DOST Form 2 (for Basic/Applied Research)
DETAILED RESEARCH & DEVELOPMENT PROJECT PROPOSAL

(1) PROJECT PROFILE
Program Title: GIA
Project Title: **Golden Apple Snail** (Pomecea *caniculata*) **and Telescope Snail** (Telescopium *telescopium*) **as feed sources for Tiger Lobster** (Panulirus *ornatus)* **culture in the Municipality of Dumaran, Palawan**

Project Leader/Sex: **MR. ARIEL M. MAGBANUA**
Project Duration (number of months): **1 year**
Project Start Date: **June 2024**
Project End Date: **June 2025**

Implementing Agency (Name of University-College-Institute, Department/Organization or Company): **Office of Municipal Agriculture (OMA) of LGU-Dumaran**

Address/Telephone/Fax/Email (Barangay, Municipality, District, Province, Region):
Bgy. Danleg, Dumaran, 1st District, Palawan, MIMAROPA/ 09198568748

(2) COOPERATING AGENCY/IES (Name/s and Address/es)

(3) SITE(S) OF IMPLEMENTATION

IMPLEMENTATION SITES NO.	COUNTRY	REGION	PROVINCE	DISTRICT	MUNICIPALITY	BARANGAY
1.	**Philippines**	**MIMAROPA**	**Palawan**	**1st District**	**Dumaran**	**Danleg**
2.						
3.						
4.						
5.						

(4) TYPE OF RESEARCH
__/___ Basic
_____ Applied

(5) R&D PRIORITY AREA & PROGRAM (based on HNRDA 2017-2022)
__/__ Agriculture, Aquatic and Natural Resources
Commodity: **_Lobster**_____
_____ Health
Priority Topic: _____
_____ Industry, Energy and Emerging Technology
Sector: _____
_____ Disaster Risk Reduction and Climate Change Adaptation
_____ Basic Research
Sector: _____

Sustainable Development Goal (SDG) Addressed

Goal No. 2. Zero Hunger: (i.e promote sustainable agriculture)
Goal No. 8. Decent Work and Economic Development
Goal No. 9: Industry, Innovation, and

	Infrastructure (i.e promote inclusive and sustainable industrialization and foster innovation) Goal No. 10: Reduced inequalities Goal No. 12: Responsible Consumption and Production

(6) EXECUTIVE SUMMARY (not to exceed 200 words)

With the increasing population around the world who consider fish and seafood as important part of a diet especially during important events and celebrations, global seafood industry is expected to keep growing. On the other hand, studies also reveal that fishery productivity continues to decline over the past few years. Thus, fish and fishery production have to keep pace with the demand in both local and international markets. Aquaculture has gained popularity and is now widely adopted all over the world to satisfy the increasing demand for seafood. Variety of fishery species in the country are being cultured commercially for profit while small fisherfolk also engaged in small scale production for livelihood and source of income.

Lobster aquaculture is an emerging industry in the Municipality of Dumaran which promises profitable livelihoods and viable source of income, and generates employment for residents of the municipality. Lobster farming also provides local residents as well as visitors and tourists in the municipality access for lobster products anytime of the year. Culture of lobster in the municipality uses telescopic snail and other kinds of shellfish as major ingredients of aquafeeds.

However, due to high cost of commercially available aquafeeds, small fisherfolk become less interested in lobster farming. Affordable aquafeeds must be made available and accessible specifically for small-scale production which oftentimes operated and maintained by marginalized fisherfolk. Reliance to wild sourced feed ingredients is never a guaranty for sustainable production. Thus, research and experimental studies that will test and determine aquafeeds of which nutritional values are also comparable to that of commercial feeds, and telescopic snail and other shellfish is crucial.

(7) INTRODUCTION

Considered as one of the world's fastest growing sector in food industry, the substantial increase in aquaculture output from 1990-2000, along with an annual growth rate of 6.7% (www.seafish.org) underscores the industry's importance in meeting global demand for seafood. This scenario has raised concerns about its potential impact on the supply of fish and fish meal, which are traditionally important ingredients in aquafeeds. To address concerns about the reliance on fish meal and fish oil, research is being conducted to develop aquafeeds with alternative ingredients of find other sources with comparable nutritional value. According to Greg Lutz (2022), many aquafeed manufacturers are already sourcing "the most sustainable ingredients available and devoting substantial resources to develop alternative ingredients, which includes insect meals and omega-3 oils from algae and GMO canola". While efforts are being made to develop more sustainable aquafeeds, these innovations can lead to higher production costs for aquaculture operations. Aquafeed is identified as the largest expense item in aquaculture operations, and the increased costs could impact the economic viability of aquaculture ventures. For local aquaculture farmers, such as those in Dumaran, factors like the availability and market accessibility of commercial aquaculture feeds are crucial. However, feed costs emerge as a primary concern, highlighting the financial considerations that farmers must weigh in when investing in aquaculture.

One of the known and viable sources of livelihood among the residents of coastal barangays in the Municipality of Dumaran is aquaculture, such as seaweeds, bangus, sea cucumber; and few are starting to take interest in lobster farming. Most lobster farmers in the municipality established an offshore farm of lobster grown in floating cages made of nylon materials located in the open sea. Sources of live lobster fry are never a challenge for them; for they collect their own lobster fry in the wild and also, there are many fisherfolk whose primary livelihood is collecting and selling fry to lobster farmers. Marketing of live lobster is also easy in Palawan as there is a good demand of lobster in the local market. However, since the primary food of lobster is fresh fish and mollusks, lobster farmers tend to compete with fishermen in catching fish for lobster feeding. This may result in overfishing and reduce water quality and species imbalance.

At present, aquaculture farmers, specifically in lobster farming, preferred telescopic snails (Telescopium *telescopium*) as the main source of feeds for lobster which is apparently dependent from the wild stock. Known as “Balilit” to locals, telescopic snails are commonly found in mangrove areas or intertidal muddy flats (*www.seabaselife.ca*). Studies showed that telescope snails have a high protein content, rich in omega-3 fatty acids and also rich in vitamin B12 and minerals. The nutritional profile of telescopic snails makes them a valuable and potentially cost-effective alternative source of feed for lobster farming. However, this dependence on wild populations raises concerns about the sustainability of this feeding practice. Furthermore, “balilit” is also a delicacy in Dumaran which adds layer of complexity to the management of telescopic snails populations. Another threat in the decrease of telescopic snails is overcollection for food and lobster feeds apart from mangrove deforestation and marine pollution. Given the environmental challenges, exploring other alternative feed sources or sustainable practices for telescopic snails is important.

Another potential source of lobster feed that are locally available, and as an alternative to the dependence in “balilit”, is the Golden Apple Snail (GAS). The Golden (GAS), Pomacea *canaliculata*, popularly known as Golden kuhol is considered as one of the major rice pests in the Philippines. It was introduced in the 1980s from South America as a potential food source and in support to improving farmer’s income; as studies showed that GAS has a good source of protein for human and animal diets for it contains 54% to 62% protein (dry weight basis). However, the Golden kuhol did not gain popularity as food among Filipinos, thus, its economic potential as food evaporated. Instead, it creates a significant problem in rice paddies and other bodies of water, where they cause extensive damage to crops. Berto (2019) wrote that Golden kuhol can devoured a whole rice paddy in one night. According to Adalla and Magsino (2006), the economic loss due to Golden kuhol invasion reached at least US $1 Billion in 1990s.

Despite the negative impact of “snail invasion” in the country’s rice production, Pomacea can still be considered as a farmer’s “friend”. A research conducted by the Philippine Rice Institute (PhilRICE) has revealed that Pomacea species can help farmers by controlling rice bugs in an “easy and environmental sound manner” (Berto, 2019). Another potential benefit of Pomacea, due to its high protein and calcium content (Visca and Palla, 2018), is it can also be utilized as a raw material for feed ingredients of aquaculture, aside from livestock and poultry. The utilization of these snails as feed alternative in aquaculture is a practical and cost-effective solution. Aquaculture typically relies on fish meal as a source of protein, but this can be expensive and unsustainable due to overfishing and environmental concerns. Pomacea snails offer a potentially cheaper and more sustainable alternative for providing essential nutrients being raised in aquaculture operations.

(7.1) RATIONALE/SIGNIFICANCE (not to exceed 300 words)

This study aims to compare the effectiveness of Telescopic Snails (TS) and Golden Apple Snails(GAS) as feed sources for lobster in terms of growth performance and yield.

(7.2) SCIENTIFIC BASIS/THEORETICAL FRAMEWORK

The study aims to provide a comprehensive understanding of the comparative effectiveness of Telescopic Snails and Golden Apple Snails as feed sources for lobsters, with implications for optimizing feed management practices and promoting sustainable aquaculture development.

(7.3) OBJECTIVES

General:
To compare the effectiveness of Telescopic Snails and Golden Apple Snails as feed sources for lobster in terms of growth performance and yield. Specifically, it seeks to:

1. Determine the effect of Telescopic Snails and Golden Apple Snails on growth of lobster in terms of:
   a. Monthly increment in length (cm);
   b. Monthly increment in weight (g);
2. Determine the effect Telescopic Snails and Golden Apple Snails on yield/productivity of lobster in terms of:
   a. Total production (kg);
   b. Average yield (kg)
3. Determine the cost of production of two feed sources:
   a. Golden Apple Snail (GAS)
   b. Telescope Snail

(8) REVIEW OF LITERATURE

Feeds is one of the most important aspect of lobster farming according to www.asiafarming.com. However, due to high market price of commercial feeds, local lobster farmers rely heavily on wild-caught seafood as nutrient source for lobster, such as fish, mussels, sea urchins and crabs. Based on the studies of Nakervis and Jones (2022), although the practice of feeding cultured lobsters with their “natural food preference” ensures palatability and nutritionally complete, this affects the quality of water that may result to less suitability of the environment for lobster culture and might lead to diseases. (Leo Nakervis and Clive Jones, 2022, Practical diet formulation and adoption in tropical spiny lobster aquaculture). Gonzalez (2022) reported that the Southeast Asian Fisheries Development Center (SEAFDEC) is also conducting a research study on lobster farming, specifically on raising slipper lobster. The study aims to develop the hatchery technologies and, eventually, the development of commercial feeds. (Ruby Gonzales” First steps for slipper lobster in the Philippines. 2022).

In the late 1700s, lobster was considered as “poor man’s chicken”. It was used primarily as fertilizers or food for the prisoners and slaves. However, in the 1800s, when lobsters are plentiful and cheap, it was served to train passengers in Old America. Most of the passengers though the food being served were decadent, the demand for lobster suddenly increases, so was the price. Soon, lobster was no longer considered as a food for the poor (www.capeporpoiselobster.com, 2019). At present, export demand for lobster is very high. Based on the Philippines Lobster Industry Outlook, by 2026 the Philippines’

lobster exports may reach up to 1.6 million kilograms. Philippines is the third largest lobster exporting country in the world (www.reportlinker.com).

In 2020, the Department of Agriculture issued a trade and collection restriction due to indiscriminate catching of lobster; as lobsters are mainly captured by traps or hand caught by divers. Then, lobster farming was introduced. However, according to Dianila and Armada (2023), the major challenge poise by our lobster farmers is the reliable source of lobster seeds. Most source of juveniles are from the wild. Another roadblock to lobster farming success is the availability of artificial or commercial feeds in the market that will help reduce feed cost, as reported in www.poseidonsciences.com.

Before being used as aquaculture feeds, Golden Apple Snails were initially developed for livestock and poultry feeds. According to a study conducted by Serra (1997), the high protein content of Golden apple Snails, at 62% crude protein, allows them to replace fish meal in animal diets. They can constitute up to 15% of swine and layer diets, and up to 12% in broiler diets. Meanwhile, a higher concentration of Golden Apple Snails, up to 50% can be included in duck diets. Additionally, in tilapia feeds, Golden apple Snails can replace up to 75% of fish meal when in combined with rice bran.

In 2022, the Department of Agriculture reported that SEAFDEC/AQD had already developed a sustainable and lowcost feeds for aquaculture, specifically in milkfish. Due to high cost of fish meal, Dr. Roger Mamamuag successfully developed aquaculture feeds using corn, poultry-abbattoir and coconut-fermented copra meal as alternatives for fish meal. Studies have demonstrated that these formulated feeds can compete with commercially available feed in terms of growth performance and other biological parameters (www.da.gov.ph). Another study on the development of sustainable and low-cost aquaculture feeds conducted by Bombeo-Tuluran, et. al. (1996) through SEAFDEC/AQD, involved the use of Golden Apple Snails (GAS) in combination with cassava and maize as feed for tiger shrimps. Their study showed that the combination of three ingredients (GAS, cassava and meal) fed in tiger shrimps yielded a higher production and better-size distribution of shrimps compared to feeding with GS and maize alone.

According to the study done by Adriani, et. al (2023), the nutrient composition of GAS is comparable to fish meal, with a high protein level, essential amino acids, and significant calcium content. The fact that GAS can be easily obtained in large quantities from ponds and other bodies of water due to their rapid growth and reproduction makes them a potentially cost-effective feed option for aquaculture. The study by Visca and Palla (2018) on the replacement of fish meal in the feeds of rabbit fish culture suggests that there might be a growth performance difference between those fed with GAS meals and those fed with commercial feed, especially beyond the initial 75 days of the culture period. In addition, the chance of survival rates is significantly higher in fish fed with commercial feeds. GAS meal has a better result in the growth performance if vitamins and minerals are added. Moreover, the study points out that there were significant changes in growth when GAS was used as an alternative feed for crustaceans, these changes were observed mainly in the first two months. This information underscores the potential of GAS meal as a viable alternative protein source in fish culture (Jintasataporn et at 2024). However, the need to further research, especially in the context of crustaceans feeding, highlights the importance of understanding the long-term effects and optimizing the use of GAS in aquaculture practices.

Aside from GAS, Telescopium *Telescopium* (common names: telescope snails, horn snails, telescope snail shells) have also been used as alternative feeds in aquaculture. A study by Zurbano et al. (2021) showed that mud crabs fed with horn snails had the highest weight and protein content among crabs fed with trash fish and yellow

corn. A similar study conducted by Porfirio and Baltar in 2022 found that mud crabs fed with gastropod meat (African snails and horn snails) demonstrated better growth performance compared to those fed with trash fish and edible frogs, as mud crabs preferred gastropod meats.

Another study by Kurnia et al. (2012) on the growth performance and survival rate of mud crabs fed with telescope snails found that Telescopium species could be a better protein source replacement for fish meal in mud crab diets in hatcheries. When included at 100% in the diets, it exhibited better growth rates compared to diets in combination with fish meals. However, Kurnia et al. recommended further evaluation of the efficacy of Telescopium meal as an alternative protein replacement for fish meals in the diets of mud crabs raised in ponds.

Renato Alber (2003) conducted a similar study on feeding trials of mud crabs using telescope shells, revealing that mud crabs fed with 100% telescope shell meat obtained the highest weight gain compared to those fed with diets combining fish meal. This implies that telescope shell meat can be a better substitute for fish meal and most cost-effective alternative, according to the cost and return analysis by Alber (2003). Additionally, it is readily available for aquaculture farmers due to its abundance in mangrove areas.

(9) METHODOLOGY

The following shall be the major steps during the implementation of the project:

Experimental Site

The experimental site will be located near Dulanding's lobster farm at Sitio Balatan, Sta. Teresita, Dumaran, Palawan. The site was chosen based on the confirmation by the farm operator and fisheries technicians from the Office of Municipal Agriculture, who found it to be suitable for lobster farming based on their experience and technical knowledge. The location of the experimental site is approximately 3 kilometers away from the barangay proper of Sta. Teresita, Dumaran, and can be reached by using either a small to medium-sized motorized or non-motorized banca.

Experimental set-up

The lobster cages for the study will be positioned at least 50 meters away from Mr. Dulanding's farm's mainline. A separate mainline will be used to anchor 6 cages, each capable of accommodating 2 treatments, with three replications per treatment.

The cages will be constructed using a Reinforced Steel Bar (RSB), black net, plastic cover, and nylon as tying material. Before assembling the cages, RSB will be covered with plastic and black net to minimize rusting, ensuring a longer lifespan. The black net will be used as cage walls. All cages will have uniform sizes and materials, with dimensions of 1 meter in width, 1.5 meters in length, and 1.5 meters in height.

Experimental cages will be installed in two mainlines. Three replications for treatment 1 (t1) will be installed together in one mainline, while the three cages for treatment 2 (t2) will be placed in a separate mainline. Each cage will be set up at a distance of at least 2

meters away from each other. Quality floating materials will be used to secure the experimental cages and lobsters at both ends of each mainline.

Each experimental cage will contain 5 pieces of 1-month-old lobster fingerlings of similar size, acquired from a local supplier. All cages will be installed simultaneously, and the lobster fingerlings will be placed in the cages on the same day.

Feeds and feeding

Quantity of feeds for each of the 3 replications for Treatment 1 (T1), using telescopic snail as feeds will be the same, while the feed quantity for replications 1, 2 and 3 for Treatment 2 (T2), using the GAS will also be equal. Feeding will be done simultaneously once a day, preferably in the afternoon.

The aquafeeds for the study will be locally sourced. The telescopic snail is abundant in barangays of Capayas, Sta. Teresita, Poblacion, Bohol and Calasag. Residents of these barangays have committed their willingness to supply Telescopic Snails not only for the project but for lobster farms as well. Some are interested to engage into culturing Telescopic Snail for livelihood and sustainability of supply for food and aquafeed. Snail gatherers will also be encouraged to engage into lobster and green mussel culture for additional source of income so that they will not rely heavily on gathering of telescopic snails.

The Office of the Municipal Agriculture will initiate collaboration and seek support from research institutions and concerned agencies like BFAR for thorough understanding on sustainable production and culture of Telescopic Snail, so to prevent resource exploitation and ecological imbalance.

On the other hand, GAS will be collected from rice fields or nearby areas within the municipality that are known to be free from chemical contamination. Most of the rice farmers in island barangays prefer not to use chemicals in rice production. Therefore, GAS feed will be collected mainly from island barangays of the municipality, while some portion will be acquired from areas in mainland barangays.

The project will use freshly harvested Telescopic snail and GAS as feeding material which will be slightly crushed first before putting it into the cage. It will not be mixed with other feed materials and will be given for 5 days in a week.

The project will also use fresh fish and other feeding materials as alternate and/or supplemental feeds, which will be given twice for 2 days in a week to provide the lobster stocks with other kinds of feeds for optimum nourishment.

Starting in August 2024, the researcher will establish an area where GAS and egg masses can be cultured or reproduced quickly. This will be in the swampy and wetland areas where there is an abundant supply of weeds that GAS feeds on. Technology demonstration fields showcasing GAS culture will be established by the Office of the

Municipal Agriculture (OMA) so that farmers will also be encouraged to produce GAS to be supplied for lobster farms. More farmer cooperators will be encouraged to partner with OMA in establishing and maintaining such technology demonstration fields.

Care and maintenance

The lobster cages will be cared for and maintained by a hired farm laborer. The researcher will monitor the laborer's work periodically. The laborer's main responsibilities will include feeding the lobster, collecting waste, cleaning the cages, and repairing damaged nets. The researcher will supervise the study and conduct observations at least once a month.

Data Collection and Analysis

Please take note of the following procedures:

To assess the growth performance of the experimental stock, the length and girth of each stock from 3 replications of T1 and T2 will be measured every three months within a day. Length will be measured from the tip of the antennae to the tip of the tail pan. Girth will be measured using a tape measure at the center of the body. Additionally, the weight of each experimental stock will be measured using an electronic weighing scale during each data collection schedule. Furthermore, observations of the physical body and behavior of the stocks will be conducted during the data collection schedule, and all observations will be noted in the monitoring book.

All expenses, including labor and materials for both T1 and T2, will be tabulated using a prescribed format for data processing and analysis. After a year, all experimental stocks will be harvested and weighed. The average weight for the 3 replications for the two treatments will be recorded to appropriately infer yield.

The harvested stocks will be sold to buyers in Puerto Princesa City, and the total sales for Treatment 1 and Treatment 2 will be recorded to compute and determine the profit margin.

Collaboration and Partnerships

The study will be conducted by the Local Government of Dumaran through the Office of the Municipal Agriculture in partnership with the Bureau of Fisheries and Aquatic Resources (BFAR) – Provincial Fishery Office, located in Puerto Princesa City. The main responsibility of the BFAR is to provide technical assistance on proper handling and management of the study. Funds for this proposed experimental study will be provided by the Department of Science and Technology (DOST) – Palawan Science and Technology Office.

Cost Comparison between Treatment 1 and 2

Table 1. Cost Comparison of using Telecospic Snail and Golden Apple Snail (GAS) as main aquafeed for lobster

Age of lobster (Month)	**Cost of Aquafeed (Php)**					
	Treatment 1 (Telescopic Snail)			**Treatment 2** (Golden Apple Snail)		
	Quantity (kg)	Cost/kilogram (Php)	Total (Php)	Quantity (kg)	Cost/kilogram (Php)	Total (Php)
1	13.50	16.67	225.00	13.50	6.67	90.00
2	34.50	16.67	575.00	34.50	6.67	230.00
3	39.00	16.67	650.00	39.00	6.67	260.00
4	48.00	16.67	800.00	48.00	6.67	320.00
5	57.00	16.67	950.00	57.00	6.67	380.00
6	66.00	16.67	1,100.00	66.00	6.67	440.00
7	75.00	16.67	1,250.00	75.00	6.67	500.00
8	84.00	16.67	1,400.00	84.00	6.67	560.00
9	93.00	16.67	1,550.00	93.00	6.67	620.00
10	102.00	16.67	1,700.00	102.00	6.67	680.00
11	111.00	16.67	1,850.00	111.00	6.67	740.00
12	120.00	16.67	2,000.00	120.00	6.67	800.00
TOTAL	**843.00**		**14,050.00**	**843.00**		**5,620.00**

(10) TECHNOLOGY ROADMAP (if applicable) (use the attached sheet)
N/A

(11) EXPECTED OUTPUTS (6Ps)

Publication
Publication regarding the successful implementation of the project in local newspapers and website publications will be done as well as national publications on DOST's website and social media accounts.

Patent/Intellectual Property

Product

The product of this project will be alternative feed for lobster.

People Service

Place and Partnership
The project will take place in the municipality of Dumaran, where raw materials are gathered from fisherfolk and farmers.

(12) POTENTIAL OUTCOMES
Sustainable supply of affordable feed ingredients for lobster culture becomes available. As a result, more farmers will be encouraged to engage in lobster farming. As the number of lobster farmer increases, volume of lobster produced also increases, thus supply of lobster products becomes sustainable, i.e., lobster products become readily available and /or accessible for the consuming public, year-round. Availability of affordable aquafeeds helps improve income of fisherfolk through savings.

Use of Golden Apple Snail (GAS) as alternative feed ingredient for lobster culture helps rice farmers reduce pest population as well as the cost for snail prevention and control using molluscicide. Decreased expenses for pest control will generate savings on the part of rice farmers which is equivalent to additional income.

Farmers will have an additional source of income through culturing of Golden Apple Snails to be sold to aquafeed processors and lobster farm operators. Diversity of income sources has been proven to help improve household economy of farm families.

(13) POTENTIAL IMPACTS (2Is)
Increased production of lobster in the municipality through aquaculture will directly and indirectly benefit all stakeholders through creation of sustainable livelihoods and reliable source of income for the family. Improved income from a reliable source helps improved the quality of life of fisherfolk. The project will also generate employment among local residents. Sustainable production will consequently create production surplus which in turn create resource inflow for the locality, and eventually improve local economy.

The availability of alternative aquafeed for lobster culture aside from wild-sourced ingredients such as telescopic snail will help reduce dependence and reliance on wild stock which might result in resource exploitation. Thus, the project is expected to contribute for the achievement of ecological balance.

(14) TARGET BENEFICIARIES

Target beneficiaries are not only fisherfolk who engage in lobster culture but also include all other individuals who will directly or indirectly be involved in the industry. Primary beneficiaries are lobster farm owners/operators, be it small-scale or commercial scale farms. Farmers who will earn additional income out of GAS and Telescopic Snails culture as well as those who will engage into aquafeed formulation using GAS and Telescopic Snails are among those who will benefit from the project.

With the increasing number of individuals who will venture on lobster culture, employment generation will eventually take place, thus providing job opportunities for local population.

(15) SUSTAINABILITY PLAN (if applicable)
The results of the study will be disseminated to all interested fisherfolk through the use of IEC materials such as flyers, pamphlets, and others. Small group orientations will also be conducted for fisherfolk.

Other potential aquafeeds made of locally available materials will also be explored through another round of research activities to be requested for financial assistance from DOST and BFAR.

Programs and projects promoting the production of alternative feeds for lobster culture will be proposed for funding to concerned Government and non-government agencies to help farm operators/owners expand production.

Office of the Municipal Agriculture (OMA) to provide technical assistance to farm operators on lobster culture and farm operation. It will also assist beneficiaries prepare requests/proposals requesting machinery and equipment necessary for the production of aqua feeds. Beneficiaries of the project will also be assisted by OMA in availing credit and insurance programs of the government for additional capital and resource security respectively.

(16) GENDER AND DEVELOPMENT (GAD) SCORE (refer to the attached GAD checklist)

(17) LIMITATIONS OF THE PROJECT

1) Untimely release of project fund
2) No fisherfolk who are willing and committed to cooperate with the project
3) Administrative requirements/documents to be issued by concerned government agencies like WFP by PCSD, business permit by LGU – BPLO, environmental certification by LGU – MENRO, and others

(18) LIST OF RISKS AND ASSUMPTIONS RISK MANAGEMENT PLAN (List possible risks and assumptions in attaining target outputs or objectives.)

RISKS:

1) Occurrence of extreme weather events such as storm surge, strong winds, high sea temperature and others;
2) Unpredictable occurrence of pests and diseases; and
3) Security related concerns – presence of theft or poachers and individuals who have the intent to sabotage the project;
4) Availability and abundance of GAS; and
5) Unpredictable withdrawal of support and commitment of fisherfolk-cooperator

ASSUMPTIONS:

1) Regular monitoring and evaluation of the project for effective decision making;
2) Timely release of fund for project operation and maintenance;
3) Active support of the Local Government Unit;
4) Continued support from DOST

(19) LITERATURE CITED

Leilidyn Y Zurbano, Mary Lynn M Mariposque, Lyka M Buenaobra, John Christopher Marquez, 2021, Growth performance and Protein content of mud crab (Scylla serrata)

Serra, A. B (1997).The golden Apple Snail (Pomace asp.) as Animal Feed in the Philippines

Agus Kurnia1 , Wellem H. Muskita2 , Oce Astuti3 , Adnan Hakim4 (2013) Utilization of Telescopium Mussel Meal as an Alternative Protein Source in the Diet of Black Tiger Shrimp,

PENAEUS MONODON

"Growth and Survival of Mudcrab (Scylla serrata) Fed with Bagungon Meat (Telescopium telescopium) as Alternative Feed Ingredient in Mudcrab Fattening" by Renato B. Alber, Camarines Norte State College, Daet Camarines Norte. This paper was presented during the recently held 15th National Research Symposium held at the BSWM Convention Hall, on 8 October 2003

(20) PERSONNEL REQUIREMENT

Position	Percent Time Devoted to the Project	Responsibilities
Fisheries Technologist	**100%**	1) Supervise overall operation of the project; 2) Take charge all issues and concerns as to technical aspect of the project 3) Submit progress report in a regular basis to DOST, OMA and Office of the Mayor; 4) Perform other functions that maybe necessary for the successful implementation of the project in close coordination with DOST and OMA
Farm Laborer	**100%**	1) Take charge in the feeding and ensuring the health, safety and security of the entire farm 2) Take charge in the repair and maintenance of the cage 3) Ensure the cleanliness and sanitation of cages and the entire farm; 4) Closely work and coordinate with the Fisheries Technologist re: over-all maintenance of the farm and any other matters concerning the farm operation 5) Perform other functions that maybe assigned by the immediate supervisor (Fisheries Technologist)

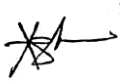
(21) BUDGET BY IMPLEMENTING AGENCY				
IMPLEMENTING AGENCY	**PS**	**MOOE**	**EO**	**Total**
Year 1	**120,000.00**	**193,636.33**		**313,636.33**
Year 2				
Year n				
TOTAL				

(22) OTHER ONGOING PROJECTS BEING HANDLED BY THE PROJECT LEADER:
_0____ (number)

Title of the Project	Funding Agency	Involvement in the Project
None	N/A	N/A

(23) OTHER SUPPORTING DOCUMENTS (Please refer to page 2 for the additional necessary documents.)

I hereby certify the truth of the foregoing and have no pending financial and/or technical obligations from the DOST and its attached Agencies. I further certify that the programs/projects being handled are within the prescribed number as stipulated in the DOST-GIA Guidelines. Any willful omission/false statement shall be a basis for disapproval and cancellation of the project.

	SUBMITTED BY (Project Leader)	ENDORSED BY (Head of the Agency)
Signature		
Printed Name	**Ariel M. Magbanua**	
Designation/Title	**Assistant Municipal Agriculturist**	
Date	**February 17, 2024**	

Note: See guidelines/definitions at the back.