Introduction

The University of Hawai‘i Sea Grant College Program (Hawai‘i Sea Grant) is a unit of the prestigious School of Ocean and Earth Science and Technology of the University of Hawai‘i at Mānoa (UH). Mānoa-based and operating systemwide, Hawai‘i Sea Grant partners with schools and colleges across the ten campus University of Hawai‘i System as well as the Pacific region, bringing to bear the full force of the university's knowledge and human resources to serve citizens and decision-makers in Hawai‘i and the Pacific.

Motivating our integrated research, extension, and education activities is the understanding that the vast majority of the issues we face in our oceans and on our coasts are directly linked to human behavior on land and that critical to ecosystem, economic, social, and cultural well-being is the energy-water-food nexus. **Hawai‘i Sea Grant's programmatic efforts in these areas are organized into five interdisciplinary Centers of Excellence:** Smart Building and Community Design, Sustainable Coastal Tourism, Marine Science Education, Island Climate Adaptation and Policy, and Sustainable Aquaculture and Fisheries. Although not an official center of excellence, but as a result of demonstrated leadership in water resources, UH administration placed the directorship of the UH Water Resources Research Center under Hawai‘i Sea Grant as of 2013. A common focus of the centers is the development of resilient, economically and socially inclusive, and sustainable coastal communities that function within the capacity of their habitats and ecosystems. Hawai‘i Sea Grant's Centers of Excellence were recognized by **the 2011 Site Review Team as a National Best Management Practice.**

Recognizing the exceptional record of collaboration and partnership and the diverse achievements and impacts supporting sustainability, UH awarded Hawai‘i Sea Grant **seven new tenure-track faculty positions in six disciplines through a competitive UH Sustainability Initiative.** Each of the seven hires has a 25 percent appointment as Sea Grant extension faculty. Since 2013 there are now two new faculty in the School of Ocean and Earth Science and Technology, two in the College of Social Sciences, one in the College of Engineering, one in the School of Architecture, and one who is co-shared between the Hawai‘inuiākea School of Hawaiian Knowledge and the College of Tropical Agriculture and Human Resources. **Over the next 30 years, this will represent a more than $50 million investment in Hawai‘i Sea Grant.** This initiative was recognized by **the 2014 Site Review Team as a National Best Management Practice.**

Hawai‘i Sea Grant consistently ranks among the most highly-leveraged programs in the Sea Grant network. **Although a program with $2 million in federal core funding, we are a $6 million/year program employing 45 faculty and staff to serve Hawai‘i and its communities.** Annually ranking at or near the top among its Sea Grant peers, Hawai‘i Sea Grant produced a total of 125 peer-reviewed publications in prestigious journals such as Science, Nature, Nature Climate Change, and the Proceedings of the National Academy of Sciences, and supported 322 students (155 undergraduates, 59 masters, 82 PhDs, 20 post-doctorals, 5 professional degrees, and 1 intern). **Identified as a Best Management Practice in 2011 and 2014, Hawai‘i Sea Grant annually funds more than 15 graduate students within its Graduate Trainee Program,** focusing its competitive research funding on graduate student success and providing student researchers with experiential learning in extension and outreach activities.

Our integrated and multidisciplinary research, extension, and education activities are direct and planned, others are serendipitous, and many lead to new opportunities. By our program's very nature we are nimble and flexible, with our projects and activities reflecting the unique needs of Hawai‘i and the Pacific region. To the best of our ability we have attempted below and in our online reporting to separate the activities within our inextricably interconnected focus areas. The following information, organized by focus area, seeks to provide a snapshot of the contributions Hawai‘i Sea Grant has made to the coastal communities we serve.

Safe and Sustainable Seafood Supply

University of Hawai‘i Sea Grant College Program Center of Excellence for Sustainable Aquaculture and Fisheries

Initially, Hawai‘i Sea Grant’s Center of Excellence for Sustainable Aquaculture and Fisheries (CSAF) was a partnership between Hawai‘i Sea Grant and the University of Hawai‘i at Hilo’s Pacific Aquaculture and Coastal Resources Center (PACRC) with central foci in conservation, sustainability, and food security in coastal communities worldwide. The strategies for success include building support for sustainable aquaculture development; undergraduate and graduate education along with increasing opportunities for careers in aquaculture and fisheries; and motivating demand for local aquaculture products. This center is unique among Sea Grant Centers of Excellence in that the partnership includes substantial physical facilities including laboratories, offices, and hundreds of aquaculture tanks ranging from aquaria to two one-half million-gallon tanks. Funding came from federal, state, foreign, private, and multilateral funding sources with an annual budget approaching $1 million.

Professor Kevin Hopkins, an internationally distinguished scientist who managed aquaculture and fisheries development projects worldwide for over 35 years, served as the director of the CSAF and also PACRC. More recently, Dr. Maria Haws, a former Hawai‘i Sea Grant extension specialist and distinguished researcher in her own right, serves as the director of PACRC and CSAF. This center has evolved into a partnership between Hawai‘i Sea Grant, PACRC, and UH Hilo’s College of Agriculture, Forestry, and Natural Resource Management with a broader focus including coastal resource management and water resource sustainability.

Signature Projects

Restoring Indigenous and Cultural Practices in Native Hawaiian Fishponds

Native Hawaiian fishponds are a sustainable indigenous and historical practice of local seafood production and ecosystem management that has seen resurgence in interest by local landowners and community groups. He‘eia Fishpond, on the east side of the island of O‘ahu, is one of the most advanced Native Hawaiian fishponds in Hawai‘i that is actively being restored for aquaculture. This pond, like many others across the state, faces challenges due to historical land-use patterns that have dramatically altered the nutrient inputs and physical characteristics of the fishpond, and ultimately fish production.

Since 2007, UH researchers supported by Hawai‘i Sea Grant have been continuously monitoring the physical and geochemical aspects of He‘eia Fishpond. This has been occurring through a coastal observing program called “Na Kilo Honua o He‘eia” with the goal of informing management practices by Paepae o He‘eia, a private non-profit organization dedicated to caring for the fishpond. The observing program includes *in situ* instruments and a monthly sampling program. This work, coupled with water column profiling and discrete sampling for physical and biogeochemical parameters, is enabling researchers to track the health of the fishpond. It is also acting as baseline data as land use changes occur. There have been several positive outcomes from this work:

- The results have been used to gain necessary permits for the repair of a serious break in the seawall of the fishpond, which will then allow the fishpond to be able to support fish production.

- Hawai‘i Sea Grant researcher/extension faculty Rosie Alegado developed a Na Kilo Honua o He‘eia website (nakilohonuaoheeia.org) to provide public access to methods and data from the eight-year time series. Dr. Alegado initiated a regular “Science Nights” community presentation that was hosted by the stewards of the fishpond to share information with the public.
- Due to the integration of research and outreach activities at He‘eia Fishpond, Paepae o He‘eia staff and university researchers have an improved relationship and enhanced collaboration with fishpond practitioners statewide.
- In addition, in 2013 a collective of community groups, individual landowners, and practitioners from across the main Hawaiian Islands leveraged previous and current support from Hawai‘i Sea Grant to obtain foundational funding in support of a full time coordinator for the non-profit fishpond group, Hui Mālama Loko I‘a.

Establishing a New Aquaculture Industry in Hawai‘i

The Hawai‘i Sea Grant CSAF has led the effort to establish a commercial bivalve industry in Hawai‘i; the only coastal state where bivalve shellfish culture was illegal due to the lack of a shellfish sanitation program for producers. Hawai‘i imports more than 80 percent of its seafood including about 400,000 oysters monthly. Hawai‘i Sea Grant and PACRC worked with the Hawai‘i Department of Health (DOH) to facilitate the implementation of the new shellfish sanitation program. Prior to this, they also worked with non-profit groups managing traditional Hawaiian fishponds to test the biological feasibility of using these cultural resources to grow shellfish.

Since 2010 their efforts have focused on three main bottlenecks that needed to be addressed for the industry to develop: 1) Examine the social and biological feasibility of growing bivalves in Hawai‘i’s coastal regions; 2) Determine the economic feasibility of culturing bivalves in the state; and 3) Ensure that coastal grow out areas could meet the federal regulations established and mandated by the Food and Drug Administration. The economic feasibility was examined in a bivalve market study, and successful grow out trials were carried out in three traditional Hawaiian fishponds on Moloka‘i and O‘ahu, and a shrimp pond on Kaua‘i, which showed that market size oysters can be produced in 5-6 months as compared to 2-3 years at mainland sites. These results allowed DOH to prioritize its support for developing this new industry for Hawai‘i. The DOH subsequently trained its personnel in the process of classifying shellfish growing areas. In 2013, DOH approved two private operations, Kaua‘i Clams and Moli‘i fishpond, to sell shellfish to the public. Two other shellfish farms are currently pending approval. In addition, broodstock of various indigenous species was established at PACRC, construction of a private hatchery in Hilo was completed, and bivalve spat are now available to local and West Coast shellfish producers. These results, combined with the new DOH shellfish sanitation program, have opened the door to a new commercial industry that will lessen dependence on imports and likely provide dozens of seafood-related jobs.

Establishing Food Production Systems for Native Hawaiian Families

To help families supplement their income and put fresh and safe seafood, herbs, and vegetables on the table, Hawai‘i Sea Grant has trained them to produce fresh fish and vegetables using backyard aquaponics systems. Pre-contact Hawaiians consumed a diet of fresh fish, taro, fruits, and vegetables which changed with the introduction of the western diet. Native Hawaiians now experience a very high rate of obesity, high blood pressure, diabetes, and heart disease. Hawai‘i Sea Grant worked closely with families to set-up low cost, small-scale aquaponics systems. With

easier and more affordable access to these foods, families are assisted in returning to a more healthful lifestyle. Initially, four systems for individual families and training and demonstration systems were installed, and due to the success of these projects, there are now more than 20 new aquaponics systems on Maui, including three commercial systems. Hawai‘i Sea Grant also worked with the Maui School Gardening Network to introduce secondary and intermediate school students to fundamentals of home gardening, including small-scale aquaponics systems.

Providing Assistance to the West Coast Oyster Industry

The shellfish hatchery at PACRC, part of the Hawai‘i Sea Grant CSAF, supported Northwest oyster farmers for seven years who were hit hard by the scarcity of oyster seed brought on by ocean acidification. The Oregon and Washington coasts have one of the most rapid rates of ocean acidification in the world, and this affected the local hatcheries since young oyster larvae cannot build their shells if the water is too acid. Perhaps more alarming to the farmers who also rely partially on wild set to supply their farms with young oysters was that there had not been any wild settlement for nearly four years, an indication of an ecosystem in serious trouble. The CSAF was approached to help out with this dire situation by conducting research on oyster larvae and supplying some of the Washington farms with oyster seed to help out in the crisis. Production has totaled $148,781 and produced nearly 21,518 million spat and 3,610 million larvae. This seed is provided to approximately twelve farms on the West Coast and three in Hawai‘i. The CSAF is largely student operated with 25-30 employed each year which provides income for the students to support their studies and valuable hands-on training.

Providing Technical Assistance to Support Expansion of the Aquaculture Industry in American Samoa

In American Samoa, Hawai‘i Sea Grant has been working closely with the community and the students at the American Samoa Community College (ASCC) to promote the development of the aquaculture industry. One of the signature projects was the design, construction, and management of the Center for Sustainable Integrated Agriculture and Aquaculture (CSIAA) in 2008, a freshwater aquaculture training facility at ASCC developed in collaboration with the ASCC Land Grant Program. Since its inception, the aquaculture center has expanded its services to provide training in fish culture, local fish feeds production, aquaponics, and aquarium science.

Through this center, Hawai‘i Sea Grant worked with the ASCC Land Grant Program to provide community access to fish feed production equipment. Historically, the lack of a low-cost, high-quality fish feed in American Samoa was the greatest challenge to the growth of aquaculture in American Samoa. In response, Hawai‘i Sea Grant submitted a grant to the American Samoa government to purchase larger scale feeds production equipment, which was purchased and delivered in 2014. Hawai‘i Sea Grant also collaborated with Eni Hunkin Faleomavaega, then Congressman of American Samoa, to secure donated fishmeal from the Starkist Samoa tuna cannery for use by fish farmers in producing a local fish feed. This equipment, along with the donated fishmeal that is mixed with a vitamin and mineral supplement to enhance the nutritional content of the fishmeal, has greatly expanded the industry.

Hawai‘i Sea Grant has also been working on developing more efficient aquaponics systems that produce a higher density of plants. Significant advances have been made in building systems inexpensively using locally available materials. New systems were built between 2010-2013 and are producing fish and vegetables for family use as well as sales. The estimated combined value of

aquaculture production from these systems is $5,000 per year; the societal value of community-produced, inexpensive, healthy, homegrown food in these remote islands is perhaps invaluable.

Collaboratively Managing a Coastal Fishery

In 2006, the state of Hawai‘i designated a Community-based Subsistence Fishing Area in the Ha‘ena ahupua‘a (an ancient Hawaiian system of land division) on the island of Kaua‘i to reaffirm and protect fishing practices traditionally exercised for Native Hawaiian subsistence, culture, and religion. With assistance from Dr. Mehana Vaughan, one of Hawai‘i Sea Grant’s seven coastal sustainability faculty, and information from her dissertation research documenting this effort, the state’s Board of Land and Natural Resources unanimously approved the community-generated rules for this area in October 2014, making it the first of its kind in the state. Other local communities statewide have embarked on a similar process with the state in an effort to co-manage their local fisheries resources.

PIER PRP Program Focus Area Report

University of Hawai'i Sea Grant

Safe and Sustainable Seafood Supply

Program Focus Area: SAFE AND SUSTAINABLE SEAFOOD SUPPLY

Program Goals

1. A sustainable supply of safe seafood to meet public demand.
2. A healthy domestic seafood industry that harvests, produces, processes, and markets seafood responsibly and efficiently.

JUMP TO REPORT SECTION

Full Text of Impacts
Program Performance Measures
Objectives

Impacts and Accomplishments toward Program Goals

1. **Program Goal: A sustainable supply of safe seafood to meet public demand.**
   Impact(s)
   - 20464 - Hawaii Sea Grant's "Voice of the Sea" televison show wins 6 Telly Awards
   - 20435 - Hawaii Sea Grant supports establishment of the state's first community-based subsistence fishing area in Haena, Kauai
   - 20178 - Fishpond managers at He'eia Fishpond informed by Hawaii Sea Grant's integrated research and outreach activities
   - 20177 - Native Hawaiian fishpond practitioners incorporate Hawaii Sea Grant research into best management practices
   - 19702 - UH Sea Grant annual support is leveraged to garner extramural funding in support of an independent coordinator for the Hawaiian Fishpond Organization, Hui MÄlama Loko I'a.
   - 19052 - Hawaii Sea Grant established the development of a new commercial bivalve industry in Hawaii
   - 16429 - Hawaii Sea Grant secured a long-term supply of donated fish meal for producing high quality fish feed
   - 16038 - Hawaii Sea Grant examined the impact of alien algae removal on the bonefish fishery in Maunalua Bay
   - 14194 - Hawaii Sea Grant supported the County of Maui in developing safe and sustainable food production systems

   Accomplishment(s)
   - 20438 - Hawaii Sea Grant conducts an aquaponics workshop to increase local capacity in American Samoa
   - 16440 - 2012 Update for Insular Pacific Regional Research, Information Planning and Coordination

2. **Program Goal: A healthy domestic seafood industry that harvests, produces, processes, and markets seafood responsibly and efficiently.**
   Impact(s)
   - 20177 - Native Hawaiian fishpond practitioners incorporate Hawaii Sea Grant research into best management practices
   - 19702 - UH Sea Grant annual support is leveraged to garner extramural funding in support of an independent coordinator for the Hawaiian Fishpond Organization, Hui MÄlama Loko I'a.
   - 16430 - Hawaii Sea Grant supported workforce development by offering a underwater surveying course at the community college

   Accomplishment(s)
   - 20438 - Hawaii Sea Grant conducts an aquaponics workshop to increase local capacity in American Samoa
   - 19056 - Hawaii Sea Grant supported an expansion of the feeds production lab for the aquaculture community in American Samoa

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Full Text of Impacts and Accomplishments

20464 - Hawaii Sea Grant's "Voice of the Sea" televison show wins 6 Telly Awards
RELEVANCE: In Hawaii, there is a strong need to not only educate K-12 students but also the public about relevant marine science research and ocean policy issues as well as showcase a variety of careers

associated with the ocean sciences.

RESPONSE: Hawaii Sea Grant's Center for Marine Science Education in partnership with the University of Hawai'i Curriculum Research & Development Group and NOAA produced a Voice of the Sea (VOS) television show that exposed viewers to marine research, indigenous cultural practices, and ocean policy issues relevant to Hawaii and the Pacific region. The show profiled scientists, cultural practitioners, and other professionals in marine-related careers. The 30-minute show made its statewide debut on January 5, 2014 on KFVE The Home Team, channel 5. Nineteen new online episodes and 33 re-runs aired this past year.

RESULTS: In 2014, Hawaii Sea Grant was awarded six 2014 Telly Awards, which are the premier regional television awards honoring excellence in programming. Voice of the Sea received a silver Telly for cultural programming and five bronze Tellys for educational programming, documentary programming, use of graphics, editing and videography.

RECAP: In 2014, Hawaii Sea Grant's Voice of the Sea television show received six 2014 Telly Awards, which are the premier regional television awards honoring excellence in programming. The half-hour television show started airing on local television in Hawaii in January of 2014 and has been promoting ongoing scientific and cultural work in the Pacific from recognized experts. Back to Goals

20438 - Hawaii Sea Grant conducts an aquaponics workshop to increase local capacity in American Samoa

RELEVANCE: American Samoa has very limited arable land owing to its small size and steep slopes. In addition, there are many pests and blights that thrive in the tropical climate, making growing leafy greens and many vegetables challenging. Food security is low since approximately 90% of American Samoa's food is imported. Due to the customary land tenure system in Samoa, many people only have very small pieces of land.

RESPONSE: Hawaii Sea Grant has been providing aquaculture extension services to American Samoa stakeholders since 2002. In response to a new focus by the American Samoa School Lunch Program on growing lettuce that is not planted in the soil, Hawaii Sea Grant extension agent Kelley Tagarino organized a workshop in partnership with Olomana Gardens, a private business dedicated to designing modern, sustainable food production systems. The topic focused on demonstrating a new aquaponics A-frame technology, which allows farmers to plant their lettuce vertically and thus increasing plant production by three to four fold.

RESULTS: In May of 2014, 25 participants were trained in the new aquaponics technique. One participant committed to build a new aquaponics farm that will utilize the vertical aquaponics technology taught at workshop. In addition, the participants were also exposed to different recipes for cooking tilapia. As a result, 20 people who ate tilapia for the first time reported liking it and planned to buy it in the future.

RECAP: In 2014, Hawaii Sea Grant partnered with Olomana Gardens to provide a training workshop to aquaculture stakeholders in American Samoa. The workshop showcased a cutting-edge aquaponics technology that will at least triple or quadruple plant production and support local food security initiatives in American Samoa. Back to Goals

20435 - Hawaii Sea Grant supports establishment of the state's first community-based subsistence fishing area in Haena, Kauai

RELEVANCE: Communities in Hawaii have been engaging in comprehensive planning efforts to make informed strategic decisions and advise state resource management agencies, conservation groups, community networks, and funding organizations to support policies that foster collaborative resource management. In particular, partnerships have developed between the Hawaii Department of Land and Natural Resources (DLNR) and select communities around the state to take an active role in the management of their coastal resources.

RESPONSE: Hawaii Sea Grant researcher Dr. Mehana Vaughn conducted research and outreach that helped inform/guide the community and DLNR in creating a community-based subsistence fishing area in Haena, Kauai, where stakeholders in the community created rules for management of its inshore fishery based on ancestral Hawaiian gathering practices.

RESULTS: On 24 October 2014 the Hawaii Land Board approved the adoption of the state's first community-based coastal management rules for Haena. These rules included a ban on commercial harvest, three year rest period for opihi (limpet) gathering, ban on lay nets and spear guns, and protection of nursery habitats. The rules applied only in Haena and will require state and community collaboration for rule enforcement. These rules are the culmination of 20 years of community effort, over 60 public/community meetings, 15 separate rules drafts, 40 community interviews, and seven scientific studies. These rules are also serving as a framework for 10 other Hawaii communities statewide who are seeking to propose similar rules packages that protect their nearshore fisheries for subsistence harvesting.

RECAP: In 2014, Hawaii Sea Grant helped support the creation of the state's first administrative rules in Haena, Kauai for a community-based subsistence fishing area. The collaborative process not only

created ecosystem approaches for managing the coastal environment but provided valuable lessons for co-management practices that will help inform future collaborative efforts for other Hawaii communities pursuing their own rules with the state. Back to Goals

20178 - Fishpond managers at He'eia Fishpond informed by Hawaii Sea Grant's integrated research and outreach activities

RELEVANCE: He'eia Fishpond, on the east side of the island of Oahu, is one of the few Native Hawaiian fishponds in Hawaii that is actively being restored for aquaculture. Historical land-use patterns have dramatically altered the nutrient inputs and physical characteristics of the fishpond, and ultimately the production of fish. Since 2007, University of Hawaii researchers supported by Hawaii Sea Grant have been monitoring the physical and geochemical aspects of He'eia Fishpond through an observing program called "Na Kilo Honua o He'eia" in order to inform management practices by Paepae o He'eia, a private non-profit organization dedicated to caring for the fishpond.

RESPONSE: In 2014, Hawaii Sea Grant researcher/extension faculty Rosie Alegado developed a Na Kilo Honua o He'eia website (nakilohonuaoheeia.org) to provide public access to methods and data from the eight-year time series. In addition, Dr. Alegado initiated a regular "Science Nights" community presentation that was hosted by the stewards of the fishpond to share information with the public.

RESULTS: One outcome that resulted from integrating research and outreach activities at He'eia Fishpond was the improved relationship and enhanced collaboration between Paepae o Heeia staff and university researchers. Fishpond staff has incorporated viewing the website for water quality information as part of their routine husbandry practices. The university researchers have also been requested to participate in educational workshops for the state-wide fishpond practitioner network, Hui Malama Loko I'a. He'eia Fishpond can serve as a model system for conducting integrated research and outreach activities at other fishponds across the state.

RECAP: In 2014, Hawaii Sea Grant integrated outreach with research activities at He'eia Fishpond. Na Kilo Honua o He'eia is a consortium of University of Hawaii researchers who have been conducting research at the fishpond since 2007. Hawaii Sea Grant facilitated dissemination of scientific data to local community stakeholders via a website and regular community presentations. Information from the website has informed fish culture practices and management decisions by the fishpond practitioners. Back to Goals

20177 - Native Hawaiian fishpond practitioners incorporate Hawaii Sea Grant research into best management practices

RELEVANCE: He'eia Fishpond, on the east side of the island of Oahu, is one of the few Native Hawaiian fishponds in Hawaii that is actively being restored for aquaculture. Historical land-use patterns have dramatically altered the nutrient inputs and physical characteristics of the fishpond, and ultimately the production of fish.

RESPONSE: Hawaii Sea Grant researcher/extension faculty Rosie Alegado and her research team conducted research to determine the distribution and diversity of the microbial community within He'eia Fishpond over an annual cycle (2014-2015).

RESULTS: Dr. Alegado's research team has thus far collected over 40 weeks of paired microbial, physical and biogeochemical data which includes three hurricanes and a tropical storm. The faculty member worked with He'eia fishpond practitioners to develop and implement practices to mitigate runoff and further sedimentation into the fishpond during these extreme weather events.

RECAP: In 2014, Hawaii Sea Grant conducted research to characterize the distribution and diversity of the microbial community in He'eia Fishpond. The information from this study is being utilized by fishpond practitioner staff to implement best management practices during extreme weather events that impact fish production. Back to Goals

19702 - UH Sea Grant annual support is leveraged to garner extramural funding in support of an independent coordinator for the Hawaiian Fishpond Organization, Hui MÄlama Loko I'a.

RELEVANCE: Native Hawaiian Fishponds are a sustainable historical practice for local seafood production that has seen a recent resurgence in interest by local land owners and community groups.
RESPONSE: UH Sea Grant has supported the annual meetings that bring together individuals and community members working to revive, restore and reinvigorate the development and traditional use of native Hawaiian fishponds.
Results: A collective of community groups, individual landowners, and practitioners from across the main Hawaiian islands leveraged previous and current support from UH Sea Grant to obtain foundational funding in support of a full time coordinator for the fishpond group (Hui Malama Loko I'a).
RECAP: A collective of community groups, individual landowners, and practitioners from across the main Hawaiian islands leveraged previous and current support from UH Sea Grant to obtain foundational funding in support of a full time coordinator for the fishpond group (Hui Malama Loko I'a).
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19056 - Hawaii Sea Grant supported an expansion of the feeds production lab for the aquaculture community in American Samoa

RELEVANCE: The lack of a low-cost, high-quality fish feed in American Samoa has historically been a

major hurdle for local fish farmers. Historically, fish farmers would either feed their tilapia table scraps, which does not provide optimum nutrition for fish growth, or they would purchase expensive feeds that are shipped from Hawaii or the Philippines, which negatively impacted the profitability of their operations.

RESPONSE: Over the past three years, Hawaii Sea Grant worked with the American Samoa Community College's Community and Natural Resources Program on providing community access to fish feed production equipment at the college's aquaculture center. Hawaii Sea Grant secured donated fishmeal from the StarKist Samoa cannery in Pago Pago and provided a mineral and vitamin supplement that enhances the nutritional content of the StarKist Samoa fishmeal. Fish farmers have been utilizing the feeds equipment to make fish feed daily but the volume of feeds produced is limited because of the small scale of the equipment.

RESULTS: To address this need, Hawaii Sea Grant submitted a Community Block Grant in the amount of $33,000 to the American Samoa Department of Commerce to purchase larger scale feeds production equipment several years ago. In 2013, the grant was funded. The new equipment, which is being purchased and delivered in 2014, will greatly expand the capacity of fish feed production at the college.

RECAP: Hawaii Sea Grant worked with the American Samoa Community College to establish an aquaculture center at the college that provided fish farmers access to fish feed production equipment. Because of the small scale of the equipment, only a small volume of fish feed was produced daily. To address this need Hawaii Sea Grant submitted a grant to the local government that was funded in 2013. The new equipment is expected to arrive in 2014 and will greatly enhance the capacity of fish feed production at the college. Back to Goals

19052 - Hawaii Sea Grant established the development of a new commercial bivalve industry in Hawaii

RELEVANCE: Hawaii is the only coastal state without a commercial bivalve industry. There were three main bottlenecks that needed to be addressed for this industry to develop: 1) Examine the social and biological feasibility of growing bivalves in Hawaii's coastal regions; 2) Determine the economic feasibility of culturing bivalves in the state; and 3) Ensure that coastal grow out areas could meet the federal regulations established and mandated by the Food and Drug Administration. Furthermore, the Hawaii Department of Health (DOH), which is responsible for approving grow out areas, initially did not have the staffing capacity to carry out this responsibility.

RESPONSE: Hawaii Sea Grant collaborated with Dr. Maria Haws of the Pacific Aquaculture and Coastal Resources Center (PACRC) at the University of Hawaii at Hilo and other partners to address these obstacles over the past six years. The economic feasibility was examined in a bivalve market study. Successful grow out trials were carried out in three traditional Hawaiian fishponds on Molokai and Oahu and a shrimp pond on Kauai. These results allowed DOH to prioritize its support for developing this new industry for Hawaii and trained personnel in the shoreline certification process.

RESULTS: To date, DOH approved two organizations to sell shellfish to the public, Kauai Clams and Moli'i fishpond; two other shellfish farms are pending approval. In addition, brood stock of various indigenous species was established at PACRC. Construction of a private hatchery in Hilo was completed and bivalve spat are now available to shellfish producers.

RECAP: Hawaii Sea Grant in partnership with the Pacific Aquaculture and Coastal Resources Center at the University of Hawaii at Hilo led the effort to establish a commercial bivalve industry in Hawaii. In 2013, the Hawaii Department of Health approved two operations, one on Kauai and the other on Oahu, to sell shellfish to the public. Two other shellfish farms are pending approval. Back to Goals

16440 - 2012 Update for Insular Pacific Regional Research, Information Planning and Coordination

RELEVANCE: Several years ago, NOAA initiated a program to identify the ocean research and information needs in each of the nation's major coastal ecoregion to support the new national policy objectives. The Insular Pacific is one such region formally identified by NOAA and includes the state of Hawaii, the territories of American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands, as well as the freely-associated states of the Republic of Palau, the Federated States of Micronesia, and the Republic of the Marshall Islands.

RESPONSE: In 2006, the NOAA National Sea Grant Office charged Hawaii Sea
Grant with developing and implementing a plan to identify the ocean research priorities for the Insular Pacific region. Hawaii Sea Grant developed the plan by utilizing local partners and by facilitated discussions among a broad range of Insular Pacific stakeholders. The input helped identify and prioritize critical research and information needs necessary for the development of practical solutions that addressed resource management problems in each place.

RESULTS: Hawaii Sea Grant published the regional research needs report entitled "Research Priorities in the Insular Pacific: Transforming Research into Regional Management in June 2012 and formally submitted to NOAA and made available to Pacific region stakeholders. The Hawai'i Coastal Zone Management Program, which is part of the State of Hawai'i Office of Planning, utilized the priority

research needs identified for the state in updating its Ocean Resources Management Plan. The year-long process was initiated in early 2012 and ended in January of 2013.
RECAP: Hawaii Sea Grant developed a plan to identify the ocean research and information needs for the Insular Pacific region to inform marine and coastal resource management decision-making.

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16430 - Hawaii Sea Grant supported workforce development by offering a underwater surveying course at the community college

RELEVANCE: In American Samoa, there is a high need for trained specialists in marine resource management agencies. Students graduating from the college are often forced to seek higher education opportunities off island in order to meet the requirements to qualify for these professions. One strategy agencies employ to address this need involves hiring employees from off island on short-term contracts. A negative impact associated with this hiring strategy is high staff turnover, which impacts project continuity and management, as well as institutional knowledge.

RESPONSE: In 2010, Hawaii Sea Grant partnered with the college to create a snorkeling version of the Quantitative Underwater Ecological Surveying Techniques (QUEST) course patterned after the one developed by the University of Hawaii at Hilo Marine Option Program. Hawaii Sea Grant Extension Agent Ephraim Temple secured funding from NOAA NMFS to develop the training course. The first QUEST course was offered in January 2011 to four students. The second QUEST course was conducted in March 2012 with eight students.

RESULTS: One student from the first training is currently majoring in marine biology at the University of Hawaii at Manoa while another was hired as the Marine Protected Areas Coordinator at American Samoa Department of Marine and Wildlife Resources. All eight students who participated in the second training were hired by NOAA to assist with sedimentation monitoring efforts in Fagaalu Bay. Three of these students also received funding support for conducting undergraduate research projects. Another student was employed by the local National Marine Sanctuary Program.

RECAP: Hawaii Sea Grant partnered with the college to offer a training course that produces 12 participants who are versed in underwater surveying and are pursuing educational and employment opportunities in marine resource management.

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16429 - Hawaii Sea Grant secured a long-term supply of donated fish meal for producing high quality fish feed

RELEVANCE: The lack of a consistent supply of ingredients (e.g., fish meal) needed for producing a local fish feed is a major concern expressed by fish farmers in American Samoa. Importing commercial feeds is not economically viable due to high shipping and feed costs. Not having a locally produced feed is a major bottle neck in growing the local aquaculture industry.

RESPONSE: Over the past 10 years, Hawaii Sea Grant has been working with fish feed experts from the Oceanic Institute, Auburn University, and University of Hawaii to develop fish feed recipes that utilize locally-sourced ingredients. These experts also provided technical guidance to Hawaii Sea Grant staff in establishing a feeds production facility at the college that is being utilized by fish farmers. The Samoa Family Sunfish Cooperative, a non-profit composed of tilapia farmers, has also been supporting this effort. Starkist Samoa, a local tuna cannery, agreed to donate a one year trial of fish meal to the college to support local feeds production.

RESULTS: The one year trial of free fish meal donated from StarKist Samoa recently ended. Hawaii Sea Grant worked with one of the fish farmers to conduct grow out trials of the fish meal-based feed and tripled his annual production of tilapia. His success resulted in StarKist Samoa management making a commitment to supply free fish meal to the college indefinitely for feeds production. This commitment in turn has reduced the college's costs of producing a high-quality fish feed by more than one half.

RECAP: Hawaii Sea Grant and partners secured a long-term agreement from StarKist Samoa to supply fish meal at no cost to support local feeds production in American Samoa.

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16038 - Hawaii Sea Grant examined the impact of alien algae removal on the bonefish fishery in Maunalua Bay

Relevance: Mud weed (Avrainvillea amadelpha) is an alien invasive alga that is prevalent in Maunalua Bay and is detrimental to the native ecosystem. In an attempt to restore the bay, the community-based organization Malama Maunalua along with The Nature Conservancy (TNC) Hawaii Chapter directed the removal of invasive alien algae from over 22 acres of the Kuliouou reef flats of Maunalua Bay. Oio, or bonefish, are one of the most important recreational and subsistence fisheries species in Maunalua Bay.

Response: UH Sea Grant Fisheries Extension Agent Kimberlee Harding secured funding from The Nature Conservancy to conduct the bonefish study in partnership with the Hawaii Cooperative Fisheries Research Unit. Data (2008 to 2011) from an angler-based tagging program was examined for spatial and temporal patterns in the catch of oio including catch-per-unit-effort (CPUE), size, location, and time of capture. Data were examined for any changes before, during, and after invasive seaweed removal. The agent also acquired traditional and local knowledge about the fishery through interviews with anglers who have historically fished in Maunalua Bay.

Results: The overall results of the study showed that the removal of the invasive seaweed resulted in a diversification of diet for bonefish found within Maunalua Bay. Fishing catch and effort rates were reduced during the removal period but recovered after removal of the seaweed. Angler responses showed that there is a perceived positive benefit to the bonefish fishery as a result of the seaweed removal project.

RECAP: Hawaii Sea Grant conducted a study of bonefish in Maunalua Bay that demonstrated a recovery of the fishery following alien algae removal. Back to Goals

14194 - Hawaii Sea Grant supported the County of Maui in developing safe and sustainable food production systems
Relevance: With the median home price reaching a record high of $780,000 and other exorbitant living expenses, most local residents in Maui County pay a high price for living in paradise. This is an especially difficult burden for a number of families who live close to or under the poverty level, including a number of Native Hawaiians.

Response: In collaboration with the University of Hawai'i Maui College and University of Hawai'i College of Tropical Agriculture and Human Resources, Sea Grant Aquaculture Specialist Dr. Robert Howerton conducted an aquaponics workshop for 70 participants. Four additional workshops were carried out in Maui County on bivalve culture, water quality, and Chinese catfish spawning. The specialist also set up an aquaponics demonstration at the Farm Bureau's Maui County Farm Fest event, which exposed the public to various aspects of farming and farm products.

Results: Following the conclusion of these workshops more than 12 new aquaponics systems were constructed, ranging from small backyard systems to two large commercial aquaponics systems. These backyard operations have allowed working families to supplement their income and put fresh and safe seafood, herbs and vegetables on the table. At the Maui County Farmfest hundreds of school children and more than 1,500 residents and visitors were exposed to small-scale food production.
RECAP: Hawaii Sea Grant provided technical assistance to aquaculture stakeholders on Maui to establish aquaponic systems for raising vegetables and fish. Back to Goals

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Program Performance Measures (2010 - 2013)

Program Performance Measure	Program Plan Target (2010-2013)	Reported	Program Comments
Number of aquaculture stakeholders (e.g., aquafarmers, businesses, educators, students, hobbyists, governmental agencies, non-profits, community organizations) who adopt and implement responsible, sustainable aquaculture practices.	125	309	2010 - Maui and American Samoa aquaculturalists. 2011 - Maui, Hawaii Island and American Samoa aquaculturists. 2012 - Note:UH Sea Grant will no longer report on the SSSS focus area performance measures from 2013 since it's not part of updated strategic plan. Ephraim Temple: -9 aquaculture stakeholders (Duke Purcell, Lole Endemann, Mike King â€" using an improved variety of tilapia (GIFT) Duke Purcell, Lole Endemann â€" using improved feeds Lole Endemann, Nia Naiuli, Larry Hirata, Dustin Snow, Apela Afoa â€" using aquaponics methods to improve the sustainability of their aquaculture farms Duke Purcell â€" using integrated pig-cum-fish methods to reduce the environmental impacts of pig farming Ministry of Agriculture and Fisheries (Western Samoa) â€" using aquaponics methods taught by Sea Grant Latter-day Saint Farms (Western Samoa) â€" using aquaponics methods taught by Sea Grant. Bob Howerton: -24 aquaculture stakeholders (8 fishpond operators at Heeia, Keawanui, Molii, Ko`ie`ie 12 commercial and small-scale aquaponics operators five educational institutions) Maria Haws: -100

			individual members for Hui Malama Loko I`a (25 group members) -7 organizations: NOAA aquaculture program and NOAA Humpback Whale Sanctuary (collaborate on streamlining the permitting) Farber and Associates (collaborate on streamlining the permitting) Hawaii Department of Health (shellfish sanitation) Goosepoint Oyster, Nisbet Oyster, Hawaiian Shellfish LLC (oyster companies: assist with hatchery technology) -40 aquaculture farmers in US Affiliated Pacific Islands -3 organizations in Western Pacific: College of the Marshall Islands Land Grant, Namdrik Island pearl farm, Marine and Environmental Research Institute of Pohnpei -20 students employed at UH Hilo PACRC (received training in aquaculture) 2013 - Note: Hawaii Sea Grant dissolved its Center for Sustainable Aquaculture in 2013. This center was a partnership with Dr. Kevin Hopkins of the Pacific Aquaculture and Coastal Resources Center at the University of Hawaii at Hilo who served as the Director of this Sea Grant Center. Thus data reflected in this performance measure does not include that from PACRC in this year's reporting. 1. Anderson Tagarino (4): Duke Purcell, Mapu Jamias - using an improved variety of tilapia (GIFT) Duke Purcell, Apela Afoa, Mapu Jamias, Dustin Snow - using improved feeds Dustin Snow, Apela Afoa - using aquaponics methods to improve the sustainability of their aquaculture farms and Duke Purcell - using integrated pig-cum-fish methods to reduce the environmental impacts of pig farming. 2. Howerton (32): 32 aquaculture stakeholders: 8 fishpond operators at He'eia, Keawanui, Moli'i, Ko`ie`ie 20 commercial and small-scale aquaponics operators and five educational institutions.
Number of stakeholders (e.g., aquafarmers, businesses, educators, students, hobbyists, governmental agencies, non-profits, community organizations) trained in sustainable aquaculture practices.	325	3,119	2010 - Maui, Hawaii Island, American Samoa. 2011 - Maui, Hawaii Island and American Samoa aquaculturalists. 2012 - Note:UH Sea Grant will no longer report on the SSSS focus area performance measures from 2013 since it's not part of updated strategic plan. Ephraim Temple: -163 stakeholders (reached through 6 guest lectures, 1 workshop, 2 presentations) Bob Howerton: -24 aquaculture stakeholders (8 fishpond operators at Heeia, Keawanui, Molii, Ko`ie`ie 12 commercial and small-scale aquaponics operators five educational institutions) Maria Haws: -100 individual members for Hui Malama Loko I`a (25 group members) -7 organizations: NOAA aquaculture program and NOAA Humpback Whale Sanctuary (collaborate on streamlining the permitting) Farber and Associates (collaborate on streamlining the permitting) Hawaii Department of Health (shellfish sanitation) Goosepoint Oyster, Nisbet Oyster, Hawaiian Shellfish LLC (oyster companies: assist with hatchery technology) -40 aquaculture farmers in US Affiliated Pacific Islands -3 organizations in Western Pacific: College of the Marshall Islands Land Grant, Namdrik Island pearl farm, Marine and Environmental Research Institute of Pohnpei -20

			students employed at UH Hilo PACRC (received training in aquaculture) -200 individuals: 3 presentations at World Aquaculture Society conference -60 individuals: 1 HCC presentation -20 individuals: 3 training workshops -20 individual farm members trained on farm visits (10) -150 students: through teaching 4 classes in fall 2012 2013 - Note: Hawaii Sea Grant dissolved its Center for Sustainable Aquaculture in 2013. This center was a partnership with Dr. Kevin Hopkins of the Pacific Aquaculture and Coastal Resources Center at the University of Hawaii at Hilo who served as the Director of this Sea Grant Center. Thus data reflected in this performance measure does not include that from PACRC in this year's reporting. 1. Anderson Tagarino (4): Duke Purcell, Mapu Jamias - using an improved variety of tilapia (GIFT) Duke Purcell, Apela Afoa, Mapu Jamias, Dustin Snow - using improved feeds Dustin Snow, Apela Afoa - using aquaponics methods to improve the sustainability of their aquaculture farms and Duke Purcell - using integrated pig-cum-fish methods to reduce the environmental impacts of pig farming. 2. Howerton (32): 32 aquaculture stakeholders: 8 fishpond operators at He'eia, Keawanui, Moli'i, Ko`ie`ie 20 commercial and small-scale aquaponics operators and five educational institutions.

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Program Objectives (2010 - 2013)

Program Objective	Achieved (yes/no)	Program Comments
By 2013, Sea Grant has provided information, tools and/or technologies to aquaculture stakeholders that enable them to increase the availability of seafood and profitability of the Hawaii aquaculture industry.	Yes	2012 - 1. Hawaii: conducted grow-out trials of native shellfish species in fishponds provided technical assistance on hatchery technology to Goosepoint Oyster, Nisbet Oyster, Hawaiian Shellfish LLC companies provided technical assistance and training on aquaponics 2. American Samoa: provided technical assistance and training on aquaponics, fish feed manufacturing, integrated farming practices with swine and fish importation of fast growing tilapia (GIFT hybrid) for fish farmers 3. Western Pacific: provided technical assistance and training for sponge, coral and pearl farmers Please note: based on the results of the 2012 PRP review by the National Sea Grant Office, UH Sea Grant administration has decided to discontinue its efforts associated with the Safe and Sustainable Seafood Supply focus area in 2013 so it can focus its limited resources on other higher priority initiatives and issues in the state. 2013 - 2013: 1. Hawaii: conducted grow-out trials of native shellfish species in fishponds provided technical assistance on hatchery technology to Goosepoint Oyster, Nisbet Oyster, Hawaiian Shellfish LLC companies provided technical assistance and training on aquaponics 2. American Samoa: provided technical assistance and training on aquaponics, fish feed manufacturing, integrated farming practices with swine and fish importation of fast growing tilapia (GIFT hybrid) for fish farmers 3. In 2013, the Hawaii State Department of Health certified the waters of two aquaculture operations (Kauai Shellfish on Kauai and Moli'i Fishpond on Oahu) for selling bivalves commercially, creating a new aquaculture

		industry in the state.
By 2013, Sea Grant has provided information, tools and/or technologies to aquaculture stakeholders that enable them to support a viable aquaculture industry with acceptable environmental impacts.	Yes	2012 - 1. Hawaii: conducted shellfish sanitation training for aquaculture stakeholders established partnership with NOAA Aquaculture Office, NOAA Hawaiian Humpback Whale National Marine Sanctuary, Hawaii Department of Land and Natural Resources, Fishpond operators, Hawaii Department of Health, and others to streamline the permitting process for fish pond restoration provided technical assistance and training on aquaponics 2. American Samoa: provided technical assistance and training on aquaponics and integrated farming practices with swine and fish Please note: based on the results of the 2012 PRP review by the National Sea Grant Office, UH Sea Grant administration has decided to discontinue its efforts associated with the Safe and Sustainable Seafood Supply focus area in 2013 so it can focus its limited resources on other higher priority initiatives and issues in the state. 2013 - 2013: 1. Hawaii: conducted shellfish sanitation training for aquaculture stakeholders established partnership with NOAA Aquaculture Office, NOAA Hawaiian Humpback Whale National Marine Sanctuary, Hawaii Department of Land and Natural Resources, Fishpond operators, Hawaii Department of Health, and others to streamline the permitting process for fish pond restoration provided technical assistance and training on aquaponics 2. American Samoa: provided technical assistance and training on aquaponics and integrated farming practices with swine and fish 3. In 2013, the Hawaii State Department of Health certified the waters of two aquaculture operations (Kauai Shellfish on Kauai and Moli'i Fishpond on Oahu) for selling bivalves commercially, creating a new aquaculture industry in the state.
By 2014, Sea Grant has provided information, tools and technologies to aquaculture stakeholders that enable them to produce seafood responsibly and efficiently.	Yes	2012 - 1. Hawaii: conducted grow-out trials of native shellfish species in fishponds provided technical assistance on hatchery technology to Goosepoint Oyster, Nisbet Oyster, Hawaiian Shellfish LLC companies provided technical assistance and training on aquaponics 2. American Samoa: provided technical assistance and training on aquaponics, fish feed manufacturing, integrated farming practices with swine and fish importation of fast growing tilapia (GIFT hybrid) for fish farmers 3. Western Pacific: provided technical assistance and training for sponge, coral and pearl farmers Please note: based on the results of the 2012 PRP review by the National Sea Grant Office, UH Sea Grant administration has decided to discontinue its efforts associated with the Safe and Sustainable Seafood Supply focus area in 2013 so it can focus its limited resources on other higher priority initiatives and issues in the state. 2013 - 2013: 1. Hawaii: conducted grow-out trials of native shellfish species in fishponds provided technical assistance on hatchery technology to Goosepoint Oyster, Nisbet Oyster, Hawaiian Shellfish LLC companies provided technical assistance and training on aquaponics 2. American Samoa: provided technical assistance and training on aquaponics, fish feed manufacturing, integrated farming practices with swine and fish 3. In 2013, the Hawaii State Department of Health certified the waters of two aquaculture operations (Kauai Shellfish on Kauai and Moli'i Fishpond on Oahu) for selling bivalves commercially, creating a new aquaculture industry in the state.
By 2014, Sea Grant has	Yes	2012 - 1. Hawaii: conducted grow-out trials of native

provided information, tools and technologies to aquaculture stakeholders that enable them to produce seafood safely and sustainably.		shellfish species in fishponds provided technical assistance on hatchery technology to Goosepoint Oyster, Nisbet Oyster, Hawaiian Shellfish LLC companies provided technical assistance and training on aquaponics 2. American Samoa: provided technical assistance and training on aquaponics, fish feed manufacturing, integrated farming practices with swine and fish importation of fast growing tilapia (GIFT hybrid) for fish farmers 3. Western Pacific: provided technical assistance and training for sponge, coral and pearl farmers Please note: based on the results of the 2012 PRP review by the National Sea Grant Office, UH Sea Grant administration has decided to discontinue its efforts associated with the Safe and Sustainable Seafood Supply focus area in 2013 so it can focus its limited resources on other higher priority initiatives and issues in the state. 2013 - 2013: 1. Hawaii: conducted grow-out trials of native shellfish species in fishponds provided technical assistance on hatchery technology to Goosepoint Oyster, Nisbet Oyster, Hawaiian Shellfish LLC companies provided technical assistance and training on aquaponics 2. American Samoa: provided technical assistance and training on aquaponics, fish feed manufacturing, integrated farming practices with swine and fish 3. In 2013, the Hawaii State Department of Health certified the waters of two aquaculture operations (Kauai Shellfish on Kauai and Moli'i Fishpond on Oahu) for selling bivalves commercially, creating a new aquaculture industry in the state.