House District(s) 51

Senate District(s) 25

THE TWENTY-NINTH LEGISLATURE
APPLICATION FOR GRANTS
CHAPTER 42F, HAWAII REVISED STATUTES

Log No:

For Legislature's Use Only

Type of Grant Request:

☒ GRANT REQUEST – OPERATING ☐ GRANT REQUEST – CAPITAL

"Grant" means an award of state funds by the legislature, by an appropriation to a specified recipient, to support the activities of the recipient and permit the community to benefit from those activities.

"Recipient" means any organization or person receiving a grant.

STATE DEPARTMENT OR AGENCY RELATED TO THIS REQUEST (LEAVE BLANK IF UNKNOWN): _____

STATE PROGRAM I.D. NO. (LEAVE BLANK IF UNKNOWN): _____

1. APPLICANT INFORMATION:

Legal Name of Requesting Organization or Individual:
Hawai'i Pacific University

Dba: Oceanic Institute of Hawai'i Pacific University

Street Address: 41-202 Kalanianaole Hwy.

Mailing Address:
Oceanic Institute of Hawaii Pacific University
41-202 Kalanianaole Hwy.
Waimanalo, HI 96795-1820

2. CONTACT PERSON FOR MATTERS INVOLVING THIS APPLICATION:

Name: Shaun Moss, Ph.D.

Title: Executive Director

Phone #: (808) 259-3110

Fax #: (808) 259-5971

E-mail : smoss@hpu.edu

3. TYPE OF BUSINESS ENTITY:

☒ NON PROFIT CORPORATION INCORPORATED IN HAWAII
☐ FOR PROFIT CORPORATION INCORPORATED IN HAWAII
☐ LIMITED LIABILITY COMPANY
☐ SOLE PROPRIETORSHIP/INDIVIDUAL
☐ OTHER

6. DESCRIPTIVE TITLE OF APPLICANT'S REQUEST:

Production of Local Animal Feeds
To Enhance Hawaii's Food Security

4. FEDERAL TAX ID #: [redacted]

5. STATE TAX ID #: [redacted]

7. AMOUNT OF STATE FUNDS REQUESTED:

FISCAL YEAR 2019: $ 177,577

8. STATUS OF SERVICE DESCRIBED IN THIS REQUEST:

☒ NEW SERVICE (PRESENTLY DOES NOT EXIST)
☐ EXISTING SERVICE (PRESENTLY IN OPERATION)

SPECIFY THE AMOUNT BY SOURCES OF FUNDS AVAILABLE AT THE TIME OF THIS REQUEST:

STATE $ 0
FEDERAL $ 28,500
COUNTY $ 0
PRIVATE/OTHER $ 0

TYPE NAME & TITLE OF AUTHORIZED REPRESENTATIVE: [redacted]

SHAUN MOSS, EXECUTIVE DIRECTOR
NAME & TITLE

1/19/18
DATE SIGNED

Rev 11/21/17

JAN 19 2018 1:55 pm

Production of Local Animal Feeds To Enhance Hawaii's Food Security

Grant-In-Aid

Oceanic Institute of Hawai'i Pacific University
41-202 Kalaniana'ole Hwy.
Waimanalo, HI 96795-1820

Table of Contents

I. Background and Summary

1. Applicant's Background

Founded in 1960, Oceanic Institute of Hawaii Pacific University (OI) is a nonprofit research and development organization dedicated to marine aquaculture, biotechnology, and coastal resource management. OI's mission is to develop and transfer environmentally responsible technologies to increase aquatic food production while promoting the sustainable use of ocean resources. OI works with community, industry, government and academic partners, and non-governmental organizations to benefit the state, the nation, and the world. In 2014, OI merged with Hawaii Pacific University, the largest private university in Hawaii, to become the University's first directed research unit.

OI is located on 56 acres in Waimanalo, Hawaii and employs a team of about 45 scientists, professionals, and support personnel. OI conducts applied research which is integrated across five technical programs including marine fish and shrimp aquaculture, applied marine biotechnology, training and education, and aquatic feeds development. OI's Aquatic Feeds and Nutrition Department has been conducting aquatic feeds research for over 30 years and has extensive laboratory facilities with a wide range of analytical capabilities, as well as support infrastructure, to assess the nutritional requirements of a variety of aquatic organisms. In addition, OI recently completed construction of a Feeds Research and Pilot Production Facility (aka feed mill) located on a 1-acre parcel of land at the Panaewa Agricultural Park in Hilo, Hawaii. The feed mill contains various types of feed production equipment and has the capacity to produce several tons of animal feed per hour. This high-level capacity allows OI researchers to develop animal feeds, using locally sourced ingredients, which can then be evaluated to determine if local ingredients and novel feed formulations can promote good animal health and growth at a commercially relevant scale. This feed mill is the first of its kind ever in Hawaii.

OI is seeking Grant-in-Aid funds to produce livestock (cattle) and fish (tilapia)) feeds at its newly constructed feed mill, using locally sourced ingredients, and to evaluate these feeds on a commercially relevant scale. The project will be managed by OI's Director of Aquatic Feeds and Nutrition Department, based in Waimanalo, who will work closely with OI's Feed Mill Operator in Hilo.

2. Goals and Objectives Related to the Request

In an effort to help catalyze Hawaii's livestock and aquaculture industries, OI constructed and now operates a Feeds Research and Pilot Production Facility (aka feed mill) which is designed to produce commercial quantities of terrestrial (e.g. cattle, hogs, chickens) and aquatic (e.g. fish, shrimp) animal feed using locally sourced ingredients. OI received financial support for the construction of the feed mill from Hawaii State Legislature's Grant-in-Aid program in 2016. In November, 2017, OI received the *Certificate of Occupancy* for the feed mill and produced the first batch of animal feed in December 2017. OI scientists are starting to develop ingredient

supply chains to support the expansion of animal production in Hawaii. Importantly, many of these ingredients likely will come from dedicated supply chains from local agriculture businesses, as well as from co-products or waste streams from this sector. One example that shows promise is the recycling of unmarketable papaya grown in the State. Surprisingly, as much as 40% of the papaya grown in Hawaii are culled at the packing shed and cannot be sold due to bruising of the fruit. OI researchers have used fungal proteins produced from these culled papaya to make fish and shrimp feed and we hope to source this ingredient from local papaya producers for our feed mill in the future. This activity not only benefits the end users of the feed but creates value-added, co-products for the papaya growers, plus it recycles nutrients. This type of integration and synergy can also occur with tomato and banana growers, for example, as well as the emerging biofuels industry which produces co-products from algae, kukui nut, coconut, and other seed plants. Stakeholders involved in a new, diversified agribusiness model, currently being implemented on Maui in the aftermath of Alexander & Baldwin's decision to shut down their Hawaiian Commercial & Sugar (HC&S) mill in Puunene, also could benefit from OI's Feeds Research and Pilot Production Facility by supplying products and co-products from their operations. Recently, OI received 28,000 pounds of corn produced on Maui for our feed mill and we have included this local ingredient in our feed formulations during the commissioning of the feed mill in December 2017. In addition to corn, OI hopes to receive soy, sorghum, and other crops from Maui in the future. In addition, there are substantial amounts of slaughterhouse and seafood processing waste currently being discarded in overburdened landfills which could be converted into potential feed ingredients.

OI's Feeds Research and Pilot Production Facility is located on a 1-acre parcel of land at the Panaewa Agricultural Park in Hilo, Hawaii. The land is leased to OI from the University of Hawaii at Hilo under an agreement which terminates in December, 2036. The feed mill occupies 5,700 ft^2 and contains a hammer mill, mixer, pellet mill, wet extruder, dryer, and fat coater, all of which have been donated to OI from the private sector (see Figs. 1-3). The feed mill has the capacity to produce several tons of animal feed per hour and this high-level capacity will allow OI scientists to develop animal feeds which can then be evaluated on a commercial scale to determine if the ingredients and novel feed formulations promote good animal health and growth. The magnitude of processing capacity and the scale of testing cannot be understated. Our ability to produce large quantities of test diets and evaluate them on a commercial scale makes OI's Feeds Research and Pilot Production Facility unique in the region and will serve as an invaluable resource both for the suppliers of potential feed ingredients, as well as the end users of the feed. Although the research feed mill is owned and operated by OI, we view this facility as an important community resource. We have met with members of the Hawaii Farm Bureau Federation, Hawaii Crop Improvement Association, Hawaii Cattlemen's Council, and Hawaii Aquaculture and Aquaponics Association, as well as representatives of local and State government, and all have been highly supportive of our efforts to build and operate the mill. In addition, we have received support from Ulupono Initiative, a Hawaii-focused impact investment firm, who provided construction funds for the feed mill. Importantly, we have met with faculty from the College of Tropical Agriculture and Human Resources, University of Hawaii at Manoa, as well as from the University of Hawaii at Hilo, and they too are eager to work with us to evaluate locally sourced ingredients for a variety of terrestrial and aquatic animals. The enhanced capacity of the feed mill will allow Hawaii's agriculture and aquaculture researchers to conduct experiments they previously were unable to execute, as well as allow them to partner with

farmers in the private sector to evaluate novel feed formulations on a meaningful scale. This opportunity could translate into millions of research dollars for Hawaii through federal, state, and private grants and contracts. Ultimately, we believe these collective efforts will allow us to use locally sourced ingredients to produce feeds which promote healthy, fast-growing animals, and this will revitalize various agriculture sectors here in Hawaii and help move us towards greater food self-sufficiency and enhanced food security in the future.

Fig. 1. Oceanic Institute's Feeds Research and Pilot Production Facility.

Fig. 2. Extruder used to make animal diets at Oceanic Institute's Feeds Research and Pilot Production Facility.

Fig. 3. Pellet Mill used to make pelleted animal feed at
Oceanic Institute's Feeds Research and Pilot Production Facility.

In light of the information above, broad project goals of this proposal include:

- Provide research feed for terrestrial and aquatic animals grown in Hawaii using locally sourced ingredients
- Provide research feed and technical assistance to support growout trials with terrestrial and aquatic animals on commercially relevant scales
- Provide experimental feed for terrestrial and aquatic animals for use in genetic, nutritional, or other focused research
- Expand feed product development, research, equipment evaluation, and testing
- Demonstrate, promote, and display U.S. feed milling technology, goods, and services to the countries of the Pacific Rim and beyond
- Assist in market development and increasing the demand for American feed commodities, manufacturing equipment, computer software, and other products related to aquatic feed production
- Offer short courses in nutrition and feed processing in cooperation with universities, private research organizations, and commercial companies
- Enable Oceanic Institute of Hawaii Pacific University (OI) to become a leader in aquatic animal nutrition and feeds production research and to forge long-term research partnerships with faculty at the University of Hawaii

In light of the information above, key project objectives of this proposal include:

- Work with local farmers / co-product producers to identify and secure ingredient supply chains
- Conduct biochemical analyses of local feed ingredients to develop nutritional profiles for each candidate ingredient
- Formulate diets for cattle and tilapia based on feed ingredient nutritional profiles and nutritional requirements of target species (i.e. cattle and tilapia)
- Develop processing methods and processing specifications to optimize use of locally sourced ingredients for cattle and tilapia feeds
- Produce cattle and tilapia feeds using feed formulations which will include locally sourced ingredients
- Evaluate cattle and tilapia feeds at commercial farms in Hawaii

3. Public Purpose and Needs to be Served

Hawaii's agriculture industry plays a critical role in addressing food security in our State. However, because more than 85% of our food is imported, our communities are extremely vulnerable if food supply chains become disrupted. Disruptions can arise from a number of causes including dock strikes at major ports, farm production fluctuations on the U.S. mainland due to global climate change, and the destructive forces of a tsunami. Because of this vulnerability, it is imperative that we invest in ways to increase local food production. In addition to enhancing food security, local food production would provide enormous economic benefits to our State. The economic impact of food import replacement is significant and replacing just 10% of the food we currently import would amount to more than $313 million which would remain in Hawaii. Also, local food production would allow for access to cheaper, high-quality foods and would help create jobs in the agriculture and aquaculture sectors. In addition, there are significant environmental benefits to local food production. Producing foods locally would decrease the number of "food miles" associated with shipping across the Pacific Ocean, thereby conserving energy and reducing the carbon footprint associated with food distribution. Also, by producing more foods locally, we would mitigate the accidental introduction of harmful, invasive pests which can disrupt the local agriculture economy and adversely impact our island ecosystems.

Although Hawaii is self-sufficient in some fruits and vegetables, there has been a dramatic decline in the local chicken broiler industry, and now the egg layer, swine, dairy, and beef cattle sectors are threatened. A major factor impacting these sectors is the high cost of animal feed which must be imported because there are no commercial feed mills operating in Hawaii. Feed represents the single largest operating cost of any livestock or aquaculture operation, accounting for up to 70% of total production cost, and importing animal feed into Hawaii adds considerable expense to the farmer. Some estimates suggest that shipping feed from the U.S. mainland adds an addition $150 - $200 per ton to feed cost, essentially doubling the total feed cost to Hawaii's farmers. In fact, feed costs are so expensive in Hawaii that most cattle ranchers in the State ship their calves to the mainland, after they are weaned, to be grown out and then sold back to Hawaii as finished product. In addition, feed costs for aquatic animals (e.g. fish and shrimp) are so high in Hawaii that they pose a significant barrier to entry into the aquaculture sector. As a result, the majority of our seafood is imported despite the fact that we are surrounded by water.

According to the *Sustainable Hawaii Initiative* web site (https://governor.hawaii.gov/sustainable-hawaii-initiative/), there is an aspirational goal for the State to double local food production by 2020, although an article in the *Star Advertiser* (published on 11 September, 2016) indicates that achieving this goal by 2030 is more realistic. Irrespective of the time line, the benefits of producing more food locally are unequivocal. In addition to enhancing food security in our State, there are tremendous economic multiplier effects of increasing food self-sufficiency. However, unless innovative solutions are sought to stimulate local food production, Hawaii residents will continue to be highly dependent on imported food and unable to reap these economic benefits. We believe that producing animal feed in Hawaii, using locally available ingredients, is an important, innovative step towards achieving food security and food self-sufficiency for our State.

4. Target Populations to be Served

This proposed project will serve five (5) targeted populations in Hawaii, as described below.

End-users of animal feed: OI researchers will produce commercial quantities of cattle and tilapia feed which will be provided directly to local farmers for evaluation and feedback about feed quality. Specifically, we have discussed this opportunity with Mr. Dale Sandlin, Managing Director of Hawaii Cattlemen's Council, Inc., as well as representatives from Parker Ranch and Ulupono Initiative. There is a strong interest among cattle ranchers in the State to have access to supplemental cattle feed when the quality of natural forage is compromised, for example, during periods of drought. In addition, we have discussed this opportunity with members of the Hawaii aquaculture industry, including representatives from Mari's Gardens located in Mililani in Central Oahu. Mari's Gardens is the largest aquaponics operation in Hawaii and produces tilapia, as well as a variety of vegetables including lettuce, green onions, Japanese cucumbers, and beets. We have also discussed this opportunity with the owner of Hawaii Fish Company (HFC) which is the longest operating commercial aquaculture farm in the State, having been established in 1978. HFC is located on Oahu's North Shore and grows tilapia in floating cages located in a deep spring-fed pond. All of these farmers have expressed an urgent need for locally produced feeds which could have a significant, positive impact on their profitability.

Beyond the immediate scope of this proposed project, Hawaii's livestock and aquaculture farmers will work with OI and University of Hawaii (UH) researchers, as well as representatives from State government and local NGOs, to evaluate feeds produced at OI's feed mill and identify those diets which promote good animal performance. The inherent flexibility of OI's feed mill will allow local farmers to evaluate a wide variety of potential feed ingredients (e.g. papaya waste, cassava flour, fish trimmings) for a number of different target species (e.g. cattle, hogs, chickens, fish, shrimp), with the expectation that some of these ingredients, when used in a proper formulation, will promote good animal health and growth. When operating at full capacity, OI's feed mill should produce more than 450 tons of aquatic animal feed per year and more than 900 tons of terrestrial animal feed per year, all of which can be evaluated on a commercially relevant scale. This large supply of diverse animal feed will provide an immediate and direct benefit to Hawaii's livestock and aquaculture farmers, as well as create a pathway for future, substantial economic benefits. In addition, OI's feed mill could be used to develop specialty research feeds for the Honolulu Zoo, Waikiki Aquarium, Sea Life Park, and other

public and private zoos and aquariums locally, nationally, and globally.

Suppliers of feed ingredients: OI researchers will identify locally sourced ingredients to include in diet formulations to make cattle and tilapia feed for this project. Some of these ingredients will be grown specifically for direct inclusion in animal diets and will come from local agriculture businesses. Other ingredients will come from co-products or waste streams from agribusinesses and the emerging biofuels industry, as well as from slaughterhouses and fish processing plants. By converting co-products and waste streams from these sectors into value-added feed ingredients, famers and operators supplying these ingredients may generate additional income and will not have to pay to dispose of their wastes. Specifically, we have discussed this opportunity with representatives from HC&S on Maui to provide OI with corn, soy, sorghum, and other crops; Cyanotech Corporation on the Big Island to supply microalgae co-products as a protein source; TerViva on Oahu for pongamia co-products; Pacific Biodiesel to supply co-products from the extraction of oil from coconut, kukui, and jatropha seeds, and Cellana, Inc. to supply microalgae co-products. This is not an exhaustive list of potential feed ingredient suppliers and we will continue to explore others potential partners.

Local research community: OI researchers will collaborate with UH scientists to identify the most effective feed formulations, using locally sourced ingredients, for the cattle and tilapia populations to be evaluated in this project. Specifically, we have discussed this opportunity with UH scientists from the College of Tropical Agriculture and Human Resources (CTAHR) at the University of Hawaii at Manoa, as well as from the Pacific Aquaculture & Coastal Resource Center (PACRC) at the University of Hawaii in Hilo.

Beyond the immediate scope of this proposed project, OI's feed mill will allow Hawaii's agriculture and aquaculture researchers to conduct large-scale feeding trials to evaluate the efficacy of specific animal diets for a variety of terrestrial and aquatic animals. Researchers at OI and UH (both at Manoa and Hilo) are ready to take advantage of this unique resource and will seek funding to support their work. Previously, Hawaii's researchers had to rely on small-scale, laboratory based, feed-processing capabilities for their research and were unable to ask research questions at a meaningful scale. OI's feed mill will provide a new opportunity for the research community which could translate into millions of research dollars for Hawaii through federal, state, and private grants and contracts.

Students and those seeking job training: During this project, OI will not only use the newly commissioned feed mill in Hilo to make the cattle and tilapia feed, but will use the facility as a platform to train college-level students enrolled at the University of Hawaii in Hilo and Hawaii Pacific University in an effort to produce the next generation of feed mill operators. Beyond the immediate scope of this proposed project, OI's feed mill will be used to hold training workshops, international training programs, and short courses related to feed processing, as well as to showcase next generation feed mill technology.

Hawaii residents and visitors: Ultimately, the impact of this project will generate valuable information about the economic viability of a commercial feed mill to serve the needs of Hawaii's livestock and aquafarmers. If this can be accomplished, and if a commercial feed mill is built here, we will have moved Hawaii towards greater food self-sufficiency and enhanced

food security. This will serve both Hawaii residents and our visitors by providing high-quality food at affordable prices without having to depend on imported products to meet market demand.

5. Geographic Coverage

Although the cattle and tilapia feed used for this project will be made at OI's Feeds Research and Pilot Production Facility in Hilo, feed ingredients will come from Maui, Oahu, and the Big Island, and possibly Molokai. In addition, end users of the cattle and tilapia feed will be farmers from the Big Island and Oahu, and possibly Maui, Molokai, and Kauai.

Beyond the immediate scope of this proposed project, livestock and aquaculture farmers throughout the State will participate in evaluating novel feeds for a variety of target animals in addition to cattle and tilapia (e.g. hogs, chickens, other fish species, shrimp), and fruit and vegetable growers throughout the State will supply potential feed ingredients as co-products or wastes from their operations. Biofuel companies and companies that manufacture microalgae products, as well as slaughterhouse and fish processing plants, are located throughout the State and can contribute to the ingredient supply chain.

Importantly, OI's feed mill will be unique, as no similar facility exists in the U.S. Pacific region which targets the use of tropical and sub-tropical ingredients. This feature makes OI's feed mill a valuable resource to those living in U.S.-affiliated Pacific Islands. Effective feed formulations that are developed with tropical and sub-tropical ingredients can be used in U.S.-affiliated Pacific Islands to make animal feeds to support greater food self-sufficiency and enhanced food security in the region. Additionally, OI's feed mill will be unique, as no similar facility exists in the U.S. for research on aquaculture ingredients and aquatic feed development. Finally, the feed mill will be used to hold training workshops, international training programs, and short courses related to feed processing, and these learning opportunities will be available to a global audience.

II. Service Summary and Outcomes

1. Scope of Work, Tasks and Responsibilities

OI is seeking Grant-in-Aid funds to produce livestock (cattle) and fish (tilapia)) feeds at its newly constructed feed mill, using locally sourced ingredients, and to evaluate these feeds on a commercially relevant scale.

In an effort to execute this broad objective, key project objectives defining the scope of work of this proposal include:

- Work with local farmers / co-product producers to identify and secure ingredient supply chains
- Conduct biochemical analyses of local feed ingredients to develop nutritional profiles for each candidate ingredient
- Formulate diets for cattle and tilapia based on feed ingredient nutritional profiles and nutritional requirements of the target species (i.e. cattle and tilapia)
- Develop processing methods and processing specifications to optimize use of locally

sourced ingredients for cattle and tilapia feeds
- Produce cattle and tilapia feeds using feed formulations which will include locally sourced ingredients
- Evaluate cattle and tilapia feeds at commercial farms in Hawaii

Task #1: Develop Nutritional Profiles

Once ingredient supply chains are identified and secured, OI researchers will develop nutritional profiles for candidate ingredients by analyzing each ingredient for levels of crude protein, crude fat, crude fiber, and ash content, as well as for amino acids and fatty acids. These data will be imported into OI's feed ingredient database and will be used to help formulate cattle and tilapia diets (see Task #2). OI has a 150-m^2 Analytical Feeds Quality Control Laboratory which is used to analyze feed ingredients, whole feeds, and animal tissue. This lab contains an HPLC amino acid analyzer, elemental nitrogen analyzer, gas chromatograph - fatty acid & pesticide analyzer, UV spectrophotometer, and near infrared spectrophotometer, among other standard analytical laboratory equipment. This lab is managed by Dr. Zhi Yong Ju who has over 12 years of experience as a Research Scientist at OI where he specializes in biochemical analysis. Dr. Ju will participate in this project by establishing biochemical nutrient profiles of potential feed ingredients from a variety of sources including local agriculture businesses, co-products or waste streams from this sector, as well as from the biofuels industry, slaughterhouse wastes, and seafood processing plants.

Task #2: Formulate Diets

In addition to developing new nutritional profiles for candidate ingredients (see Task #1), OI has developed and maintained a feed ingredient database for over 10 years. This database is an invaluable tool when developing novel feed formulations and includes detailed nutritional composition data of commercially and locally available ingredients. The database also includes information about ingredient prices and annual yields. However, the biochemical composition of feed ingredients, as well as price, may vary within batch, season, location, and supplier, so updating the database is an important task for this proposed project.

OI researchers will review OI's database, as well as published literature, to understand the nutritional quality and digestibility of available feed ingredients. Nutritional and price data, and nutrient requirements for cattle and tilapia, will be entered into feed formulation software. Additives, including vitamin and mineral mixes and binder, also will be included in the feed formulation. A cost-effective feed formulation for cattle and tilapia will be developed for production at OI's Feeds Research and Pilot Production Facility. Feed formulation and use of software will be managed by Dr. Fabio Soller, Director of OI's Aquatic Feeds and Nutrition Department, who has over 10 years of experience as an aquatic nutritionist.

Task #3: Develop Processing Methods

Once feed formulations are developed, OI researchers will optimize processing conditions for cattle and tilapia feeds at OI's Feeds Research and Pilot Production Facility (see description of feed mill above). Feed processing is one of the most important factors affecting the physical and

nutritional composition of formulated diets. Even with the same formulation, the physical quality of the feed (such as water stability and durability) can vary because different processing approaches involve diverse factors, such as pressure, temperature, and moisture level. OI's Feeds Research and Pilot Production Facility will be managed by Mr. Lucas Porter who has over 10 years of experience operating research and commercial feed mills.

Task #4: Produce Cattle and Tilapia Feeds

Once the proper feed processing conditions are defined, OI researchers will produce up to 20 tons of cattle feed and 10 tons of tilapia feed at OI's feed mill. Prior to dissemination to farmers, the cattle and tilapia feeds will be analyzed for physical qualities and nutritional composition at OI's Analytical Feeds Quality Control Laboratory. Feed processing will be managed by Mr. Lucas Porter, whereas feed analyses will be managed by Dr. Zhi Yong Ju.

Task #5: Evaluate Cattle and Tilapia Feeds

Participating cattle ranchers and tilapia farmers will be asked to evaluate OI's animal feeds by conducting a feeding trial using the novel feed formulations generated from this project. Likely candidates include Parker Ranch for the cattle feed evaluation and Mari's Gardens and Hawaii Fish Company for the tilapia feed evaluation. Feeds will be distributed to the ranchers and farmers for free and in appropriate quantities to ensure a valid trial at a commercially relevant scale.

For the cattle feed evaluation, there will be two (2) lots of 100 grass-fed head weighing an average of 800 pounds. Cattle will be fed for 90-120 days and will receive 3.5-4.0 pounds of feed per animal per day. One lot will receive a formulated feed made by OI and which will complement available pasture. Cattle on the other lot will only have pasture available as a food source (standard reference diet). At the end of the evaluation period, cattle from each lot will be weighed and weight gain will be compared between the two lots. Growth rate, feed consumption, and cost of production will be quantified.

For the tilapia feed evaluation, juvenile tilapia (~ 20-30 grams) will be grown for 8-10 weeks on at least two commercial tilapia farms. Each participating farm will receive an appropriate amount of feed to conduct a valid feeding trial. Feed conversion ratio for tilapia is expected to be ~ 1.5 (feed weight/fish weight). The commercial feed used at each farm will serve as a standard reference diet. At harvest, OI technicians and students will measure tilapia for weight gain. An overall count of fish harvested versus number stocked will be used to determine survival. Tilapia performance comparisons will be made between the locally produced diet and commercial reference diets. Cattle and tilapia feeding trials will be arranged and managed by Dr. Fabio Soller, Director of OI's Aquatic Feeds and Nutrition Department.

2. Project Timeline

Task	1	2	3	4	5	6	7	8	9	10	11	12
1												
2												
3												
4												
5												
Report												

Task 1: Develop Nutritional Profiles
Task 2: Formulate Diets
Task 3: Develop Processing Methods
Task 4: Produce Cattle and Tilapia Feeds
Task 5: Evaluate Cattle and Tilapia Feeds
Report: month 12

3. Quality Assurance and Evaluation Plan

OI will implement a rigorous quality assurance program to ensure that feed ingredients used in the manufacture of cattle and tilapia feeds will be of high quality and free of potential contaminants. This quality assurance program will be implemented at OI's Analytical Feeds Quality Control Laboratory which contains state-of-the-art analytical equipment (e.g. HPLC amino acid analyzer, elemental nitrogen analyzer, gas chromatograph - fatty acid & pesticide analyzer, UV spectrophotometer, and near infrared spectrophotometer) to carry out the program. Biochemical composition of feed ingredients used in this project will be compared against a feed ingredient database which we have maintained for over 10 years. If there are significant discrepancies in the biochemical composition between feed ingredients used in this project and similar ingredients in our feed ingredient database, biochemical analyses will be repeated. In addition, once the cattle and tilapia feeds are produced at OI's Feeds Research and Pilot Production Facility, samples of these feeds will be analyzed for physical qualities and nutritional composition at OI's Analytical Feeds Quality Control Laboratory prior to distribution to the ranchers and farmers participating in the feeding trials. In addition, due to potential variation in biochemical composition of feed from batch to batch, samples from every batch of feed (a "batch" is an amount of feed made at any one time) will be analyzed for biochemical composition to ensure that the nutritional profile of each feed is accurate. OI's Analytical Feeds Quality Control Laboratory is managed by Dr. Zhi Yong Ju who has over 12 years of experience as a Research Scientist at OI where he specializes in biochemical analysis. Broad oversight of the lab will be conducted by Dr. Fabio Soller, Director of OI's Aquatic Feeds and Nutrition Department.

4. Measure of effectiveness

The key measure of effectiveness for this project is the manufacture of high-quality cattle and tilapia feed at OI's Feeds Research and Pilot Production Facility and good animal performance using OI's feed relative to a standard reference diet, as indicated by good growth, feed

conversion efficiencies, and survival of cattle and tilapia on commercial farms. Specific metrics include:

- Nutrient profiles of locally sourced feed ingredients
- Cost-effective feed formulations for cattle and tilapia which include locally sourced feed ingredients
- Feed processing specifications optimized for using locally sourced ingredients
- Sufficient quantities of cattle and tilapia feed so that animals can be evaluated at a commercially relevant scale
- Animal performance data (weight gain, feed conversion efficiencies, and survival)
- Comparison of animal performance when fed OI feed *versus* standard reference diet

III. Financial

1. Project Budget:

a. Budget request by source of funds
"next page"

BUDGET REQUEST BY SOURCE OF FUNDS

Period: July 1, 2018 to June 30, 2019

Applicant: Oceanic Institute of Hawaii Pacific University

BUDGET CATEGORIES	Total State Funds Requested (a)	Total Federal Funds Requested (b)	Total County Funds Requested (c)	Total Private/Other Funds Requested (d)
A. PERSONNEL COST				
1. Salaries	38,610			
2. Payroll Taxes & Assessments				
3. Fringe Benefits	8,494			
TOTAL PERSONNEL COST	**47,104**			
B. OTHER CURRENT EXPENSES				
1. Airfare, Inter-Island				
2. Insurance				
3. Lease/Rental of Equipment				
4. Lease/Rental of Space				
5. Staff Training				
6. Supplies (Feed Ingredients)	78,200			
7. Telecommunication				
8. Utilities				
9 Feed Mill Operating Costs	41,273			
10 Biochemical Analysis Costs	10,000			
11 Transportation Costs	1,000			
12				
13				
14				
15				
16				
17				
18				
19				
20				
TOTAL OTHER CURRENT EXPENSES	**130,473**			
C. EQUIPMENT PURCHASES				
D. MOTOR VEHICLE PURCHASES				
E. CAPITAL				
TOTAL (A+B+C+D+E)	**177,577**			

SOURCES OF FUNDING	
(a) Total State Funds Requested	177,577
(b) Total Federal Funds Requested	
(c) Total County Funds Requested	
(d) Total Private/Other Funds Requested	
TOTAL BUDGET	**177,577**

Budget Prepared By:

Dr. Shaun Moss 808-259-3110

Phone

[redacted] 1/19/18

Signature of Authorized Official Date

Executive Director

Name and Title (Please type or print)

b. Personnel salaries and wages

BUDGET JUSTIFICATION - PERSONNEL SALARIES AND WAGES

Period: July 1, 2018 to June 30, 2019

Applicant: Oceanic Institute of Hawaii Pacific University

POSITION TITLE	FULL TIME EQUIVALENT	ANNUAL SALARY A	% OF TIME ALLOCATED TO GRANT REQUEST B	TOTAL STATE FUNDS REQUESTED (A x B)
Feeds Department Director (Research Scientist)		$85,000.00	15.00%	$ 12,750.00
Feed Mill Processor		$55,000.00	30.00%	$ 16,500.00
Feed Mill Research Technician		$31,200.00	30.00%	$ 9,360.00
				$ -
				$ -
				$ -
				$ -
				$ -
				$ -
				$ -
				$ -
				$ -
				$ -
				$ -
TOTAL:				38,610.00

JUSTIFICATION/COMMENTS:

c. Equipment and motor vehicles

BUDGET JUSTIFICATION - EQUIPMENT AND MOTOR VEHICLES

Period: July 1, 2018 to June 30, 2019

Applicant: Oceanic Institute of Hawaii Pacific University

DESCRIPTION EQUIPMENT	NO. OF ITEMS	COST PER ITEM	TOTAL COST	TOTAL BUDGETED
			$ -	
			$ -	
			$ -	
			$ -	
			$ -	
TOTAL:				
JUSTIFICATION/COMMENTS:				

DESCRIPTION OF MOTOR VEHICLE	NO. OF VEHICLES	COST PER VEHICLE	TOTAL COST	TOTAL BUDGETED
			$ -	
			$ -	
			$ -	
			$ -	
			$ -	
TOTAL:				
JUSTIFICATION/COMMENTS:				

e. Government contracts, grants, and grants in aid

GOVERNMENT CONTRACTS AND / OR GRANT

Applicant: Oceanic Institute of Hawaii Pacific University

Contracts Total: $3,623,162

	CONTRACT DESCRIPTION	EFFECTIVE DATES	AGENCY	GOVERNMENT ENTITY (U.S. / State / Haw / Hon / Kau / Mau)	CONTRACT VALUE
1	Federal funds to construct Research Feed Mill	Expires 2/28/18	USDA NIFA	US	1,719,162
2	State funds to construct Research Feed Mill	Expires 2/28/18	DLNR	State/Haw	804,000
3	State funds for planning, design and construction of	Expired 6/30/14	Department of Agriculture	State/Haw	450,000
4	State funds to construct Research Feed Mill	Expires 2/28/18	Department of Agriculture	State/Haw	300,000
5	State funds to construct Research Feed Mill (GIA)	Expired 10/31/17	Department of Agriculture	State/Haw	350,000
6					
7					
8					
9					
10					
11					
12					
13					
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15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					

2. Anticipated quarterly funding requests for FY2019.

Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total Grant
$44,394	$44,394	$44,394	$44,394	$177,577

3. List all other sources of funding that they are seeking for fiscal year 2019.

- U.S. Department of Agriculture / Center of Tropical and Subtropical Aquaculture (Federal)
- U.S. Department of Commerce / NOAA (Federal)
- Ulupono Initiative (Private)

4. All Federal, State, and County Tax Credits Granted in Past 3 Years.

"not applicable"

5. List of all federal, state, and county government contracts, grants and grants in aid within the prior three years and will be receiving for fiscal year 2019.

"see form e. Government contracts, grants, and grants in aid"

6. Balance of Unrestricted Current Assets as of 12/31/2017.

For Oceanic Institute as of 12/31/17 is $16,490,955 and for Hawaii Pacific University as of 6/30/16 is $76,612,591.

IV. Experience and Capability

1. Necessary Skills and Experience

The overall project will be managed by Dr. Fabio Soller, Director of OI's Aquatic Feeds and Nutrition Department, who has over 10 years of experience as an aquatic nutritionist (see select publication list below). Dr. Soller also will have primary responsibilities associated with Task #2 (Formulate Diets), Task #5 (Evaluate Cattle and Tilapia Feeds), and preparing the Final Report. Dr. Zhi Yong, who has over 12 years of experience as a biochemist (see select publication list below) will manage OI's Analytical Feeds Quality Control Laboratory and will have primary responsibilities associated with Task #1 (Develop Nutritional Profiles). Mr. Lucas Porter, Feed Mill Manager, who has over 10 years of experience operating research and commercial feed mills, will have primary responsibilities associated with Task #3 (Develop Processing Methods) and Task #4 (Produce Cattle and Tilapia Feeds).

OI researchers have been involved in the following verifiable animal feeds research projects from 2015 – 2017:

- *Developing diets for Hawaii cultured abalone with normal shell color and high growth performance using local algae and their co-products* (funded by U.S. Dept. Agriculture)

- *Utilization of locally available algae in the culture of the ezo abalone and opihi in Hawaii* (funded by U.S. Dept. Agriculture)
- *Natural whole-cell oil microcapsules as innovative enrichment diets for live feeds* (funded by U.S. Dept. Agriculture)
- *Development of locally made commercial feed for tilapia aquaculture in Hawaii* (funded by U.S. Dept. Agriculture)
- *Development of local feeds to support sustainable aquaculture in Hawaii and other Pacific Islands* (funded by U.S. Dept. Agriculture)
- *Utilization of local agri-processing by-products to produce fungal protein for aquatic feed production* (funded by U.S. Dept. Agriculture)
- *Aquaculture of Opihi* (funded by U.S. Dept. Agriculture)
- *Black Soldier Fly as a feed ingredient to support Hawaiian aquaculture* (funded by U.S. Dept. Agriculture)
- *Development of cost effective aquatic feeds using locally sourced ingredients* (funded by U.S. Dept. Agriculture)
- *Improving nursery grow-out culture of mangrove crab by minimizing cannibalism and developing feed supplements* (funded by U.S. Dept. Agriculture)
- *Cost effective local feeds for carnivorous and omnivorous fish with varying characteristics* (funded by U.S. Dept. Agriculture)

2. Facilities

OI's Feeds Research and Pilot Production Facility

OI's Feeds Research and Pilot Production Facility is located on a 1-acre parcel of land at the Panaewa Agricultural Park in Hilo, Hawaii. The land is leased to OI from the University of Hawaii at Hilo under an agreement which terminates in December, 2036. The feed mill occupies 5,700 ft^2 and contains a hammer mill, mixer, pellet mill, wet extruder, dryer, and fat coater, all of which have been donated to OI from the private sector (see Figs. 1-3). The feed mill has the capacity to produce several tons of animal feed per hour and this high-level capacity will allow OI scientists to develop animal feeds which can then be evaluated on a commercial scale to determine if the ingredients and novel feed formulations promote good animal health and growth.

The new feed mill significantly enhances OI's animal feeds production capabilities, as shown in the following table.

Table 1. Feed milling capabilities of OI's existing mill on Oahu and OI's new mill in Hilo.

Processing Capability	Existing Mill (Oahu)	New Mill (Hilo)
Hammer mill	75 kg/hr	3,000 kg/hr @ 420 microns
Mixer	300 kg/hr @ 20 min mixing time	4,000 kg/hr @ 3 min mixing time
Pellet mill	5–10 kg/hr	1,500–4,000 kg/hr
Meat grinder	1-2 kg/hr	
Wet extruder	100-500 kg/hr	100–500 kg/hr
Dryer	1,500-4,000 kg/hr	1,500–4,000 kg/hr
Fat coater	N/A	2,000 kg/hr @ 6 min coating time

OI's new feed mill in Hilo consists of a single steel-framed structure complete with utilities, parking area, truck off-loading and turn-around, and a short access road from the public highway. In December 2017, OI commissioned the feed mill and tested specialized feed mill equipment, including:

- *Wenger* X-20 cooking extruder and 360 dryer/cooler
- *CPM* series 1112-2 pellet mill with double pass conditioners
- *Bliss Hammer mill* with product filter collector
- *Forberg* high-mixer
- *Forberg* high speed fat coater
- *Abel* micro ingredient bins, liquid scale, and dispenser
- *Rotex* screens and scalpers
- *Clever-Brooks* 100 hp boiler
- *Ingersoll-Rand* air compressor

All equipment has been tested and the feed mill is ready to begin manufacturing animal feed for this proposed project.

Additional Facilities. OI's main campus is located on a narrow coastline, approximately 56 acres in area, on Kalanianaole Highway in Waimanalo, Hawaii. Research and training are conducted in several of the 25+ separate buildings, ponds, tanks, and laboratories that constitute the existing campus.

Infrastructure used to support OI's aquatic feeds and nutrition research includes four separate buildings for aquatic animal feed production and five separate facilities for feed testing. The four facilities used for feed production include: 1) a 97-m^2 building containing two offices, two air-conditioned dry feed ingredient storage rooms, three dry feed processing laboratories, and a small boiler room; 2) a 93-m^2 laboratory containing a cooking extruder, steam dryer, moisture tester, and steam boiler; 3) a 39-m^2 lab containing an oil press, pulverizer, and a fixed blade hammer mill; and 4) an 11-m^2 lab to test the physical quality of the finished feeds.

The five facilities used for feed testing include: 1) an Indoor Clean Laboratory containing 75 52-liter glass aquaria with flow-through seawater; 2) an Industry Support Module with 56 1,500-liter fiberglass tanks located outdoors and 52 115-liter plastic tanks located indoors; 3) a Digestibility & Attractability Laboratory equipped with 24 675-liter digestibility tanks and 36 55-liter attractant tanks; 4) an Outdoor Microcosm Laboratory equipped with 56 1,500-liter fiberglass tanks supplied with air and seawater; and 5) a 150-m^2 Analytical Feeds Quality Control Laboratory used to analyze feed ingredients, feeds, and animal tissue and containing an HPLC amino acid analyzer, elemental nitrogen analyzer, gas chromatograph - fatty acid & pesticide analyzer, UV spectrophotometer, and near infrared spectrophotometer, among other standard analytical laboratory equipment.

OI scientists have been conducting aquatic feeds research for over 30 years and have developed defined diets for a variety of marine organisms. More recently, through USDA funding, OI scientists are

identifying, characterizing, and evaluating locally based plant and animal co-products as potential ingredients for aquatic feeds in an effort to reduce the use of fish meal and fish oil in animal diets.

V. Personnel: Project Organization and Staffing

1. Proposed Staffing, Staff Qualifications, Supervision and Training

Finance team

The finance team consists of Mr. Bruce Edwards, HPU Vice President and Chief Financial Officer, and Ms. Marina Ong, Associate Controller for Business Affairs at OI. A grants office is also part of the finance team, where Robin Springer ensures that procurement and compliance requirements of the project are met.

Engineering team

The engineering team includes Mr. John Russell, HPU Director of Facilities, Mr. Randall Honke, and Mr. Harry Ho. Mr. Honke is OI's Senior Mechanical Engineer and served as the Project Manager during construction of OI's new feed mill in Hilo. Mr. Honke is a licensed mechanical engineer in the State of Hawaii and has over 20 years of design and construction-related experience. Mr. Ho is OI's Director of Facilities and serves as Construction Manager. Mr. Ho also is in charge of planning for all OI construction projects. Mr. Ho is an architect with over 45 years of design and construction related experience.

Scientific and technical team

The strength of OI lies in its professional staff and employs a team of about 45 scientists, professionals, and support personnel. OI conducts applied research which is integrated across five technical programs including marine fish and shrimp aquaculture, stock enhancement, applied marine biotechnology, and aquatic feeds development. OI's Aquatic Feeds and Nutrition Department has been conducting aquatic feeds research for over 30 years and has extensive laboratory facilities with a wide range of analytical capabilities, as well as support infrastructure to assess the nutritional requirements of a variety of aquatic organisms.

Key members of the OI staff who play important roles in OI's research include:

Dr. Shaun Moss, Executive Director of OI, received his Ph.D. degree in Zoology from the University of Hawaii in 1993

Dr. Fabio Soller, Director of OI's Aquatic Feeds & Nutrition Department, received his Ph.D. degree in Aquaculture from Auburn University in 2013

Dr. Zhi Yong Ju, Interim Director of OI's Aquatic Feeds & Nutrition Department, received his Ph.D. degree in Animal Sciences from Northwest A&F University in P.R. China

Mr. Lucas Porter, Feed Mill Manager, received his M.S. degree in Agricultural Education from Montana State University in 2003

Dr. Dustin Moss, Director of OI's Shrimp Department, received his Ph.D. in Molecular Biology and Bioengineering from the University of Hawaii in 2013

Dr. Chad Callan, Director of OI's Finfish Department, received his Ph.D. in Fisheries from the University of Maine in 2008

Dr. Cheng-Sheng Lee, Executive Director of the Center for Tropical and Subtropical Aquaculture, received his Ph.D. in Aquaculture from the University of Tokyo, Japan, in 1979

Below is a listing of select peer-reviewed publications from OI scientists related to OI's proposed GIA-funded project:

Ju, Zhi Yong, Cecilia Viljoen, Peter Hutchinson, Justin Reinicke, F. David Horgen, Luke Howard & Cheng-Sheng Lee. 2015. Effects of diets on the growth performance and shell pigmentation of Pacific abalone. Aquaculture Research (2016).

Daqui, L.A.; Soller, F.; Mertz, K.; Bell, E. 2015 (September/October). The real world answer to the investment in Empyreal® 75 for your shrimp production. Aquafeed; Advances in processing & formulation. 7 (3): 39-40.

Soller, F. 2014. Physical characteristics and functionality of Corn Protein Concentrate in animal feeds. Aquafeed; Advances in processing & formulation. 6 (3): 27-31.

http://aquafeed.com/newsletter_pdfs/nl_000719.pdf?utm_source=Aquafeed+%3A+Advances+In+Processing+%26+Formulation&utm_campaign=bf494e7cfc-AAPF-10-08-14-aqua&utm_medium=email&utm_term=0_6ee246441b-bf494e7cfc-57493

Soller, F.; Klapperich, M.; Bartsch, E. 2014. Pea starch. Aquafeed; Advances in processing & formulation. 6 (3): 15-18.

Sookying, D.; Davis, D.A.; Silva, F.S.D. 2013. A review of the development and application of soybean-based diets for Pacific white shrimp *Litopenaeus vannamei*. Aquaculture Nutrition. 19 (4): 441-448. DOI: 10.1111/anu.12050

Deng. D.F., Z.Y. Ju, W.G. Dominy, L. Conquest, S. Smiley & P.J. Bechtel. 2014. Effect of replacing dietary menhaden oil with pollock or soybean oil on muscle fatty acid composition and growth performance of juvenile Pacific threadfin (*Polydactylus sexfilis*). Aquaculture 422–423, 91–97.

Ju, Zhi Yong, Ian P. Forster, Dong-Fang Deng, Warren G. Dominy, Scott Smiley & Peter J. Bechtel. 2013. Evaluation of skate meal and sablefish viscera meal as fish meal replacement in diets for Pacific threadfin (*Polydactylus sexfilis*). Aquaculture Research 44, 1438-1446.

Deng. D.F., Z.Y. Ju, W.G. Dominy, P.J. Bechtel & S. Smiley. 2013. An evaluation of pink salmon (*Oncorhynchus gorbuscha*) testes meal in diets for pacific white shrimp (*Litopenaeus vannamei*): effect on palatability, digestibility and growth performance. Aquaculture Nutrition 19, 908–916.

Ju, Zhi Yong, Deng, Dong-Fang, Dominy, Warren. 2012. A defatted microalgae (*Haematococcus pluvialis*) meal as a protein ingredient to partially replace fishmeal in diets of Pacific white shrimp (*Litopenaeus vannamei*). Aquaculture 354–355, 50–55.

Ju, Zhi Yong, Frank Castille, Dong-Fang Deng, Warren G. Dominy, Addison L. Lawrence, Ian P. Forster. 2012. Effects of replacing fish oil with stearine as main lipid source in diet on growth and survival of Pacific White Shrimp, *Litopenaeus vannamei*. Aquaculture Research 43, 1528–1535.

Ju, Zhi Yong, Deng, Dong-Fang, Dominy, Warren, Forster, Ian. 2011. Pigmentation of Pacific White Shrimp (*Litopenaeus vannamei*) by Dietary Astaxanthin Extracted from Haematococcus pluvialis. Journal of the World Aquaculture Society 42, 633-644.

Forster, I. P., Bechtel, W.G. Dominy, R. Avena, Z.Y. Ju, L. Conquest. 2011. Use of fish hydrolysates and fishmeal by-products of the Alaskan fishing industry in diets for Pacific White Shrimp, Litopenaeus vannamei. North American Journal of Aquaculture 73:288-295.

Dong Fang Deng, Zhi Yong Ju, W. Dominy, Ryan Murashige, Robert Wilson. 2011. Optimal dietary protein levels for juvenile Pacific threadfin (*Polydactylus sexfilis*) fed diets with two levels of lipid. Aquaculture 316, 25-30.

Ju, Zhi Yong, Forster, Ian, Dominy, Warren, Lawrence, Addison. 2011. Classification and quantification of phospholipids and dietary effects on lipid composition in shrimp (*Litopenaeus vannamei*). North American Journal of Aquaculture 73: 221-229.

Dong Fang Deng, Zhi Yong Ju, W. Dominy, Ryan Murashige, Robert Wilson. 2011. Optimal dietary protein levels for juvenile Pacific threadfin (*Polydactylus sexfilis*) fed diets with two levels of lipid. Aquaculture 316, 25-30.

D.F. Deng, W.G. Dominy, Z.Y. Ju, S. Koshio, R. Murashige, R. Wilson. 2010. Dietary lysine requirement of juvenile Pacific threadfin. (*Polydactylus sexfilis*). Aquaculture 308, 44-48.

Ju, Zhi Yong, Forster, I., and Dominy, W.G. 2010. Effects of supplementing bioactive compounds to a formulated diet on sensory compounds and growth of shrimp, (*Litopenaeus vannamei*) (Boone, 1931). Aquaculture Research 41, 1421-1431.

2. Organization Chart

"See included chart on page 29"

3. Compensation

Annual salaries paid to the three highest employees of Hawaii Pacific University include:

- Geoffrey Bannister, President - $505,829
- Matthew A Liao Troth, Provost and VP of Academic Affairs- $299,750
- Bruce Edwards, CFO and VP - $281,678

VI. Other

1. Litigation

Hawaii Pacific University and the Oceanic Institute currently do not have any pending litigation.

2. Licensure or Accreditation

OI is licensed and accredited in accordance with federal, state, county statutes, rules, or ordinances, to conduct the activities and provide the services for which this grant is requested. OI possesses the State of Hawai'i Aquaculture Facility Licenses numbers 18051 and 18052.

Hawai'i Pacific University is accredited by the Accrediting Commission for Senior Colleges and Universities of the Western Association of Schools and Colleges (WASC).

The School of Education has received accreditation for its education programs (B.Ed. and M.Ed. degrees) by the Council for the Accreditation of Educator Preparation (CAEP).
The Nursing Program (BSN and MSN degrees) is approved by the Hawai'i Board of Nursing and is accredited by the Commission on Collegiate Nursing Education (CCNE).

The Social Work program (BSW and MSW degrees) is accredited by the Council on Social Work Education (CSWE).

The University is a member of:

- Hawaii Public Health Association
- The American Association of Colleges of Nursing

3. Private Educational Institutions

Hawaii Pacific University is a private, non-sectarian, non-profit educational organization.

4. Future Sustainability Plan

OI's Feeds Research and Pilot Production Facility will be used to support research activities at OI and the University of Hawai'i's Manoa and Hilo aquaculture and animal science programs. Funding to support feeds research will come from federal, state, and private sources, such as U.S. Department of Agriculture, Agriculture and Food Research Initiative (AFRI) Program, U.S. Department of Commerce, NOAA, Saltonstall-Kennedy Program, and the U.S. Department of Agriculture, Center for Tropical and Subtropical Aquaculture (CTSA). Additional support for feeds research and the production of research feeds could come from collaborators at academic institutions in the U.S.-affiliated Pacific Islands (e.g. University of Guam, Northern Marians College, Palau Community College) and on the U.S. mainland (e.g. Texas A&M University, Kansas State University). Importantly, several academic institutions in the U.S.-affiliated Pacific Islands have access to formula grants (e.g. Hatch funds) and these funds may be used to produce research feeds and support OI's feed mill.

OI's Feeds Research and Pilot Production Facility also will be used for research for private-sector companies through direct contracts or SBIR collaborative government grants in the following areas:

- New feed ingredients from agricultural & biofuel by-products
- New feed product development (abalone, opihi, sea urchin)
- Equipment optimization and efficacy for producing specific feeds
- Processing effects on nutritional value of ingredients
- Pharmaceutical additives for the aquatic feed industry
-

Note: UH-Hilo has a Pharmacy School and collaboration on aquatic and terrestrial animal feed pharmaceutical additives trials can be developed.

Commercial partners who have participated in OI-sponsored research include:

- Diamond Head Seafood Wholesale, Inc. (fish processing by-products)
- Kona Blue (Longfin amberjack growout and broodstock feeds development)
- Big Island Abalone (abalone growout feeds development)
- Pacific Biodiesel, Inc. (new feedstock's from biofuel processing by-products)

These, and other, companies may be interested in contract work using OI's feed mill.

Commercial feed and feed ingredient companies who also may be interested in contract work include:

- Monsanto / Bunge / Solea / General Atomics
- Novus / Degussa-Evonik
- Cargill / Land-O-Lakes / Rangen / Zeigler / Burris
- U.S. Soybean Board / American Soybean Association
- EWOS Innovation
- Skretting / Nutreco

The Feeds Research and Pilot Production Facility will support several new training initiatives including:

1. Certificate Program with short and intensive extension courses by OI in:
    - Aquatic nutrition and aquatic feed formulations
    - Aquatic feed manufacturing and equipment processing parameters
    - Quality control (nutritional and physical characteristics) on ingredients and finished feeds.
    - Terrestrial feeds manufacturing (formulations, processing equipment,)
2. Undergraduate- and graduate-level courses in aquatic nutrition and feeds processing technology conducted by OI researchers with Hawaii Pacific University and the University of Hawaii Manoa and Hilo.

Finally, the Feeds Research and Pilot Production Facility will allow OI researchers to expand their nutrition and feeds technology consultant services to include subject matter expertise in formulations, processing technology, plant retrofitting, and planning of new commercial and research plants.

1. Consulting contracts with commercial companies will include:

    - Biofuel companies in utilization of co-products in aquatic and terrestrial feeds.
    - In-plant design processing and QC training
    - Co-product utilization in aquatic and terrestrial animal feeds

5. Certificate of Good Standing

"Please see included on page 30"

6. Declaration Statement

DECLARATION STATEMENT OF APPLICANTS FOR GRANTS PURSUANT TO CHAPTER 42F, HAWAI'I REVISED STATUTES

The undersigned authorized representative of the applicant certifies the following:

1) The applicant meets and will comply with all of the following standards for the award of grants pursuant to Section 42F-103, Hawai'i Revised Statutes:

   a) Is licensed or accredited, in accordance with federal, state, or county statutes, rules, or ordinances, to conduct the activities or provide the services for which a grant is awarded;

   b) Complies with all applicable federal and state laws prohibiting discrimination against any person on the basis of race, color, national origin, religion, creed, sex, age, sexual orientation, or disability;

   c) Agrees not to use state funds for entertainment or lobbying activities; and

   d) Allows the state agency to which funds for the grant were appropriated for expenditure, legislative committees and their staff, and the auditor full access to their records, reports, files, and other related documents and information for purposes of monitoring, measuring the effectiveness, and ensuring the proper expenditure of the grant.

2) If the applicant is an organization, the applicant meets the following requirements pursuant to Section 42F- 103, Hawai'i Revised Statutes:

   a) Is incorporated under the laws of the State; and

   b) Has bylaws or policies that describe the manner in which the activities or services for which a grant is awarded shall be conducted or provided.

3) If the applicant is a non-profit organization, it meets the following requirements pursuant to Section 42F- 103, Hawai'i Revised Statutes:

   a) Is determined and designated to be a non-profit organization by the Internal Revenue Service; and

   b) Has a governing board whose members have no material conflict of interest and serve without compensation.

Pursuant to Section 42F-103, Hawai'i Revised Statutes, for grants used for the acquisition of land, when the organization discontinues the activities or services on the land acquired for which the grant was awarded and disposes of the land in fee simple or by lease, the organization shall negotiate with the expending agency for a lump sum or installment repayment to the State of the amount of the grant used for the acquisition of the land.

Further, the undersigned authorized representative certifies that this statement is true and correct to the best of the applicant's knowledge.

Oceanic Institute of Hawaii Pacific University

Oceanic Institute of Hawaii Pacific University
(Typed Name of Individual or Organization)

[redacted] 1/19/18

(Signature) (Date)

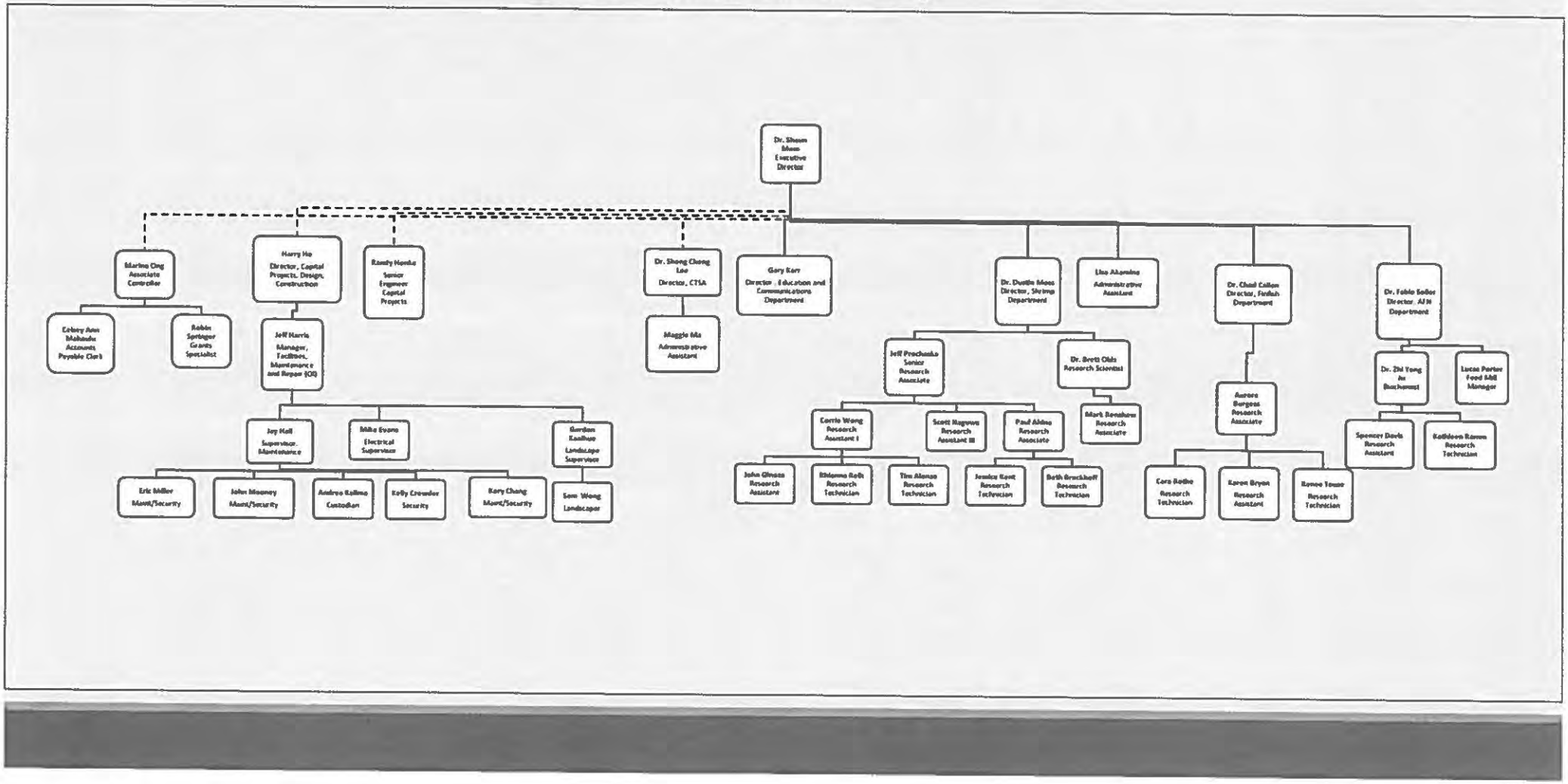
Shaun Moss Executive Director

(Typed Name) (Title)

7. Public Purpose

"not applicable"

Oceanic Institute of Hawaii Pacific University



Department of Commerce and Consumer Affairs

CERTIFICATE OF GOOD STANDING

I, the undersigned Director of Commerce and Consumer Affairs of the State of Hawaii, do hereby certify that

HAWAI`I PACIFIC UNIVERSITY

was incorporated under the laws of Hawaii on 09/22/1965 ; that it is an existing nonprofit corporation; and that, as far as the records of this Department reveal, has complied with all of the provisions of the Hawaii Nonprofit Corporations Act, regulating domestic nonprofit corporations.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the seal of the Department of Commerce and Consumer Affairs, at Honolulu, Hawaii.

Dated: January 18, 2018

Director of Commerce and Consumer Affairs

To check the authenticity of this certificate, please visit: http://hbe.ehawaii.gov/documents/authenticate.html
Authentication Code: 295349-COGS_PDF-13419D2

ulupono INITIATIVE

January 13, 2018

Dear Shaun:

The Ulupono Initiative is a strong supporter of the Ocean Institute Feed Research and Pilot Production Facility in Pana'ewa Agricultural Park, in Hilo Hawaii ("Feed Mill"). The Feed Mill serves as the critical infrastructure for the revitalization of agriculture, linking farmers of crops with the animal husbandry community. The Feed Mill is one of the successful public private partnerships bringing together, federal, state, foundation, and private sector funds. We greatly appreciate the legislature's $350,000 Grant in Aid to help complete the construction in 2016. Ulupono provided $2,000,000 in financial commitment to allow the Oceanic Institute to complete the Feed Mill. This is our largest single grant in our 8 year history. The mill is entering its final stage of construction and should be operational this year.

As we enter production, the Feed Mill will need some operational funds to help it start up. Ulupono has committed to help feed research in the mill, and has been working with ranchers, chicken, pig and fish farmers to work with the staff at Oceanic Institute to devise formulations to trial in 2018 and 2019. Ulupono has committed to cover the difference between the cost of production through the Feed Mill and the cost of imported feeds that are being displaced.

Ulupono would be deeply appreciative of the legislature's willingness to consider a second Grant in Aid to help the operational start up. This effort will cover four major areas: 1) working with local farmers to secure ingredient supply chains; 2) developing processing methods and specifications to optimize the use of locally sourced ingredients for animal feeds; 3) producing cattle and tilapia feeds using feed formulations which will include locally sourced ingredients; and 4) evaluating cattle and tilapia feeds at commercial farms in Hawaii.

At Ulupono Initiative, we strive to improve the quality of life for the people of Hawaii by investing in key mission areas of local food, renewable energy, and waste reduction. We are honored to be partners with the State of Hawaii in this venture

Sincerely

[redacted]

Kyle Datta
General Partner

P.O. Box 437462 | Kamuela, Hawaii 96743 | +1 808 887-6411 | Fax +1 808 885-6707 | kohalacenter.org

THE KOHALA CENTER

January 17, 2018

Nandana Kalupahana
State Capital Rm. 306
Honolulu, HI 96813

Dear Nandana Kalupahana,

I am writing in support of the Oceanic Institute of Hawaii Pacific University's application for the Grant-in-Aid from the Hawaii Sate Legislature.

As the Cooperative Business Development Specialist at The Kohala Center, I work closely with local meat and pork producers. A major challenge they face is the cost of imported feed and the reality of competing for markets that can be filled by inexpensive meat and pork supplied from a global marketplace. Still there is much interest in local meat and pork when it is available. Getting input costs lower helps them be more competitive and produce a great local product that is in demand.

Dr. Fabio Soller and his team at the Aquatic and Nutrition Program has been supportive, specifically to the Hawaii Swine Producers Cooperative. This cooperative was started as a group effort to find a solution to "not importing feed". They have started their own feed mill, which is run by one of the cooperative members supplying feed to the other members of the cooperative. Dr. Soller and his team worked with them to do a nutrition analysis on feed sources they are testing. This work needs to continue.

Please support the important work they are doing. If you have any questions, please feel free to call me at 808-313-0430.

Teresa Young MA
[redacted]
Cooperative Development Specialist
The Kohala Center

PACIFIC BIODIESEL

40 Hobron Ave.
Kahului, Hawaii 96732
Phone (808) 877-3144
Fax (808) 877-5030
www.biodiesel.com

Dr. Shaun Moss
Executive Director
Oceanic Institute of Hawai`i Pacific University
41-202 Kalaniana`ole Hwy.
Waimanalo, HI 96795-1820

Dear Dr. Moss,

Pacific Biodiesel is pleased to hear of the completion of the Oceanic Institute feed mill in Hilo. We support the goals of this mill, which are to promote feed development within our state using locally-produced feed ingredients. We are looking forward to the beginning of operations at the feed mill facility.

As a producer of feed ingredients on Hawaii Island, including macadamia and sunflower meal, we believe this feed mill will help us with market development as well as help Hawaii's livestock and aquaculture industry. Imported feed is not of as high a quality as freshly produced feed, as well as being expensive, so we believe this project will benefit all in the state who grow or eat locally produced meat or fish.

Mahalo,

[redacted]

Jenna Long
Director of Operations
Pacific Biodiesel Technologies

MARI'S GARDENS

growing in balance

January 15, 2018

Dear Dr. Shaun Moss:

It is my pleasure to write this letter in support of Oceanic Institute's construction of a Feed Research and Pilot Production Facility in Pana'ewa Agricultural Park, Hilo, Hawai'i ("Feed Mill"). Once completed, we believe that the Feed Mill can help catalyze the research and development of lower cost, local feed ingredients for the aquaculture and other animal husbandry industries in Hawai'i.

Mari's Gardens believes in the potential of the Feed Mill and feels that it may greatly aid in our mission to create food security for Hawai'i. Lowering feed cost by eliminating importation would directly lower the cost of production for our and many other aquaculture operations in the state.

We hope that this project receives the support that it deserves.

Thank you,

[redacted]

Brendon Lau
Manager

January 16, 2018

Fabio Soller, Ph.D.
Director of Aquatic Feeds and Nutrition Department
Oceanic Institute of Hawaii Pacific University
Makapu'u Point
41-202 Kalaniana'ole Hwy.
Waimanalo, HI 96795-1820
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Dear Dr. Soller

This letter is being written in support of the Oceanic Institute Research Feed Mill at the UH Panaewa Farm in Hilo, Hawaii. The project, which incorporates both research and pilot production capabilities, will be capable of testing aquatic and terrestrial feed formulations from the recycling of Island generated co-products.

Our abalone business has been working with the Oceanic Institute since 2011 regarding feed development for our high end abalone, the Japanese ezo. We have run several rounds of feed trials with feeds produced by the pilot plant on Oahu. We will be very happy to support the upgrade at UH Panaewa Farm in Hilo.

High feed costs represent a significant obstacle to meat production in Hawaii and this threatens island food security. The feed mill in Hilo will be used to evaluate locally sourced ingredients, for both terrestrial and aquatic animal feeds, with the goal of reducing feeds costs to farmers and enhancing food security and food sustainability in Hawaii.

We understand the broad objectives of the proposed project include: 1) working with local farmers to secure ingredient supply chains; 2) developing processing methods and specifications to optimize the use of locally sourced ingredients for animal feeds; 3) producing cattle and tilapia feeds using feed formulations which will include locally sourced ingredients; and 4) evaluating cattle and tilapia feeds at commercial farms in Hawaii.

Sincerely,

Kowa Premium Foods Hawaii Corporation

[redacted]

Hirokazu Ishikawa COO

Jan 16, 2018

Date

Hawaii
Aquaculture &
Aquaponics Association

January 15, 2018

Shaun M. Moss, Ph.D.
Executive Director
Oceanic Institute of Hawai'i Pacific University
41-202 Kalaniana'ole Highway
Waimanalo, HI 96795

Dear Dr. Moss,

Please accept and use this letter as confirmation of the Hawaii Aquaculture and Aquaponics Association (HAAA)'s continuing long term support of the Oceanic Institute of Hawaii Pacific University's Feed Research and Pilot Production Facility in Pana'ewa Agricultural Park, Hilo, Hawaii. We are delighted that this facility is now commissioned and ready for long-awaited feed research operations focusing on local ingredients to the extent that it is economical to do so.

Feed and feed-related transportation costs are two of the largest operational expenses for most commercial aquaculture and aquaponic operations in Hawaii and the U.S. affiliated Pacific Islands; and for most other forms of livestock production in this central Pacific region. If land-based aquaculture and aquaponic operations and offshore fish farms are to survive, prosper, and reach their enormous economic potential going forward, then the research and development of feeds manufactured from locally produced agricultural and fishery by-products and locally-grown feed ingredients is absolutely essential.

The research feed mill will provide the essential facilities necessary for the sound scientific research to determine and demonstrate the technical feasibility of developing local feeds. It will also enable and support essential economic studies to determine and demonstrate sufficient regional demand to support the establishment of a commercial feed mill in the islands. In addition, the research feed mill will support the continuing development of specialized scientifically-based formulations and diets for the culture of the highly diverse tropical and subtropical species that could be cultured in the region for which the dietary requirements are largely or entirely unknown.

For these reasons and more, the HAAA strongly supports the Institute's request for State funds for the operation of this long awaited and economically important research feed mill in Hawaii.

Sincerely,

[redacted]

Ronald P. Weidenbach, HAAA President

Cyanotech

www.cyanotech.com

January 17, 2017

Letter of Support

Dear Hawaii State Legislature:

Cyanotech Corporation strongly supports the Grant-in-Aid request made by the Oceanic Institute to secure operating funds for the Feed Mill in Hilo.

High feed costs represent a significant obstacle to meat production in Hawaii and this threatens island food security. The Hilo Feed Mill will be used to evaluate locally sourced ingredients, for both terrestrial and aquatic animal feeds, with the goal of reducing feeds costs to farmers and enhancing food security and food sustainability in Hawaii.

Operating funds for the Hilo Feed Mill will allow the Oceanic Institute to:

- Work with local farmers to secure ingredient supply chains;
- Develop processing methods and specifications to optimize the use of locally sourced ingredients for animal feeds;
- Produce cattle and tilapia feeds using feed formulations which will include locally sourced ingredients; and
- Evaluating cattle and tilapia feeds at commercial farms in Hawaii.

Cyanotech supports these efforts and feels that such efforts will lead to the productive use of over 60 tons per year of spent biomass Cyanotech produces in its production of astaxanthin oleoresin.

Thank you for your consideration.

Sincerely,

[redacted]

Gerald R. Cysewski, Ph.D
Chief Executive Officer

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CENTER
FOR
TROPICAL
AND
SUBTROPICAL
AQUACULTURE

January 15, 2018

Dear Dr. Moss,

On behalf of CTSA and the Regional Aquaculture Center program, I am pleased to hear that construction of the Oceanic Institute feed mill has been completed and that research on local feeds will soon be underway in Hilo.

As you know, the development of local aquatic feeds is a top industry priority for farmers in our region, and as such is a regular topic of discussion during CTSA meetings in Hawaii and across the Pacific Islands. Our program has invested significant funds in feeds research, and CTSA-supported projects have demonstrated that locally available ingredients such as algae and agriculture byproducts can be used to create high-quality feeds. Forthcoming CTSA-supported research scheduled to take place at the new OI feed mill will investigate additional potential ingredients and develop new local feed formulations for commonly farmed species.

The cost to import feeds for both aquatic and terrestrial animals from the continental United States and abroad continues to increase each year. Furthermore, landings from capture fisheries are stagnant while aquaculture is growing rapidly worldwide. Hawaii has an abundance of natural resources, including low-cost feed ingredients, that make it an ideal location for aquaculture. Determining how to best utilize those resources in a sustainable and efficient manner will go a long way to realizing the full potential for aquaculture here.

CTSA and our stakeholders are looking forward to the commencement of operations at the feed mill and the production of affordable diets using locally available ingredients. Hope OI will be able to find additional funding to achieve the goal sooner. Should you have any questions or wish to discuss the matter further, please do not hesitate to contact me at (808) 956-3385 or chenglee@hawaii.edu.

Very truly yours,

[redacted]

Cheng-Sheng Lee, Ph.D.
Director, CTSA

CSL:mb

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