



PROJECT DOCUMENT

Program Categories: Departmental Programs
Project Title: Healthy and Wholesome Aquaculture
Responsible Department: Aquaculture Department
Total Duration: 2016-2020
Funding Sources: AQD
Estimated Budget for 2020: USD 663,443

1. INTRODUCTION

The concept of healthy and wholesome aquaculture is an integral component in improving and sustaining aquaculture production to provide the protein needs of an escalating human population. Research and development efforts in aquaculture have resulted in phenomenal growth of the sector in the last four decades, but more problems need to be studied and solved to attain significant improvements and assure sustainability for future generations in the face of many challenges posed by ecological, economic, and climatic changes, among others, happening in our world today.

This program has two main components: fish health and nutrition and feed. Fish health concentrates on disease diagnosis, control, monitoring and surveillance of aquatic animals; and environmental integrity, certification, and food safety. While nutrition and feed component conducts studies to address some problem and need areas to sustain the production of aquaculture products in the region.

2. PROJECT

1.1 Goal /Overall Objectives

Fish health component aims to improve aquaculture production through innovations in nutrition and feeding and fish health management in aquaculture and in maintaining the environmental integrity of aquaculture systems.

Nutrition and feed component aims to (a) find effective alternative protein sources to fish meal in dietary formulations; (b) to determine specific nutrients that enhances growth performances; and (c) to promote practices and strategies to improve production.

1.2 Outcomes and Expected Outputs

Fish health component is expected to:

- (1) promotion of a the wider use of conventional diagnostic as well as new methods especially for newly reported, emerging diseases;
- (2) finding an effective alternative safe drugs/chemicals (including natural products) to manage aquaculture diseases in lieu of harmful chemicals and drugs which have been discouraged or banned for use due to quality and safety issues;
- (3) re-education of stakeholders and develop the capability of fish health specialists on fish disease diagnosis using gross clinical examination and bacteriology, mycology, parasitology and histopathology techniques;
- (4) enhancement of the stakeholders and fish health specialists' understanding and interpretation of molecular diagnostic techniques and to develop healthy broodstock through pathogen exclusion; and
- (5) promotion of the group implementation of BMP/GAP and certification of small-scale farmers in the region and incorporate FAO Technical Guidelines to Aquaculture Certification into national aquaculture certification schemes and development of regional standards as well as promotion of global standard for responsible supply certification system

For 2019, nutrition and feed component conducted research studies which are aligned to the objectives under the program. For the high value species pompano (*Trachinotus blochii*), the effective level of spray dried hemoglobin as alternative protein source in dietary formulation will be known and the requirement for some essential amino acids. Also, the response of tiger shrimp will be determined when fed different dietary levels of the algae, *Chaetomorpha*, as fermented, unfermented or as a fresh meal. The culture of hatchery-bred *Penaeus indicus* in ponds would yield information on the effectivity of using a feed formulated for low value fish species.

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

Fish health component

Activity 1: *Detection, quantification, and viability of Tilapia Lake Virus (TiLV) in pond soil and water as influenced by water quality parameters and culture management*

The study detects and quantifies TiLV in pond soil, water, and fish samples using quantitative reverse transcription PCR (qRT-PCR). TiLV risk and protective factors will be identified by correlating water quality parameters (temperature, dissolved oxygen, pH, ammonia, transparency, water depth, salinity) with TiLV loads in pond soil/water/ fish samples.

Activity 2: *Efficacy of different therapeutants against Caligus sp. infestation in tropical fish under laboratory conditions*

The study evaluates the efficacy and determines the effective dose of different chemotherapeutants (emamectin benzoate, hydrogen peroxide and onion) against pre-adult and adult sea lice in pompano.

Activity 3: *Production of Penaeus vannamei using Biofloc System with sludge removal facility (SRF) to demonstrate the productivity of old earthen ponds during the wet season*

The study runs for 18 months and demonstrates the production of *Penaeus vannamei* using Biofloc System with sludge removal facility in old earthen brackishwater ponds during the wet season, and illustrates the economic benefits of using the system.

Activity 4: *Safeguarding the future of the Seaweed Industry of the Philippines: Disease and Pest Detection*

The study identifies the key diagnostic tools (detection protocols and molecular diagnostic tools) for yield-limiting seaweed diseases and pests (e.g. epiphytes and endophytes) associated with cultivation sites and the wider environment; and compiles a central open access database and national biobanks leading to an open access, digital 'Atlas' (Shore, DAPS).

Nutrition and feed component

Activity 5: *Quantitative amino acid requirements of pompano (Trachinotus blochii)*

The requirement for essential amino acids of a high value aquaculture species was conducted. The quantitative requirement of pompano, *Trachinotus blochii* for leucine, isoleucine and histidine was started this year. Test diets have been formulated to contain different levels of the specific amino acid. Feeding trials are on-going.

Activity 6: *Spray dried hemoglobin powder meal as an alternative protein source in pompano diets*

Spray dried hemoglobin powder meal is a good source of protein. This was initially used in the formulation for grouper diet as an alternative protein source. The experimental fish was unavailable and with unpredictable production, pompano *Trachinotus blochii*, was used

instead. The study will determine the proximate, amino acid, and fatty acid composition of hemoglobin meal as well as determine the digestibility of hemoglobin meal in a carnivorous fish. It will be followed by an efficacy evaluation of the meal when used as an ingredient in pompano diets. It will be evaluation in terms of performance parameters, feed efficiency, and comparative body composition (amino acid, proximate, and fatty acid profile).

Activity 7: Evaluation of unfermented, fermented and live green macroalgae Chaetomorpha linum as food source for farmed Penaeus monodon

The use of *Chaetomorpha* seaweed as food source, either through inclusion in formulated feeds or by direct feeding through co-culture system, can potentially benefit culture shrimps and possibly other farmed aquatic species. The study will optimize the fermentation protocol of *Chaetomorpha* meal. Unfermented *Chaetomorpha* meal will also be fed as diet to shrimp and tilapia, and milkfish juveniles hence, this study will determine the animal's survival and growth parameters. The study will also evaluate and estimate the nutrient digestibility of the meal among the aforementioned commodities.

Activity 8: Hatchery production and semi-intensive pond culture of Penaeus indicus

The hatchery production and semi-intensive pond culture of *Penaeus indicus* were conducted with the aim to compare growth using *P. indicus* feeds (34-40%) and low-cost tilapia feeds (28-35%) and to demonstrate the profitability of *P. indicus* semi-intensive pond culture.

3. PROGRESS/ACHIEVEMENTS OF ACTIVITIES IN THE YEAR 2019

Project/Activity Title	Duration	Remarks
Fish health component		
<p>Tilapia Detection, quantification, and viability of Tilapia Lake Virus (TiLV) in pond soil and water as influenced by water quality parameters and culture management</p> <p>A total of 1,541 tilapia samples for TiLV detection were collected from various farms in Taal Lake, Laguna de Bay, Pampanga and Calauan, Laguna for Tilapia from May 2019 to July 2019. Eleven of the samples came from a cage with previously observed mortalities. Clinical signs observed in tilapia samples are erratic swimming, bilateral exophthalmia, enlarged spleen, pus in eyes, brain erosion and degradation, hemorrhages on the skin and base of pectoral and dorsal fin, bloated abdomen and ascites. <i>Streptococcus</i> sp. and <i>Vibrio</i> sp. were isolated from the fish samples.</p>		
<p>Pompano Efficacy of different therapeutants against <i>Caligus</i> sp. infestation in tropical fish under laboratory conditions</p> <p>A study was conducted to evaluate the efficacy and determine the effective dose of different chemotherapeutants (emamectin benzoate, hydrogen peroxide, and onion) against pre-adult and adult sea lice in pompano under laboratory conditions.</p> <p><i>Caligus</i> sp. were exposed to different concentrations (0, 25, 50, 100, 200, 400, 800 ppb) of emamectin benzoate (EMB). Preliminary results showed that 400 and 800 ppb of EMB were effective against the parasite.</p>		
<p>Whiteleg shrimp Production of <i>Penaeus vannamei</i> using Biofloc System with sludge removal facility (SRF) to demonstrate the productivity of old earthen ponds during the wet season</p>		

<p><i>P. vannamei</i> were cultured in two ponds, using biofloc system with sludge removal facility and fed with commercial pellet. Commercial probiotics were used during water culture and during culture. At DOC 42, average body weight is 7.77 g; survival rate is 91.15%.</p>																						
<p>Seaweed Safeguarding the future of the Seaweed Industry of the Philippines: Disease and Pest Detection</p> <p>A sentinel farm was identified and is located in Brgy. Tiabas, San Dionisio, Iloilo. Environmental parameters monitoring and monthly biomass sampling were done.</p> <p>Seaweed, <i>Kappaphycus striatus</i>, sampling was done in three sites in Zamboanga, namely: Layag-layag, Tigtabon, and Arena Blanco. Occurrence of disease and pests (epiphytes and ice-ice) were monitored during sampling. Occurrence (%) of disease or pest during sampling is presented in the table below.</p> <table border="1" data-bbox="193 712 963 1003"> <thead> <tr> <th>Disease/pest occurrence</th> <th>Layag-layag</th> <th>Tigtabon</th> <th>Arena Blanco</th> </tr> </thead> <tbody> <tr> <td>endophytes</td> <td>3.0</td> <td>3.6</td> <td>11.2</td> </tr> <tr> <td>ice-ice</td> <td>0</td> <td>0.4</td> <td>5</td> </tr> <tr> <td>macrophyte (Ulva)</td> <td>0</td> <td>7.7</td> <td>0.8</td> </tr> <tr> <td>red seaweed</td> <td>0</td> <td>1.2</td> <td>0</td> </tr> </tbody> </table>	Disease/pest occurrence	Layag-layag	Tigtabon	Arena Blanco	endophytes	3.0	3.6	11.2	ice-ice	0	0.4	5	macrophyte (Ulva)	0	7.7	0.8	red seaweed	0	1.2	0		
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Nutrition and feeds component																						
<p>Pompano Quantitative amino acid requirements of pompano <i>Trachinotus blochii</i></p> <p>The test to quantify the requirements of pompano for leucine, isoleucine and histidine started this year. Test diets have been formulated to contain different levels of the specific amino acid. Feeding trials is currently on-going. This project will take about two years as amino acid studies needed longer period to undertake.</p>																						
<p>Pompano Spray dried hemoglobin powder meal as an alternative protein source in pompano diets</p> <p>Pompano was also used as experimental fish to test if <i>spray dried hemoglobin powder meal</i> can be a good source of protein. This was previously used as protein source for grouper but due to the unpredictability of its production, researchers opted to use pompano. A growth experiment using spray dried hemoglobin for pompano was conducted for 90 days. Results were expected to be reported at the end of 2019.</p>																						
<p>Tiger shrimp, milkfish, and tilapia Evaluation of unfermented, fermented and live green macroalgae <i>Chaetomorpha linum</i> as food source for farmed <i>Penaeus monodon</i></p> <p>Survival and growth of tiger shrimp (<i>Penaeus monodon</i>) juveniles fed with diets containing unfermented <i>Chaetomorpha</i> meal was completed. Growth in terms of %WG and SGR of shrimps fed 0 to 10% inclusion remained comparable up to 120 DOC (days of culture) indicating that the inclusion of unfermented <i>Chaetomorpha</i> meal of up to 10% does not adversely affect shrimp growth. The experiment on Apparent</p>																						

<p>Nutrient Digestibility of <i>Chaetomorpha</i> in shrimp is on-going. A control diet (CD) as well as two reference diets (RFs) were formulated.</p> <p>The algae <i>Chaetomorpha</i> is about 15% crude protein which can be used as feed ingredient after fermentation as it would enhance its levels of nutrients. The protocol on optimization was completed. Partial counts indicated that although the highest total number of particles (TNP) at 1.83 x 10⁸ particles/mL was produced using an enzyme concentration of 750 µL per 100 mL base material and incubation period of 60 min, lower concentrations can be effective as well. Final interpretation of the results will be presented after the completion of the count.</p> <p>The efficacy of unfermented <i>Chaetomorpha</i> meal for other species was also conducted by incorporating this material in diets for juvenile tilapia and milkfish. The feeding experiment on milkfish is on-going.</p>		
<p>Indian white prawn Hatchery production and semi-intensive pond culture of <i>Penaeus indicus</i></p> <p>Feed is an important component in the production of <i>Penaeus indicus</i> in pond as feeding with a feed formulated for a low value fish might increase its production.</p> <p>The hatchery production and semi-intensive pond culture of <i>Penaeus indicus</i> were conducted with the aim to compare growth using <i>P. indicus</i> feeds (34-40%) and low-cost tilapia feeds (28-35%) and to demonstrate the profitability of <i>P. indicus</i> semi-intensive pond culture.</p> <p>Stocking of PL20 was done in four ponds with biosecurity implemented in the ponds and its surrounding area. Shrimp and water samples are regularly analyzed while water parameters are monitored regularly. Shrimp length and weight were recorded from samples at DOC 30, 45 and 60.</p>		

4. PROPOSED FUTURE ACTIVITIES FOR THE YEAR 2020

4.1 Planning of the Project Activities

Project/Activity Title	Duration	Remarks
Fish health component		
<p>Tilapia The study on TiLV will continue in 2020 with genomic sequencing and histopathological studies as well as tilapia sampling.</p>		
<p>Caligus sp. Experiments on the toxicity test of EMB, onion, and hydrogen peroxide against sea lice in pompano will continue. Furthermore, the life cycle of <i>Lepeophtheirus spinifer</i> (another genus of sea lice) will be conducted upon the availability of these parasites</p>		
<p>Whiteleg shrimp The study will continue in 2020 and the activities will be determined depending on the results of the present experiment</p>		
<p>Seaweeds Sentinel farm sampling and monitoring will be continued until June 2020. Field sampling in Palawan, Philippines will also be conducted as well as molecular identification and histological analysis of epiphytes.</p>		
<p>New studies The following studies will be proposed for 2020: (a) Quantitative and qualitative analyses of the bacterial microbiota of catfish (<i>Clarias macrocephalus</i>) cultured in</p>		

<p>earthen ponds as a tool for investigating emerging and re-emerging diseases of catfish in the Philippines – the study will address the concern on disease affecting catfish as identified by the Quality Seed program</p> <p>(b) Studies on the virulence factors of the Philippine strains of <i>Streptococcus</i> spp. and their potential application for vaccine development against streptococcal infection in tilapia and other susceptible fish species – this study will address the concern on Streptococcal infection affecting finfishes especially grouper which has been identified through commodity meeting on marine fish</p> <p>(c) Molecular studies on seaweeds</p> <p>(d) Antimicrobial resistance study on bacteria from shrimp and its environment – the study will be done as an update of a 1997 study by AQD</p>		
Nutrition and feed component		
<p>Tiger shrimp, milkfish, and tilapia</p> <p>Confirmatory runs be conducted during the first half of the year in order to have ample time to analyze results or to conduct another run when necessary.</p>	1 year	Side studies will be conducted to achieve firm results and conclusions
Consider proposing more studies on soybean meal as fish meal replacement	1 year	

4.2 Expected Outcomes/Outputs

The experiments conducted on different species are significant in the sustainability of aquaculture production in the region. However, an increased number of studies under the program objectives would contribute more to the overall thrust.