PROJECT DOCUMENT

Program Categories: Departmental Programs
Project Title: Meeting Social and Economic Challenges in Aquaculture
Responsible Department: Aquaculture Department
Total Duration: 2016-2020
Funding Sources: AQD and JIRCAS
Estimated Budget for 2020: USD 114,940

1. INTRODUCTION

Growth of aquaculture in the Southeast Asian region is driven by the scientific and technological breakthroughs developed and adopted by receptive entrepreneurs and investors. However, the development of aquaculture in the region has brought and caused a number of unintended problematic scenarios, such as: (1) inequitable distribution of opportunities and benefits across adopters of aquaculture; (2) technology and production cost dualism among aquaculturists; (3) social conflicts and economic losses due to competing uses of resources for aquaculture and other purposes; and (4) high cost of rehabilitation of habitats affected by misuse of natural resources for aquaculture.

2. PROJECT

1.1 Goal /Overall Objectives

This program generally aims to develop and implement social and economic strategies in aquaculture and resource management to secure food and income through stakeholder collaboration. The main objective is to respond to the specific recommendations for meeting the social and economic challenges in aquaculture identified and adopted during the *ASEAN-SEAFDEC Fish for All Conference* in June 2011. These include: (a) prioritizing collaborative R&D in aquaculture in the region to have a clear regional assessment and understanding of the role of aquaculture in poverty alleviation and provide basis for policy formulation; (b) allocating R&D resources to address emerging issues on the impacts of climate change and global trade on aquaculture with emphasis on small-holder fish farmers; and (c) enhancing multi-agency collaboration, sharing of information and resources between and among SEAFDEC and its Member Countries and other organizations in addressing the common problems of alleviating the socioeconomic conditions of the poor sector of region.

1.2 Outcomes and Expected Outputs

For 2019, the main outcomes of the program are the following:

(1) Operationalization of the abalone and sandfish hatchery component of the Community-Based Resource Enhancement (CBRE) project in Brgy Molocaboc in Sagay Marine Reserve in Negros Occidental. However, the initial production runs need improvement.
(2) Capacitated fisherfolks in hatchery operations through demo-training and actual operations being conducted by selected members of the Molocaboc Sea Ranchers Association (MOSRA).
(3) Preliminary consultation for turn-over of the CBRE release site and hatchery for abalone and sandfish has been initiated with beneficiaries namely, the MOSRA and local government of Sagay City and Barangay Molocaboc.

(4) Replication of the CBRE project in Lahuy Islands in Caramoan, Camarines Sur have been initiated through site assessment, baseline sampling of wild abalone and sandfish, consultation with fisherfolks, traders and local government stakeholders.
(5) Required data for determining an economically efficient stocking density in mangrove crab hatchery operations have been identified and needs to be collected prior to application bioeconomic modeling methods.
(6) Seven Integrated Multi-Trophic Aquaculture (IMTA) milkfish mariculture runs implemented through community-based approach have been completed since 2015. The data provided basis for socioeconomic and environmental evaluation of IMTA runs during summer and rainy seasons. Profitability is primarily constrained by high production cost due to high feeding rate and cost of feeds, and unrecovered proportion of stocks due to some factors such as mortality, probable poaching and escapees. Monitoring of environmental parameters such as organic matter and other pollutants does not indicate significant deterioration. Harvest of co-cultured sandfish and seaweeds needs improvement.
(7) Characterization and levels of improvement of sustainable livelihood assets were determined from the community-based IMTA milkfish mariculture in Guimaras province. The stakeholders assessed that human, financial, environmental and social livelihood assets improved significantly during the project duration from 2015 to 2018. Physical livelihood assets such as culture pens and fish culture equipment did not improve significantly because the limited mariculture pens of the project can only accommodate a few of the many fisherfolk stakeholders.

1.3 Project Description/Framework (*for total duration of the project*)

Activity 1: *Community-Based Integrated Production of abalone* Haliotis asinina *and sea cucumber* Holothuria scabra *through culture, sea ranching and stock enhancement*

This is a five-year study that aims to conduct community-based integrated production abalone and sandfish through sea-ranching and stock enhancement using locally produced hatchery-bred seeds to provide sustainable sources of income for coastal dwellers in remote island communities while maintaining the health of the intertidal and reef environment. The study also aims to develop strategies towards governance of coastal resources in the Philippines and similar areas in Member Countries in Southeast Asia.

Activity 2: *Selecting optimal stocking density of mangrove crab* Scylla serrata *hatchery production in different seasons: A decision theory approach*

The study aims to select the optimal stocking density of mangrove crab (*Scylla serrata*) hatchery production across seasons. Specifically, it aims to identify the optimal mangrove crab stocking density in dry and wet seasons, taking into account water temperature uncertainty within them and the risk preferences of the producer or farm decision-maker. It will also determine the stocking density with the optimum economic yield to select in each season. All data will be evaluate using decision theory approach which integrate the bioeconomic model of the mangrove crab hatchery production.

Activity 3: *Community-Managed Small-holder IMTA Milkfish Mariculture and Value-adding in Guimaras, Philippines*

The project aims to develop technologies for sustainable aquatic production in harmony with tropical system. It will also test the economic and environmental efficiency of improved IMTA systems for milkfish cultured in marine pens, together with other high-value aquatic organisms such as sandfish, *Holothuria scabra*, and seaweeds, *Kappaphycus* sp.

3. PROGRESS/ACHIEVEMENTS OF ACTIVITIES IN THE YEAR 2019

Project/Activity Title	Duration	Remarks
Abalone and sea cucumber Community-Based Integrated Production of abalone *Haliotis asinina* and sea cucumber *Holothuria scabra* through culture, sea ranching and stock enhancement Results from this study showed continuing progress of stock enhancement of abalone and sandfish. This year, the project had: 1) operationalized the on-site abalone and sandfish hatchery in Brgy. Molocaboc in Sagay Marine Reserve in Negros Occidental; 2) started the replication of the project in Lahuy Islands in Caramoan, Camarines Sur; and 3) successfully capacitated fisherfolks in hatchery operations. Preliminary turnover to beneficiaries were also initiated. Monthly monitoring of abalone in Dacu. the bigger islet in Molocaboc and one of the two release sites for this study, recorded catch per unit effort (CPUE, 1-hour fishing effort with 3 divers) at >200 individuals. Since March 2018, all samples caught were untagged abalones indicating spill-overs. Mean shell length (SL), body weight (BW) and body mass index (BMI) are declining over time due to increasing number of small-sized abalone spill-overs. Following the abalone catch size ordinance promulgated through this project, regulated harvesting of individuals >6 cm SL inside the release site continue during monthly sampling and occasionally as determined by the Molocaboc Sea Ranchers Association (MOSRA) and as needed to replenish organizational funds. Meanwhile, sandfish monitoring in Dacu and Diut, another islet and release site for the study, showed that average growth rates were higher in Diut than in Dacu. However, recapture rate is better in Dacu than in Diut where no sandfish were recovered in one of the pens for two consecutive sampling periods. This indicated low level of participation of MOSRA members and guarding of release site is problematic in Diut than in Dacu. Hence, series of meetings to sustain participation and demo-training on hatchery operations are being done to develop nurturing skills relevant to seed production for stock enhancement. In the long-run, it tames the hunting attitude that is detrimental to the sustainability of aquatic resources and environment. Freeze-drying (FD) trials for abalone was done to explore better marketing options. Preliminary results showed that freeze drying for 24 hours reduced moisture content (MC) 2.06% while 8 hours reduced MC to 26.85%. For both cases, salmonella and coliform were observed in the samples at levels that can be eliminated by cooking. Water activity test showed same yeast and molds for those freeze-dried at 24, 12 and 8. Only 58 and 66% of the original weight of the abalone flesh was recovered after rehydration for 52 and 96 hours, respectively. The operations of the newly-constructed, solar-powered abalone hatchery began with four spawning from 19-23 July 2019 with		

variable results. Fertilized egg production ranged from 50,000 to 850,000 harvested and 20% of which formed into larvae. Another spawning and hatching runs took place in the week of 20 September. Preliminary sampling showed some larval settlement. However, larval settlement rate needs improvement and more diatoms are needed. In preparation of the end of project in December 2019, meetings between stakeholders in the tri-party collaboration were held to discuss the turn-over of the project and facilities to the MOSRA and the local government of Sagay City and Brgy. Molocaboc who have official jurisdiction over the location of the project. The activities to replicate the CBRE in two sites such as in Molocaboc Diut in Sagay Marine Reserve and in the Lahuy Island Group in Caramoan, Camarines Sur province continues. The monitoring of the released sandfish continues to show the potential of rebuilding stocks in Diut. However, there were incidents of unrecovered sandfish in pens due perhaps to poaching. Hence, meetings were held with fisherfolks to address such problems. The replication in Caramoan was determined to focus on resource management instead of enhancement of juveniles because abalone stocks were still available in the area		
Mangrove crab Selecting optimal stocking density of mangrove crab *Scylla serrata* hatchery production in different seasons: A decision theory approach Relevant literature on mangrove crab life cycle, production, and bio-economic analysis were reviewed for this study. Findings from this study have significant implications to the multi-million mangrove crab aquaculture industry. The existing mangrove crab hatchery protocols were reviewed and water samples were collected daily with AQD hatchery staff since 1 April 2019. Preliminary results of the crab instar harvest on 16 April 2019 showed the completed larval cycle (from early to crab instar) with stocking density of 60 zoea/L, the observed average ammonia level at (0.88 ppm) is less than the normal range of ≤ 1ppm. Nitrite level at 0.29 ppm was higher than normal at ≤0.1ppm. Despite its quite high reading, crab larvae were able to tolerate. Temperature (29.9°C) and dissolved oxygen (4.91) however, was within the optimum level (27-30°C and >4ppm, respectively). Crab larvae survival is 1% which is reasonably satisfactory compared to the 80 zoeas per liter survival of 0.37%. These initial results indicate that mangrove larvae perhaps have high tolerance of nitrogen loading in the environment that may be associated with increasing anthropogenic activities and climate changes. These environmental conditions may have significant implications to the multi-million mangrove crab aquaculture industry. The study, therefore, requires further data collection and analyses for conclusive results. The next batch of stocking is pending and waiting for breeders to spawn since the last hatched eggs were discarded due to poor quality.		

Milkfish Community-Managed Small-holder IMTA Milkfish Mariculture and Value-adding in Guimaras, Philippines This study continues to implement the IMTA of milkfish, *Chanos chanos*, together with sandfish, *Holothuria scabra*, and seaweeds, *Kappaphycus* sp. in collaboration with local fisherfolks, women and local government in Barangay Pandaraonan in the municipality of Nueva Valencia in Guimaras province. Results for the seventh IMTA milkfish run (April to August 2019) showed 92.8% harvest, 0.8 mortality and 6.4% uncounted. Meanwhile, interviews with 52 stakeholders were conducted from December 2018 to February 2019 for an inter-temporal analysis of sustainable livelihood assets (SLA) relevant to the implementation of community-managed IMTA in rural coastal communities. The analysis showed improvement of four out of five categories of livelihood assets such as human, environmental, financial and social assets associated with this IMTA project. Physical livelihood assets (such as pens, cages, fish value-adding equipment) did not significantly increase as perceived fisherfolk stakeholders. These physical assets are dissipated and are thus limited for the many project beneficiaries. Therefore, there is the need to organize more and bigger collaborative projects with emphasis on sustainable livelihood asset development to create significant impacts in coastal communities. Seven IMTA milkfish mariculture runs implemented through community-based approach have been completed since 2015. The data from these runs became the basis for socioeconomic and environmental (summer and rainy seasons) evaluation of IMTA runs. Findings show that profitability was primarily constrained by high production cost due to high feeding rate and cost of feeds. The unrecovered proportion of stocks due to some factors such as mortality, probable poaching and escapees also caused the constraints. Monitoring of environmental parameters such as organic matter and other pollutants does not indicate significant deterioration. Harvest of co-cultured sandfish and seaweeds needs improvement. Characterization and levels of improvement of sustainable livelihood assets were determined from the community-based IMTA milkfish mariculture in Guimaras province. The stakeholders assessed that human, financial, environmental and social livelihood assets improved significantly during the project duration from 2015 to 2018. Physical livelihood assets such as culture pens and fish culture equipment did not improve significantly because the limited mariculture pens of the project can only accommodate a few fisherfolk stakeholders.		

4. PROPOSED FUTURE ACTIVITIES FOR THE YEAR 2020

4.1 Planning of the Project Activities

Project/Activity Title	Duration	Remarks
Continuation of study "Selecting optimal stocking density of mangrove crab *Scylla serrata* hatchery production in different seasons: A decision theory approach" The study will continue to be implemented when required data set (*i.e.* salinity, temperature, dissolved oxygen, ammonia and nitrite level, etc.) is completed. For the remaining months until December 2019, it was suggested that: (1) a template of data needs be provided to the AQD hatchery facility operators to guide data collection; (2) hypothetical data be combined with available data to be used in the bioeconomic model in order to come up with sample results that will demonstrate the utility of the model; and (3) recommend that budget be provided to hatchery facilities to fund required laboratory analysis. This sample bioeconomic model aims to motivate other researchers in AQD hatchery facilities to collect the needed data for modeling the optimal stocking density across seasons.		
A study on "Developing Institutions and Governance Policies for the Adoption of Stock Enhancement" is being proposed. The study aims to review and evaluate existing fisheries and aquaculture policies relevant to fisheries management; formulate policies to mobilize government support for community-based stock enhancement using hatchery-reared seeds; and recommend coastal tenurial arrangements to benefit fishing communities in the Philippines and the SEA Region with similar circumstances. Activities for 2020-2021: (1) Review existing policies and sectoral statistics that are relevant to the role of aquaculture (especially hatcheries and nurseries) in fisheries management; (2) Conduct dialogues with stakeholders to gather data for the formulation of policies for implementation of stock enhancement; and (3) Publish policy notes for promoting support to aquaculture and stock enhancement.	**2020-2021**	
Another study on sandfish will be proposed with funding from ACIAR	**2020**	

4.2 Expected Outcomes/Outputs

For 2020, the program will aim to address one of its main objective and that is to enable mechanisms and institutions to encourage the adoption of better aquaculture practices. Especially with the newly proposed study on *"Developing Institutions and Governance Policies for the Adoption of Stock Enhancement"*, with emphasis on the important role of aquaculture seed production technologies to support rehabilitation of fisheries through stock enhancement.