Labor (Caretaker)	300.00	300.00
Hired Labor	400.00	400.00
Total Cost	3,280.40	3,196.48
Net Return	1,094.60	1,153.52

Table 8. Production and income data on milkfish processing in Aringay, La Union

Month/year	Marinated Deboned Milkfish (Packs)	Milkfish Lumpia (packs)	Smoked Deboned (packs)	Net Income (per operation)
May-July 2005	230	144	67	4,496
August	90	102	21	2,118
September	31	2	2	379
October	20	-	-	274
November	30	-	-	310
December	13	-	30	481
January-April 2006	91	-	-	1,229
May	31	-	-	342.00
June	28	-	-	285.00
July	20	-	-	281.00
August	20	-	-	265.00
September	12	-	-	180.00
October	6	-	-	90.00
November	5	9	-	162.50

Dasol Pangasinan

May&June 2005	211	34	42	4,192.00
September	654	30	127	9,376.00
October	661	-	159	1,748.00
November	559	-	159	9,921.20
December	371	-	114	6,315.00
January 2006	425	-	117	5,562.50
February	725	43	226	12,895.00
March	466	-	133	10,245.00
April	552	-	164	9,664.00
May	390	98	-	8519.50
June	275	67	-	4779.00
July	397		108	5,686.00
August	348	35	95	5,414.00
September	140		259	3,868.00
October	244		187	6,222.00
November	116	10	65	1,916.00
December	87	31		1,862.00
January 2007	79	42		2,086.50
February	285	110		6,160.00
May	16	-	-	360.00
June	78	37	-	2,101.00

Infanta, Pangasinan

October 2006	37.5	120	-	1,025.00
November	20	62	-	372.00
December	42	110	-	947.00
January 2007	20	61	-	620.00
February	50	119	-	1,325.00
March	138	250	-	2,005.00
April	26	45	-	271.00

Figure 1. Conceptual framework of the Milkfish Project, 2004.

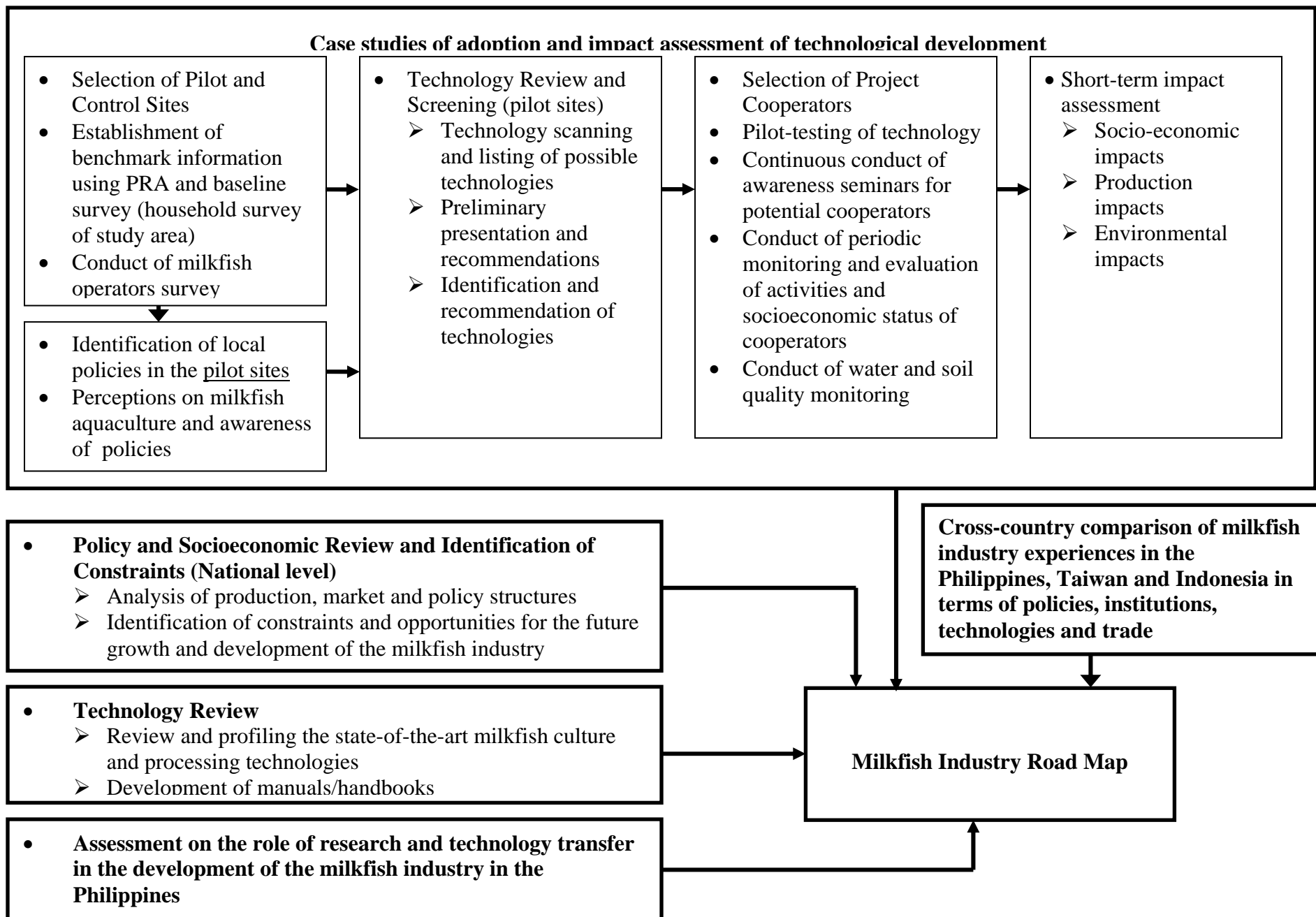


Figure 2. Comparison of average weight (g) of milkfish at different treatments

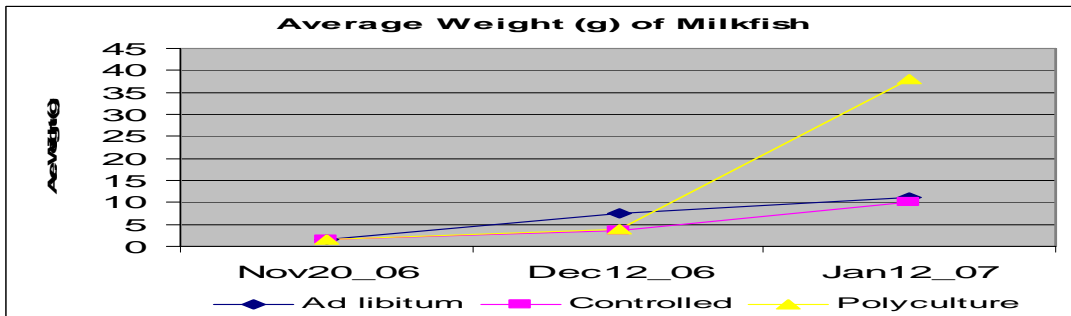


Figure 3. Comparison of average length (mm) of milkfish at different treatments

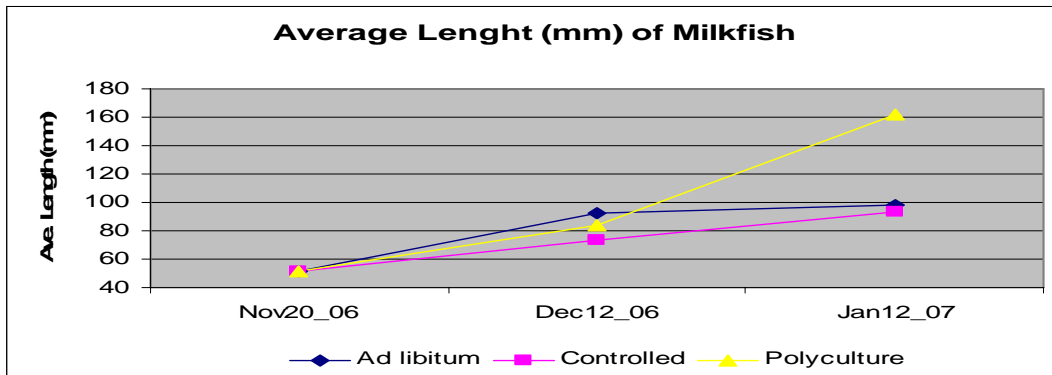


Figure 4. Comparison of average width (mm) of milkfish at different treatments

